5 T856/857 Fault Finding

Caution: **This equipment contains CMOS devices which are susceptible to damage from static charges. Refer to Section 1.2 in Part A for more information on anti-static procedures when handling these devices.**

The following test procedures and fault finding flow charts may be used to help locate a hardware problem, however they are by no means a complete fault finding procedure. If you still cannot trace the fault after progressing through them in a logical manner, contact your nearest Tait Dealer or Customer Service Organisation. If necessary, you can get additional technical help from Customer Support, Radio Systems Division, Tait Electronics Ltd, Christchurch, New Zealand (full contact details are on page 2).

Note 1: In this and following sections deviation settings are given first for wide bandwidth sets, followed by settings in brackets for mid bandwidth sets ( ) and narrow bandwidth sets [ ].

Note 2: Unless otherwise specified, the term "PGM800Win" used in this and following sections refers to version 2.00 and later of the software.

Refer to Section 6 where the parts lists, grid reference index and diagrams will provide detailed information on identifying and locating components and test points on the main PCB. The parts list and diagrams for the VCO PCB are in Part E.

The following topics are covered in this section

5.1 Visual Checks

Remove the covers from the T856/857 and inspect the PCB for damaged or broken components, paying particular attention to the surface mounted devices (SMD's).

Check for defective solder joints. If repair or replacement is considered necessary, refer to Section 3 of Part A.

5.2 Component Checks

If you suspect a transistor is faulty, you can assess its performance by measuring the forward and reverse resistance of the junctions. Unless the device is completely desoldered, first make sure that the transistor is not shunted by some circuit resistance. Use a good quality EVM (e.g. Fluke 75) for taking the measurements (or a 20k ohm/V or better multimeter, using only the medium or low resistance ranges).

The collector current drawn by multi-junction transistors is a further guide to their performance.

If an IC is suspect, the most reliable check is to measure the DC operating voltages. Due to the catastrophic nature of most IC failures, the pin voltages will usually be markedly different from the recommended values in the presence of a fault. The recommended values can be obtained from either the circuit diagram or the component data catalogue.

5.3 Front Panel LED Indicator

The green "Supply" LED on the T856/857 front panel will flash according to the conditions described in the following table:

Flash Rate	Condition
fast (⅓ sec. on/⅓ sec. off approx.)	T856/857 is linked with PGM800Win
unequal (⅓ sec. on/1 sec. off approx.)	microcontroller has detected an internal communications error - refer to Section 5.7.1

Where two or more conditions occur at the same time, the precedence is in the order shown above (i.e. T856/857 linked has the highest priority, followed by internal error).

5.4 DC Checks

5.4.1 Power Rails

Refer to the test points and options diagrams in Section 6 for test point locations, and to the regulator fault finding chart (Section 5.7.2) for fault diagnosis.

Check the 13.8V (TP601) and 9V (TP602) supplies at their test points in the regulator compartment with a DMM.

Check the 5V (TP604) and 20V (TP603) rails at their respective test points in the regulator compartment.

Check that Tx-Reg. (TP305 in the exciter compartment) comes up to 8.8V when the exciter is keyed.

Check the +5V digital regulator output (TP607 in the regulator compartment).

T856 Only: Check the 9V supply (IC370 pin 1) with a DMM.

Check for short circuits.

5.4.2 VCO Locking

Key the exciter.

Using a DMM, monitor the VCO control voltage on the long lead of L1 on the VCO PCB.

If the synthesiser is locked and the VCO aligned, the voltage at this point should be between 3 and 16V.

If the VCO is not locked, refer to the synthesiser fault finding chart (Section 5.7.3).

5.5 RF Checks

In-circuit RF levels may be measured with an RF probe on which the earth lead has been shortened to a minimum (i.e. 13mm). Refer to the circuit diagrams for typical levels.

Figure 5.1 shows a suitable RF probe circuit..

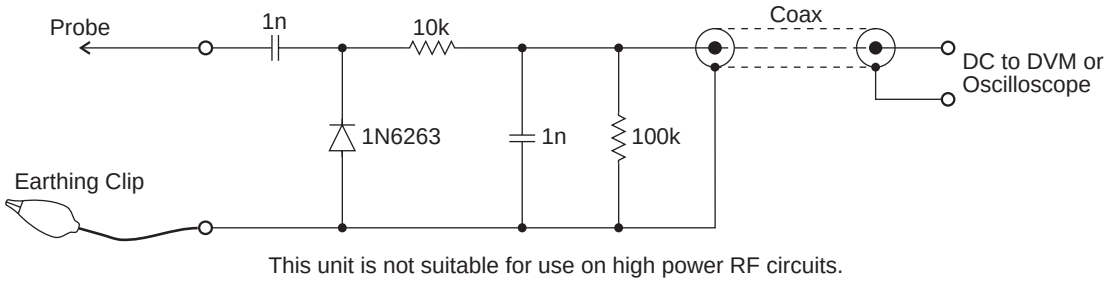


Figure 5.1 RF Diode Probe Circuit

5.5.1 T856 Drive Power

Refer to the drive amplifier fault finding chart (Section 5.7.4).

Ensure that the VCO locks (refer to Section 5.4.2).

Connect the drive output to a power meter and key the transmitter.

Check that the exciter output power (SK310) is >1.5W.

Note: If the synthesiser is out of lock, the lock detector (synthesiser IC740 and comparator IC750) will prevent the RF signal from reaching the PA by switching the supply to the exciter amplifier (Q350, Q355).

5.5.2 T856 PA Output Power

Reconnect the drive output to the PA input.

Connect the PA to a power meter and key the transmitter.

Check that the output power is >30W with RV310 (power control) adjusted fully clockwise.

5.5.3 T857 Output Power

Refer to the exciter drive amplifier fault finding chart (Section 5.7.6).

Ensure that the VCO locks (refer to Section 5.4.2).

Connect the exciter output to a power meter and key the exciter.

Check that the output power is 1W ±300mW.

Note: If the synthesiser is out of lock, the lock detector (synthesiser IC740 and comparator IC750) will prevent the RF signal from reaching the PA by switching the supply to the exciter amplifier (Q301, IC300, Q302, Q303).

5.5.4 Audio And Modulation

Refer to the audio processor fault finding chart (Section 5.7.7).

Set up the audio processor as described in Section 3.9.

Check that the demodulated RF output has the frequency response referred to in Section 4.5 with at least ±5kHz (±4kHz) [±2.5kHz] deviation available at 1kHz modulating frequency.

If the above result is not achieved, either the two modulators are incorrectly adjusted or a fault condition exists.

5.6 PGM800Win Generated Errors

The following errors are those most likely to occur using PGM800Win. Refer to the PGM800Win software user's manual for a complete list of error messages.

Channel Switch Set

The programmed default channel change was not accepted by the base station because a channel is selected externally. Try turning the external channel switch off to change the default channel in PGM800Win.

Synth Out Of Lock

The synthesiser received incorrect data, or the data was corrupted. Enter a frequency within the VCO switching range, or tune the VCO.

Internal Error

Data could not be read from the base station due to an internal error. Check for shorts or open circuits on the SDA, SCK, SYNTH and EPOT lines. The SDA, SCK and SYNTH are normally high, and the EPOT is normally low.

Write/Read To An Unlinked Module

The link to the module does not exist. Undefined error.

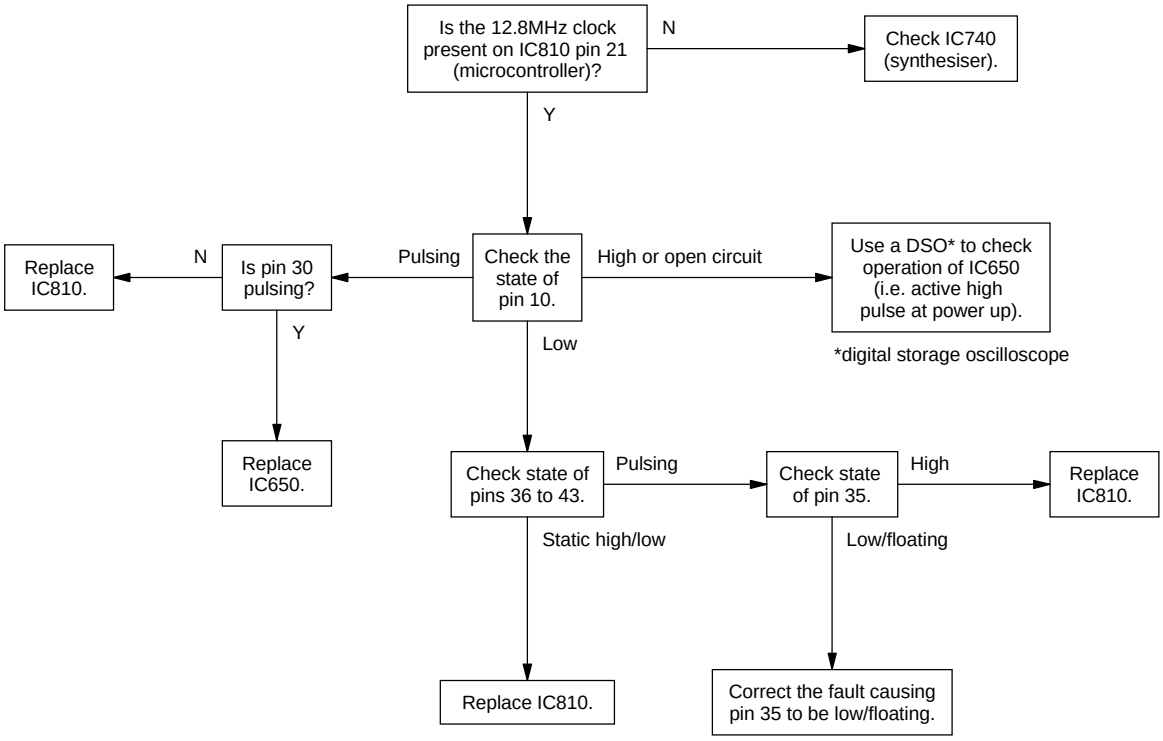
5.7 Fault Finding Charts

Note: The standard test point designations used in this section are as follows:

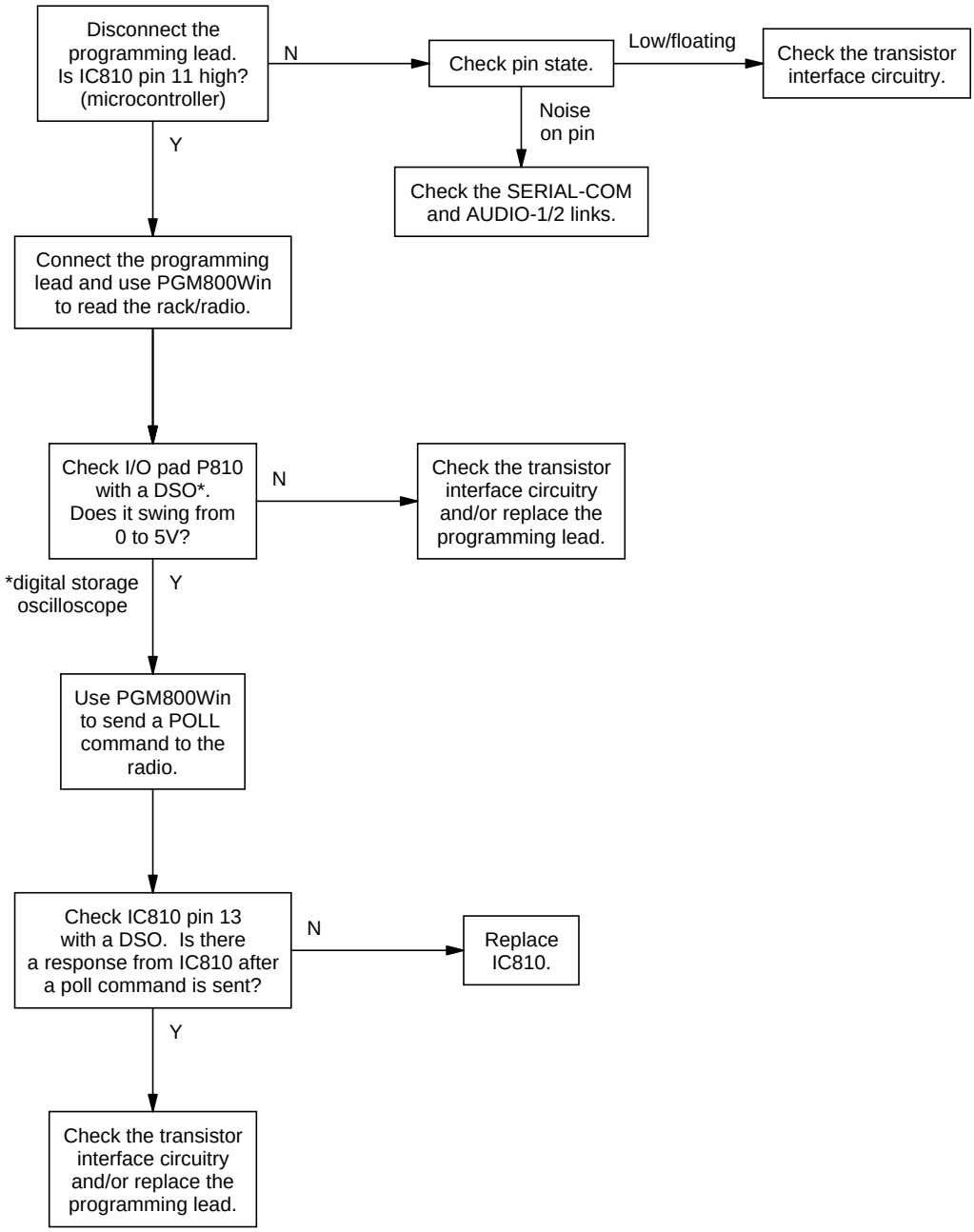
TP601	13.8V
TP602	9V
TP603	20V
TP604	5V

5.7.1 Microcontroller (IC810)

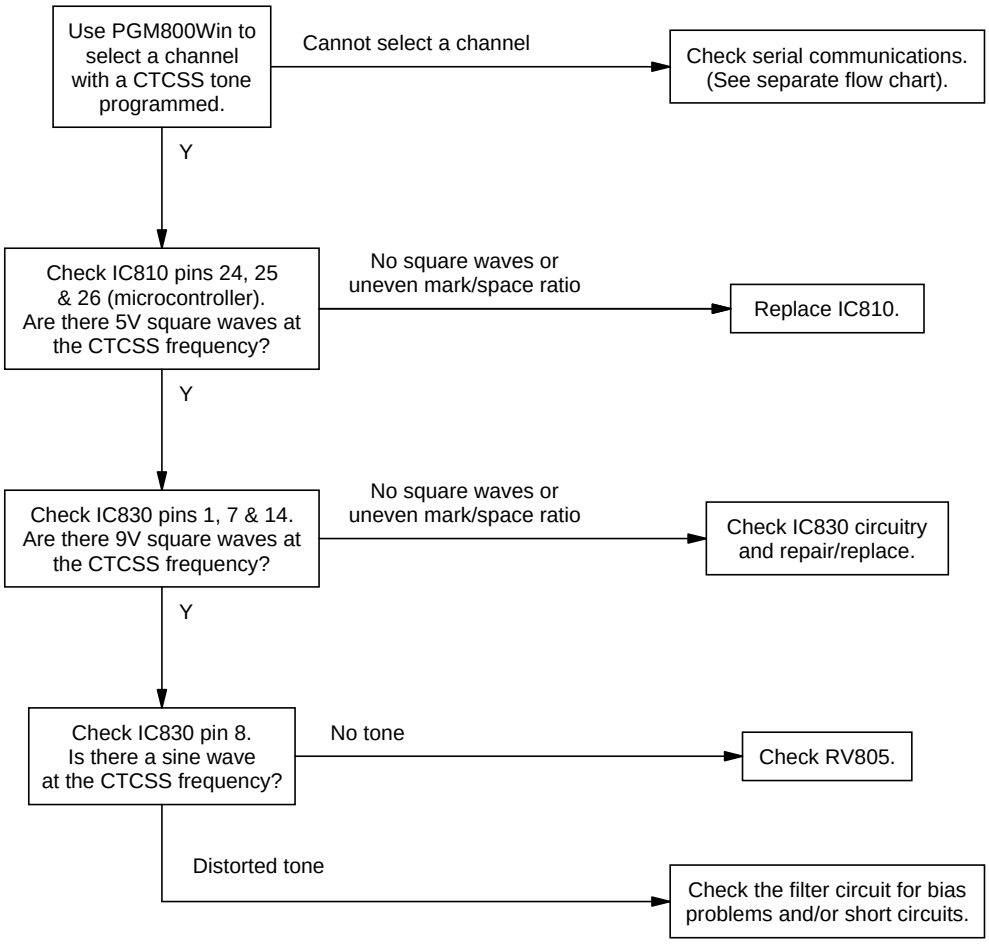
5.7.1.1 Basic Checks



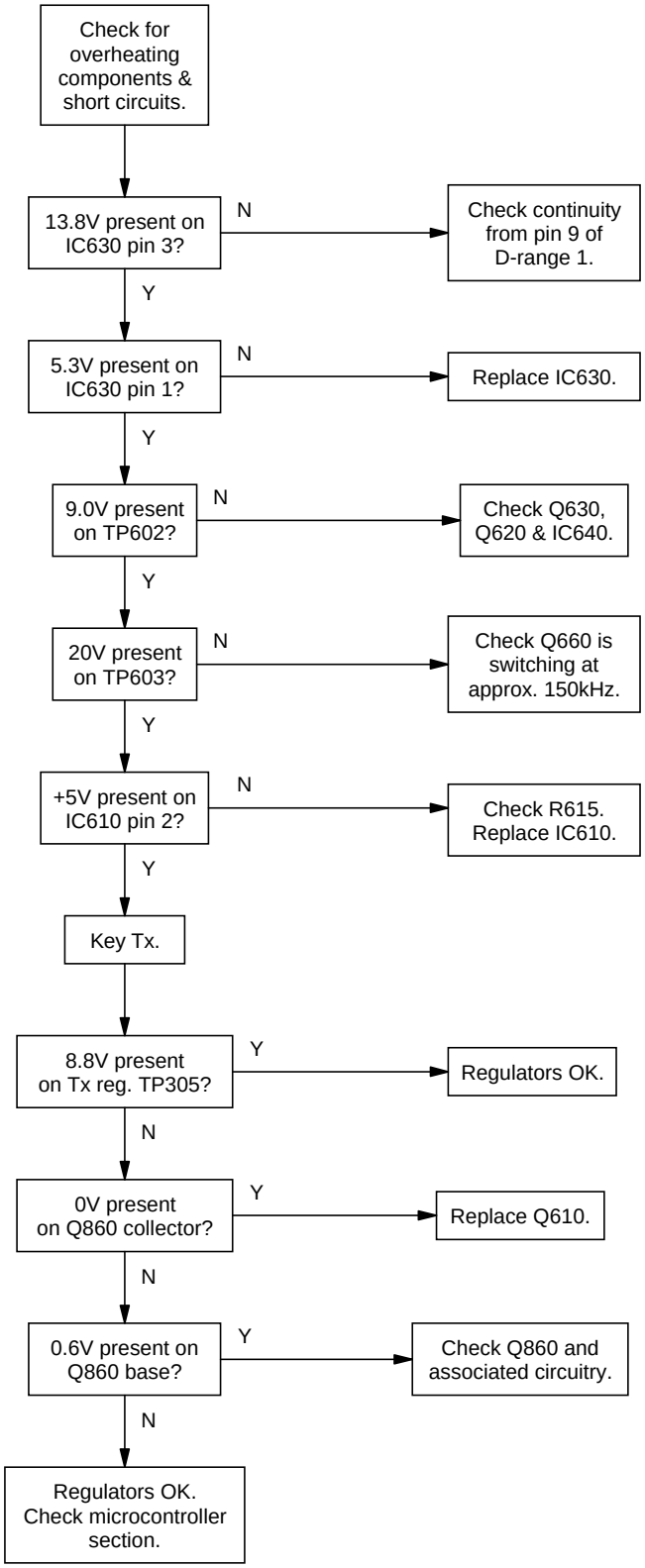
5.7.1.2 Serial Communication



5.7.1.3 CTCSS Encode

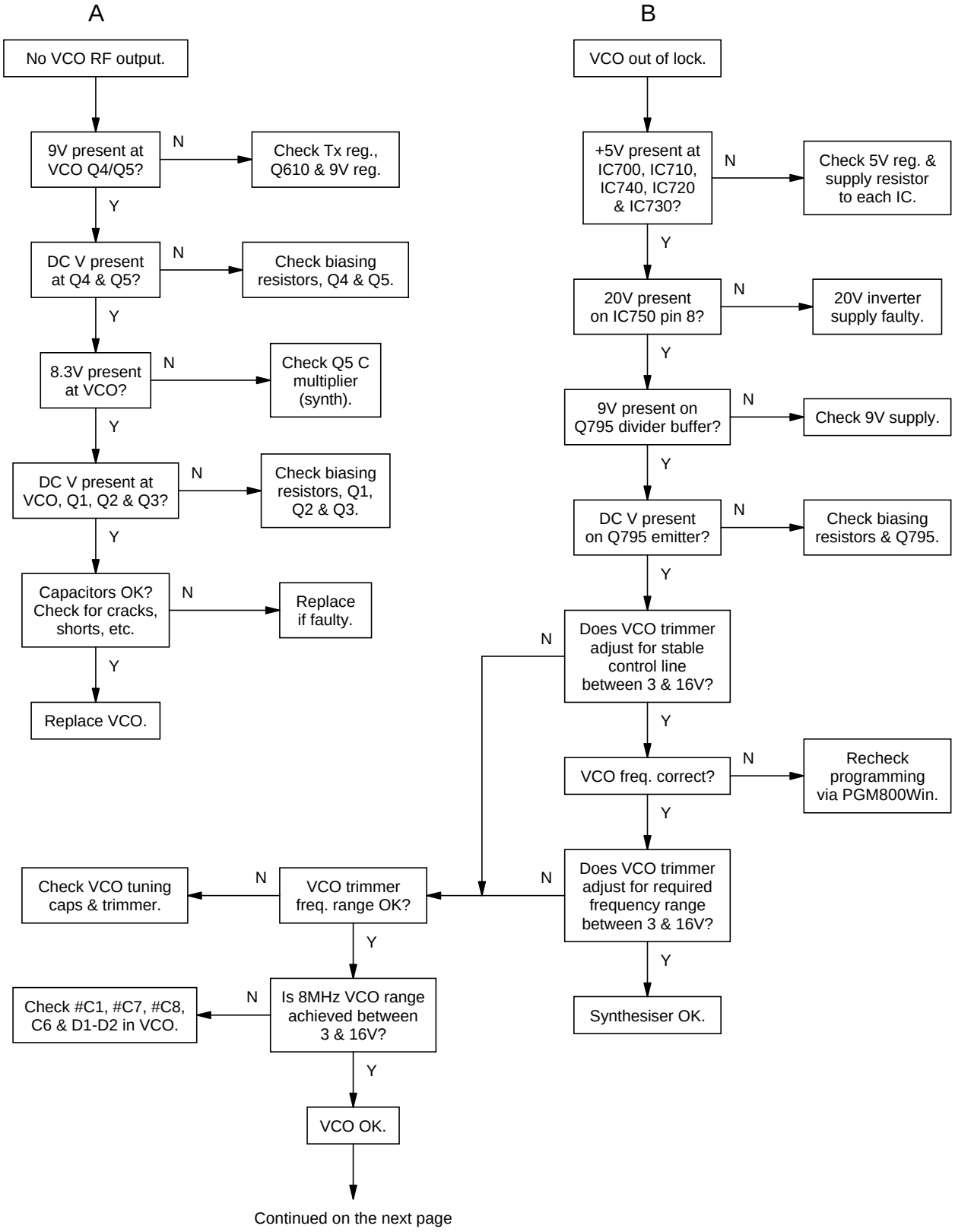


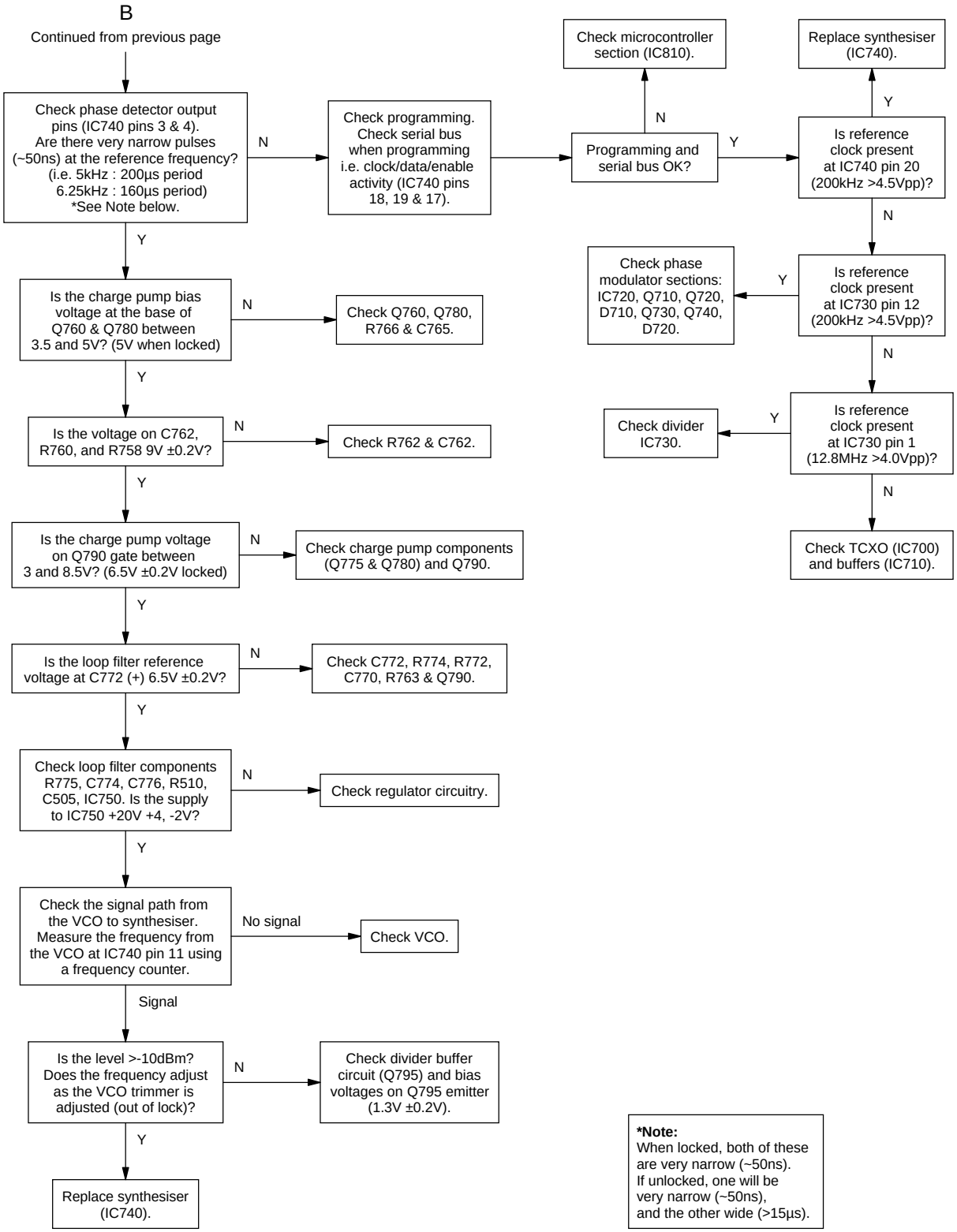
5.7.2 Regulator



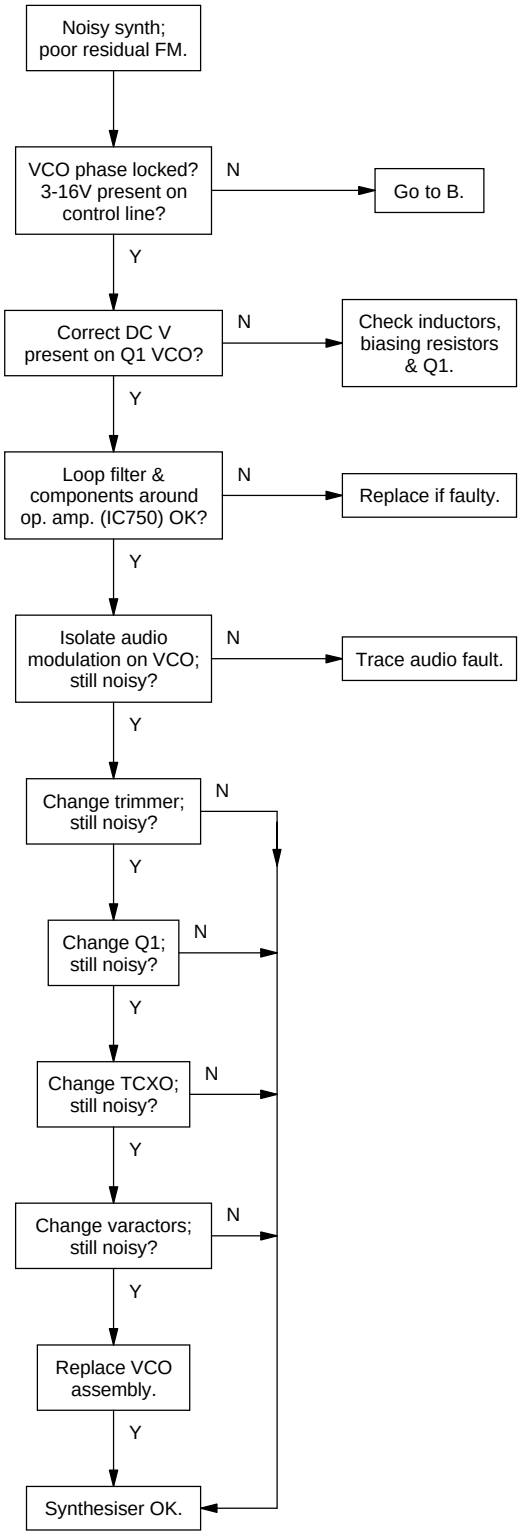
5.7.3 Synthesiser

Refer to the synthesiser circuit diagram (sheet 7) in Section 6 and the VCO circuit diagram in Part E.

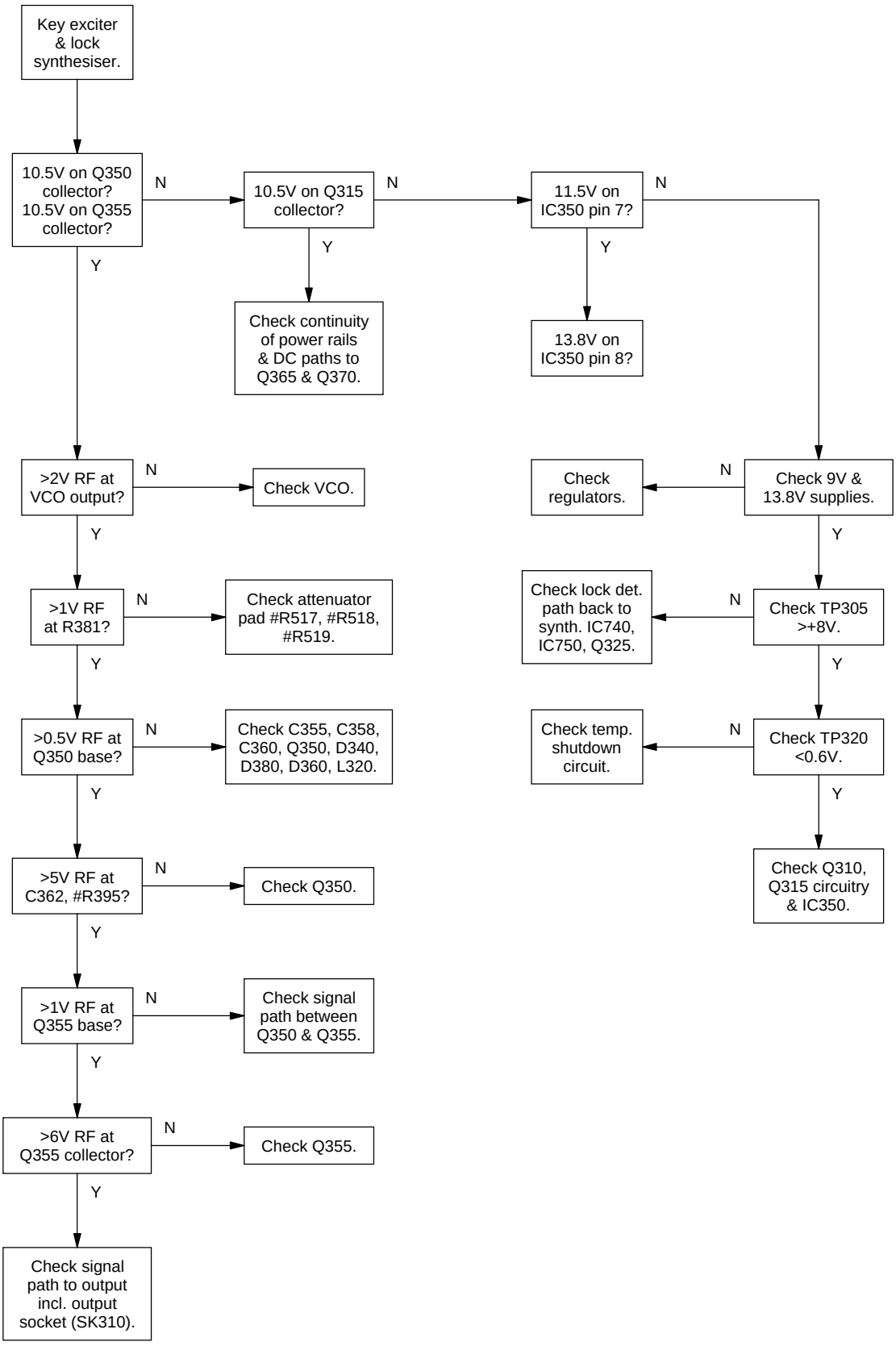



B
Continued from previous page
Check phase detector output pins (IC740 pins 3 & 4). Are there very narrow pulses (~50ns) at the reference frequency? (i.e. 5kHz : 200µs period 6.25kHz : 160µs period) *See Note below.
N
Check programming. Check serial bus when programming i.e. clock/data/enable activity (IC740 pins 18, 19 & 17).
Programming and serial bus OK?
N
Check microcontroller section (IC810).
Y
Is reference clock present at IC740 pin 20 (200kHz >4.5Vpp)?
Y
Replace synthesiser (IC740).
N
Is reference clock present at IC730 pin 12 (200kHz >4.5Vpp)?
Y
Check phase modulator sections: IC720, Q710, Q720, D710, Q730, Q740, D720.
N
Is reference clock present at IC730 pin 1 (12.8MHz >4.0Vpp)?
Y
Check divider IC730.
N
Check TCXO (IC700) and buffers (IC710).
Y
Is the charge pump bias voltage at the base of Q760 & Q780 between 3.5 and 5V? (5V when locked)
N
Check Q760, Q780, R766 & C765.
Y
Is the voltage on C762, R760, and R758 9V ±0.2V?
N
Check R762 & C762.
Y
Is the charge pump voltage on Q790 gate between 3 and 8.5V? (6.5V ±0.2V locked)
N
Check charge pump components (Q775 & Q780) and Q790.
Y
Is the loop filter reference voltage at C772 (+) 6.5V ±0.2V?
N
Check C772, R774, R772, C770, R763 & Q790.
Y
Check loop filter components R775, C774, C776, R510, C505, IC750. Is the supply to IC750 +20V +4, -2V?
N
Check regulator circuitry.
Y
Check the signal path from the VCO to synthesiser. Measure the frequency from the VCO at IC740 pin 11 using a frequency counter.
No signal
Check VCO.
Signal
Is the level >-10dBm? Does the frequency adjust as the VCO trimmer is adjusted (out of lock)?
N
Check divider buffer circuit (Q795) and bias voltages on Q795 emitter (1.3V ±0.2V).
Y
Replace synthesiser (IC740).
*Note:
When locked, both of these are very narrow (~50ns).
If unlocked, one will be very narrow (~50ns), and the other wide (>15µs).

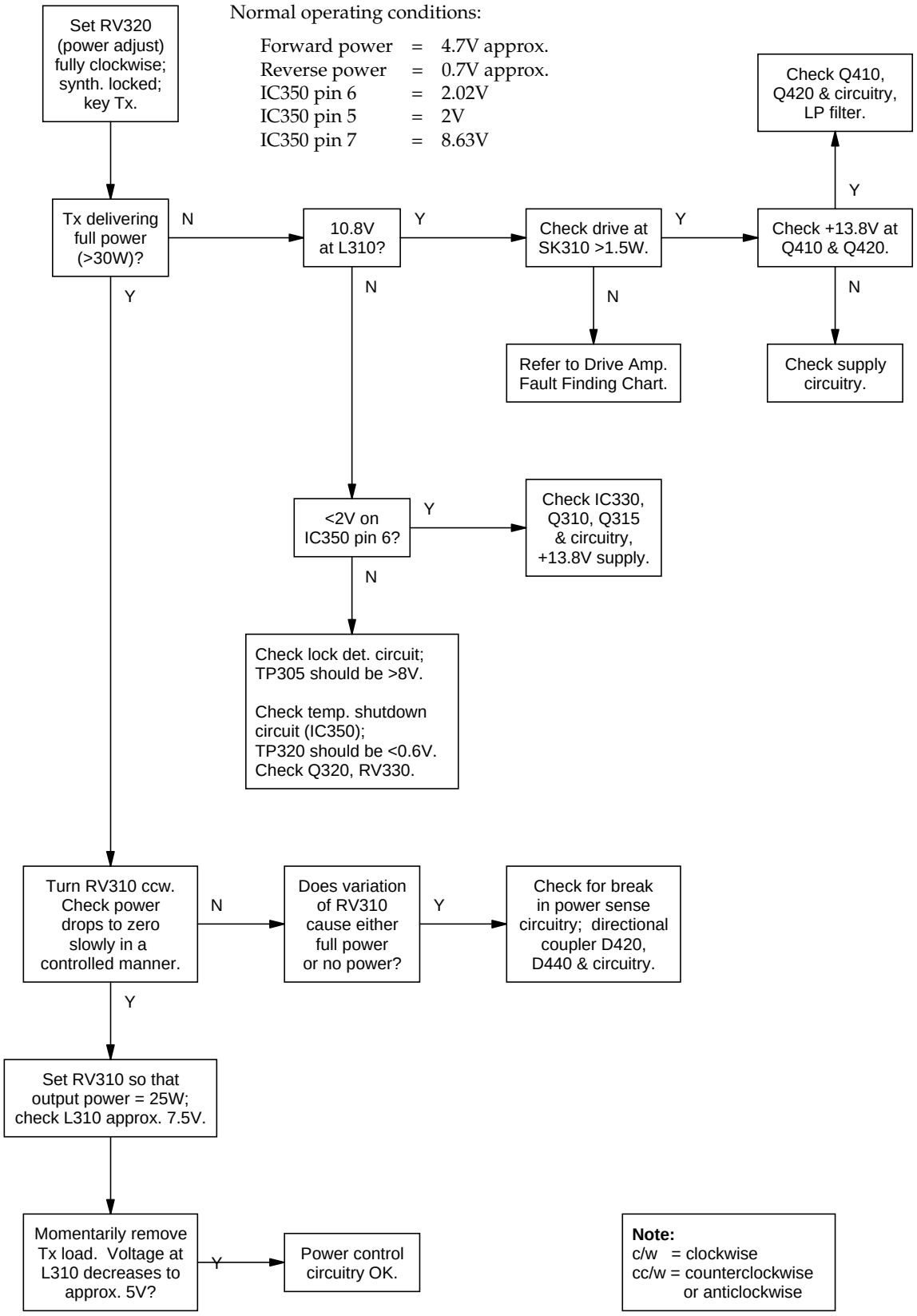
C



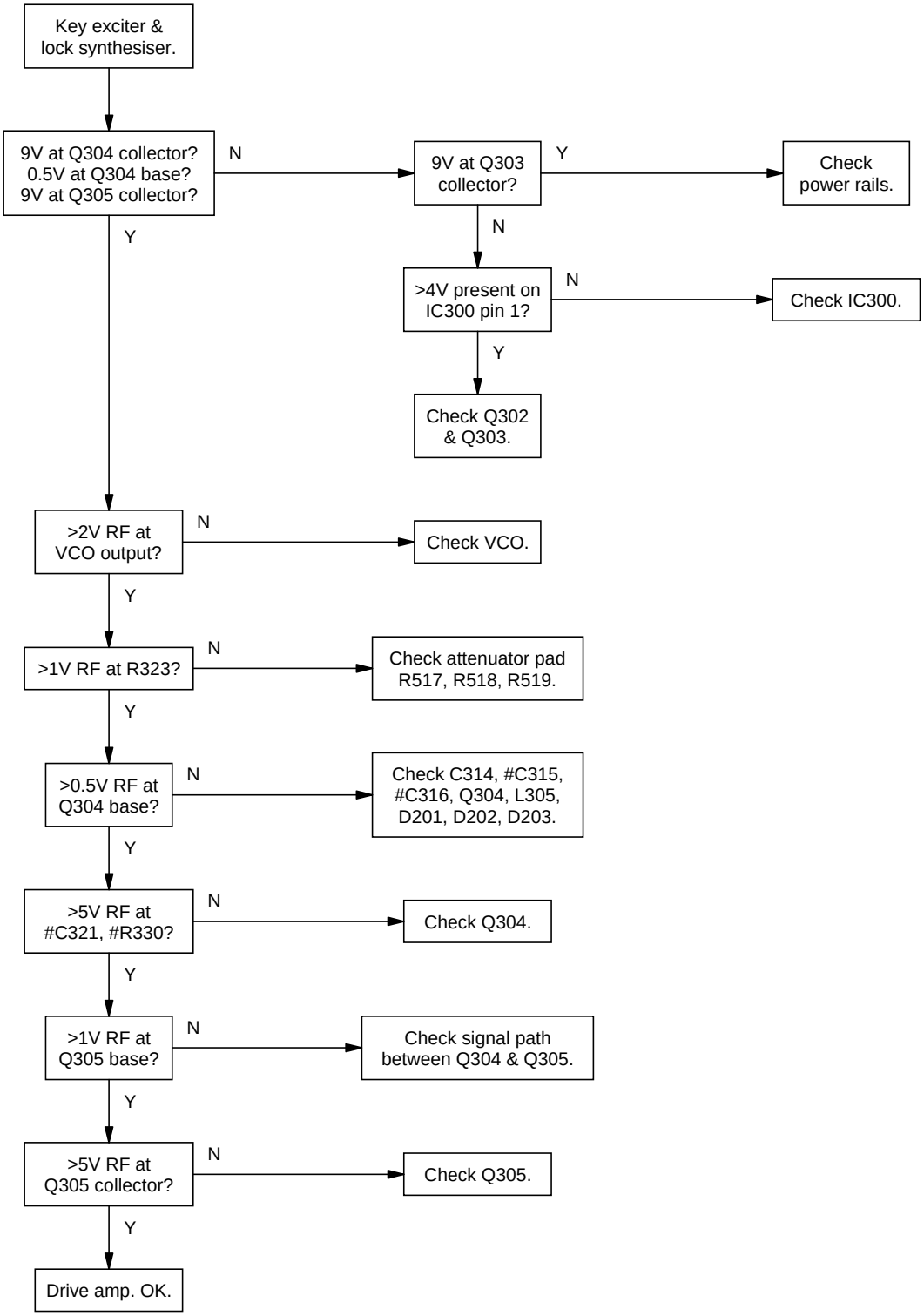
5.7.4 T856 Drive Amplifier



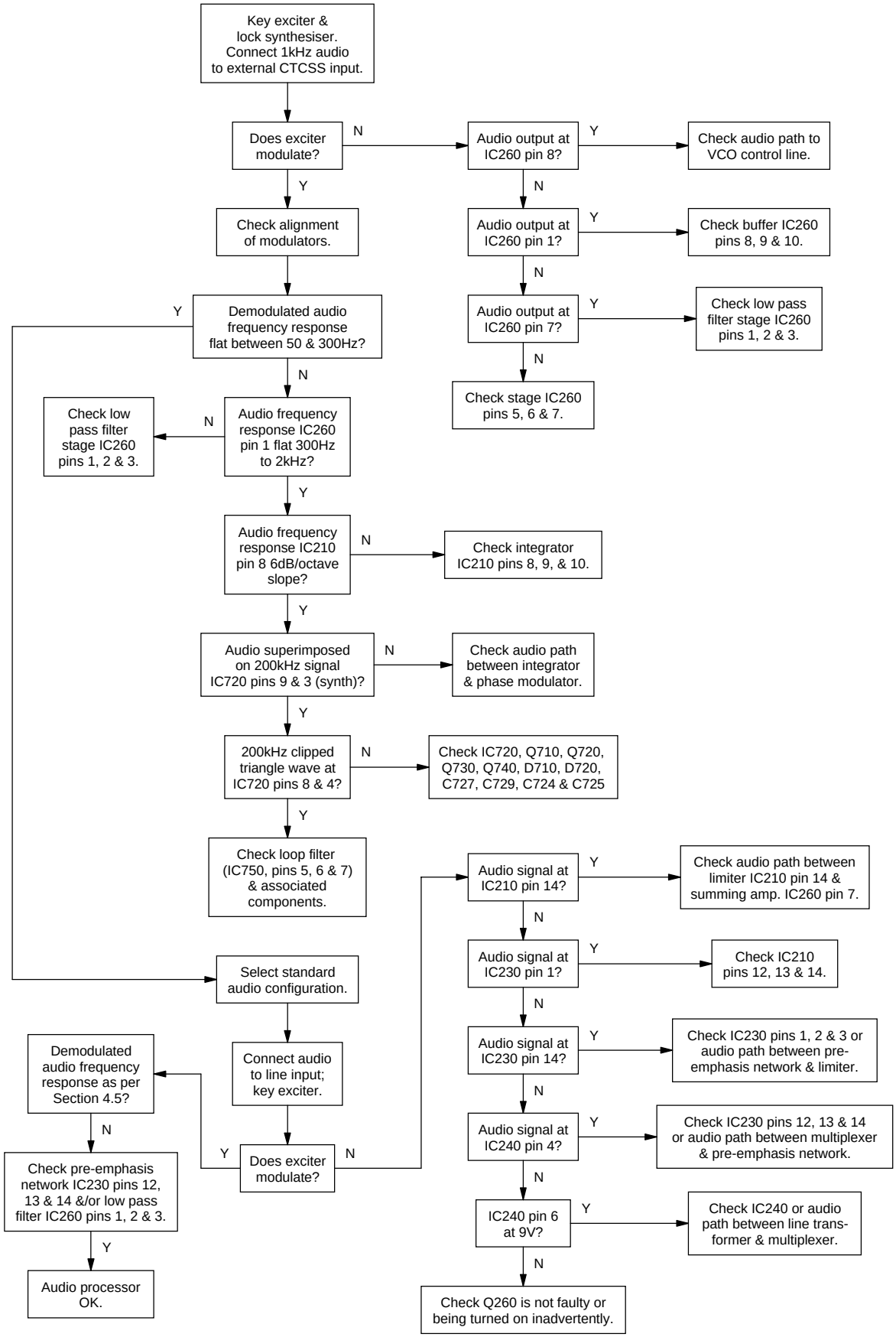
5.7.5 T856 PA & Power Control



5.7.6 T857 Exciter Drive Amplifier



5.7.7 Audio Processor



5.8 To Replace The T856 PA Transistors (Q410 & Q420)

Caution: **Failure to comply with the following procedure can result in failure of the device due to poor heatsinking, or worse, can endanger the health of the assembler if the beryllium oxide die carrier is smashed during assembly.**

Caution: **As the location of certain components in the PA is critical to performance, it is important that any components removed or disturbed are refitted in *exactly* the same position.**

Before attempting to remove a transistor, measure the distance between the capacitors and transistor body to the nearest 0.5mm (measurement "A" in Figure 5.2) so that the capacitors can be replaced in *exactly* the same position. These measurements are shown in Figure 5.2 for the 6LFL package, however the same procedure applies for the SOE (stud) package.

Caution: **Do not apply too much heat or pressure to the PCB pads and tracks as you may damage them or lift them from the PCB, causing permanent damage to the transmitter.**

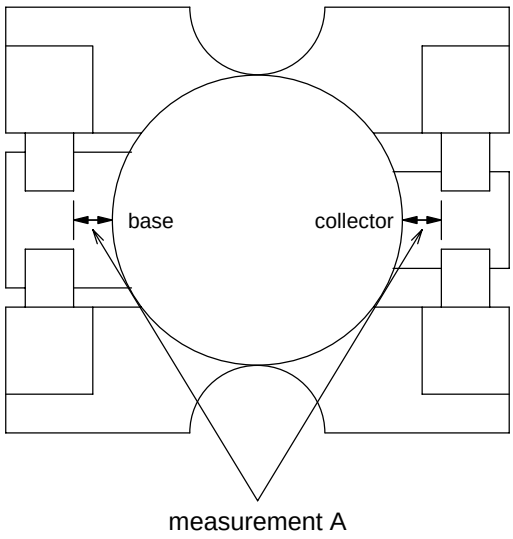


Figure 5.2 Typical Transistor/Capacitor Spacing (Not To Scale)

Desolder and remove the components from around the transistor.

Q420 Only: Desolder and remove the two solder tags.

Desolder the transistor tabs by heating with a soldering iron and lifting away from the PCB with a screwdriver or thin stainless steel spike, then remove the device.

Q410 Only: Unscrew the transistor stud nut and remove the device.

Remove any excess solder from the PCB pads with solder wick.

Trim the tabs of the replacement transistor so that the device sits neatly on the PCB pads provided.

Lightly tin the underside of the transistor tabs. Remove any excess solder to leave a thin, even layer on the tabs.

Apply a small amount of heatsink compound (Dow-Corning 340 or equivalent) to the transistor mounting surface. Sufficient compound should be used to ensure an even film over the entire mounting surface.

Place the transistor on the PCB in the correct orientation and ensure the tabs are flush to the surface.

Q410 Only: Lightly solder one tab to the PCB, then torque down the retaining nut to the correct torque (0.7Nm/6in.lbf.).

Caution: **Do not solder all the tabs before torquing down otherwise the device may be broken.**

Q420 Only: Refit the solder tags.

Solder all transistor tabs to the PCB.

Replace each component in exactly the same position as noted previously.

