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Chapter 3

TEST EQUIPMENT, ULTRA, TYPE QE406

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LEADING PARTICULARS

Test equipment, Ultra, Type QE406 ... ... *Ref. No.* 5G/3218

Input voltage ... ... 100-120*V or* 200-250*V*, 50-60 *c/s single phase*

Dimensions approx. 4 *ft. high*, 3 *ft.* 4 *in. wide and* 3 *ft. deep*
(*excluding trailer*)

Introduction

1. The Test Equipment, Ultra, Type QE406 facilitates the routine servicing and testing of the Throttle Control Equipment, Ultra, Type B.A.P.3, dispensing with the need for individual test instruments. Basically, it comprises a metering system, to assist in circuit investigation, variable simulated engine speed and temperature sources and a two-way transistor intercomm. amplifier. The equipment is mobile, thus enabling the tests to be accomplished at the aircraft. A general view of the equipment is shown in Figs. 1, 2 and 3.

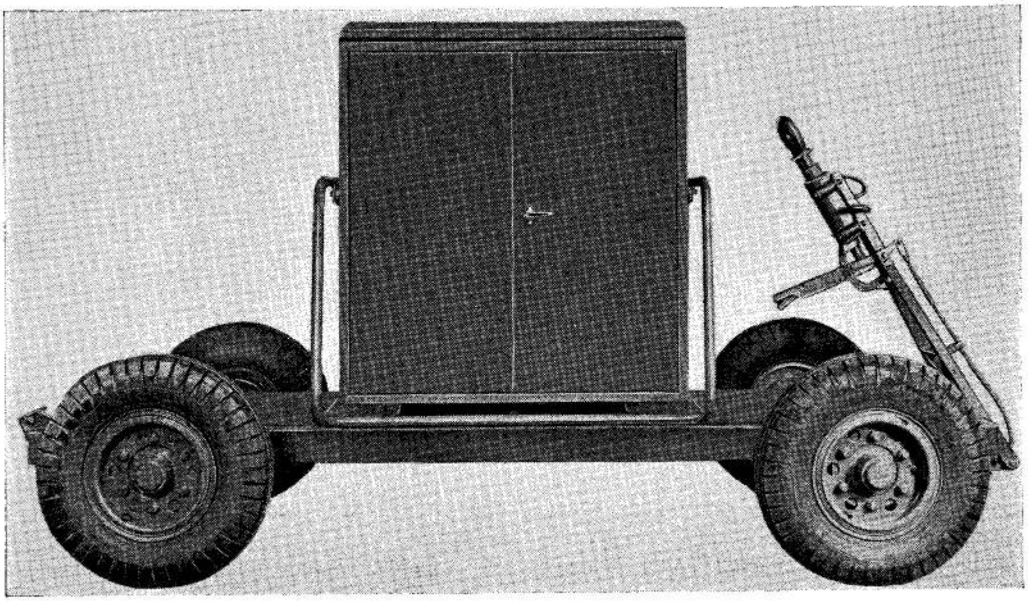

Fig. 1. Test equipment, Ultra, Type QE406

DESCRIPTION

General

2. The test equipment consists of the following units and ancillaries.

(1) Functional Unit, Type QT40011
(2) Power Unit, Type QT40012
(3) Frequency Doubler and Oscillator, Type QT4064
(4) Tacho Bedplate, Type QT4074
(5) Power Amplifier and Mains Control, Type QT40621
(6) Electronic Counter Mk. IVB—Dowty Nucleonics Ltd.
(7) Test Cable, Type QY4008—Test Set to A401 Amplifier
(8) Test Cable, Type QY4009—Test Set to Aircraft Wiring
(9) Test Cable, Type QY4090—Mains Input Supply
(10) Test Cable, Type QY4095—Test Point Connector Cable
(11) Test Cable, Type QY4004—Intercomm. Extension Lead
(12) Shorting Unit, Type QY4006

Construction

3. The test equipment consists of six rack-mounted test units housed in a large metal cabinet which is mounted on a four wheel trailer with pneumatic tyres. The positions of the individual units are shown in Fig. 2. A large bench is provided on which the system amplifier and manuals may be accommodated during testing. Twin doors conceal and protect the units when the test equipment is not in use. A built-in cupboard at the rear of the cabinet, houses the test cables and dummy amplifier. The equipment is mounted on a tubular surround which serves as a protection and an anti-vibration mounting.

Metering system

4. The metering system comprises two units, namely, the Functional Unit, Type QT40011 and its associated Power Unit, Type QT40012. With the test equipment connected in the throttle control system, the Functional Unit is effectively in series with the amplifier of the channel under test. Operation of the

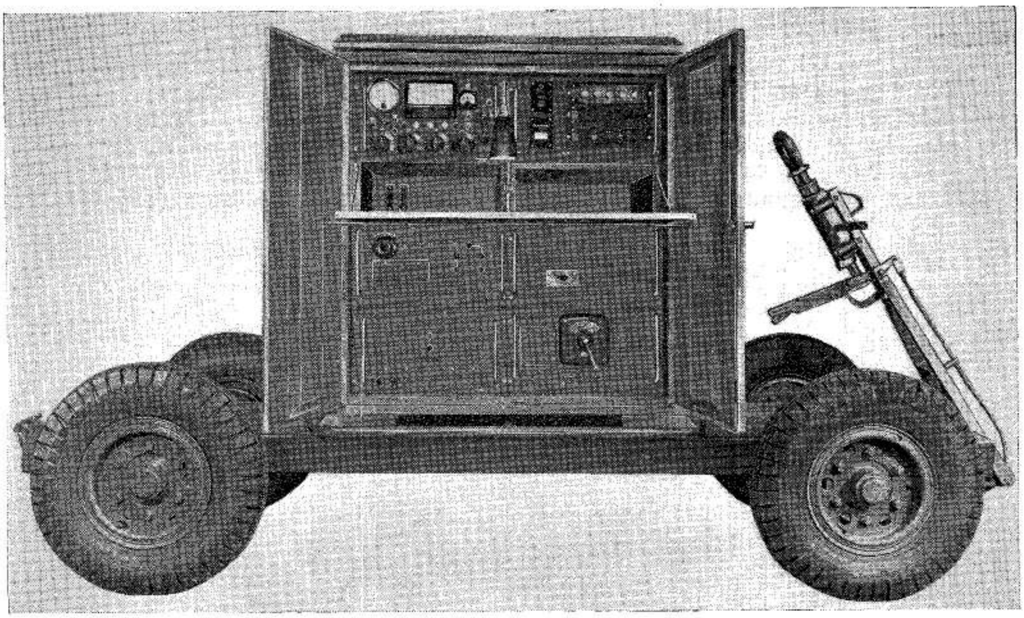

Fig. 2. Front view of equipment, showing control panels

controls, in accordance with the sequence given in Table 3, enables any of the tests summarized in paras 38 and 39 to be accomplished.

Intercommunication system

5. Two operators are normally required for functional testing of the equipment installed in an aircraft. One is situated at the test set and the other is in readiness at the pilot's control console to operate the switches and to adjust the throttle lever position as required. Communication between the two operators is provided by an intercomm. amplifier located in the Power Unit, Type QT40012. The amplifier is a hermetically sealed sub unit, and no servicing is possible. Should any fault occur, the complete unit should be renewed.

Engine speed simulator

6. The engine speed simulator is an electronically controlled system which simulates the output from the engine tacho-generator. The simulator can be varied continuously over the entire engine speed range and, when set to the required speed, will remain stable to within ± 1 r.p.m. An electronic counter displays the output in terms of engine compressor speed (C.R.P.M.).

7. The simulator is shown in schematic form in Fig. 4 and comprises the following units:—

(1) Frequency Doubler and Oscillator, Type QT4064
(2) Tachometer Bedplate, Type QT4074
(3) Power Amplifier and Mains Control, Type QT40621
(4) Electronic Counter, Dowty Nucleonics, Mk. IVB

8. The output from the low frequency oscillator is fed into the power amplifier, where the signal is amplified and used to drive the synchronous motor. The motor shaft speed is, therefore, proportional to oscillator frequency and once the motor has attained synchronous speed it will follow exactly any variation in oscillator frequency. The motor is not self starting and has to be accelerated to synchronous speed by the starter motor. The starter motor is swivelled horizontally on the bedplate and, when pulled over by the starting lever brings the friction disc in contact with the detector wheel. This movement actuates the microswitch which connects the d.c. supply to the motor.

9. The synchronous motor is mechanically coupled to the detector wheel and this in turn is coupled to the tacho-generator, from which is obtained the test output.

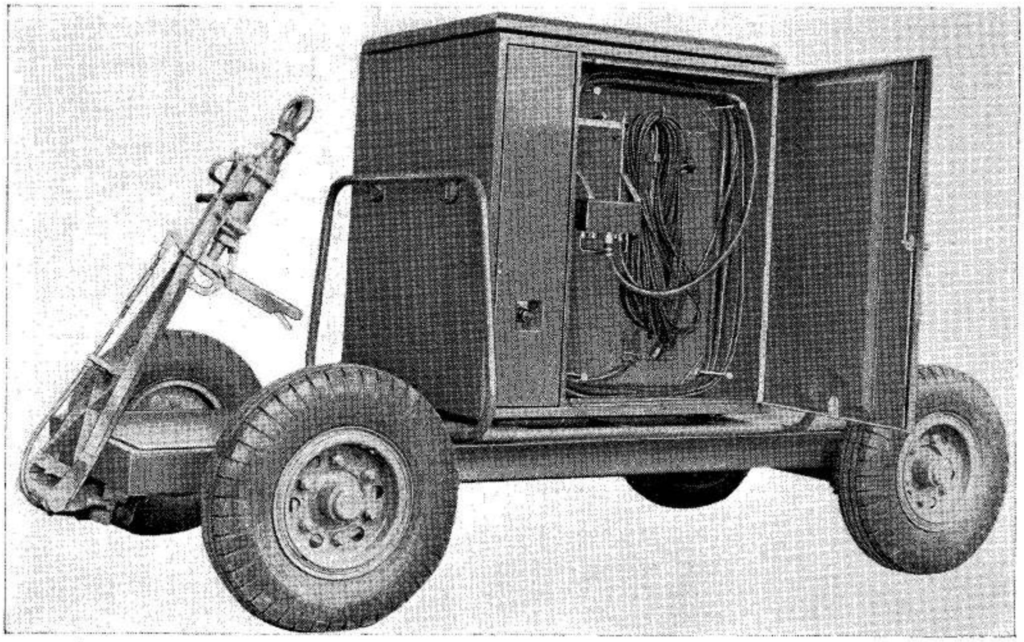

Fig. 3. Rear view of equipment, showing connecting cables

10. Also mounted on the bedplate, facing the teeth of the detector wheel is a detector probe. Pulses from this probe have a pulse frequency equal to the number of teeth passing the probe in any given time, thereby enabling an indication of the r.p.m. of the compressor to be accurately displayed on the electronic counter. However, the tacho-generator speed is one quarter of the engine compressor speed due to an engine gear ratio of 4:1 and to represent this in terms of compressor speed on the counter, the tacho shaft speed must be increased by a factor of 4. Furthermore, it is necessary to display the probe p.r.f. on a 1 second count base, i.e., a further increase by a factor of 60. The overall factor is $4 \times 60 = 240$, the number of teeth required on the detector wheel.

11. The detector wheel, due to the magnetic limitations of the probe, has only 120 teeth and this number gives exactly half the required p.r.f. The output from the probe is, therefore, passed through a voltage amplifier and frequency doubler circuit before being displayed on the counter.

*Tacho bedplate, Type QT*4074

12. The tacho bedplate is illustrated in fig. 12 and the circuit diagram is given in fig. 15. Incorporated in the unit, and mounted on the bedplate, are the detector wheel, probe, tacho-generators and starter motor. The rigid structure of the bedplate enables the necessary close tolerances to be maintained between these sub-assemblies.

13. Tacho generators G1 and G2 are of the same type as the generators used in the aircraft. G1 is, however, energized from the oscillator and is used as the frequency controlled synchronous motor.

Note . . .

Once a tacho generator has been used as a synchronous motor it must be tested to its full specification before it is fitted to an airborne channel.

14. Each generator is supported by a cast bracket, with the generator fixing holes locating on spigots on the flange of the bracket and is held in this position by a retaining screw and locknut.

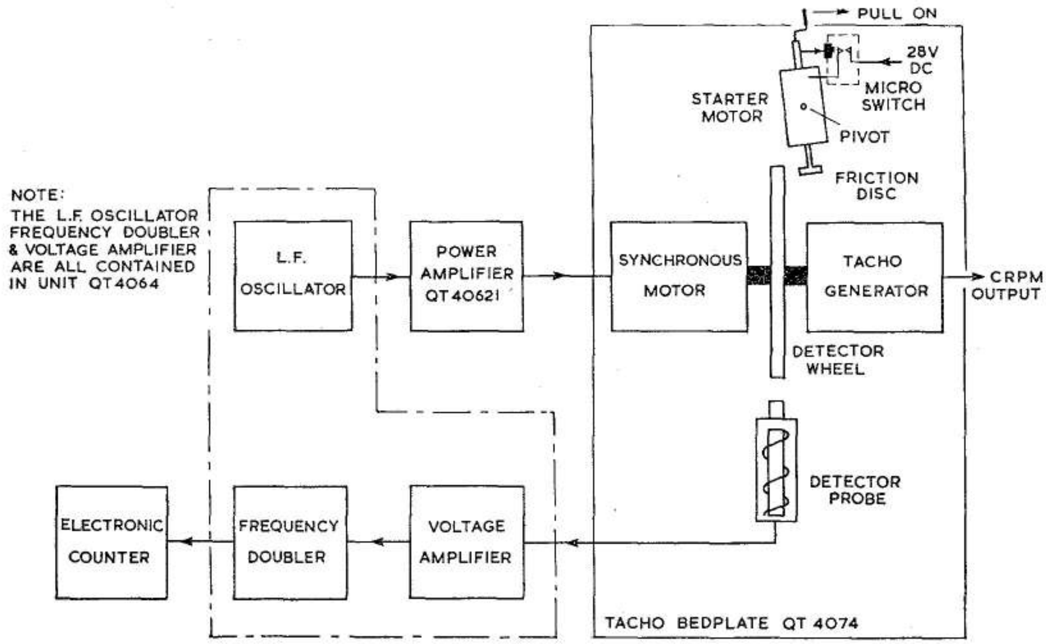

Fig. 4. Engine speed simulator—schematic

15. The detector wheel is suspended between two self aligning ball races, and is coupled either end to the shaft of the tacho-generators. Both couplings are identical and comprise two spigotted half couplings, one a drive fit on the tacho shaft and the other a drive fit on the wheel shaft, engaging in a centre leather pad. The small degree of clearance necessary between the half couplings and leather pad is provided by adjustment of the support brackets on the bedplate. The brackets are locked in position by two quick release lever bolts.

16. Starter motor M1 swivels on a phosphor bronze-brass bearing in the bedplate. Movement of the motor is restricted by two stop screws which, when adjusted to their optimum settings, restrict the wear on the friction disc. A further stop screw ensures operation of the microswitch S1 before the friction disc contacts the detector wheel.

17. The d.c. supply to the starter motor is taken from the mains transformer T1 and bridge rectifier MR1. Microswitch S1 is in the mains input lead to the transformer primary.

Power supplies

18. The equipment is completely independent of the aircraft supplies, and operates from a mains source within the ranges 100 to 120 volts and 200 to 250 volts, 50 to 60 c/s. The supply is taken via double pole switch and voltage adjustment panel, located in amplifier, Type QT40621, to an auto-transformer situated at the base of the equipment. All the units are adjusted to operate from an input of 230 volts, 50 to 60 c/s which is supplied from the 230V tapping on the auto-transformer. Neon lamps indicate when the supply is connected to the equipment and to the individual units.

CIRCUIT DESCRIPTION

Frequency doubler and oscillator, Type QT4064

19. The frequency doubler and the oscillator are both supplied from a common h.t. voltage stabilizer incorporated in the unit. The circuit diagram is given in fig. 19.

Oscillator

20. This comprises a Wien bridge circuit V10A and B and a buffer amplifier V9A and B. The frequency determining network comprises R47, RV9, C20, RV10, R48 and C21; RV9 and RV10 are ganged and provide a continuously variable frequency range of 80 to 620 c/s. Due to the non linear frequency characteristics of the Wien bridge circuit

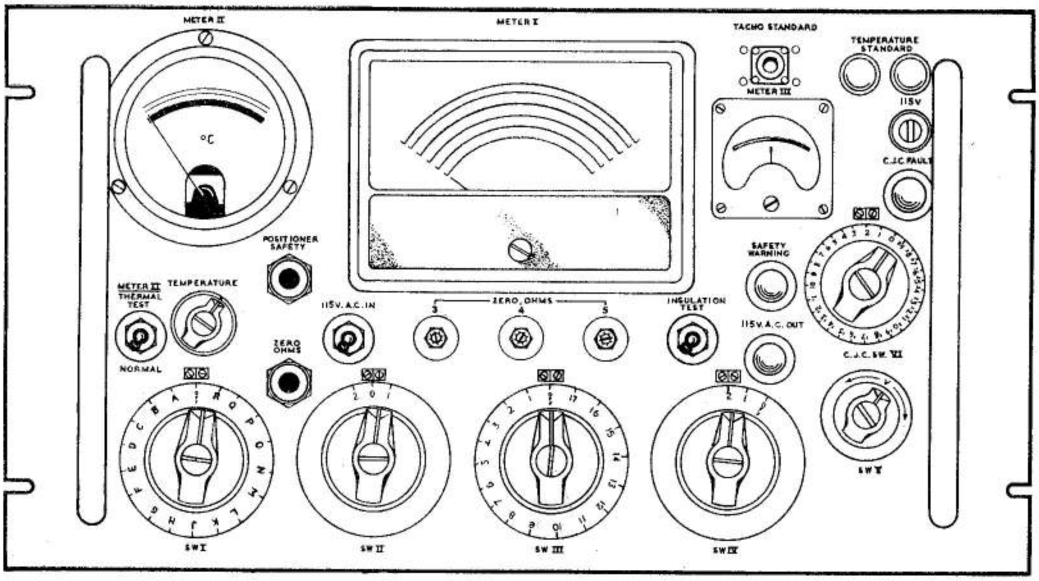

Fig. 5. Functional unit, Type QT40011—front panel

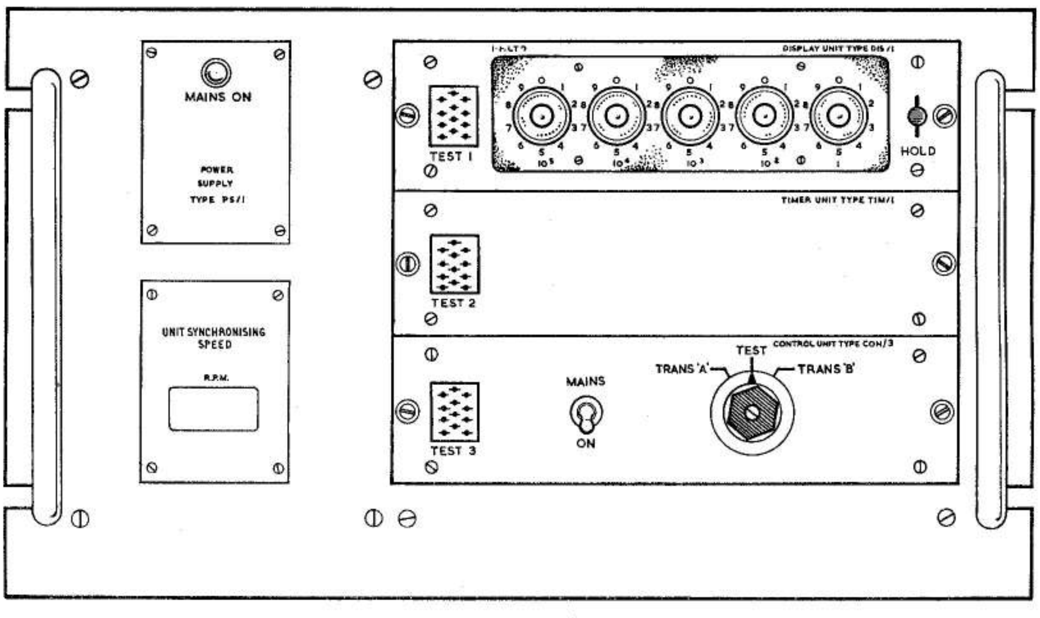

Fig. 6. Electronic Counter, Mk. IVB—front panel

when using linear control resistors, RV9 and RV10 are specially designed to enable an increase in frequency to be approximately linear with respect to potentiometer angular movement.

21. Potentiometer RV3 controls the degree of positive feedback and, in its optimum position which ensures a nearly sinusoidal output, which is taken via the buffer stage V9A and B and is developed across RV6. Buffer stage

V9A and B provide a high impedance output to avoid shift in oscillator frequency due to variation in external loads. Potentiometer RV4 provides an additional degree of amplitude control.

Frequency doubler

22. The signal from the probe is developed across RV5 and fed to the first stage of a two stage voltage amplifier V5A and B. This amplifying stage has a rising gain characteristic with respect to frequency, so that although the probe output drops off at higher frequencies the voltage output from the amplifier is near constant. This is accomplished by a degree of controlled negative feed back provided by C7, R20, C5 and R14. C5 offers a high impedance at low frequencies and a low impedance at high frequencies thereby maintaining an approximately level output for all frequencies. The output from the voltage amplifier is fed into the frequency doubling stage comprising a para-phase amplifier V6A with diodes connected in anode and cathode circuits. Negative going pulses appearing at anode and cathode are conducted through V8A and V8B respectively, and developed across R27 at twice the frequency of the input signal. Positive going pulses are conducted through V7A and V7B to chassis.

23. The final stage V6B is a limiting amplifier, and is used to suppress any secondary modulation superimposed on the probe signal due to irregularities in the detector wheel. The negative pulses of the frequency doubled signal are conducted by V6B and appear as positive signals at the anode, the peaks of which are clipped by MR1 to a level dependent upon the setting of RV3 (*fig*. 13).

Power amplifier and mains control unit, Type QT40621

Power amplifier

24. The circuit diagram is given in fig. 17. The output from the oscillator is fed via C1 to the grid of the first amplifier stage V1A. Capacitor C1 offers a high impedance at low frequencies and a low impedance at high frequencies to the input signal, thereby compensating for the variable input impedance characteristic of the synchronous motor (TACHO DRIVE). The second half of the valve V1B is used as a phase splitter, out of phase signals being taken from anode and cathode via C5 and C6 respectively to the grids of the driver stage V2A and B. This stage drives the final output stage V3 and V4 operating in class AB1 push pull. Fixed negative bias to the grid of V3 and V4 is derived from the half-wave rectifier MR1, R31, C13, RV1 and RV2. Potentiometers RV1 and RV2 enable the negative bias on each valve to be evenly matched. Negative feedback is provided by R30, R5 and R2.

Mains control

25. The circuit diagram is given in Fig. 17. The mains supply to the equipment is controlled by the fused ROTARY SWITCH S1, and is fed via the voltage adjustment panel and SKT1 to the equipment auto transformer. Neon N1 indicates when the auto transformer is energized.

Functional unit, Type QT40011

26. The circuit diagram is given in Fig. 18. METER I is a universal meter which, by operation of the four main selector switches SW.I, SW.II, SW.III and SW.IV, gives direct indication of continuity, d.c. resistance, insulation resistance (measured at 28V or 250V, the voltage used depending on the circuit under test) and voltage. The scales on the meter are printed in different colours to assist in identifying the range in use:—

(1)	0 to 100 kilohms	— Blue
(2)	0 to 100 megohms	— Green
(3)	0 to 100 ohms	Black
(4)	0 to 1 kilohm	Black
(5)	0 to 10 kilohms	Black
(6)	0 to 25 volts d.c.	— Brown
(7)	0 to 2·5 volts d.c.	Red
(8)	0 to 250 volts a.c.	— Red

27. The d.c. voltage ranges have a sensitivity of 20,000 ohms/volt, and the a.c. ranges a sensitivity of 1000 ohms/volt. Potentiometers RV3, RV4 and RV5 (ZERO OHMS) provide a zero setting adjustment for the three resistance ranges, SW8 (ZERO OHMS) short circuits the meter to facilitate these zero adjustments. Should an overload condition occur, RLH is energized and short circuits the meter to prevent damage.

28. A stabilized d.c. millivolt supply is obtained from MR8, and its associated circuit. This is the simulated temperature signal and may be varied by RV6 (TEMPERATURE) over a range 0 to 800°C indicated on METER II. No ambient compensator is applied, as the temperature signal is referred to 0 deg. C by the standard dummy C.J.C. A d.c. potentiometer may be connected to the terminals marked TEMPERATURE STANDARD if

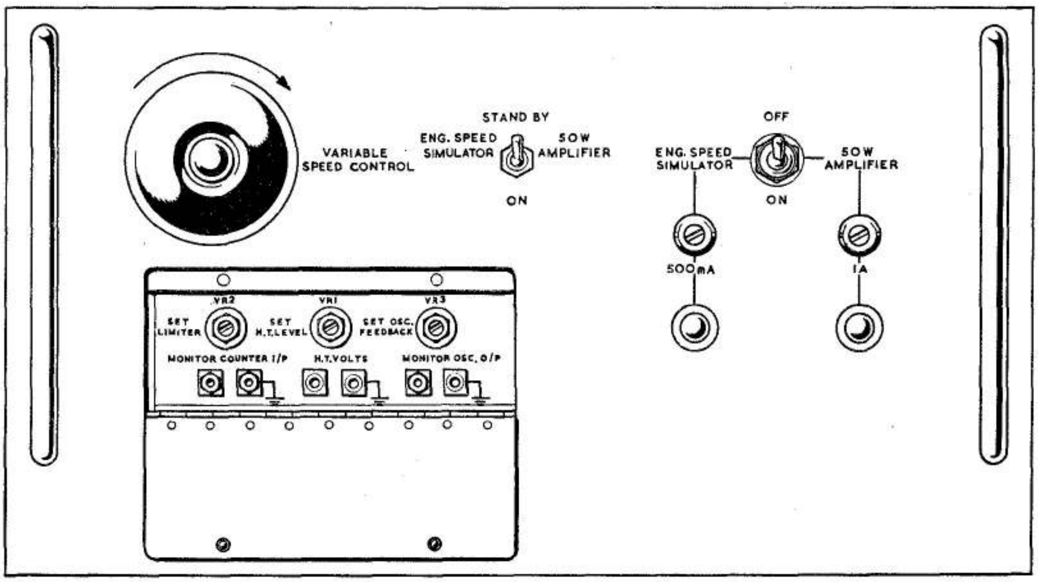

Fig. 7. Frequency doubler and oscillator unit, Type QT4064—front panel

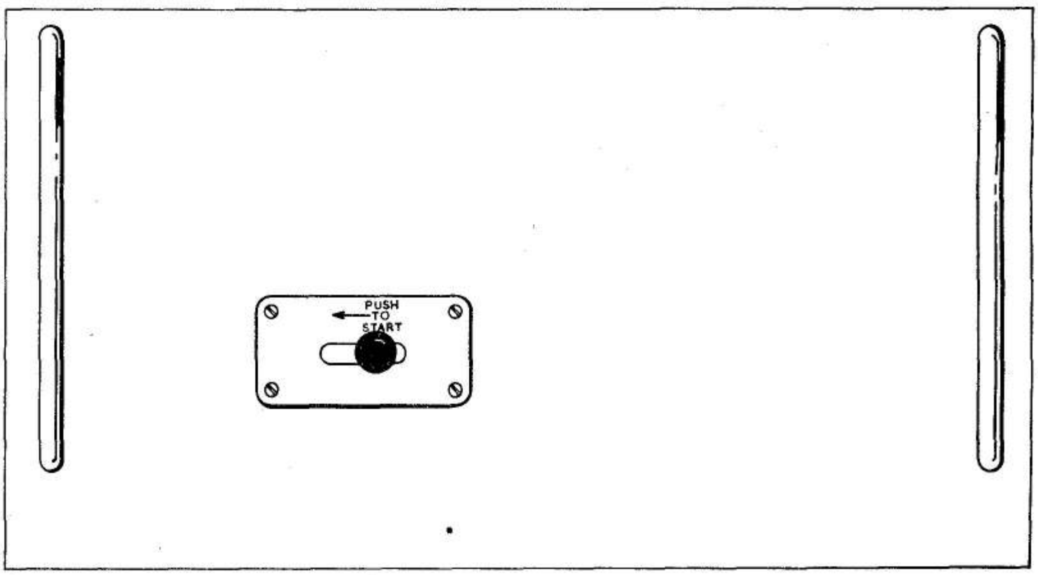

Fig. 8. Tacho bedplate unit, Type QT4074—front panel

a reading better than $\pm 2{\cdot}5$ deg. C is required, and also to calibrate the meter at datum point. With SW10 set to THERMAL position, METER II is connected across the output of the aircraft thermo-couple cluster. Relay RLB, when energized, connects a damping resistor R6 across the temperature safety relay in the amplifier, thus making it insensitive during temperature tests. Should an overload condition occur, relay RLG is energized and short circuits the METER II to prevent damage.

29. The 400 c/s supply to the amplifier on test is taken from transformer T1 via SW.V, in steps ranging from 80 to 150 volts, thereby enabling functional tests of the voltage safety system to be accomplished. The voltage safety balance can be monitored on METER I.

30. Switch SW9 (115V AC IN) when operated, breaks the 400 c/s supply to the amplifier, so that if a fault has been introduced in the installation the respective safety systems may be unlatched.

31. Switch SW.V1 open circuits or short circuits all connections to the C.J.C., thereby enabling temperature safety tests to be accomplished. SW.V1 also switches in the dummy C.J.C. for temperature datum checks. Temperature safety balance is checked on METER I.

32. The SAFETY WARNING lamp ILP2 is a duplicate of the warning lamp in the aircraft. The C.J.C. FAULT lamp ILP1 will glow when a fault is simulated on the amplifier temperature channel.

33. Switch SW7 POSITIONER SAFETY open circuits the reset telesyn circuit in the Throttle Motor, thereby enabling functional testing of the positioner safety provision. METER III governed by the discriminator R35, MR6, R38, MR7, R32 and R52, indicates the direction of the positioner signal applied to the normal throttle motor (either opening, closing or stationary) without having to run the aircraft throttle motor.

34. The TACHO STANDARD socket is incorporated to enable precise monitoring of the output voltage from the speed source tacho.

35. Relay RLA selects the signal from the engine tacho-generator or from the engine speed simulator. Relay RLD when energized, connects the test equipment to test points 9 and 10 of the amplifier, thereby enabling the Transient Temperature Datum test to be accomplished. Test points 9 and 10 are normally isolated. Relay RLE, when energized, connects the test equipment to test points 11 and 12 of the amplifier, thereby enabling the discriminator voltage to be measured. Test points 11 and 12 are normally isolated. Relay RLF, when energized, connects the test set to test points 1 and 2 of the Transmitter, thereby enabling the Governor Balance and Governor Trim Action test to be accomplished. Test points 1 and 2 are normally isolated.

Power unit, Type QT40012

36. The circuit diagram is given in Fig. 16. The power unit incorporates a conventional circuit with the outputs as given in Table 1. The intercomm. unit comprises a hermetically sealed transistor amplifier with transmit/listen sockets JK1 and JK2.

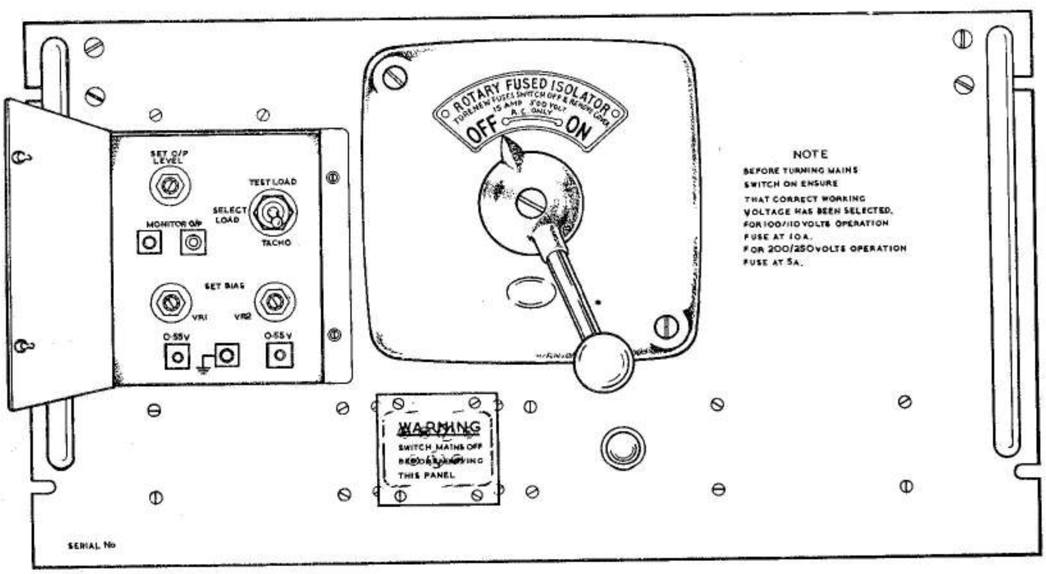

Fig. 9. Power amplifier and mains control unit, Type QT40621—front panel

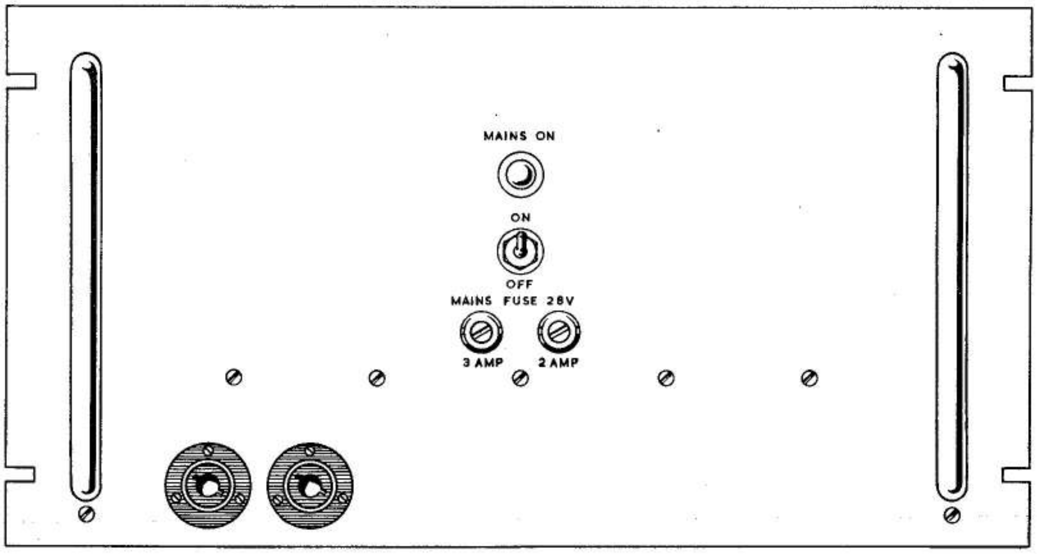

Fig. 10. Power unit, Type QT40012—front panel

TABLE 1

Power unit, Type QT40012 output voltages

Output between		Voltage
Pin A and pin F		5±10% (into 75 ohms load)
E	D	22± 2 (into 60 ohms load)
C	D	22± 2 (into 60 ohms load)
B	Chassis	250±10% (measured across C4)

TESTING FACILITIES

37. A summary is given below of the test facilities available using the QE406 test equipment and a list of equipment controls and their functions is given in table 2.

Insulation resistance and continuity tests

38. The test facilities available are:—

(1) Throttle motor
- (a) Normal motor
- (b) Feedback generator
- (c) Receive Telesyn stator
- (d) Receive Telesyn rotor

(2) C.J.C.
- (a) C.J.C. components
- (b) Thermocouples

(3) Relay unit
- (a) Bridge rectifier and relay coil

(4) Tacho generator
- (a) Stator winding

(5) Transmitter
- (a) Transmitter Telesyn rotor
- (b) Transmitter Telesyn stator
- (c) Safety relay contacts
- (d) Transmitter supply and trim

Functional checks

39. The test facilities available are:—

(1) Normal positioner control, (a stop watch is required for this test).
  (a) Normal opening rate
  (b) Normal closing rate

(2) Temperature channel
  (a) Temperature channel datum and balance
  (b) Temperature datum curve
  (c) Phase advance

(3) Safety circuits
  (a) Voltage adjustment
  (b) Positioner safety balance
  (c) Temperature safety balance

(4) Governor channel
  (a) Governor datum
  (b) Governor trim action

TABLE 2

Control functions

Control	Position	Function
	Tacho bedplate, QT4074	
PUSH TO START	Held on for approximately 5 seconds and then released.	Simulated C.R.P.M. output brought under control of the VARIABLE SPEED CONTROL in QT4064.
	Frequency doubler and oscillator, QT4064	
VARIABLE SPEED CONTROL	—	Linear speed control of the simulated C.R.P.M. The control incorporates a slow motion drive.
ENG. SPEED SIMULATOR ON/OFF	ON	Power switched to primaries of mains transformers in QT40621 and QT4064; indicated by neons glowing.
	OFF	Power off.
ENG. SPEED SIMULATOR STAND-BY/ON	ON	H.T. supplies switched on in both QT40621 and QT4064.
	STAND-BY	H.T. supplies to QT40621 and QT4064 open circuit.
	Power ampilfier and mains controls QT40621	
ROTARY FUSED ISOLATOR	ON	Auto-Transformer energized, indicated by neon glowing on amplifier panel. Power available to all units.
	Electronic counter	
Mains	ON	power supply switched to unit indicated by panel lamp.
FUNCTION SELECTOR	TRANS A	Counter indicates simulated C.R.P.M.
	TEST	Test reference to check counter alignment.
	TRANS B	direct oscillator output frequency (i.e. 1/20 C.R.P.M.)

TABLE 2—*Contd.*

Control	Position	Function
	Functional unit QT40011	
SWI	A to R	Appropriate circuit selected for investigation.
SWII	1	Amplifier isolated, remainder of installation on test.
	0	Overall system on test.
	2	Amplifier on test, remainder of installation isolated.
SWIII	1 to 17	Appropriate METER MI range selected.
SWIV	1	Basic Temperature range selected.
	2	Incremental increase of 50 deg. C. on temperature set in pos. 1.
SWV	—	400 c/s supply to Amplifier on test varied incrementally.
SWVI	1 to 29	Appropriate CJC circuit selected for investigation.
POSITIONER SAFETY	pressed	Re-set telesyn in Throttle Motor open circuited.
ZERO OHMS	pressed	METER MI short circuited.
114V AC IN	up	400 c/s to Amplifier switched off.
METER II	THERMAL TEST	METER II connected across CJC thermo-couple output.
	NORMAL	METER II connected across simulated temperature source.
INSULATION TEST	up	METER MI 100 megohms range selected.
	down	METER MI 100 kilohms range selected.
ZERO OHMS 3-4-5	—	METER MI zero adjustment.

Test procedure

40. Detailed operating instructions, together with the required test procedure and acceptable limits, are given in table 3. Before commencement of testing, the equipment is connected as follows:—

(1) Connect amplifier from channel under test to test position in equipment using Connector Type QY4008.

(2) Fit connector strip on Connector Type QY4008 to test point 3 on amplifier A401.

(3) Fit the junction box of Connector Type QY4009 into aircraft rack and connect aircraft sockets.

(4) Connect extension cable from junction box of Connector Type QY4009 to transmitter test socket.

(5) On the test equipment, set:

(a) Switch V to mid-position

(b) Switch V1 to I

(c) Set the THERMAL TEST/NORMAL switch to NORMAL and switch on c.r.p.m. signal source and counter.

Note . . .

(1) *Cable coding references to engine channel numbers are I=1, II=2, III=3, IV=4.*

(2) *The colour in METER I column in Table 3 indicates the relevant colour band on meter.*

(3) *The test equipment, Type QE406, can only be used for the tests indicated. Tests on individual components may be performed using Test Equipment QT4066.*

RESTRICTED

TABLE 3

Test procedures

INSULATION RESISTANCE TESTS with (1) AIRCRAFT SUPPLIES OFF; (2) B.A.P. 3 MASTER CONTROL SWITCH OFF

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
1	TRANSMITTER TELESYN ROTOR	B.O.2.0	2C–2D KHIa34–KHIa36	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	2
				If reading is less than	2 meg. Green	Set switch II to 1 (i.e. settings are now B:1:2:0) and proceed to next test	1A
1A				LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Renew amplifier	1
				If reading is less than	2 meg. Green	Remove plug at remote equipment end of cable and LIFT INSULATION TEST SWITCH. If reading is more than 2 meg. reject remote item. If still below 2 meg., correct fault in aircraft wiring.	1
2	TRANSMITTER SUPPLY AND TRIM	C.0.2.0.	2F–2G KHIa40–KHIa42 KHI28–KHI26	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	3
				If reading is less than	2 meg. Green	Turn switch II to 1 (C:1:2:0) and proceed as in test 1A	
3	TRANSMITTER TELESYN STATORS	G.0.2.0	2A–2D KHIa8–KHIa36	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	4
				If reading is less than	2 meg. Green	Turn switch II to 1 (G:1:2:0) and proceed as in test 1A	

RESTRICTED

TABLE 3—*Contd.*

INSULATION RESISTANCE TESTS with (1) AIRCRAFT SUPPLIES OFF; (2) B.A.P.3 MASTER CONTROL SWITCH OFF

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
4	TRANSMITTER TELESYN STATORS	H.0.2.0	2B–2D KHIa10–KHIa36	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	5
				If reading is less than	2 meg. Green	Turn switch II to 1 (H:1:2:0) and proceed as in test 1A	—

THROTTLE MOTOR

If a low insulation reading is obtained on tests 5, 6 or 7, disconnect socket No. 1 from amplifier and repeat test. If reading is now correct, proceed normally to test 13, and reconnect No. 1 socket; low insulation will probably be found on the C.J.C. circuit. If reading is still low with socket No. 1 removed, low insulation is on the motor circuit.

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
5	FEEDBACK GENERATOR	D.0.2.0.	3C–3G KHIa22–KHIa10A	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	6
				If reading is less than	2 meg. Green	Turn switch II to 1 (D:1:2:0) and proceed as in test 1A	
6	NORMAL MOTOR	E.0.2.0	3A–3B KHIa20–KHIa30	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	7
				If reading is less than	2 meg. Green	Turn switch II to 1 (E:1:2:0) and proceed as in test 1A	

TABLE 3—*Contd.*

INSULATION RESISTANCE TESTS with (1) AIRCRAFT SUPPLIES OFF; (2) B.A.P.3 MASTER CONTROL SWITCH OFF

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
7	NORMAL MOTOR	F.0.2.0	3B–3C KHIa30–KHIa22	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	8
				If reading is less than	2 meg. Green	Turn switch II to 1 (F:1:2:0) and proceed as in test 1A	—
8	MOTOR TELESYN STATOR	J.0.2.0	3E–3F KHIa8A–KHIa6A	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	9
				If reading is less than	2 meg. Green	Turn switch II to 1 (J:1:2:0) and proceed as in test 1A	
9	MOTOR TELESYN STATOR	K.0.2.0	3E–3G KHIa8A–KHIa10A	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	10
				If reading is less than	2 meg. Green	Turn switch II to 1 (K:1:2:0) and proceed as in test 1A	—
10	MOTOR TELESYN ROTOR	L.0.2.0.	3H–3J KHIa12–KHIa14	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	11
				If reading is less than	2 meg. Green	Turn switch II to 1 (L:1:2:0) and proceed as in test 1A	—

TABLE 3—*Contd.*

INSULATION RESISTANCE TESTS with (1) AIRCRAFT SUPPLIES OFF; (2) B.A.P.3 MASTER CONTROL SWITCH OFF

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
TACHOMETER GENERATOR AND DATUM SELECTOR							
11	TACHO GENERATOR DATUM SELECTOR	M.0.2.0.	3L–3M KHBIa2–KHBIbl 2.1–2.2 KHIa32–KHIa6	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	12
				If reading is less than	2 meg. Green	Turn switch II to 1 (M:1:2:0). If reading is now more than 2 meg. suspect Amplifier, Transmitter or Datum Selector. If still below 2 meg. remove tacho plug and lift insulation test switch. If reading is greater than 2 meg. reject tacho. If reading is still less than 2 meg. disconnect plug 3 at amplifier and re-test. If greater than 2 meg. the fault is in tacho generator winding. To eliminate amplifier turn switch II to 2 (M:2:2:0). If reading still below 2 meg. renew amplifier. To eliminate Transmitter and Datum Selector turn switch II to 0 (M:0:2:0) and disconnect first Transmitter plug 1. If less than 2 meg. the fault is in the Transmitter wiring. If greater than 2 meg. replace transmitter plug 1 and remove transmitter plug 2. If reading is now less than 2 meg. reject Transmitter. If greater than 2 meg. fault is either in Datum Selector or associated wiring.	1

TABLE 3—*Contd.*

INSULATION RESISTANCE TESTS with (1) AIRCRAFT SUPPLIES OFF; (2) B.A.P.3 MASTER CONTROL SWITCH OFF

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
RELAY UNIT AND MASTER RELAYS							
12	RELAY UNIT AND MASTER RELAYS	R.0.2.0.	2L–2M KHIa50–KHIa52 T2·1–T2·2	LIFT INSULATION TEST SWITCH. If reading is more than	2 meg. Green	Proceed to next test	13
				If reading is less than	2 meg. Green	Turn switch II to 1 (R:1:2:0) and Proceed as in test 1A	—
13	C.J.C. AND THERMO-COUPLES	N.0.1.0	1B–1E KHc12–KHcI18	PRESS INSULATION TEST SWITCH. If reading is more than	20K Blue	Proceed to next test	14
				If reading is less than	20K Blue	Turn switch II to 1 (N:1:1:0) and press insulation test switch. If reading is still below 20K replace Thermocouple or C.J.C. as necessary	— 13
						If reading is above 20K turn switches II and III to 2 (N:2:2:0) and lift insulation test switch. If reading is less than 2 meg. change amplifier	1

RESISTANCE TESTS OF UNITS INCLUDING AIRCRAFT WIRING with (1) AIRCRAFT SUPPLIES OFF; (2) B.A.P.3 MASTER CONTROL SWITCH OFF

Note . . .
If any reading in this Table falls outside its appropriate band, recheck calibration before proceeding

Test No.	Circuit under test	Switch settings	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
14	RESISTANCE CALIBRATION TESTS	OFF.0.3.0		Press Zero Ohms Button		If not adjust ZERO OHMS Pot No. 3. (Times 1.)	
		OFF.0.4.0		Press Zero Ohms Button		If not adjust ZERO OHMS Pot No. 4. (Times 10.)	
		OFF.0.5.0		Press Zero Ohms Button		If not adjust ZERO OHMS Pot No. 5. (Times 100.)	15

TABLE 3—*Contd.*

RESISTANCE TESTS OF UNITS INCLUDING AIRCRAFT WIRING with (1) AIRCRAFT SUPPLIES OFF; (2) B.A.P.3 MASTER CONTROL SWITCH OFF

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
15	AMP. P.U. PRIMARY	A.2.3.0	4A–4B KHIb1–KHIa4		1·25–3 Ohms	If so, proceed to next test	16
					Black	If not, change Amplifier	15
16	TRANSMITTER TELESYN ROTOR	B.1.3.0	2C–2D KHIa34–KHIa36		56–86 Ohms Black	If so, proceed to next test	17
					S.C. Black	A–If S.C. disconnect 16-way plug at Transmitter. If reading now O.C. change transmitter. If reading still S.C. correct fault in aircraft wiring.	
					O.C. Black	B–If O.C. disconnect 16-way plug at Transmitter and plug in shorting box to free socket. If reading now S.C. change Transmitter. If still O.C. correct fault in aircraft wiring.	
					Outside Band Black	C–If reading outside band, check aircraft wiring; If correct, change Transmitter.	16
17	GOVERNOR AND TRIM POTENTIOMETER	C.1.4.0	2F–2G KHIa40–KHIa42		240–325 Ohms	If so, proceed to next test	18
					Black	If not, proceed as in test 16 A.B.C.	—
18	TRANSMITTER TELESYN STATORS	G.1.4.0	2A–2D KHIa8–KHIa36		325–450 Ohms	If so, proceed to next test	19
					Black	If not, proceed as in 16 A.B.C.	—
19	TRANSMITTER TELESYN STATORS	H.1.4.0	2B–2D KHIa10–KHIa36		450–670 Ohms	If so, proceed to next test	20
					Black	If not, proceed as in 16 A.B.C.	—

RESTRICTED

TABLE 3—*Contd.*

RESISTANCE TESTS OF UNITS INCLUDING AIRCRAFT WIRING with (1) AIRCRAFT SUPPLIES OFF; (2) B.A.P.3 MASTER CONTROL SWITCH OFF

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
20	RELAY UNIT AND TRANSMITTER RELAY RL1	R.1.3.0.	2L–2M KHIa50–KHIa52		15–40 Ohms Black	If so, proceed to next test	21
					S.C. Black	If S.C., disconnect wiring at Relay Unit. If now O.C. change Relay Unit. If still S.C. disconnect Plug No. 2 at Transmitter, if now O.C. check wiring from Plug No. 2 to Relay Unit. If still S.C. disconnect Transmitter Plug No. 1. If reading now O.C. change Transmitter, if still S.C. check wiring from Transmitter Plug No. 1 to Amplifier.	
					O.C. Black	If O.C. short B & C on Relay Unit for No. 1, F & G for No. 2, K & L for No. 3, and P & Q for No. 4 channels; if reading now S.C. change Relay Unit. If still O.C. insert shorting plug at Transmitter end of cable (Plug No. 1). If now S.C. check wires T.2.1 and T.2.2. If correct change Transmitter.	
					Outside Band Black	Check wiring, if correct change Relay Unit connections to adjacent channel. If still outside band, change Transmitter.	20

TABLE 3—*Contd.*

RESISTANCE TESTS OF UNITS INCLUDING AIRCRAFT WIRING with (1) AIRCRAFT SUPPLIES OFF; (2) B.A.P.3 MASTER CONTROL SWITCH OFF

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
21	TACHO GENERATOR	M.1.3.0	3L–3M KHBIa2–KHBIb1		24–34 Ohms	If so, proceed to next test	22
					S.C.	If S.C., disconnect plug at Tacho end of cable. If reading now OC change Tacho. If reading still S.C. correct fault in aircraft wiring.	
					O.C.	If O.C., short-circuit the two sockets at the Tacho end of the cable. If reading now S.C. change Tacho, if still O.C. correct fault in aircraft wiring.	
					Outside Band	If reading is outside band, check aircraft wiring; if correct, change Tacho.	21
THROTTLE MOTOR							
22	FEEDBACK GENERATOR	D.1.3.0	3C–3D KHIa22–KHIa24	If reading higher than 80 ohms is found the high resistance may be due to poor brush contact. Select D.0.7.0. Switch on invertor and select Normal. Move throttle lever. Switch off Normal system and invertor and repeat test 22	18–80 Ohms	If so, proceed to next test	23
					S.C.	A–If S.C. disconnect socket at Motor end of Cable. If reading now O.C. reject Motor. If reading still S.C. correct aircraft wiring.	
					O.C.	B–If O.C. insert shorting plug at Motor end of cable. If reading now S.C. reject Motor. If reading still O.C. correct aircraft wiring.	
					Outside Band	C–Check wiring. If correct change Motor.	22
23	NORMAL MOTOR	E.1.3.0	3A–3B KHIa20–KHIa30		26–35* Ohms	If so, proceed to next test. If not, proceed as in 22 A.B.C.	24 —

TABLE 3—*Contd.*

RESISTANCE TESTS OF UNITS INCLUDING AIRCRAFT WIRING with (1) AIRCRAFT SUPPLIES OFF; (2) B.A.P.3 MASTER CONTROL SWITCH OFF

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
24	NORMAL MOTOR	F.1.3.0	3B–3C KHIa30–KHIa22		26–35* Ohms	If so, proceed to next test. If not, proceed as in 22 A.B.C.	25 —
25	MOTOR TELESYN STATOR	J.1.3.0	3E–3F KHIa8A–KHIa6A		43–57 Ohms	If so, proceed to next test If not, proceed as in 22 A.B.C.	26 —
26	MOTOR TELESYN STATOR	K.1.3.0	3G–3E KHIa10A–KHIa8A		43–57 Ohms	If so, proceed to next test. If not, proceed as in 22 A.B.C.	27 —
27	MOTOR TELESYN ROTOR	L.1.4.0	3H–3J KHIa12–KHIa14		400–600 Ohms	If so, proceed to next test. If not, proceed as in 22 A.B.C.	28 —
C.J.C. AND THERMOCOUPLE							
28A	C.J.C. AND THERMOCOUPLES	N.1.5.0	1B–1E KHc12–KHcI18	Switch VI to 1	1·2–2·5K ** Ohms	If so, proceed to test 28B, then 28C, then 28D. If not, check aircraft wiring. If correct change C.J.C.	— 28A
28B		N.1.4.0	1B–1C KHc12–KHcI16	Switch VI to 17	260–320 Ohms	If so, proceed to 28C, then 28D. If S.C. disconnect socket at C.J.C. end of cable. If now reading O.C. change C.J.C.; If still S.C. correct fault in aircraft wiring.	28A

*Alternatively for Mod. B132 standard, 34–43 ohms.

**These readings correct for ambient temperature of 20°C. For ambient temperature of +10°C, limits are 2·0–3·8K ohms: for +15°C. limits are 1·7–3·0K ohms: for +25°C limits are 1·1–2·2K ohms.

TABLE 3—*Contd.*

RESISTANCE TESTS OF UNITS INCLUDING AIRCRAFT WIRING with (1) AIRCRAFT SUPPLIES OFF; (2) B.A.P.3 MASTER CONTROL SWITCH OFF

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
28C		N.1.3.0	1B–1A KHc12–KHcI14	Switch VI to 25	14·5–18 Ohms	If so, proceed to test 28D. If O.C. insert shorting plug at C.J.C. end of cable. If reading now S.C. change C.J.C.; if still O.C. correct fault in aircraft wiring. If reading is outside band, check aircraft wiring; if correct change C.J.C.	28A
28D		N.1.3.0	1B–1D KHc12–KHcI10	Switch VI to 5	5–6·2 Ohms	If so, turn switch VI to 1 and proceed to next test.	29
					S.C.	If S.C., disconnect plug at C.J.C. end of cable. If reading now O.C. re-connect socket and disconnect one thermo-couple lead. If reading still S.C. change C.J.C. If not, correct Thermocouple Wiring. If reading still S.C. with socket disconnected correct aircraft wiring.	
					O.C.	If O.C. insert shorting plug at C.J.C. end of cable. If reading still O.C. correct aircraft wiring. If reading now S.C. reconnect socket and place short circuit across thermocouple connections at C.J.C. If reading now S.C. check thermocouple and wiring. If still O.C. replace C.J.C.	
					Outside Band	If outside band, check thermocouple.	28A

TABLE 3—*Contd.*

FUNCTIONAL TESTS with (1) AIRCRAFT 115V SUPPLY ON; (2) B.A.P.3 MASTER CONTROL SWITCH SET TO NORMAL

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
29	AIRCRAFT SUPPLY	A.0.9.0	4A–4B KHIb1–KHIa4		115V a.c. Red	If the inverter output voltage is exactly 115V, Meter I should read 115V with Switch V in the mid-position. If inverter voltage is not exactly 115V, adjust Switch V for 115V. Proceed to next test	30
30	NORMAL THROTTLE OPENING RATE	D.0.7.0	3C–3D KHIa22–KHIa24	Move Master Switch to OVERRIDE. Close Throttle motor with Increase – Decrease Switch. Move Throttle Lever to fully open position. Move Master Switch to Normal timing duration of reading on meter. Meter to read for 4·5 to 7 seconds.	Above 2V d.c. then decreasing Brown	If so, proceed to next test. If not, (A) Change Amplifier and revert to test 29. If still not, (B) remove lever block from Throttle Motor and revert to test 29. If still not, (C) Change Throttle Motor and revert to test 29. **Note . . .** *If there is no response from positioning system repeat tests* 16, 22, 23, 24 and 27.	31
31	NORMAL THROTTLE CLOSING RATE	D.0.7.0	3C–3D KHIa22–KHIa24	Move Throttle Lever smartly to closed position. Time for commencement of meter reading to instant when reading falls from maximum shall be less than 1·25 seconds.	Above 15Vd.c. then decreasing Brown	If so, OPEN throttle lever to two-thirds of full travel and turn Switch VI to 2 (DUMMY C.J.C.). Proceed to next test. If not, revert to test 30 A, B and C.	32

RESTRICTED

TABLE 3—*Contd.*

FUNCTIONAL TESTS with (1) AIRCRAFT 115V SUPPLY ON; (2) B.A.P.3 MASTER CONTROL SET TO NORMAL

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
TEMPERATURE CHANNEL							
32	TRANSIENT TEMPERATURE DATUM	P.0.8.2	AMPLIFIER TEST PINS 9-10	Set c.r.p.m. source to 11,000 c.r.p.m. Inject signal until Meter I reads zero. Meter II should read 556°±8°C. Increase Meter II reading by 30°C. Dummy Motor should move in a closing direction.	Zero Red	If so, proceed to next test. If not, change Amplifier and revert to test 29.	33
33	PHASE ADVANCE	P.0.8.1	AMPLIFIER TEST PINS 9-10	Set temp. to 450°C then turn Switch IV to 2. Meter II reading should increase to approx. 500°C. Note Meter I dips towards zero then partially recovers towards first reading. Dummy Motor should move in a closing direction and then return to first position.		If so, set c.r.p.m. source to approx. 4,000 and proceed to next test. If not, change Amplifier and revert to test 29.	34

TABLE 3—*Contd.*

FUNCTIONAL TESTS with (1) AIRCRAFT 115V SUPPLY ON; (2) B.A.P.3 MASTER CONTROL SET TO NORMAL

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
34	DATUM CURVE	P.0.8.2	AMPLIFIER TEST PINS 9-10	With c.r.p.m. set to 4,000±50, adjust temp. control for zero reading on Meter I. Meter II should read 556°C±20°C. Repeat test with c.r.p.m. set at values listed below. The corresponding values should be read on Meter II 6,500±50:556°±20°C 8,000±50:556°±20°C 9,000±50:556°±20°C 10,000±50:556°±8°C 12,000±50:556°±8°C		Set Switch V to I and proceed to next test. If not, change Amplifier and revert to test 29.	35
SAFETY SYSTEMS							
35	VOLTAGE ADJUSTMENT	A.0.9.0	4A–4B KHIb1–KHIa4	Adjust Switch V until meter reads . . .	115V Red	Proceed to next test.	36
36	TEMP. SAFETY BALANCE	A.0.12.0	AMPLIFIER TEST PINS 1-3	Reading should be less than . . .	0·25V d.c. Red	If so, proceed to next test If not, change Amplifier and revert to test 29.	36A
36A				Move Switch VI to position 3.		Warning light should appear. If so, return Switch VI to I and unlatch safety. If not, change Amplifier and revert to test No. 29.	37

TABLE 3—*Contd.*

FUNCTIONAL TESTS with (1) AIRCRAFT 115V SUPPLY ON; (2) B.A.P.3 MASTER CONTROL SET TO NORMAL

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
37	POSITIONER FREQUENCY SAFETY BALANCE	A.0.11.0	TRANSMITTER TEST PINS 4-5	Reading should be less than ...	0·25V d.c. Red	If so, proceed to next test. If not, change Transmitter and revert to test No. 29.	37A
37A				Press positioner safety button		Warning light ON when button pressed, and OFF when button released. Move Throttle lever to three-quarters of full travel. Wait five seconds and then proceed to next test. If not, change Transmitter and revert to test No. 29.	38

GOVERNOR CHANNEL

Switch datum selector ON. Set Pilot's Trimmer to mid position (10 clicks from fully anti-clockwise position). Select Low datum.

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
38	GOVERNOR	Q.0.10.0	TRANSMITTER TEST PINS 1-2				
38A	LOW DATUM			Inject c.r.p.m. until Meter I shows minimum dip. c.r.p.m. should be within 36 c.r.p.m. of datum selector. For appropriate governing r.p.m. refer to Engine Manuals.		If so, repeat with HIGH selected	38B

RESTRICTED

TABLE 3—*Contd.*

FUNCTIONAL TESTS with (1) AIRCRAFT 115V SUPPLY ON; (2) B.A.P.3 MASTER CONTROL SET TO NORMAL

Test No.	Circuit under test	QT40011 Switch settings I, II, III, IV	Amplifier and aircraft connections	Procedure	Meter I	Instructions for further procedure	Next Test
38B	HIGH DATUM					**Note . . .** *If it is necessary to reset a datum selector, before doing so, loosen potentiometer locking screws and turn spindles over their full travel approximately ten times.*	39
39	TRIM INDICATOR	Q.0.10.0	TRANSMITTER TEST PINS 1-2	Increase c.r.p.m. by 50. Note that Governor Trim Indicator reaches full trim.		Watch trim indicator movement over entire range, movement should be smooth. If not, a dirty trim potentiometer track is indicated. If this cannot be cleared by running trim on and off several times, change transmitter and revert to test No. 29.	39A
39A				Decrease c.r.p.m. by 100. Note that Governor Trim indicator reaches zero.			40
40	Switch off Channel and disconnect Test Equipment. Refit Amplifier Unit and reconnect aircraft plugs. Connect cable QY4095 to Amplifier Test Point and Trolly Tuchel Socket D. Alternatively a Multimeter, Type 1 may be used for the following tests. Switch Master Switch ON to check security of Amplifier plugs. Check that the aircraft Safety Warning Lamp goes out.						
41	TEMP. SAFETY BALANCES	A.0.12.0	AMPLIFIER TEST PINS 1-3	Reading should be less than . . . 0·1V d.c.	Red		

SERVICING

General

41. The procedures given in para. 42 and 43 should be performed at specified intervals. The following items are required:—

(1) Oscilloscope, Cossor 1049 or equivalent.

(2) D.C. potentiometer (accuracy 0·3% or Cambridge type).

Tacho bedplate, Type QT4074

42. (1) Free the unit connectors and remove the unit from the equipment.

(2) Free the cable connectors from the DRIVE and OUTPUT tacho-generators. Slacken the retaining screws and withdraw the generators from their spigotted mounting brackets.

(3) Carry out the electrical test on both tacho-generators in accordance with the instructions given in A.P.1275A, Vol. 1, Sect. 26.

(4) Pack the tacho-generator bearings with grease, XG–277.

(5) Replace the tacho-generators and secure the cable connectors.

(6) Ascertain that there is approximately 1/16th inch clearance between the tacho-wheel half couplings and the leather pad. To adjust them proceed as follows:—

(a) Slacken the quick-release lever and adjust the position of the tacho-generator mounting bracket on the bedplate for a 1/16th inch clearance between each half coupling and leather disc.

(b) Tighten down the quick-release lever.

(7) Pack the detector wheel shaft bearings with high melting point grease, XG–277.

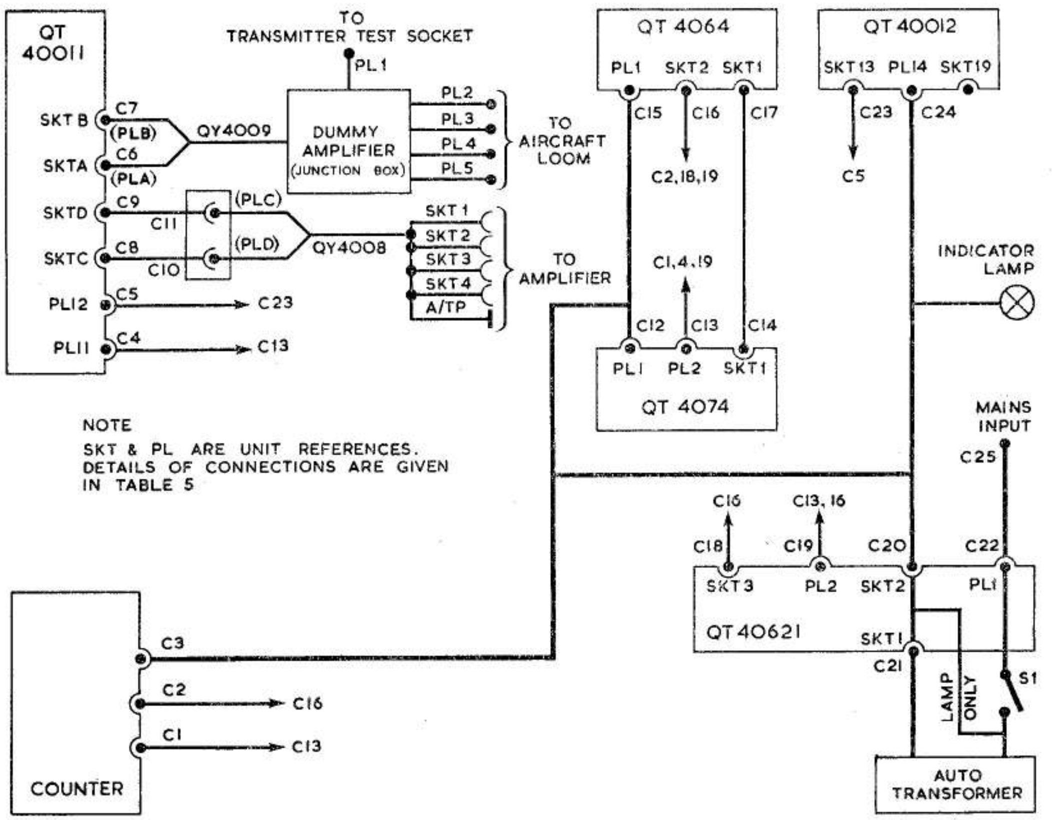

Fig. 11. Interconnection diagram

(8) Hold the friction disc firmly against the detector wheel and check the gap between stop screw B (*fig.* 12) and the starter motor arm. A gap of less than 1/16th inch indicates wear of the disc and the disc should be renewed. To renew the disc and set the stop screw B, proceed as follows:—

(a) Remove the worn friction disc and renew.

(b) Adjust the position of the starter motor in its clamp, so that the friction disc contacts the detector wheel at between 0·75 to 1·00 inch from its periphery.

(c) Hold the disc firmly against the wheel, and adjust the motor stop screws A and B to give a clearance of between 0·125 to 0·25 inch between the screw ends and the starter motor arm.

(d) Adjust the microswitch stop screw so that the microswitch is actuated when the friction disc is $0{\cdot}125+0{\cdot}06$ inch from the wheel.

(9) Lubricate the starter motor pivot, using a light machine oil.

(10) Check that there is no foreign matter between the probe and the periphery of the detector wheel. To adjust the position of the probe proceed as follows:—

(a) Slacken the probe clamp screw.

(b) Set the probe tip to within 0·00 to 0·004 inch of the wheel periphery (the exact position of the probe tip from the wheel affects the peak clipping of the waveform in the Frequency doubler).

(c) Ensure that the probe tip is horizontal to within ± 15 degrees and tighten the clamp screw.

Functional unit, Type QT40011

43. (1) Connect the d.c. potentiometer across the TEMPERATURE STANDARD test points.

(2) Set SW.IV to position 1.

(3) Rotate the TEMPERATURE control until METER II reads 500°C.

(4) Note the reading on the d.c. potentiometer which should be 500 millivolts—the equivalent of 500 ± 3 degrees Centigrade.

(5) Set the d.c. potentiometer to read the following temperature signals. The indication on METER II for each input signal should be within the specified limits.

Input Temperature Signal deg. C.	METER II *Indication deg. C.*
400	400 ± 10
535	$535\pm2{\cdot}5$
556	$556\pm2{\cdot}5$
610	$610\pm2{\cdot}5$
640	$640\pm2{\cdot}5$

TABLE 4

Test Trolley to Aircraft Units Cable Connections

Test set to A401 amplifier

Connector Type QY4008
PLC = 30-way Tuchel plug
PLD = 30-way Tuchel plug
A/TP = 12-way "T" piece and terminal block assembly

SKT1 = 5-way Plessey socket
SKT2 = 14-way Plessey socket
SKT3 = 12-way Plessey socket
SKT4 = 2-way Plessey socket

PLC/a7—SKT1/A	PLC/c3—SKT2/L	PLD/b1—SKT3/L
PLC/a8—SKT1/B	PLC/c4—5KT2/M	PLD/b2—SKT3/M
PLC/a9—SKT1/C	PLC/c5—SKT2/1	PLD/b5—SKT4/A
PLC/a0—SKT1/D	PLC/c6—SKT2/2	PLD/b6—SKT4/B
PLC/b1—SKT1/E	PLD/a1—SKT3/A	PLD/b9—A/TP/1
PLC/b3—SKT2/A	PLD/a2—SKT3/B	PLD/c1—A/TP/3
PLC/b4—SKT2/B	PLD/a3—SKT3/C	PLD/c2—A/TP/4
PLC/b5—SKT2/C	PLD/a4—SKT3/D	PLD/c3—A/TP/5
PLC/b6—SKT2/D	PLD/a5—SKT3/E	PLD/c7—A/TP/9
PLC/b7—SKT2/E	PLD/a6—SKT3/F	PLD/c8—A/TP/10
PLC/b8—SKT2/F	PLD/a7—SKT3/G	PLD/c9—A/TP/11
PLC/b9—SKT2/G	PLD/a8—SKT3/H	PLD/c0—A/TP/12
PLC/b0—SKT2/H	PLD/a9—SKT3/J	

TABLE 4—*Continued*

Test set to aircraft wiring

Connector Type QY4009

PLA = 30-way Tuchel plug
PLB = 30-way Tuchel plug
PL1 = cannon plug
PL2 = 5-way plug
PL3 = 14-way plug
PL4 = 12-way plug
PL5 = 2-way plug

PLA/a7—PL2/A	PLA/c1—PL3/H	PLB/a8—PL4/H
PLA/a8—PL2/B	PLA/c4—PL3/L	PLB/a9—PL4/J
PLA/a9—PL2/C	PLA/c5—PL3/M	PLB/a0—PL4/K
PLA/a0—PL2/D	PLA/c6—PL3/1	PLB/b1—PL4/L
PLA/b1—PL2/E	PLA/c7—PL3/2	PLB/b2—PL4/M
PLA/b4—PL3/A	PLB/a1—PL4/A	PLB/b5—PL5/A
PLA/b5—PL3/B	PLB/a2—PL4/B	PLB/b6—PL5/B
PLA/b6—PL3/C	PLB/a3—PL4/C	PLB/c2—PL1/4
PLA/b7—PL3/D	PLB/a4—PL4/D	PLB/c3—PL1/5
PLA/b8—PL3/E	PLB/a5—PL4/E	PLB/c4—PL1/1
PLA/b9—PL3/F	PLB/a6—PL4/F	PLB/c5—PL1/2
PLA/b0—PL3/G	PLB/a7—PL4/G	

Test point connector cable

Connector Type QY4095

PLD = 30-way Tuchel plug
A/TP = 12-way "T" piece and terminal block assembly.
PL1 = 6-way cannon plug

PLD/b3—PL1/1	PLD/b9—A/TP/1	PLD/c7—A/TP/9
PLD/b4—PL1/2	PLD/c1—A/TP/3	PLD/c8—A/TP/10
PLD/b7—PL1/5	PLD/c2—A/TP/4	PLD/c9—A/TP/11
PLD/b8—PL1/4	PLD/c3—A/TP/5	PLD/c0—A/TP/12

Intercomm extension lead

Connector Type QY4004
PL1=Speaking set plug. Phoenix
SKT1=Speaking set socket. Phoenix
CABLE. 35 feet. 3 core

Shorting unit

Connector Type QY4006
PL1 = 5-way Plessey plug
PL2 = 16-way Cannon plug
PL3 = 9-way Plessey plug
PL1: A to E connected together
PL2: 1 to 16 connected together
PL3: 1 to 9 connected together

TABLE 5

Internal Inter-Unit Cable Connections

The table below gives the inter-unit cable connections and should be used with reference to the inter-unit diagram Figure 11.

Conn-Pin to Conn-Pin		Conn-Pin to Conn-Pin		Conn-Pin to Conn-Pin	
C1—F	C13—E	C13—F	{C19—B {C 1—D	C20—D	C12—B
C1—D	C13—F			C20—E	Lamp
C2—F	C16—G	C14—A	C17 {INNER	C20—G	C3—N
C2—D	C16—H	C14—B	{OUTER	C20—H	C24—N
C3—L	C20—A	C15—A	C20—J	C20—J	C15—A
C3—N	C20—G	C15—B	C20—C	C20—K	C12—A
C4—A	C13—A	C16—A	C19—E	C20—L	Lamp
C4—B	C13—B	C16—B	C19—F	C21—A and B	Auto Trans + 10
C5—A	C23—A	C16—C	C18—D	C21—C and D	Auto Trans + 5
C5—B	C23—B	C16—G	C2—F	C21—E and F	Auto Trans — 0
C5—C	C23—C	C16—H	C2—D	C21—G and H	Auto Trans 110
C5—D	C23—D	C16—J	C18—B	C21—J	Auto Trans 200
C5—E	C23—E	C16—K	C18—A	C21—K	Auto Trans 220
C5—F	C23—F			C21—L	Auto Trans 240
		C17 {INNER	C14—A	C22—A	C25—L
		C17 {OUTER	C14—B	C22—B	C25—N
		C18—A	C16—K	C23—A	C5—A
		C18—B	C16—J	C23—B	C5—B
		C18—D	C16—C	C23—C	C5—C
		C19—A	C13—E	C23—D	C5—D
C12—A	C20—K	C19—B	C13—F	C23—E	C5—E
C12—B	C20—D	C19—E	C16—A	C23—F	C5—F
C13—A	C4—A	C19—F	C16—B	C24—L	C20—B
C13—B	C4—B	C20—A	C3—L	C24—N	C20—H
C13—E	{C19—A {C 1—F	C20—B	C24—L	C25—L	C22—A
		C20—C	C15—B	C25—N	C22—B

Additional servicing

44. At periods when a greater depth of servicing is called for, and also when the test equipment is suspect, the following procedures are given, which comprise:—

(1) Meter check and calibration

(2) Functional testing of the equipment, using the bench test set, Type QT4066.

(3) Fault finding

Test equipment required

45. (1) Multimeter, Type 1 or equivalent.

(2) Oscilloscope, Cossor 1049 or equivalent.

(3) Resistor 75 ohms ±10%, 1 watt rating.

(4) Resistor 60 ohms ±10%, 10 watts rating.

(5) Resistor 40 kilohms ±1%, 1·0 watt rating.

(6) Resistor 2·5 megohms ±1%, 1·0 watt rating.

(7) Resistor 20 ohms ±1%, 1·0 watt rating.

(8) Resistor 100 ohms ±1%, 1·0 watt rating.

(9) Resistor 200 ohms ±1%, 1·0 watt rating.

(10) Resistor 2 kilohms ±1%, 1·0 watt rating.

(11) Resistor 3·2 ohms ±1%, 1·0 watt rating.

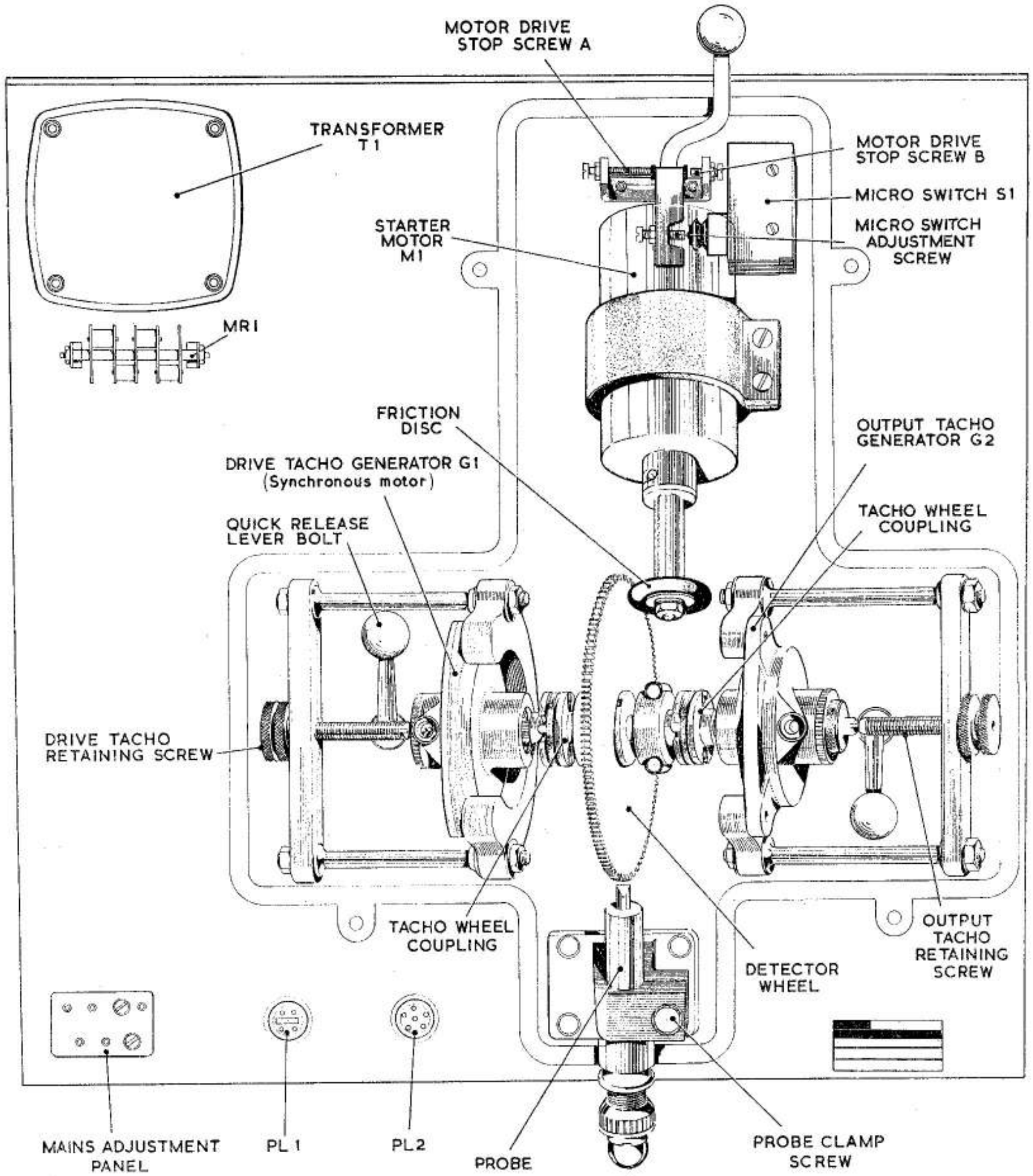

Fig. 12. Tacho bedplate, Type QT4074—interior

(12) D.C. Potentiometer (accuracy 0·3% or Cambridge type).

(13) Equipment Bench Test Set, Type QT4066.

(14) Interconnecting Harness of Test Set Type QT4066.

(15) Stop watch with three seconds sweep.

(16) Two low impedance head sets.

(17) Wheatstone Bridge, range 3·2 ohms to 2 kilohms. (3 decade boxes, battery and meter).

Voltage supplies required

46. (1) Power supply 200 to 250 volts, 50 c/s, a.c., single phase.

(2) An a.c. supply continuously variable between 0 and 10 volts, 400 c/s, capable of supplying a current of 100 milliamps.

(3) A d.c. supply continuously variable between 0 and 25 volts, capable of supplying a current of 100 milliamps.

(4) A d.c. supply continuously variable between 0 and 2·5 volts capable of supplying a current of 100 milliamps.

(5) An a.c. supply of 115 volts, 400 c/s, capable of supplying a current of 1 amp.

Meter check and calibration

Setting-up equipment

47. (1) Free the unit connectors and remove the Functional Unit QT40011 and Power Unit QT40012 from the equipment.

(2) Set the QT40012 voltage adjustment plug to the tapping nearest that of the local mains supply and connect the supply to the unit.

(3) Set the MAINS switch to ON and test the following output voltages of QT40012 using the multimeter:—

Between	*Voltage V*
(SKT13) pin A and F	5±0·5 (into 75 ohms load)
pin E and D	22± 2 (into 60 ohms load)
pin C and D	22± 2 (into 60 ohms load)
pin B and Chassis	250±25 (measured across C5)

(4) Set MAINS switch to OFF on QT40012.

(5) Connect up the two units, referring to Fig. 11 and Table 5.

(6) Set the MAINS switch to ON, and allow approximately 15 minutes for the QT40012 to warm up before proceeding with the meter calibration.

METER I *Blue range* 0–100 *kilohms*

48. (1) Set the following switches to the positions shown:—

Switch	*Position*
SW.I	B
SW.II	0
SW.III	1
SW.IV	OFF

(2) Connect the 40 kilohm resistor between SKTC pin b5 and chassis.

(3) Depress the INSULATION TEST switch and adjust RV1 for METER I centre scale deflection ±3%. If these limits cannot be met, proceed as follows:—

(a) Set RV1 to its mid-position.
(b) Replace R18 by the decade box set to 510 ohms.
(c) Adjust the final setting of the decade box to give a METER I centre scale deflection ±3% together with a correct indication when the zero ohms switch is operated.
(d) Replace the decade box by a resistor of the same value.
(e) Recheck METER I for centre scale deflection ±3%.

(4) Disconnect the 40 kilohms resistor and connect a shorting link between SKTC pin b5 and chassis.

(5) Lift the INSULATION TEST switch and ascertain that METER I indicates zero ohms.

(6) Remove the shorting link.

METER I *Green range* 0–100 *megohms*

49. (1) Set SW.III to 2.

(2) Connect the 2·5 megohms resistor between SKTC pin b5 and chassis.

(3) Lift the INSULATION TEST switch, and adjust RV7 until METER I indicates 2·5 megohms ±3%. If these limits cannot be met proceed as follows:—

(a) Set RV7 to its mid-position.
(b) Replace R25 by the decade box set to 3·3 kilohms.
(c) Adjust the final setting of the decade box until METER I indicates 2·5 megohms ±3%, together with correct indication when the zero ohms switch is operated.
(d) Replace the decade box by a resistor of the same value.
(e) Recheck that METER I indication is 2·5 megohms ±3%.

(4) Remove the 2·5 megohms resistor and connect a shorting link between SKTC pin b5 and chassis.

(5) Lift the INSULATION TEST switch and ascertain that METER I indicates zero ohms.

(6) Remove the shorting link.

METER I *Black range* 0–100 *ohms*

50. (1) Switch SW.III to 3.

(2) Connect the 20 ohms resistor between SKTC pin b5 and SKTC pin b6.

(3) Depress the ZERO OHMS switch and adjust RV3 to give a zero ohms indication on METER I.

(4) Release the ZERO OHMS switch, METER I should indicate 20 ohms ±5%. If these limits cannot be met proceed as follows:—

(a) Set RV3 to its mid-position.

(b) Replace R30 by the decade box set to 2·7 ohms.

(c) Adjust the final setting of the decade box until METER I indicates 20 ohms ±5% together with correct zero indication when the zero ohms switch is operated.

(d) Replace the decade box by a resistor of the same value.

(e) Recheck that METER I indicates 20 ohms ±5%.

(5) Disconnect the 20 ohms resistor and connect a shorting link between pins b5 and b6 of SKTC.

(6) Lift the INSULATION TEST switch and ascertain that METER I indicates zero ohms.

(7) Remove the shorting link.

METER I *Black range* 0–1000 *ohms*

51. (1) Set SW.III to 4.

(2) Connect a 200 ohms resistor between SKTC pin b5 and SKTC pin b6.

(3) Depress the ZERO OHMS switch and adjust RV4 to give a zero ohms indication on METER I.

(4) Release the ZERO OHMS switch. METER I should indicate 200 ohms ±5%. If these limits cannot be met, proceed as follows:—

(a) Set RV4 to its mid-position.

(b) Replace R28 by the decade box set to 100 ohms.

(c) Adjust the final setting of the decade box until METER I indicates 200 ohms ±5% together with the correct zero indication when the zero ohms switch is operated.

(d) Replace the decade box by a resistor of the same value.

(e) Recheck that METER I indicates 200 ohms ±5%.

(5) Disconnect the 200 ohms resistor and connect a shorting link between pins b5 and b6 of SKTC.

(6) Lift the INSULATION TEST switch and ascertain that METER I indicates zero ohms.

(7) Remove the shorting link.

METER I *Black range* 0–10,000 *ohms*

52. (1) Set SW.III to 5.

(2) Connect a 2,000 ohms resistor between SKTC pin b5 and SKTC pin b6.

(3) Depress the ZERO OHMS switch and adjust RV5 to give a zero ohms indication on METER I.

(4) Release the ZERO OHMS switch, METER I should indicate 2,000 ohms ±5%. If these limits cannot be met, proceed as follows:—

(a) Set RV5 to its mid-position.

(b) Replace R26 by the decade box set to 300 ohms.

(c) Adjust the final setting of the decade box until METER I indicates 2,000±5% together with the correct zero indication when the zero ohms switch is operated.

(d) Replace the decade box by a resistor of the same value.

(e) Recheck that METER I indicates 2,000 ohms ±5%.

(5) Disconnect the 2,000 ohms resistor and connect a shorting link between pins b5 and b6 of SKTC.

(6) Lift the INSULATION TEST switch and ascertain that METER I indicates zero ohms.

(7) Remove the shorting link.

0–10*V a.c. Governor balance, null indicator*

53. (1) Set SWI to Q and SWIII to 10.

(2) Connect the 0 to 10 volts a.c. supply between SKTB pin c4 and SKTB pin c5.

(3) Vary the supply from 0 to 10 volts smoothly, observing that the change in potential is indicated on METER I.

(4) Disconnect the 0 to 10V supply.

0–25*V d.c.—Brown range*

54. (1) Set SWI to D and SWIII to 7.

(2) Connect the 0–25V d.c. supply

between SKTB pin a3 and SKTB pin a4, positive connection to a4.

(3) Connect the multimeter, set to its 25V range, between SKTB pin a3 and SKTB pin a4.

(4) Adjust the d.c. supply until the multimeter indicates 15V, ascertain that METER I indication is within ±5% of the multimeter indication. If this limit cannot be met, proceed as follows:—

(a) Replace R15 by the decade box set to 1·8 kilohms.

(b) Adjust the final setting of the decade box until METER I indication is within ±5% of the multimeter indication.

(c) Replace the decade box by a resistor of the same value.

(d) Recheck that METER I indication is within ±5% of the multimeter indication.

(5) Vary the supply from 0 to 25V smoothly, observing that the change in potential is indicated on METER I.

(6) Disconnect the 0–25V d.c. supply and the multimeter.

0–2·5V d.c.—Red range

55. (1) Set SWI to A and SWIII to 12.

(2) Connect the 0 to 2·5V d.c. supply between SKTD pin b9 and SKTD pin c1, positive connection to b9.

(3) Connect the multimeter, set to its 2·5V range, between SKTD pin b9 and SKTD pin c1.

(4) Adjust the d.c. supply until the multimeter indicates 200 millivolts. Ascertain that METER I indication is within ±3% of the multimeter indication. If these limits cannot be met proceed as follows:—

(a) Replace R50 by the decade box set to 470 ohms.

(b) Adjust the final setting of the decade box until METER I indication is within ±3% of the multimeter indication.

(c) Replace the decade box by a resistor of the same value.

(d) Recheck that METER I indication is within ±3% of the multimeter.

(5) Vary the supply from 0 to 2·5V smoothly, observing that the change in potential is indicated on METER I.

(6) Set SW.III to 13.

(7) Disconnect the 2·5V d.c. supply and connect it, together with the multimeter, between SKTD pin c2 and SKTD pin c3, positive connection to pin c3.

(8) Repeat sub-para. (4) and (5). If the limits cannot be met proceed as given in sub-para. (4) but read R12 for R50.

(9) Set SWIII to 11.

(10) Disconnect the 2·5V d.c. supply and connect it, together with the multimeter, between SKTB pin c2 and SKTB pin c3, positive connection to c2.

(11) Adjust the d.c. supply until the multimeter indicates 150 millivolts; ascertain that the METER I indication is within ±3% of the multimeter indication. If the limits cannot be met proceed as given in sub-para. (4) but read R10 for R50.

(12) Disconnect the multimeter and the 2·5V d.c. supply.

(13) Set SW.I to P and SW.III to 8.

(14) Connect the 2·5V d.c. supply between SKTD pin c7 and SKTD pin c8, positive connection to pin c7.

(15) Vary the supply from 0 to 2·5 volts smoothly, observing that the change in potential is indicated on METER I. If the meter does not indicate the change, check the value of resistor R8 (43 kilohm).

(15) Disconnect the 2·5V d.c. supply.

0–250V a.c. Red range

56. (1) Set the following switches to the positions shown:—

SW.I	to	A
SW.III	to	9
SW.V	to	mid-position

(2) Connect the 100 ohms resistor, the multimeter and the 115V, 400 c/s supply between SKTD pin b5 and SKTD pin b6; pin b6 should be earthed.

(3) Ascertain that the METER I indication is within ±3% of the multimeter indication. If these limits cannot be met proceed as follows:—

(a) Replace R17 by the decade box set to 100 kilohms.

(b) Adjust the final setting of the decade box until the METER I indication is within ±3% of the multimeter indication.

(c) Replace the decade box by a resistor of the same value.

(d) Recheck that METER I indication is within ±3% of the multimeter indication.

(4) Set SW.V fully anti-clockwise; the indication on METER I should be 85±5 volts.

(5) Rotate SW.V fully clockwise and ascertain that, for each position of the switch, METER I indicates an increase in voltage. With the switch fully clockwise the meter indication should be 150±5 volts.

(6) Disconnect the 115V supply, the 100 ohms resistor and the earth connection.

Temperature source of control

57. (1) Set the following switches to the positions shown:—

SW.I	to	OFF
SW.II	to	0
SW.III	to	OFF
SW.IV	to	OFF
SW.VI	to	2
SW.10	to	METER II NORMAL

(2) Ascertain that METER II indicates zero.

(3) Set SW.IV to 1 and the TEMPERATURE control fully clockwise; METER II should indicate a temperature signal.

(4) Set RV8 to a position where further adjustment has no effect on the METER II indication.

(5) Connect the d.c. potentiometer across the TEMPERATURE STANDARD test points. Adjust the TEMPERATURE control until the voltage across the test points is equivalent to 550 deg. C. (reference Thermocouple Tables, Chromel Alumel, Chap. 4).

(6) Adjust RV2 until the METER II indicates 550 deg. C.

(7) Set SW.IV to 2 and the TEMPERATURE control fully clockwise; METER II indication should be greater than 750 deg. C.

(8) Set SW.IV to 1, and adjust the TEMPERATURE control to give an indication 400 deg. C. on METER II.

(9) Set SW.IV to 2; the indication on METER II should be not less than 450 deg. C.

(10) Set the d.c. potentiometer to read the following temperature signals. The indication on METER II for each input signal should be within the limits specified.

Input Temperature Signal deg. C.	*METER II Indication deg. C.*
400	400±10
535	535±2·5
556	556±2·5
610	610±2·5
640	640±2·5

Dummy C.J.C.

58. (1) Set SW.VI to 2.

(2) Using a suitable Wheatstone bridge ascertain that the resistance between each pair of pins is as follows:—

SKTC pin a9—SKTC pin b1, 2 kilohms ±5%

SKTC pin a9—SKTC pin a7, 263 ohms ±5%

SKTC pin a7—SKTC pin a0, 10 ohms ±5%

SKTC pin a0—SKTC pin a8, 3·2 ohms ±5%

If these limits cannot be met, check the values of R1, R2 and R3.

Dummy throttle motor

59. (1) Set SW.I to E.

(2) Using the multimeter, ascertain that the resistance between each pair of pins is as follows:—

SKTD pin a1—SKTD pin a2, 22 ohms ±20%

SKTD pin a1—SKTD pin a3, 10 ohms ±20%

Disconnect the mains supply from the units and remove the inter unit connections. Set the voltage adjustment plug in QT40012 to the 230V tapping. Replace both units into the equipment and refit all connectors.

Functional tests

60. The following procedure is used to test the QE406, using the bench test equipment QT4066.

Setting-up equipment

61. (1) Disconnect the Amplifier from the bench test equipment and replace it by test cable QY4009.

(2) Connect the Amplifier to the test equipment with cable QY4008.

(3) Connect the 3·2 ohms resistor across the THERMOCOUPLE terminals of the C.J.C. Unit.

(4) Set the following switches to the positions shown:—

(5) Connect the mains supply and set the ROTARY FUSED ISOLATOR switch to ON.

(6) Rotate the shaft of the Transmitter and check for the resultant throttle motor movement.

Insulation checks

62. (1) Set SW.III to 2.

(2) With the switches set to the required positions check the meter indications given in table 6.

Switch	*Position*
Mains (located on counter)	ON
FUNCTION SELECTOR	TEST
STAND-BY/ON	STAND-BY
OFF/ON (located on QT4064)	ON
OFF/ON (located on QT40012)	ON
SW.I	A
SW.II	0
SW.III	OFF
SW.IV	OFF
SW.V	mid-position
SW.VI	1
METER II	NORMAL

TABLE 6

Insulation checks

Switches		Meter I	
SW.I	Insulation test	Reading	Range
A	LIFT	Greater than 2M ohms	GREEN
B	,,	,, ,, ,,	,,
C	,,	,, ,, ,,	,,
D	,,	,, ,, ,,	,,
E	,,	,, ,, ,,	,,
F	,,	,, ,, ,,	,,
G	,,	,, ,, ,,	,,
H	,,	,, ,, ,,	,,
J	,,	,, ,, ,,	,,
K	,,	,, ,, ,,	,,
L	,,	,, ,, ,,	,,
M	,,	,, ,, ,,	,,
N	,,	,, ,, ,,	,,
P	PRESS	,, ,, 20K ohms	BLUE

Resistance checks

63. (1) Set SW.I to O.

(2) Establish the ohmmeter zero as follows:—

Switch SW.III	*Adjust for zero*
3	ZERO OHMS 3
4	ZERO OHMS 4
5	ZERO OHMS 5

(3) With the switches set to the required positions check the meter indications as given in table 7.

TABLE 7

Resistance checks

SWI	SWII	SWIII	SWIV	SWVI	METER I READING ohms	METER I RANGE ohms
A	2	3	OFF	1	2±0·5	100
B	1	3	OFF	1	66±16	100
C	1	4	OFF	1	260±69	1K
D	1	3	OFF	1	20 to 100*	100
E	1	3	OFF	1	26 to 35**	100
F	1	3	OFF	1	26 to 35**	100
G	1	4	OFF	1	360±90	1K
H	1	4	OFF	1	540±130	1K
J	1	3	OFF	1	50±12	100
K	1	3	OFF	1	50±12	100
L	1	4	OFF	1	480±120	1K
M	1	3	OFF	1	27±7	100
N	1	5	OFF	1	2000±300	10K
N	1	4	OFF	17	290±30	1K
N	1	3	OFF	25	14·5±2	100
N	1	3	OFF	5	6±0·7	100
R	1	3	OFF	1	27±7	100

* This reading is dependent on brush contact. If the reading is found to be greater than 100 ohms the transmitter shaft should be rotated, D.O.7.O selected, the 115V supply switched on and the test repeated.

** Alternatively for Mod. B132 standard 34-43 ohms.

115V supply

64. (1) Set the following switches to the positions shown:—

Switch	*Position*
SW.I	A
SW.II	O
SW.III	9
SW.IV	OFF
SW.VI	1

(2) Rotate the shaft of the Transmitter and ascertain that there is a corresponding movement of the throttle motor.

(3) Ascertain that the supply voltage is 115±1V.

(4) Adjust SW.V until METER I indicates the same value as the supply voltage.
LIMITS: SW.V should be within ±3 divisions of mid-position.

Normal system opening and closing rate

65. (1) Set SW.I to D and SW.III to 7.

(2) Rotate the shaft of the Transmitter from fully closed to the fully open position in less than 1 second.

LIMITS: METER I indication should rise to above 2V (Brown Scale) and then fall to zero. The duration of the indication should be 4·5 to 7 seconds.

(3) Rotate the shaft of the Transmitter fully open to the fully closed position in less than 1 second.

LIMITS: METER I indication should rise to above 15V (Brown Scale) and then fall to zero. The duration of indication should be less than 1·25 seconds.

Transient temperature datum

66. (1) Set the following switches to the positions shown:—

Switch	*Position*
SW.I	P
SW.III	8
SW.IV	2
SW.VI	2

(2) Adjust the TEMPERATURE control until METER I indicates zero (Red Scale).

LIMITS: METER II should indicate 556 $\pm$5 deg. C.

Phase advance

67. (1) Set SW.IV to 1.

(2) Adjust the TEMPERATURE control until METER II indicates 400 deg. C.

(3) Set SW.IV to 2:—

METER I pointer should dip towards zero and then rise to its original position.

METER III pointer should move in the CLOSE direction and then return to its original position.

Datum curve

68. (1) Set the STAND-BY/ON switch to ON.

(2) Set the FUNCTION SELECTOR switch to TRANS. A.

(3) Adjust the VARIABLE SPEED CONTROL until the counter indicates synchronizing speed.

(4) Operate the PRESS TO START control and ascertain that when the control is released the system is synchronized.

(5) Set the VARIABLE SPEED CONTROL to the speeds listed in table 3, test 34, and establish the temperature datum by adjusting the TEMPERATURE control for zero indication at each speed setting and noting that METER II indication is within the limits specified.

Temperature safety balance

69. (1) Set the following switches to the positions shown:—

SW.I to A
SW.III to 12
SW.VI to 1

If the SAFETY WARNING lamp glows, it should be extinguished by lifting the 115V, A.C. IN switch for a few seconds and then releasing. METER I should indicate less than 0·2V d.c.

(2) Set SW.VI to 3. The SAFETY WARNING lamp should glow.

(3) Set SW.VI to I, lift the 115V A.C. IN switch and then release to extinguish the SAFETY WARNING light.

Positioner frequency safety

70. (1) Set SW.III to 11, METER I should indicate less than 0·25 volts d.c. (Red Scale).

(2) Press and hold the POSITIONER SAFETY button; the SAFETY WARNING lamp should glow and METER I should indicate not less than 0·4V d.c. (Red Scale).

(3) Release the POSITIONER SAFETY button; the SAFETY WARNING light should be extinguished.

Governor balance and trim polarity

71. (1) Set SW.I to Q and SW.III to 10.

(2) Set STAND-BY/ON switch to STAND-BY. METER I should indicate within the green sector (governor range).

(3) Set the STAND-BY/ON switch to ON.

(4) Adjust the VARIABLE SPEED CONTROL until the counter indicates synchronizing speed.

(5) Operate the PUSH-TO-START control and ascertain that when the control is released the system is synchronized.

(6) Rotate the VARIABLE SPEED CONTROL for increased r.p.m. until METER I pointer dips—null position. Note the counter indication.

(7) Rotate the VARIABLE SPEED CONTROL for a further increase of 100 r.p.m. The test rig display unit should indicate a trim signal and METER III should indicate in the CLOSE sector.

(8) Rotate the VARIABLE SPEED CONTROL to decrease the r.p.m. by 200. The test rig display unit should return to zero and the METER III pointer to its original indication.

Governor datum

72. (1) Disconnect test cable QY4009 from the test equipment loom.

(2) Disconnect test cable QY4008 from the Amplifier.

(3) Connect the Amplifier into the test equipment loom.

(4) Connect the multimeter, set to its 2·5V a.c. range, across the Transmitter Unit test points 1 and 2.

(5) Adjust the test rig r.p.m. signal until the multimeter pointer dips—null position. Note the counter indication.

LIMITS: The r.p.m. indication should not differ from the setting noted in para. 71 (6) by more than ± 20 r.p.m.

(6) Disconnect the multimeter.

Test points

73. (1) Connect test cable QY4095 between SKTD, located in the equipment desk compartment, and the Amplifier and Transmitter test points.

(2) Set SW.I to A and SW.III to 12; ascertain that METER I indication is not more than 0·2 volt d.c. (Red Scale).

(3) Short circuit C1A and C1B of the C.J.C.; the SAFETY WARNING lamp should glow and METER I indication should be not less than 1·0 volt d.c. (Red Scale).

(4) Remove the shorting links, and operate the 115V A.C. IN switch to extinguish the SAFETY WARNING light.

(5) Set SW.III to 13 and ascertain that the METER I indication is less than 0·3 volt d.c. (Red Scale).

(6) Increase the 400 c/s input supply to 120 volts; METER I indication should increase by not less than 0·2 volt d.c. (Red Scale).

(7) Set SW.III to 11 and reset the 400 c/s input supply to 115 volts. METER I indication should be less than 0·25 volt d.c. (Red Scale).

(8) Connect a shorting link between M/1/5 and M/1/6 of the Throttle Motor. The SAFETY WARNING light should glow and METER I indication should be not less than 0·4 volt d.c. (Red Scale).

Intercomm. unit

74. (1) Connect the two head-sets to their respective phone jacks on QT40012, one headset being connected via test cable QY4004.

(2) Test for correct 2-way speech/listen action.

Engine speed simulator

75. The engine speed simulator comprises an L.F. oscillator, a frequency doubler and a voltage amplifier, all of which are contained in unit QT4064, an electronic counter, a power amplifier QT40621 and a tacho bed-plate QT4074. The following tests are performed to check the operation of these units. Should any test results be outside the limits, the relevant preset components should be readjusted as detailed in the Alignment Procedure (para. 84). After any readjustment the complete equipment must be subjected to the routine tests (para. 46).

Mains supply

76. (1) Set the equipment voltage adjustment plug, located in QT40621, to the tapping nearest that of the local mains supply. Ascertain that the fuse is of the correct rating, i.e.,

10 amps for 100 to 120 volts operation
5 amps for 200 to 250 volts operation

(2) Set the voltage adjustment plugs on the individual units to the 230V tapping.

Power amplifier bias

77. (1) Turn the SELECT LOAD switch to TEST LOAD.

(2) Set the oscilloscope to its 500V range and connect it across the Monitor O/P SKTS.

(3) Ascertain that the STAND-BY/ON and OFF/ON switches are set to STAND/BY and OFF respectively.

(4) Connect the mains supply and set the ROTARY FUSED ISOLATOR switch to ON.

(5) Set the OFF/ON switch to ON, allow a delay of approximately 30 seconds and set the STAND-BY/ON switch to ON.

(6) Set the multimeter to its 2·5V d.c. range. Connect it between TPI (0·55V SKT.) and chassis (TP1+) and note the meter indication.

(7) Reconnect the multimeter between TP2 and chassis (TP2+) and note the meter indication.

LIMITS: The meter indications noted in sub-para. (6) and (7) should be 0·55±0·05 volts.

Oscillator feedback

78. (1) Rotate the VARIABLE SPEED CONTROL fully clockwise.

(2) Very slowly, and evenly, rotate the VARIABLE SPEED CONTROL anti-clockwise observing the oscilloscope to ensure that there are no ' frequency dead spots', i.e., rapid collapse and reform of the sinusoidal trace.

Power amplifier gain

79. (1) Rotate the VARIABLE SPEED CONTROL on QT4064 and SET O/P LEVEL fully anti-clockwise.

(2) Set the multimeter to its 100V a.c. range and connect it, with the oscilloscope, across the MONITOR O/P test SKTS.

(3) Rotate the VARIABLE SPEED CONTROL fully clockwise.

(4) Adjust the SET O/P LEVEL control for an undistorted sinusoidal trace of maximum amplitude.

LIMITS: The undistorted signal should be 75±10 volts, and should be free of r.f. instability.

Counter stability

80. (1) Remove the valve V1 from QT40621 and then disconnect the oscilloscope and multimeter.

(2) Replace the valve V1.

(3) Set the mains supply switch, located on the counter, to ON.

(4) Set the FUNCTION SELECTOR switch to TEST.

LIMITS: Over a period of not less than 3 minutes the indicated count should be stable at 10,000±1 of the final digit.

Synchronizing speed

81. (1) Rotate the VARIABLE SPEED CONTROL fully anti-clockwise.

(2) Set the FUNCTION SELECTOR switch to TRANS B, and rotate the VARIABLE SPEED CONTROL until the unit synchronizing speed (indicated on the counter front panel) is attained.

(3) Set the FUNCTION SELECTOR switch to TRANS A.

(3) Operate the PUSH-TO-START control whilst observing the counter indication and release when the system is synchronized.

Frequency doubler and limiter

82. (1) Connect oscilloscope across the MONITOR COUNTER I/P SKTS.

(2) Set the oscilloscope to its 15 volts range with a time base duration of 100 microseconds.

(3) Rotate the VARIABLE SPEED CONTROL fully clockwise using the fine control.

Note . . .

The limiting level of the waveform should be 8±2 *volts peak to peak and the counter should indicate and remain stable at* 12,000±5 *of the final digit.*

Output tacho volts

83. (1) Set the multimeter to its 100V a.c. range and connect it across the TACHO STANDARD socket, located on the functional unit QT40011.

(2) Rotate the VARIABLE SPEED CONTROL to give a counter indication of 12,000.

Note . . .

The multimeter should indicate 30± 0·3 *volts.*

(3) At the conclusion of the test, disconnect the multimeter and oscilloscope, and set the ROTARY FUSED ISOLATOR switch to OFF.

Alignment procedure for engine speed simulator

84. If any of the limits specified in para. 75 cannot be satisfied, the associated circuit should be subjected to the following alignment procedure. On completion of alignment the equipment must again be subjected to the engine speed simulator equipment routine test before being used.

Required test equipment

85. (1) Multimeter, Type 1 or equivalent.

(2) Oscilloscope, Cossor 1049 or equivalent.

(3) Resistor 3·2±0·1 ohms, 1 watt rating.

Mains supply

86. (1) Set the equipment voltage adjustment plug, located in QT40621, to the tapping nearest that of the local mains supply. Ascertain that the fuse is of the correct rating i.e.,

10 amps for 100 to 120 volts operation
5 amps for 200 to 250 volts operation

(2) Set the voltage adjustment plugs on the individual units to the 230V tapping.

Power amplifier bias

87. (1) Turn the SELECT LOAD switch to TEST LOAD.

(2) Set the oscilloscope to its 500V range, and connect it across the Monitor O/P SKTS.

(3) Remove valve V1 from QT40621.

(4) Ascertain that the STAND-BY/ON and OFF/ON switches are set to STAND-BY and OFF respectively.

(5) Connect the mains supply, and set the ROTARY FUSED ISOLATOR switch to ON.

(6) Set the OFF/ON switch to ON, allow a delay of approximately 30 seconds and set STAND-BY/ON switch to ON.

(7) Set the multimeter to its 2·5V d.c. range, and connect it between TPI and chassis (TP1+); TP1, TP2, RV1 and RV2 are located on QT40621 front panel.

(8) Adjust RV1 for an indication of 0·55±0·05 volt on the meter.

(9) Reconnect the meter between TP2 and chassis (TP2+). Adjust RV2 for an indication of 0·55±0·05 volt on the meter.

(11) Repeat sub-paras (8) and (9) until the two meter readings are identical.

(12) Disconnect the multimeter and replace valve V1.

Oscillator feedback

88. (1) Rotate the SET O/P LEVEL on QT40621 fully anti-clockwise.

(2) Rotate RV4, located in QT4064, fully clockwise.

(3) Set the multimeter to its 100V a.c. range and connect it, with the oscilloscope, across the MONITOR O/P SKTS on QT40621.

(4) Rotate the VARIABLE SPEED CONTROL fully clockwise.

(5) Set RV3, located in QT4064, fully anti-clockwise.

(6) Rotate the SET O/P LEVEL to approximately a quarter of its travel.

(7) Adjust RV3 to obtain a nearly sinusoidal trace on the oscilloscope.

(8) Very slowly and evenly, rotate the VARIABLE SPEED CONTROL anti-clockwise observing the oscilloscope for a frequency 'dead spot', i.e., rapid collapse and reforming of the sinusoidal trace.

(9) If a 'dead spot' is indicated, adjust RV3 further clockwise and repeat sub-para. (8) until the 'dead spot' is eliminated.

(10) Repeat sub-paras. (8) and (9) for the optimum setting of RV3.

Note . . .
The sinusoidal trace at frequencies below 300 *c/s (approximately half the total movement of the* VARIABLE SPEED CONTROL) *will tend to show a flattening of the leading edge and this is normal and acceptable.*

Power amplifier gain

89. (1) Observing the oscilloscope, adjust the SET O/P LEVEL for an undistorted sinusoidal trace of maximum amplitude (Refer to the Note below para. 88 (10)). At this setting the multimeter should indicate within the range 65 to 85 volts.

(2) If the adjustment range of the SET O/P LEVEL is insufficient to obtain the result specified in sub-para. (1) rotate RV4 to approximately a quarter of its travel and repeat sub-para. (1).

(3) Repeat sub-paras. (1) and (2) until the required output is obtained.

(4) Remove valve V1 from QT40621, disconnect the oscilloscope and multimeter and turn SELECT LOAD switch to TACHO.

(5) Reconnect the supply lead to the DRIVE TACHO.

(6) Replace valve V1.

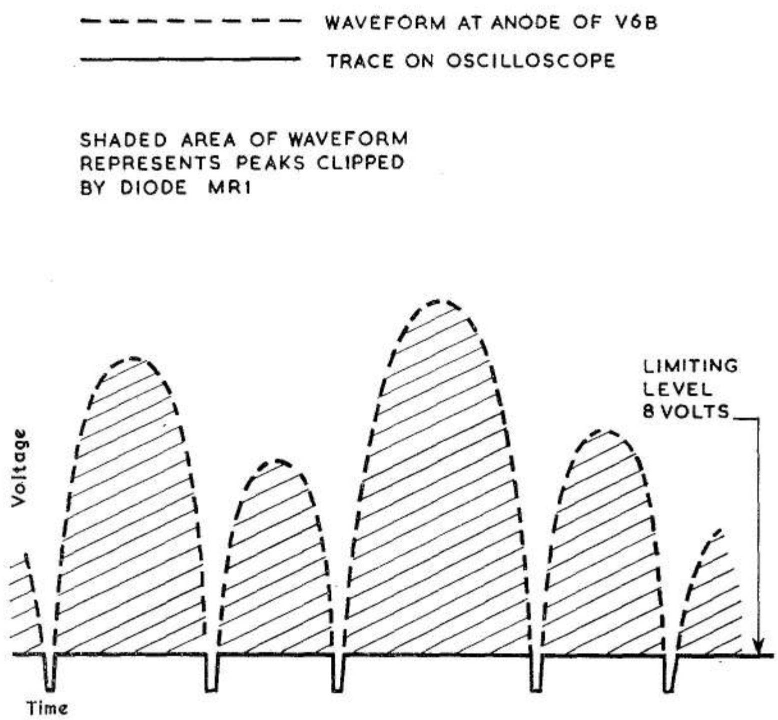

Fig. 13. Frequency doubler output waveform

Counter stability

90. (1) Set the mains supply switch, located on the counter, to ON.

(2) Set the FUNCTION SELECTOR switch to TEST.

(3) After a period of not less than 3 minutes, ascertain that the indicated count is $10{,}000 \pm 1$ of the final digit.

Frequency doubler alignment

91. (1) Rotate RV5, located in QT4064, fully clockwise.

(2) Rotate the VARIABLE SPEED CONTROL fully anti-clockwise.

(3) Synchronize the DRIVE TACHO by manually spinning the detector wheel. This is best accomplished by spinning the tacho-wheel coupling with the fore-finger, as shown in fig. 14.

Note . . .

Do not spin the wheel by placing the finger on the periphery of the wheel.

(4) Rotate the VARIABLE SPEED CONTROL fully clockwise using the fine control.

(5) Connect oscilloscope to MONITOR COUNTER I/P SKTS.

(6) Set the oscilloscope to its 50V range, with a time-base duration of 100 micro-seconds.

(7) Observing the oscilloscope, adjust RV2 to give a limiting level of 8 volts on the trace. If all peaks are not clipped at this amplitude the probe must be positioned nearer the detector wheel until the required waveform is obtained (*fig.* 13).

(8) Disconnect the oscilloscope.

(9) Check that the counter registers at least 12,000 and the count has a stability of ± 5 of the final digit.

(10) If the counter is not stable rotate the SET O/P LEVEL anti-clockwise until the DRIVE TACHO stalls, then rotate the control 5 degrees clockwise. Restart the DRIVE TACHO and check the counter stability.

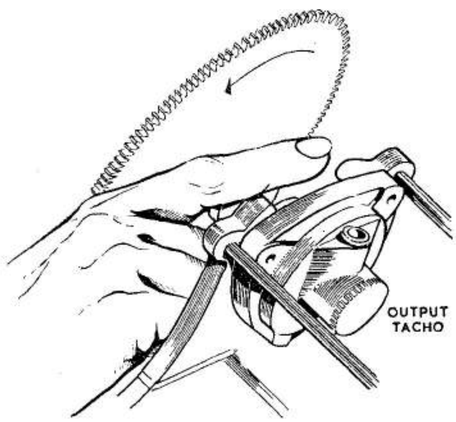

Fig. 14. Spinning detector wheel

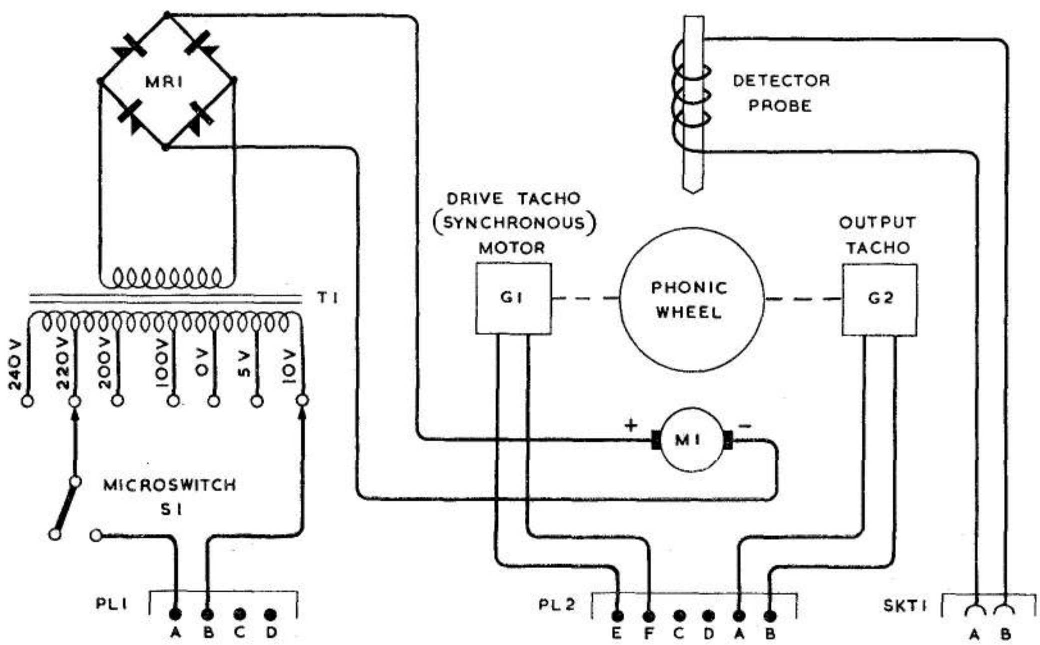

Fig. 15. Tacho bedplate, Type QT4074—circuit

Fault finding

Introduction

92. The following instructions are a guide to fault finding and should be used in conjunction with the appropriate circuit and component location diagrams. In the event of a fault occurring in part of the system, it is advisable to check all cables and plugs prior to unit investigation.

*Power amplifier and mains control, QT*40621

93. (1) Free the unit connectors and remove the unit from the equipment.

(2) Set the voltage adjustment plugs to suit the local mains supply.

(3) Earth the chassis.

(4) Connect pin D of SKT3 to chassis.

(5) Turn SELECT LOAD switch to TEST LOAD.

(6) Connect the mains supply to pins E and F of PL2.

Note . . .

As soon as the mains supply is connected the unit is 'live'. The rotary fused isolator switch being inoperative, the neon lamp does not indicate when the power is on.

TABLE 8

Fault Finding in QT40621

Symptom	Possible cause	Action
1. No h.t. or h.t. less than 560V at the junction of L1-C10	(a) Faulty mains transformers T1 and T2, or voltage adjustment panel	Test continuity of the windings across the panel connections.
	(b) Valve failure V5-V6	Test h.t. at V5 pin 2—this should be not less than 560 volts d.c.
	(c) Open circuit thermal delay switch S3	Test switch.
	(d) Component failure in smoothing circuit	Test components L1, C11, C10, C12.
	(e) Faulty h.t. de-coupling	Test components C9, C4, C3.
2. Bias adjustment of V3-V4 ineffective	(a) Low h.t.	Refer to 1.
	(b) Valve failure V3-V4	Remove and test the valves.
	(c) Component failure in bias supply	Test components C14, C13, MR1.
	(d) Faulty coupling capacitors C7-C8	Test components.
	(e) Faulty output transformer T3	Test resistance balance of windings.
3. No output or output below 65 volts	(a) Low h.t.	Refer to 1.
	(b) Ineffective adjustment of V3-V4.	Refer to 2.

TABLE 8—*Contd.*

Symptom	Possible cause	Action
	(c) Faulty component in pre-amplifier V1A, phase splitter V1B, phase driver V2A-V2B	Inject a signal continuously variable between 0 and 1V r.m.s. at a frequency of 600 c/s ±10%. Check input to grids of V1A-V1B. If no input test suspect valve and associated components.
4. Instability of output signal	(a) Faulty component in feed-back loop	Test components R30, R5 and R2.
	(b) Selected value of R5 too high	Select, incrementally, new value for R5—this must not be below 150 ohms.

*Frequency doubler and oscillator, QT*4064

94. (1) Free the unit connectors and remove the unit from the equipment.

(2) Set the voltage adjustment plug to suit the local mains supply.

(3) Earth the chassis.

(4) Connect the mains supply to pins A and B of PL1.

(5) Set the ON/OFF switch to ON; after a delay of approximately 30 seconds set the STAND-BY/ON switch to ON.

TABLE 9

Fault Finding in QT4064

Symptom	Possible cause	Action
1. No h.t. or h.t. less than 250V	(a) Fuse FS1	Test fuse
	(b) Faulty mains transformer T1 or voltage adjustment panel	Test continuity of the winding across panel connections
	(c) Valve failure V1	Test h.t. at V1 pin 8.
	(d) Faulty stabilizer V4	Test valve.
	(e) R6 open circuit	Test component.
	(f) Component failure in smoothing circuit	Test components C1, C2 and L1.
2. No output from oscillator	(a) Low h.t.	Refer to 1.
	(b) V10 ageing	Connect an oscilloscope set to its 50V range, with a time base duration of 100 microseconds, between junction of R39/R40 and chassis. Readjust RV3 for a near sinusoidal trace on the oscilloscope. If this trace is not obtainable renew V10 or replace R45 by a lower value.

TABLE 9—*Contd.*

Symptom	Possible cause	Action
	(c) Component failure in oscillator or buffer stage V10-V9	Using the multimeter set to its 250V d.c. range check that the voltage between V10B anode and chassis is in the order of 100V. If it is check V9 and associated components. If it is not, test V10 and associated components.
3. No output from frequency doubler	(a) Component failure in 1st stage of pre-amplifier	Inject a signal of 1 volt peak to peak at a frequency of 12,000 c/s into the slider of RV5. Connect the oscilloscope set to its 100V range, with a time base duration of 100 micro-seconds, between junction of C6/R17 and chassis. Output signal should be in the order of 40V. If not, test V5A and associated components. With the signal still injected, connect the oscilloscope between junction C7/R21 and chassis. The output signal should be in the order of 40V. If not, test V5B and associated components.
	(b) Component failure in frequency doubling circuit	With the signal still injected, connect the oscilloscope, set to its 25V range, with a time base duration of 100 micro-seconds, between junction of C10/R28 and chassis. Output signal should be in the order of 10V. If not, test phase reversal at anode and cathode of V6A. If correct, test V7-V8-C8-C9-C10.
	(c) Component failure in limiting amplifier	With signal still injected, connect a multimeter to 250V d.c. between V6B anode and chassis Voltage should be in order of 100V. If it is, test MR1, C13, RV2. If not, check R29, R30, C11, V6B.
4. Output unstable	(a) Low h.t.	Refer to 1.
	(b) Component failure in MR1 bias supply	Test components MR1, RV2, R33, C13.

Power unit, *QT*40012

95. (1) Free the unit connectors and remove the units from the equipment.

(2) Set the voltage adjustment plug to suit the local mains supply.

(3) Earth pin E of PL14.

(4) Connect the mains supply to pins L and N of PL14.

(5) Set the ON/OFF switch to ON.

TABLE 10

Fault Finding in QT40012

Symptom	Possible cause	Action
1. No output	(a) Fuse FS3	Test fuse.
	(b) Faulty Mains Transformer	Test continuity of the primary winding.
	(c) Neon N2 failure	Test neon.
2. No output between SKT13 pins A and F	(a) Faulty mains Transformer	Test continuity between pins 29-31
	(b) Faulty component MR8 or C1	Test components
3. No output between SKT13 pins E and D	(a) Faulty Transformer	Test continuity between pins 26-28
	(b) Faulty component MR9, C2, L4	Test components
4. No output between SKT13 pins C and D	(a) Fuse FS2	Test fuse
	(b) Faulty Transformer	Test continuity between pins 26-28
	(c) Faulty component MR9, C2	Test components
5. No output between SKT13 pin B and chassis	(a) Faulty Transformer	Test continuity between pins 34-37
	(b) Faulty component MR10, C4, R47, C5	Test components

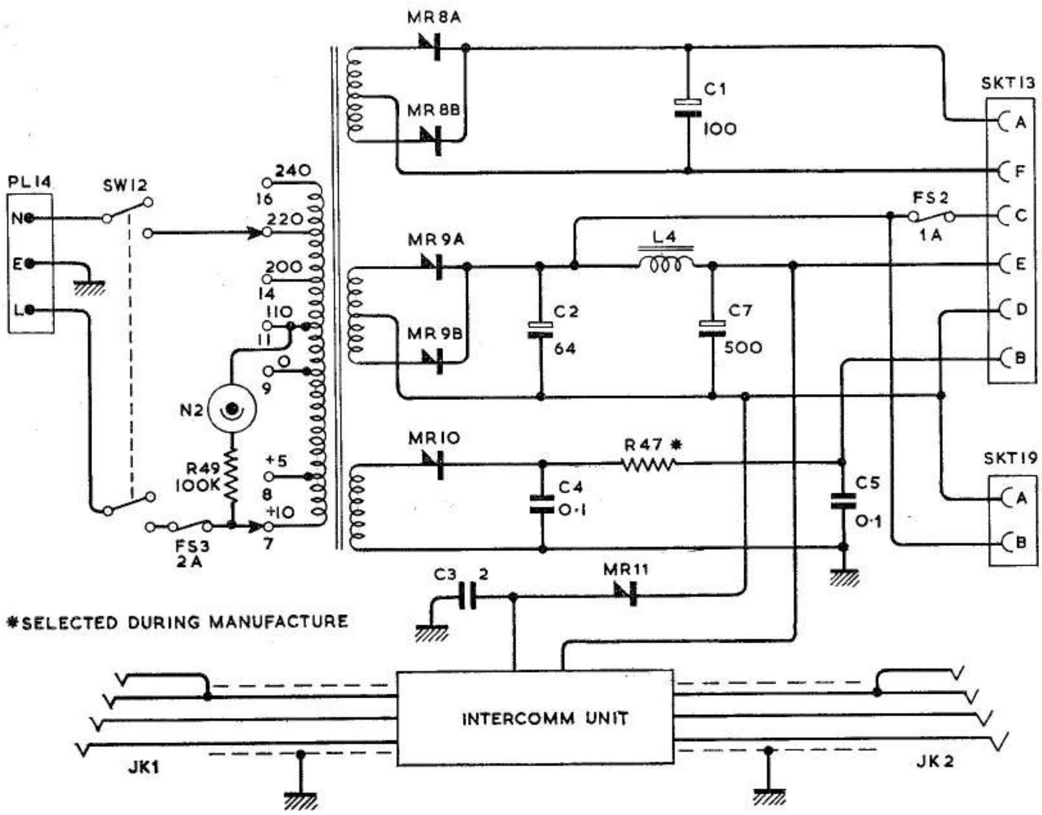

Fig. 16. Power unit, Type QT40012—circuit

*Functional unit, QT*40011

96. (1) Free the unit connectors and remove the unit from the equipment.

(2) Perform the following test procedure and if an erroneous result is obtained examine the relevant circuits for a fault.

(3) Insulation resistance.

(a) Set the following switches to the positions shown:—

SW.I to OFF
SW.II to 0
SW.III to 0
SW.IV to 0
SW.V to Mid-position
SW.VI to 1
METER II switch to NORMAL

(b) Using a 500V Insulation Tester, measure the insulation resistance between the pins listed in Table 11 and chassis. This should be not less than 5 megohms.

TABLE 11

Functional unit insulation test points

SKTA pins	SKTB pins	SKTC pins	SKTD pins	PL11 pins	PL12 pins
a7, a8, a9	a1, a2, a3	a7, a8, a9	a1, a2, a3	A, B	A, B, C
a0, b1, b4	a4, a5, a6	a0, b1, b3	a4, a5, a6		D, E, F
b5, b6, b7	a7, a8, a9	b4, b5, b6	a7, a8, a9		
b8, b9, b0	b1, b2, b5	b7, b8, b9	b1, b2, b3		
c1, c4, c5	b6, c2, c3	b0, c3, c4	b4, b5, b6		
c6, c7	c4, c5	c5, c6	b7, b8, b9		
			c1, c2, c3		
			c7, c8, c9		
			c0		

(4) Continuity

(a) Set the switches to the positions given in sub-para. (3) (a).

(b) Using the multimeter, check the continuity between the pins listed in Table 12.

TABLE 12

Functional unit continuity test points

Measure between		Reading
SKTA pin a7	SKTC pin a7	Resistance less than 1 ohm
a8	a8	Resistance less than 1 ohm
a9	a9	Resistance less than 1 ohm
a0	a0	Resistance less than 1 ohm
b1	b1	Resistance less than 1 ohm
b4	b3	Resistance less than 1 ohm
b5	b4	Resistance less than 1 ohm
b6	b5	Resistance less than 1 ohm
b7	b6	Resistance less than 1 ohm
b8	b7	Resistance less than 1 ohm
b9	b8	Resistance less than 1 ohm
b0	b9	Resistance less than 1 ohm
c1	b0	Resistance less than 1 ohm
c4	c3	Resistance 1·6K$\pm$400 ohm
c5	c4	Resistance less than 1 ohm
c6	c5	Resistance less than 1 ohm
c7	c6	Resistance less than 1 ohm

TABLE 12—*Contd.*

Measure between		Reading
*SKTB pin a1	SKTD pin a1	Resistance less than 1 ohm
* a2	a2	Resistance less than 1 ohm
a3	a3	Resistance less than 1 ohm
a4	a4	Resistance less than 1 ohm
a5	a5	Resistance less than 1 ohm
** a6	a6	Resistance less than 1 ohm
a7	a7	Resistance less than 1 ohm
a8	a8	Resistance less than 1 ohm
a9	a9	Resistance less than 1 ohm
*** b1	b1	Resistance less than 1 ohm
**** b2	b2	Resistance less than 1 ohm
b5	b5	Resistance less than 1 ohm
***** b6	b6	Resistance less than 1 ohm

* Test for continuity with SW.1 set in turn to positions A, B, C, D, F, G, H, J, K, L, M, N and R.
Test for open circuit with SW.1 set in turn to positions E, O, P, Q and OFF.

** Test for open circuit with POSITIONER SAFETY depressed.

*** Normally open circuit. Test for continuity with open contacts of RLA/1 short circuited.

**** Normally open circuit. Test for continuity with the open contacts of RLA/2 shorted.

***** Test for continuity with SW.III set to position 6 and SW.I set in turn to A, B, C, D, E, L, O, P and Q.
Test for continuity with SW.I set to position A and SW.III set in turn to positions 6, 7, 8, 9, 10, 11, 12 and 13.
Test for open circuit at all switch positions mentioned with the 115V A.C. IN switch raised.

Measure between		Switch SW.VI position	Meter indication
SKTC pin a0	SKTC pin b1	5	continuity
a0	chassis	6	continuity
a0	SKTA pin a0	7	O.C.
a0	SKTC pin a8	8	continuity
a8	SKTC pin a7	10	continuity
a8	chassis	11	continuity
a8	SKTC pin b1	12	continuity
a8	SKTA pin a8	14	O.C.
a8	SKTC pin a9	15	continuity
a9	SKTC pin b1	17	continuity
a9	chassis	18	continuity
a9	SKTC pin a9	19	continuity
b1	SKTA pin b1	21	O.C.
a9	SKTA pin a9	22	O.C.
a9	SKTC pin a7	23	continuity
a7	SKTC pin b1	25	continuity
b1	chassis	26	continuity
a7	SKTA pin a7	27	O.C.
a7	chassis	28	continuity
a7	SKTC pin a0	0	continuity

(5) D.C. resistance

(a) Set SW.I to A and SW.III to VI.

(b) Connect the multimeter, set to its $\Omega \div 100$ range, between SKTD pin b5 and SKTD pin b6.

(c) The meter should indicate 2 ± 1 ohm for all positions of SW.V.

(d) Set SW.I to E.

(e) Using the multimeter measure the resistance between the following pairs of pins:—

SKTD pin a1 to SKTD pin a2—22 ohm $\pm 20\%$

SKTD pin a1 to SKTD pin a3—10 ohm $\pm 20\%$.

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POWER AMPLIFIER

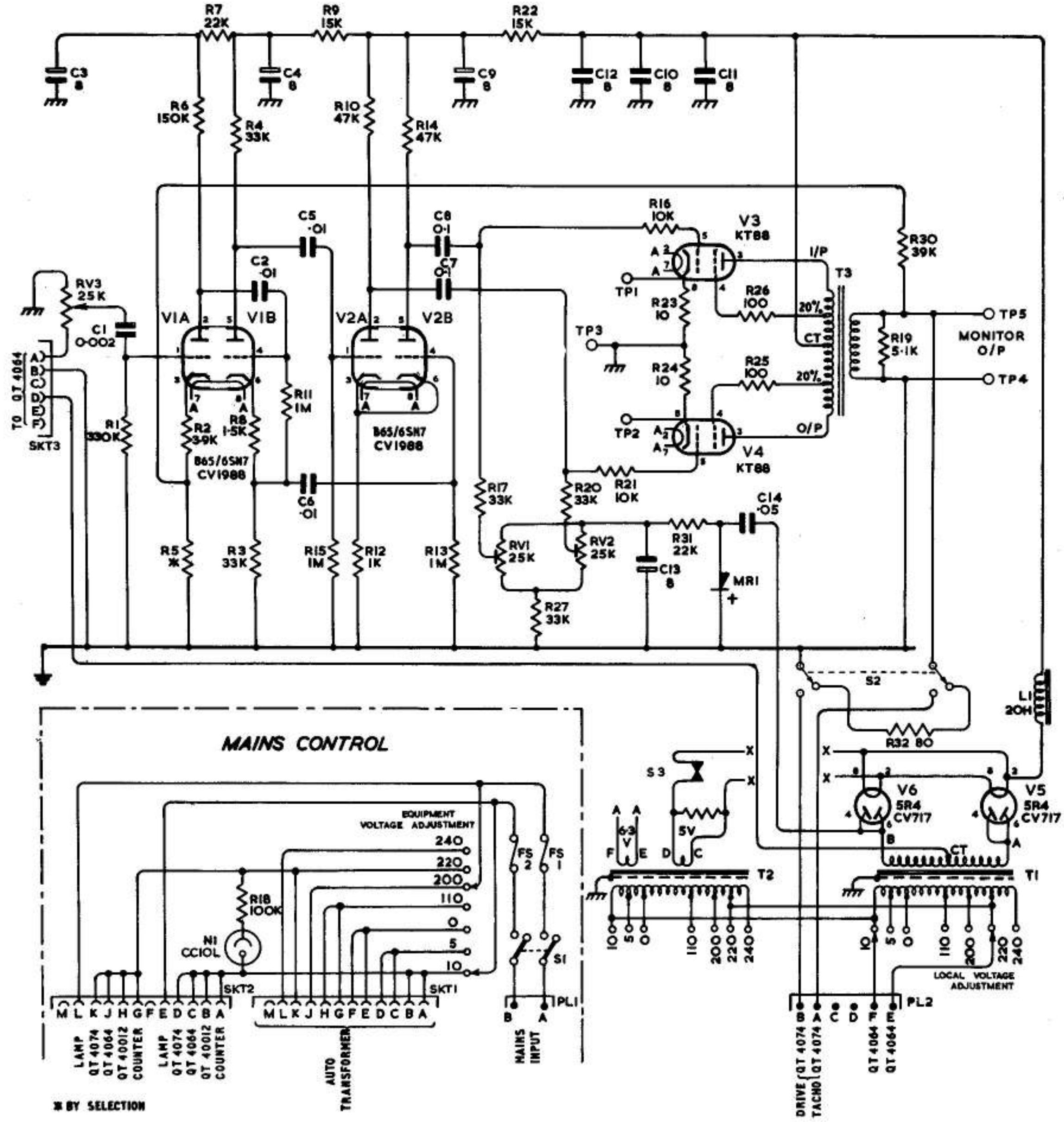

Fig.17 Power amplifier and mains control, Ultra, Type QT40621-circuit

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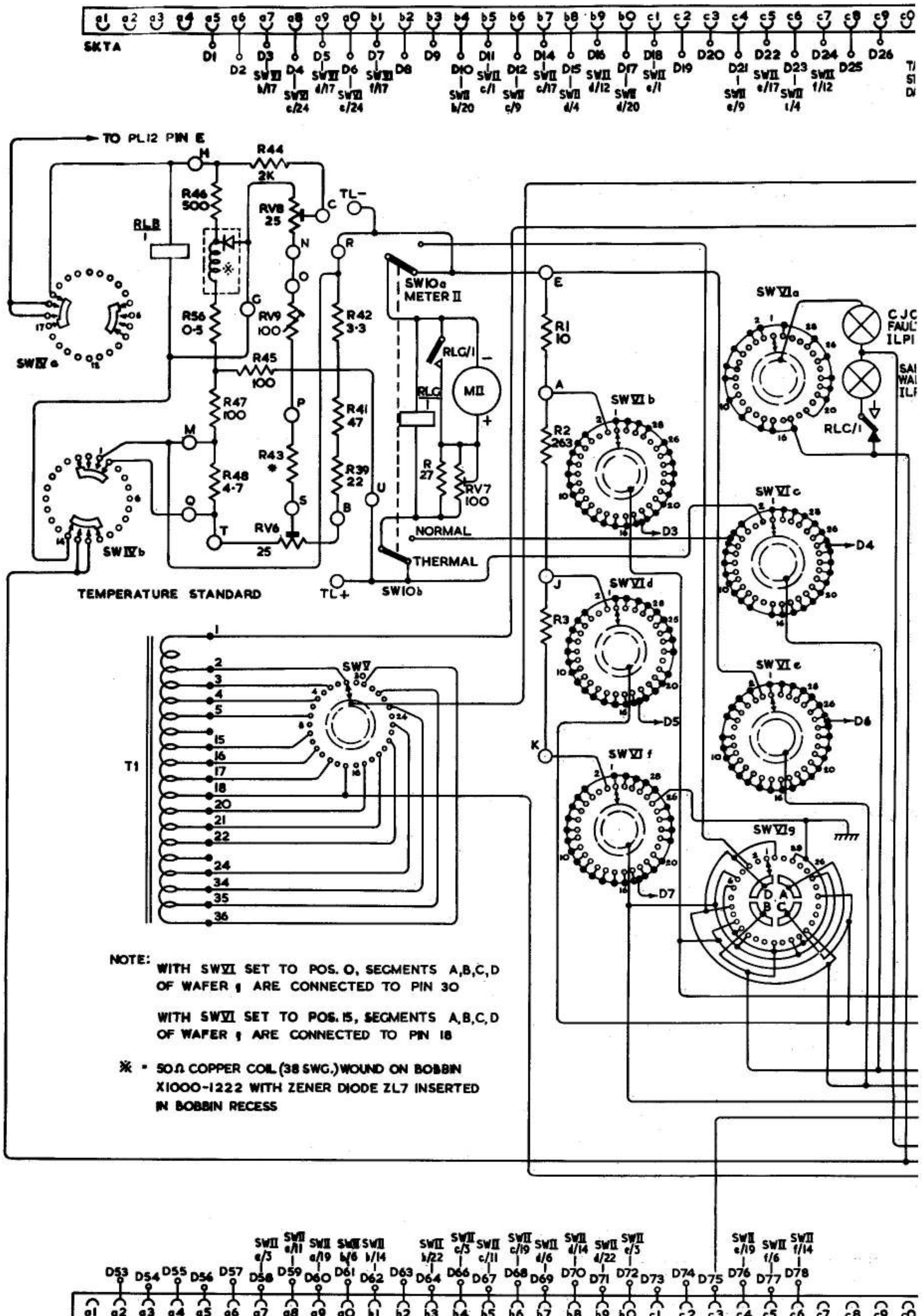
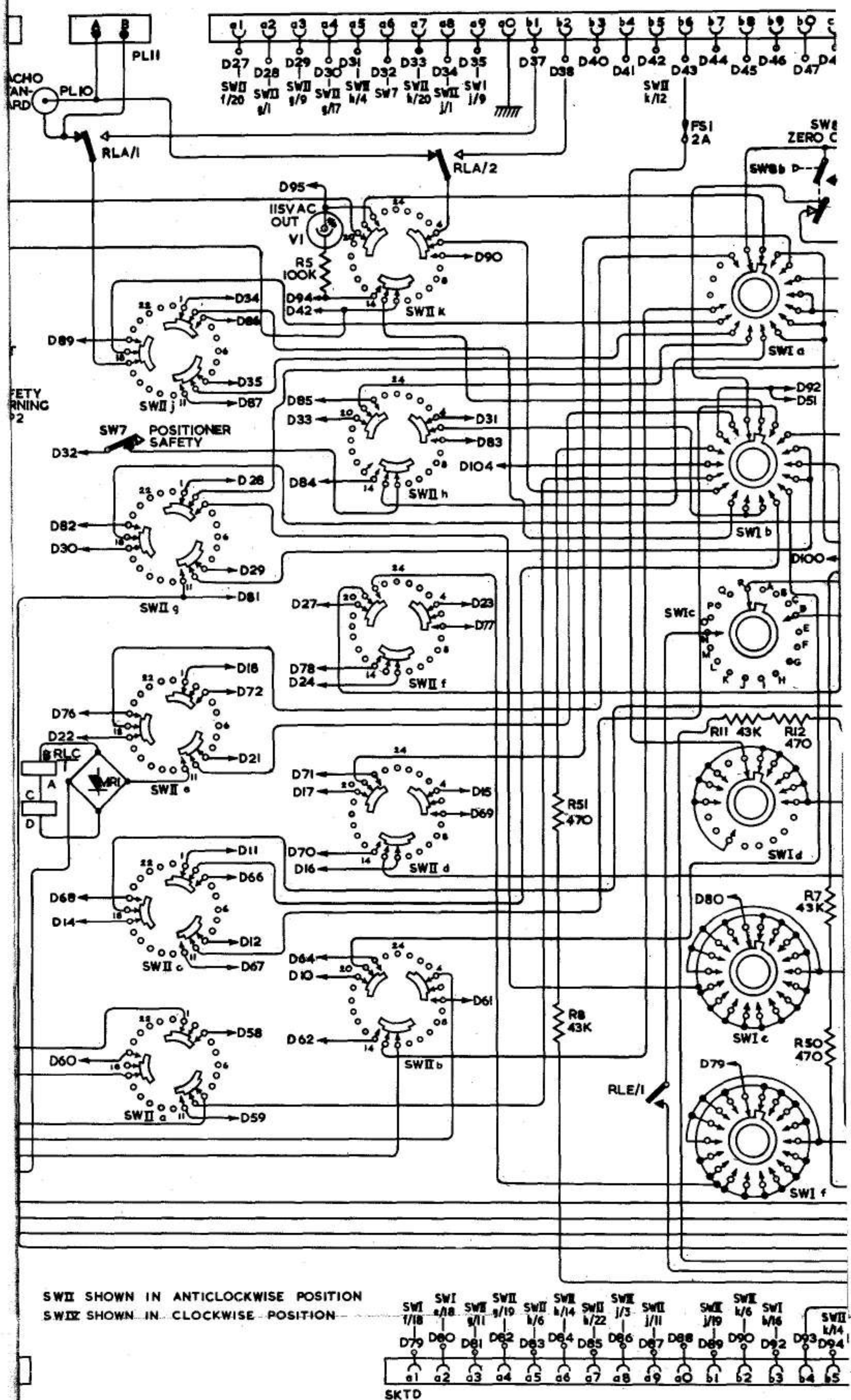
RESTRICTED



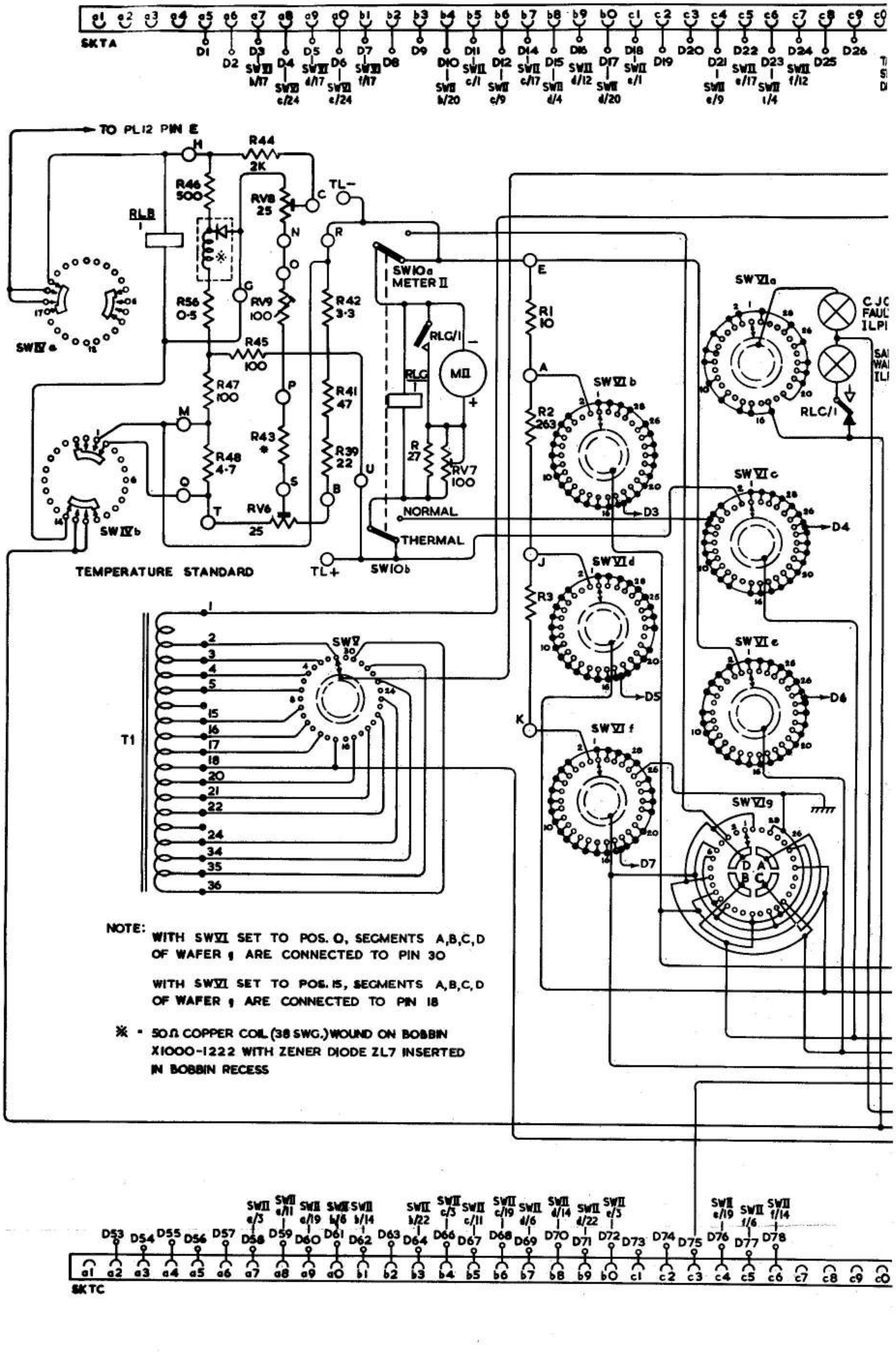
NOTE: WITH SWVI SET TO POS. O, SEGMENTS A,B,C,D OF WAFER g ARE CONNECTED TO PIN 30

WITH SWVI SET TO POS. 15, SEGMENTS A,B,C,D OF WAFER g ARE CONNECTED TO PIN 18

※ = 50Ω COPPER COIL (38 SWG.) WOUND ON BOBBIN X1000-1222 WITH ZENER DIODE ZL7 INSERTED IN BOBBIN RECESS



onal Unit, Ultra, Type QT40012-Circuit



NOTE: WITH SWVI SET TO POS. O, SEGMENTS A,B,C,D OF WAFER g ARE CONNECTED TO PIN 30

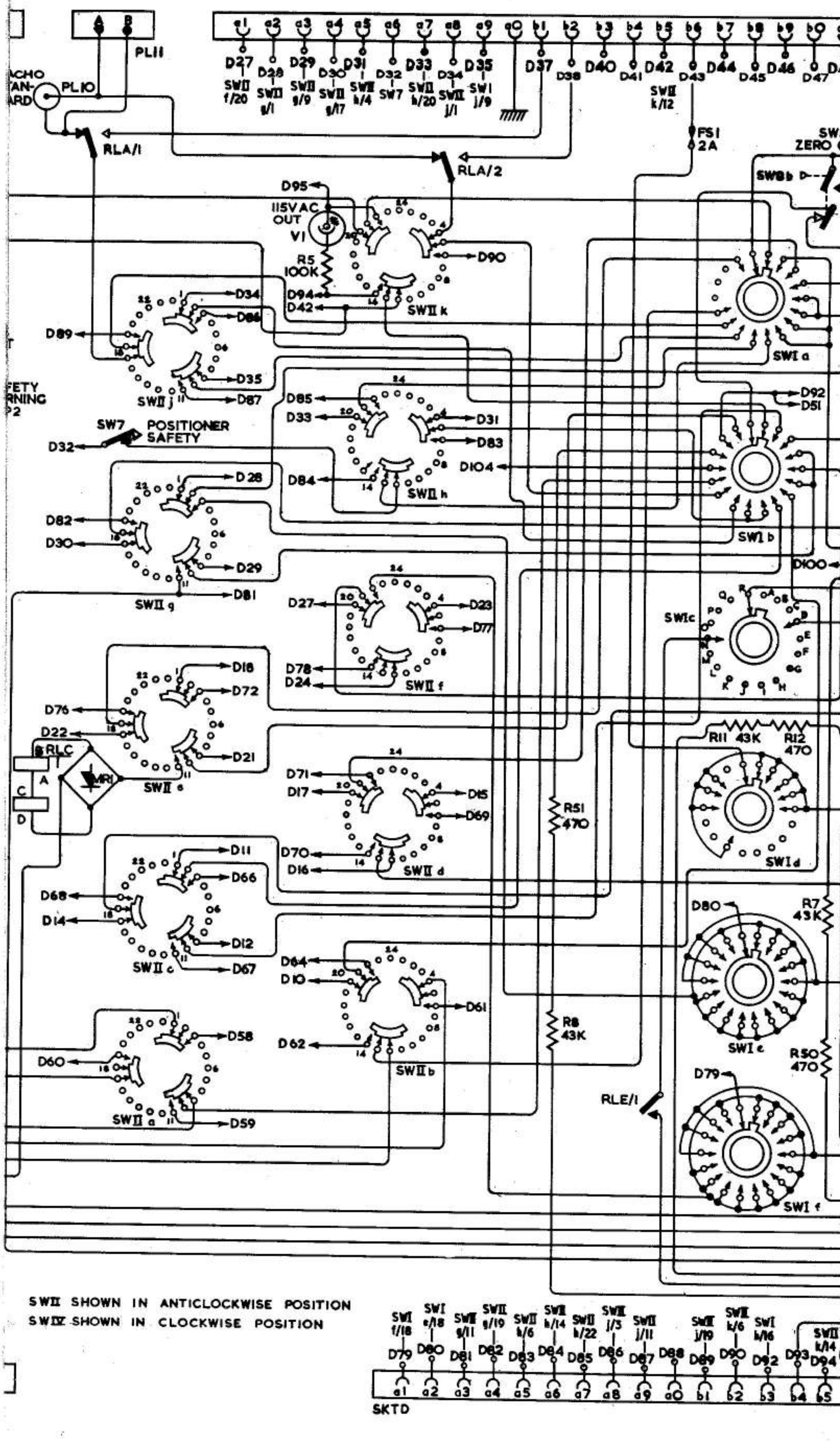
WITH SWVI SET TO POS. 15, SEGMENTS A,B,C,D OF WAFER g ARE CONNECTED TO PIN 18

※ - 50Ω COPPER COIL (38 SWG.) WOUND ON BOBBIN X1000-1222 WITH ZENER DIODE ZL7 INSERTED IN BOBBIN RECESS

Fig. 18

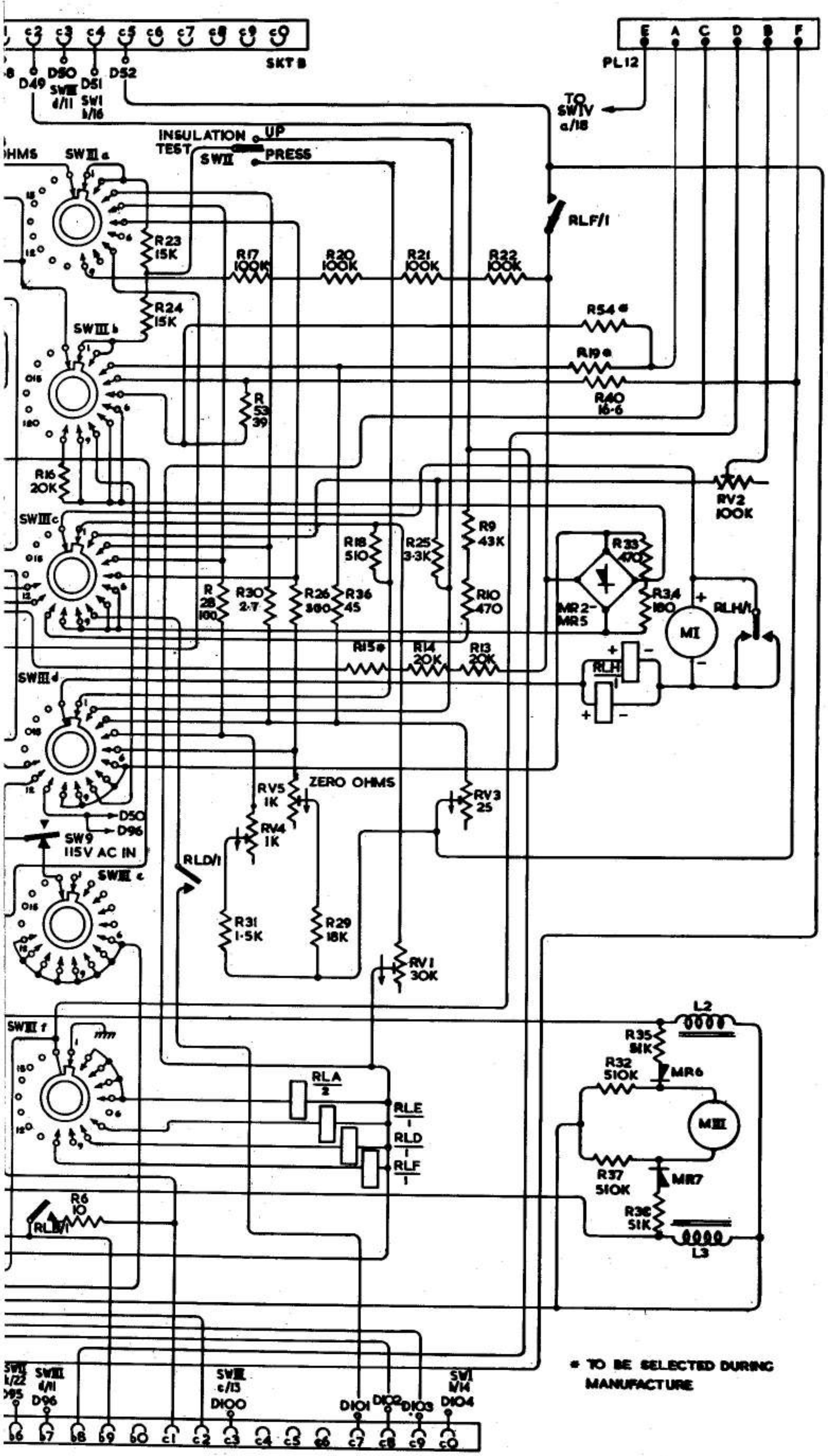
Dd.3857. 280588. 1/63. J.L.Ltd.

Functi

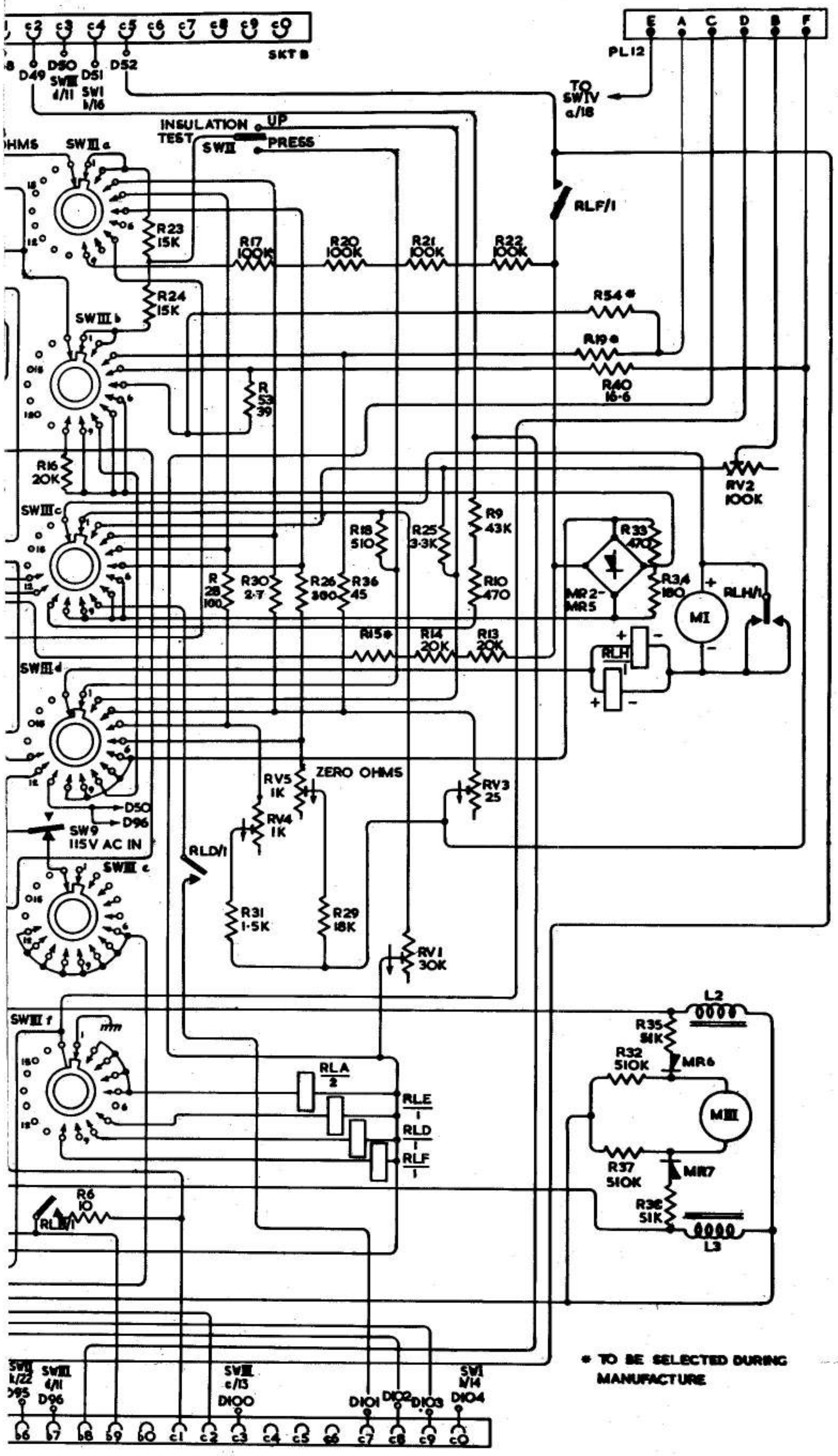


SWII SHOWN IN ANTICLOCKWISE POSITION
SWIV SHOWN IN CLOCKWISE POSITION

onal Unit, Ultra, Type QT40012-Circuit
RESTRICTED

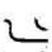


* TO BE SELECTED DURING MANUFACTURE



* TO BE SELECTED DURING MANUFACTURE

Fig.18



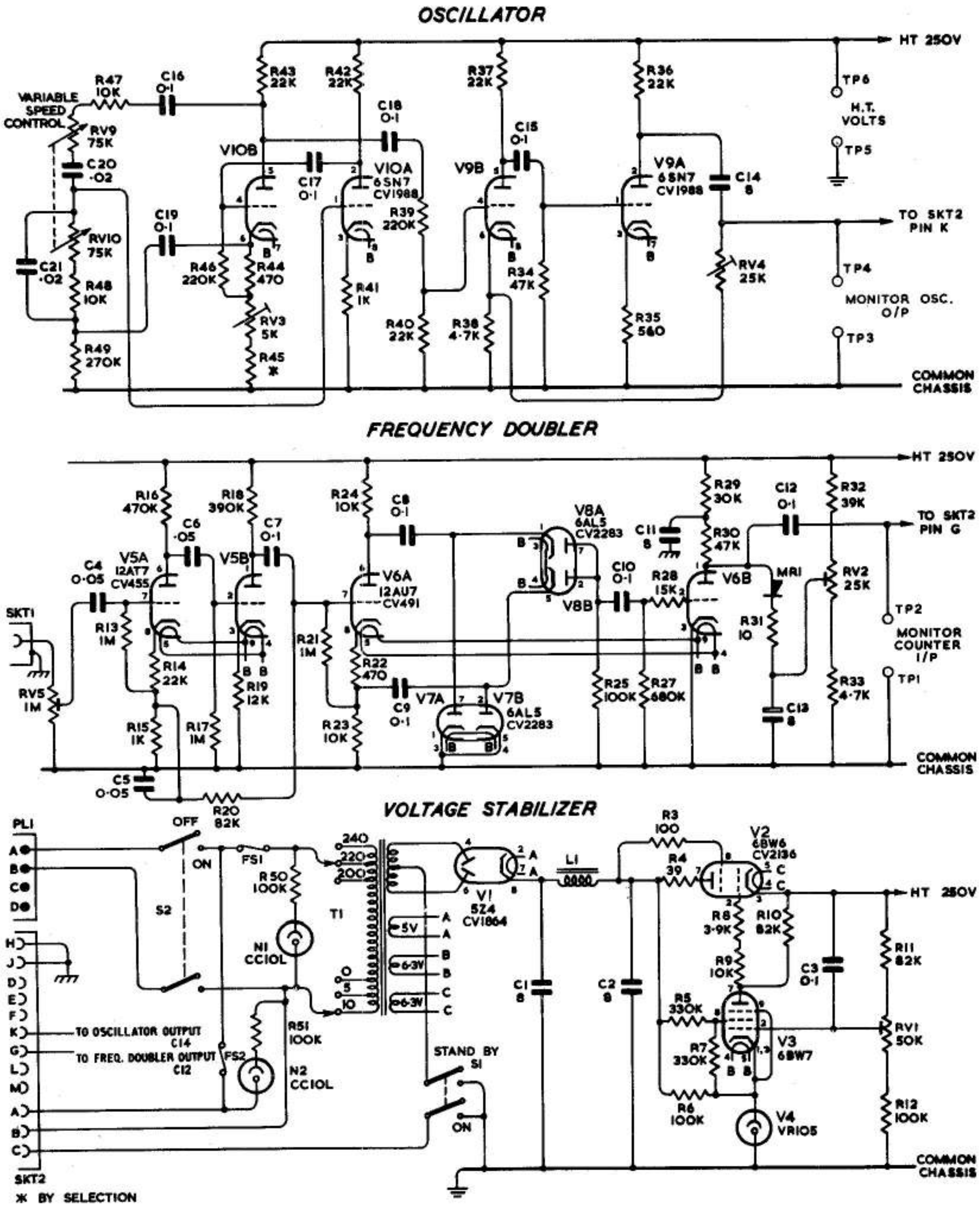


Fig. 19 Frequency Doubler and Oscillator, Ultra, Type QT4064 - Circuit

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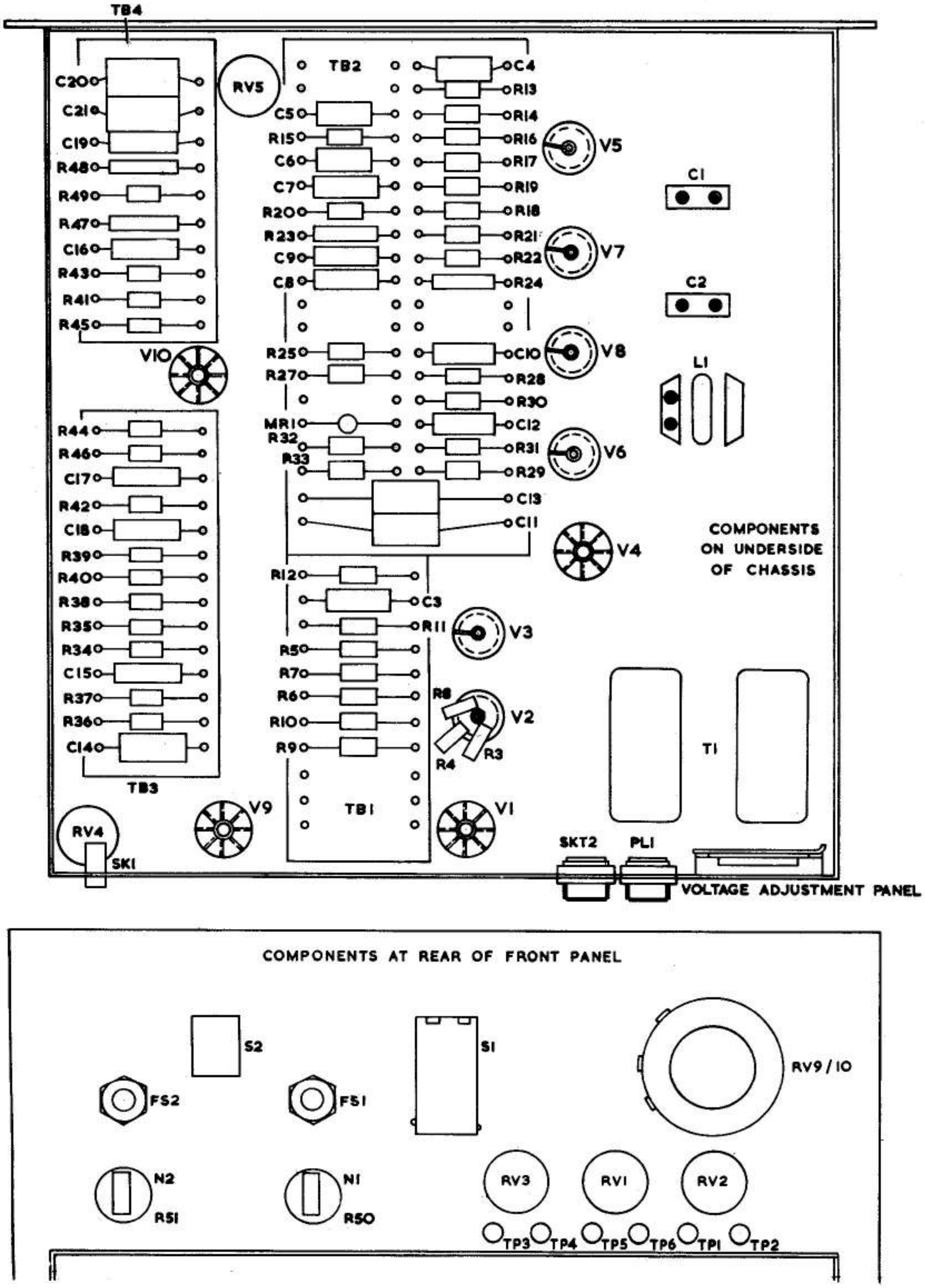

Fig.20 Frequency doubler & oscillator. Ultra Type QT4064
component location
RESTRICTED

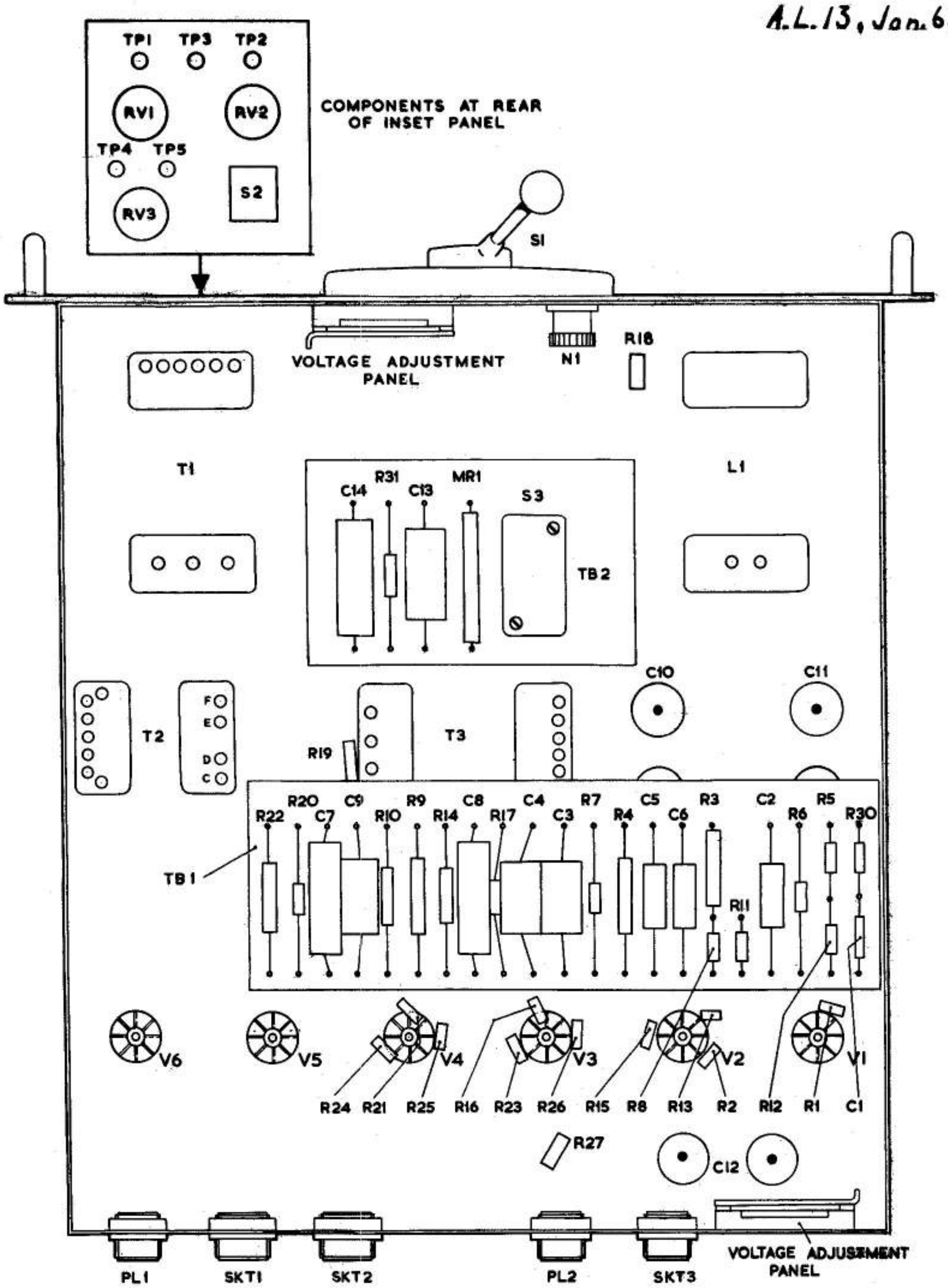

Fig.21 Power amplifier and mains control, Ultra, Type QT40621 – component location

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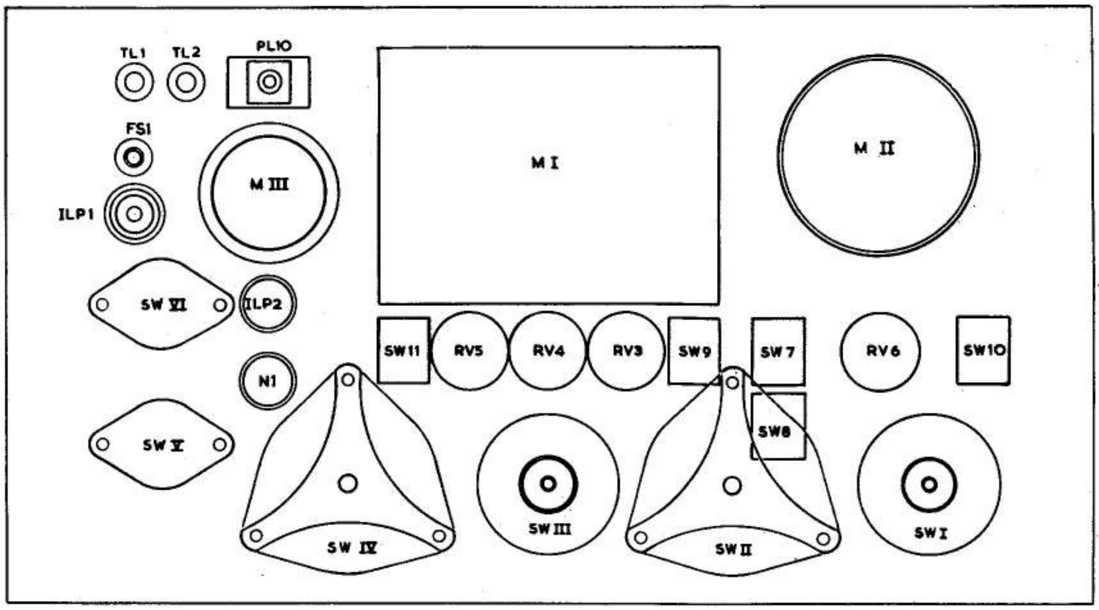
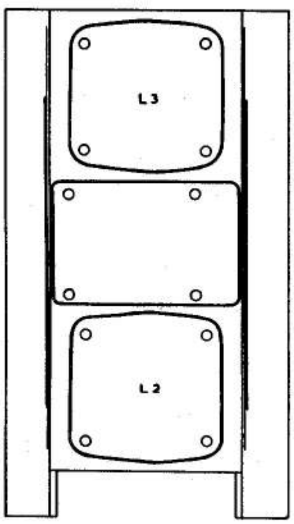


COMPONENTS AT REAR OF FRONT PANEL



COMPONENTS ON SIDE PANEL

COMPONENTS ON TOP PANEL

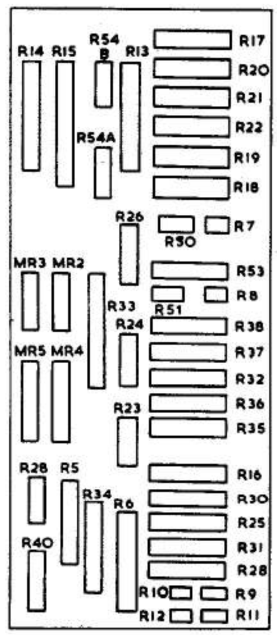


Fig.22 Functional unit, Ultra, Type QT40011 component location (panels)

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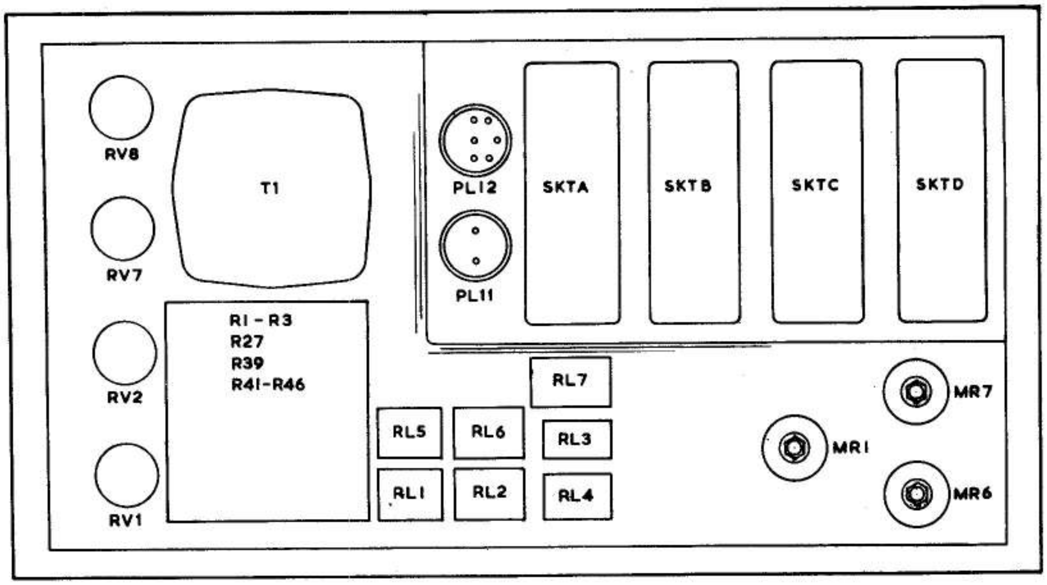

TOPSIDE OF REAR CHASSIS

UNDERSIDE OF REAR CHASSIS

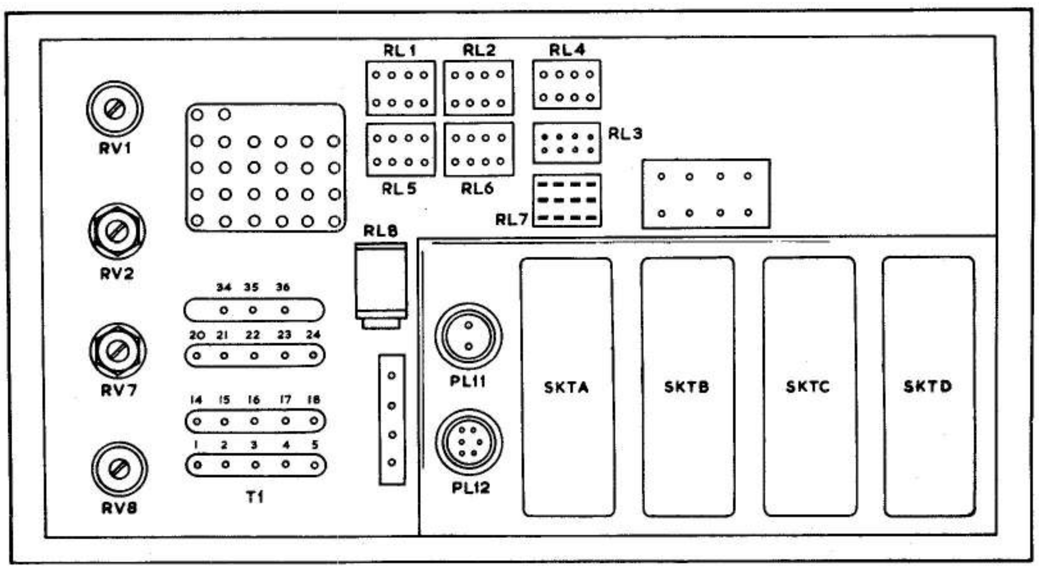

Fig.23 Functional unit, Ultra, Type QT40011 component location (chassis)

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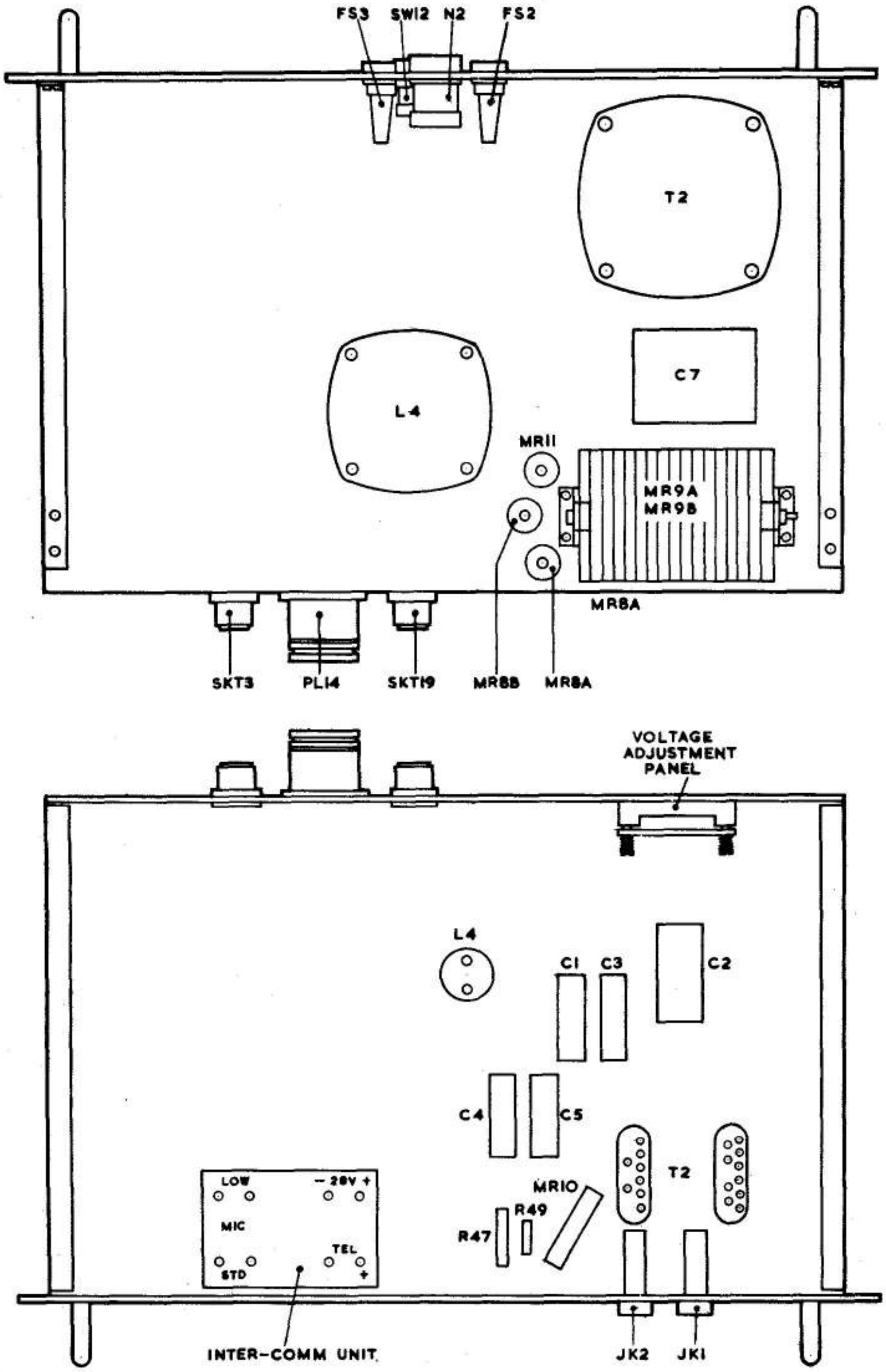

Fig.24 Power unit, Ultra, Type QT40012; component location