STORNOPHONE 800

VHF PERSONAL RADIOTELEPHONE

Type CQP833

Type CQP834

68-88MHz

INTRINSICALLY SAFE

Storno

STORNOPHONE 800-IS

TECHNICAL SPECIFICATIONS

TYPE CQP800-IS			813-IS	814-IS	833-IS	834-IS	863-IS
GENERAL	Channel separation	kHz	20-25	12, 5	20-25	12, 5	20-25
	Frequency band	MHz	146-174		68-88		420-470
	Maximum RF bandwidth	MHz	1, 5		1, 5		2, 0
	Number of RF channels		2, 4, 8, or 12 channels				
	Antenna Impedance	Ω	50				
	Ambient temperature range Operating range Functioning range		 -25°C - +55°C -30°C - +60°C				
TRANSMITTER	RF output	W	0, 2		0, 2		0, 2
	Modulation		Phase (PM)				
	AF response		+6 dB pr. octave preemphasis				
	Phase modulation	Hz	300-3000	300-2400	300-3000	300-2400	300-3000
	Maximum frequency swing	kHz	±4-5	±2, 5	±4-5	±2, 5	±4-5
	Spurious and harmonic radiation		Attenuated to meet government specifications				
RECEIVER	Sensitivity e.m.f. for: 12 dB SINAD (EIA) 20 dB S/N (FTZ)	 µV µV	 0, 5 0, 6		 0, 5 0, 6		 0, 7 0, 8
	Intermodulation attenuation	dB	75		75		70
	Adjacent channel selectivity	dB	85				
	Spurious attenuation	dB	85				
	AF output power	W	0, 2				
	AF response		-6 dB pr. octave deemphasis				
	Phase modulation		300-3000	300-2400	300-3000	300-2400	300-3000
BATTERY	Type of battery		BU805				
	Min. voltage		10. 0V				
	Nom. voltage		12. 4V				
	Max. voltage		15. 3V				
	Max. RF output power		0. 2W				

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STORNOPHONE 800-IS
INTRINSICALLY SAFE VERSION

General

This handbook refers to the intrinsically safe radiotelephone model STORNOPHONE800-IS and is intended to suplement the contents of the manuals describing the standard editions of the equipment.

Introduction

The intrinsically safe Stornophone 800-IS equipment is intended for radio communication in hazardous areas where a flameable concentration of gas or vapour may be present.

The Stornophone 800-IS is a special edition of the standard handheld and remote controlled radiotelephone which has been modified in accordance with the requirements of the safety authorities.

Items of the equipment

In terms of intrinsic safety, the various items comprising a complete equipment falls in two categories:

Category 1 - Items approved for use in hazardous environment.

Radioset for 2 metre band: Type CQP813-IS
Type CQP814-IS

Radioset for 4 metre band: Type CQP833-IS
Type CQP834-IS

Radioset for 0.7 metre band: Type CQP863-IS

Battery type BU805.

Antenna for 2 metre band: AN811, AN812, AN813.
Antenna for 4 metre band: AN831, AN832, AN833.
Antenna for 0.7 metre band: AN861, AN862.

Category 2 - Items for use outside hazardous areas only.

Key for locking the battery code 31.0592.

Battery charging unit type CU804, CU805.

Modifications

For the purpose of converting to standards of intrinsic safety, the radioset is modified as indicated below.

RF unit

AD801 is removed and replaced by two paralleled resistors, located between pin 10 and 16 of PA8x1.

VR801 value of C2 has been changed to 3.9 µF.

FN803/4 value of C18 and C22 have been changed to 3.9 µF.

RC811/31 value of C19 has been changed to 2.2 µF.
value of R4 has been changed to 1 KΩ.

RC861 value of C19 has been changed to 2.2 µF.
value of R11 has been changed to 1 KΩ.

CA801-IS A battery lock has been provided.

Tone equipment

ST801-IS The switching transistor Q1 has been removed in order to reduce the current consumption during transmission of tone calls.

Control head

CP801 A 10 Ω resistor has been inserted in series with C1 the two being incapsulated in moulded epoxy. The values of R1, R2, R3, R4, and R5 (volume control) have been changed to 820 Ω, 3.9 KΩ, 12 KΩ, and 47 KΩ, respectively.
The dial lamp V1 has been removed.

CP802 The volume control resistors have been changed as for CP801.
The dial lamp V1 has been removed.

CB803-IS A 10 Ω resistor has been inserted in series with C1 the two being incapsulated in moulded epoxy.

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The transmitter output power has been reduced to 0.2 W causing the transmitter current drain to be $\leq$ 150 mA.

In all other aspects, the modified radio set is identical with the standard equipment and should therefore be aligned and maintained in accordance with instructions contained in the standard handbook description applicable to the type in use.

Battery

The BU805 battery consists of 11 nickel-cadmium, rechangeable, cylindrical cells of 225 mA capacity. The unit also contains two cascaded active current limiters. The intrinsically safe properties of the battery are entirely governed by the function of the limiters. A detailed description of the unit is enclosed separately.

Conditions of use.

Before the Stornophone 800-IS is operated in hazardous areas, the user must be fully aware of the conditions of use. Failure to observe these conditions will invalidate the certificate of intrinsic safety.

The full meaning of the conditions can be summarised as follows:

a. Only the intrinsically safe battery type BU805 must be used.

b. No attempt must be made to remove or change the battery in the danger area.

c. Items of the equipment listed under category 2 must not be brought into or used in the danger area.

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GENERAL DESCRIPTION AND OPERATING INSTRUCTIONS

The Stornophone 800 portable radiotelephone is a combination transmitter and receiver for FM radio communication service on fixed, crystal controlled frequencies.

The CQP800 is available in either a local controlled or a remote controlled edition and can be fitted with 2, 4, 8 or 12 channels plus optional tone signalling equipment, according to individual customer requirements.

A complete radiotelephone unit consists of three sections, beginning from the bottom, these are:

1) the battery
2) the transmitter and receiver modules section
3) the control head

Local controlled sets have all of their operating controls as well as the speaker/mikrophone and the antenna connector placed in the control head, itself, and is fastened to the top of the radiotelephone.

On remote controlled radios, only the channel switch and the volume control are situated on the radiotelephone proper, while the control head, containing the transmit key, tone key and loudspeaker/squelch switches, the speaker/microphone and an earphone socket, is connected to the set by means of a cable. There are two connectors fitted on the top of the radio set, one is for the remote control cable and the other is for the antenna.

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A comparison of the various models is presented in the table below:

Type	CQP833	CQP834
4m band (VHF)	68 to 88 MHz	
channel spacing	20 / 25 kHz	12,5 kHz
number of channels	accomodation for 2, 4, 8 or 12 channels	
output power	0,1 to 1,5 W (factory adjusted)	

Type	CQP813	CQP814
2m band (VHF)	146 to 174 MHz	
channel spacing	20 / 25 kHz	12,5 kHz
number of channels	accomodation for 2, 4, 8 or 12 channels	
output power	0,1 to 1,5 W (factory adjusted)	

Type	CQP863
0,7m band (UHF)	420 to 470 MHz
channel spacing	20 / 25 kHz
number of channels	accomodation for 2, 4, 8 or 12 channels
output power	0,1 to 1,0 W (factory adjusted)

The size of a particular equipment will depend upon the number of channels, battery size, whether it includes tone equipment and, of course, whether it is local remote controlled.

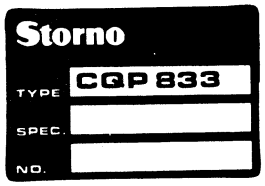
Type specification is arrived at as follows:

specification	code
local controlled	C1
remote controlled	C2
2 channels	X2
4 channels	X4
8 channels	X8
12 channels	X12
tone equipment	T

Thus a four-channel, remote controlled radio-telephone having selective calling would be designated:

C 2 X 4 T

For easy identification, each equipment has a type plate such as the one pictured below, showing its specifications.



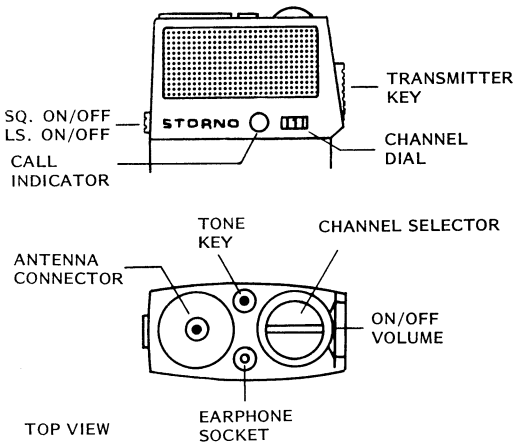
OPERATING INSTRUCTIONS

Local Controlled

Local controlled equipments are fitted with CP801 control heads which interconnect with the various transmitter and receiver modules, channel switch and tone equipment, where applicable, via an internal wiring harness.

The following functions are incorporated in the CP801:

1. push button for keying the transmitter
2. push button for tone keying
3. push button for squelch cancelling + LS IN/OUT and channel pilot lamp
4. dial-type knob for volume control and ON/OFF switch
5. 12-position channel switch
6. socket for earphone
7. antenna connector



Before switching the set on, ensure that the antenna and battery are properly connected.

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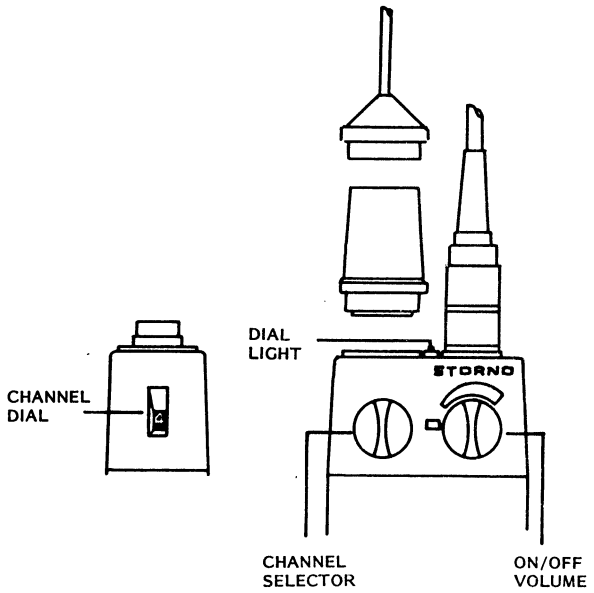

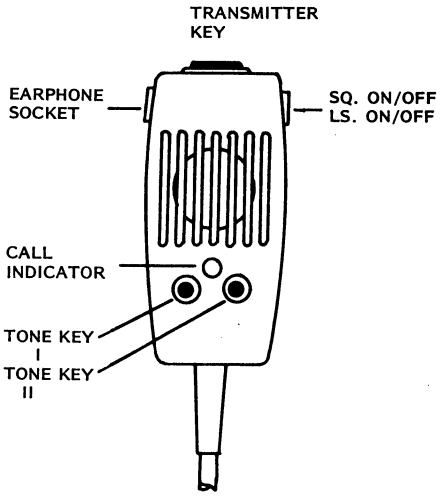

Receiving (without selective calling)

Turn the radiotelephone on by turning the volume control clockwise.

If no signal can be heard, the volume control can be set by pressing the SQ cancelling button while adjusting the volume control for the desired sound level, using the background noise for sound.

Set the channel selector switch to the channel to be used and release the SQ cancelling button. Any traffic on that channel will now be heard from the loudspeaker.

Receiving (with selective calling)

Adjusting the sound level is done just as in the sets without tone equipment except that it might be necessary to press the button twice. This is because now there are two circuits, namely the Squelch circuit and the Loudspeaker circuit, sharing the same switch.

Transmitting (without selective calling)

When the channel is clear, simply press the transmitter key button and speak with a normal voice into the loudspeaker, which functions as a microphone when transmitting.

Transmitting (with selective tone receiver)

Before transmitting, turn on the loudspeaker with the LS IN/OUT button, do not transmit until the channel is free.

Press the transmitter key and speak into the loudspeaker/microphone.

To return to stand by, turn off the loudspeaker again with the LS IN/OUT button.

Transmitting (with selective tone transmitter)

To initiate a call, press the tone key button. When the connection is made, use the ordinary transmitter key button when transmitting (when the tone key is activated the microphone is blocked).

When no longer in use, switch the radio-telephone off by turning the volume control completely counter-clockwise.

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ACCESSORIES

Antennas

The following antennas are developed for use with the STORNOPHONE 800 series radiotelephones:

AN811	36 mm Compact Antenna	146 - 174 MHz
AN812	Shortened Whip Antenna	146 - 174 MHz
AN831	36 mm Compact Antenna	68 - 88 MHz
AN832	Shortened Whip Antenna	68 - 88 MHz
AN861	36 mm Compact Antenna	420 - 470 MHz
AN862	1/4 Wavelength Antenna	420 - 470 MHz

All antennas are fitted with bayonet type plugs that fit into the antenna receptacle.

Batteries

The following Battery types are available:

BU801 silver-zink (AgZn) battery, 12V, 300 mAh
BU802 nickel-cadmium (NiCd) battery, 10, 8V, 225mAh
BU803 nickel-cadmium (NiCd) battery, 12V, 450 mAh

The batteries are encased in a high-impact cast plastic kassette with snap action locks, automatically securing the battery when slid into place.

Battery Chargers

Available battery chargers:

CU801 charging unit with two outlets
CU802 charging unit with ten outlets

Since the various battery types have different charging requirements, each outlet must be coded for one particular type.

The battery chargers can be operated from either a 110 V or a 220 V AC mains.

Earphone

An earphone, HP801, is available for use in areas where high background noise is encountered. The earphone is supplied complete with cable, connector and ear hanger. Plugging in the earphone does not disconnect the built-in speaker.

Tone Equipment

The radio set can be fitted with tone equipment which is contained in a separate panel placed between the control head and the transmitter/receiver circuitry. Incorporating tone equipment into an existing radio set increases the total length of the unit and requires a new, longer casing. Tone signalling sub-units for CQP800 are as follows:

TT801 single or double tone transmitter, tone frequencies from 885 Hz to 2900 Hz

ST801 four or five tone sequential tone transmitter, tone frequencies from 885 Hz to 2800 Hz.

SR801 four or five tone sequential tone receiver, tone frequencies from 885 Hz to 2900 Hz.
(can also be coded for use as a double tone receiver)

Carrying Devices

The following devises are available for carrying the CQP about:

CK801 carrying harness consisting of mounting hardware, short and long straps, belt and clamps
CK802 screw mounted pocket clip
CK803 shoulder strap with retainer for remote control panel
(for remote control, only)

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STORNOPHONE 800 TONE EQUIPMENT

General

The tone equipment chassis is placed between the oscillator chassis and the control head. Radioequipment, which has been delivered without tone equipment, can be extended for tone units. This, however, requires the wiring and cover to be replaced (see diagrams for details).

Available tone units

TT801 Single or double tone transmitter.
The tone frequency range is 885Hz to 2900Hz (14 tones) and the chassis will accomodate a switching unit SU801.

TT802 Single or double tone transmitter.
The tone frequency range is 1010Hz to 3047Hz (14 tones) and the chassis will accomodate a switching unit SU801.

ST801 Sequential tone transmitter for maximum 100.000 combinations.
The tone frequency range is 885Hz to 2800Hz (14 tones) and the chassis will accomodate a delay unit DU801.

ST802 Sequential tone transmitter for maximum 100.000 combinations.
The tone frequency range is 960Hz to 2110Hz (13 tones CCIR) and the chassis will accomodate a delay unit DU801.

SR801 Sequential tone receiver for maximum 100.000 combinations.
The tone frequency range is 885Hz to 2900Hz (15 tones).
A strapping arrangement allows the unit to be used as a double tone receiver for maximum 66 combinations.

SR802 Sequential tone receiver for maximum 100.000 combinations.
The tone frequency range is 960Hz to 2110Hz (CCIR, 12 tones).

TQ801 Pilot tone transmitter/receiver for 5 tones.
A switch selects the desired frequency.

Accessory units

AC801 Alarm circuit for generating an alerting signal upon reception of a command from SR800. The unit is to be used mainly in CRP800.

DU801 Delay unit for prolongating of the time between keying and the release of the first tone sequence signal and for increasing the duration of the first tone in a tone sequence signal.

SU801 Switching unit for insertion in TT801/TT802, thereby providing two tone combinations to be selected on the control unit. The unit is to be used in remote controlled equipment only.

SU802 Switching unit for automatic reset of sequential tone receiver SR800 30 sec. after reception of a call in order to maintain speach secrecy.
The unit is to be used mainly in SRP800.

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COMPACT ANTENNA AN831

AN831 is a compact VHF antenna for STORNO-PHONE800 adjustable to frequencies in the 68 - 88 MHz band.
The radiating element consists of a short toploaded helix wound on a DURAN glass tube form.
In the feeding point of the helix is inserted an LC network for adjusting to the RX and TX frequencies.
Switching between RX frequency and TX frequency is accomplished automatically by a PIN diode switch when keying the transmitter. The resistor R decharge the trimming capacitors in order to reduce the switching time.
A resistor in the radio set provide limiting of the diode current to approx. 10 mA.
AN831 is primarily intended for local controlled radio sets and can be recommended for remote controlled radio sets only if maximum communication range is not demanded.

ADJUSTMENT PROCEDURE FOR MIN. VSWR.

Instruments:
CQP800 Rho-Detector type TSD36; Storno code U95B0476.
RF Generator with Amplitude Modulation (> 80%).
AF voltmeter; $Z_{in} \geq 1\ M\Omega$; Sensitivity better than 30 mV f. s. d.
Adjustment tool; Storno code 17. 0053.
Calibrated load mismatch VSWR = 2 : 1.
Code nr. U95B0516

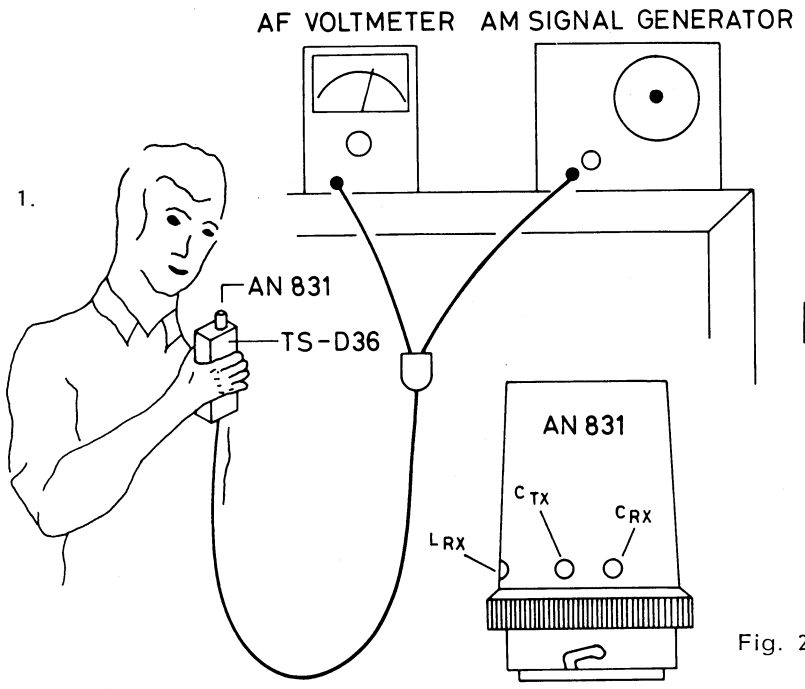
TEST SET-UP.

The cables from the Rho-Detector are connected to the RF generator and to the AF voltmeter as shown in fig. 1.

Preadjustment

AM modulate the RF generator and set the frequency to 74 MHz.

Fig. 1.



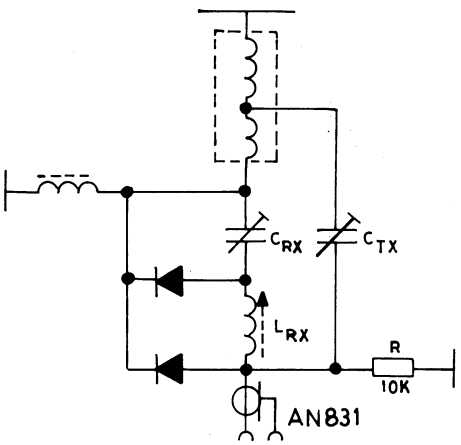


Fig. 2.

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Adjust the RF generator output for a suitable deflection on the AF voltmeter.
Note the deflection on the AF voltmeter with the calibrated load mismatch connected to Rho-detector TS-D36, ref. VSWR 2:1.
Connect the antenna to be adjusted to the Rho-detector (fig. 1), hold it by your right hand in the normal speaking position, and adjust the trimmers through the holes in the antenna housing (fig. 2).

C_{RX} is adjusted to maximum capacity (corresponding to the lowest obtainable RX frequency - adjusted according to step b).
C_{TX} is adjusted to minimum deflection on the AF voltmeter at 74 MHz.
L_{RX} is adjusted to minimum deflection on the AF voltmeter at 68 MHz.
L_{RX} is now adjusted to fulfil the requirement to a maximum frequency separation of 6 MHz between TX and RX.
L_{RX} will normally not need further adjustment.

ADJUSTMENT TO CUSTOMER FREQUENCY.

a. C_{TX} is adjusted to minimum deflection on the AF voltmeter at the mean frequency for the TX frequencies given.

b. C_{RX} is adjusted to minimum deflection on the AF voltmeter at the mean frequency for the RX frequencies given.
Repeat step a and b.

c. Note the AF voltmeter deflection at the specified frequency bandwidth limits for constant RF generator output.
The deflections must not exceed that noted for VSWR = 2: 1.

If the separation between TX and RX frequencies exceeds the normal 6 MHz, the separation may be increased by readjusting L_{RX}.

In transmit position the TS-D36 Rho-detector supplies +12V via the coaxial cable to activate the PIN diode switch in the antenna.
High RF input signals to the antenna may activate the PIN diode switch. This is noticed as the RX adjustment being detuned. If this is found the RF level is reduced until the detuning stops.

Note:

The Rho-Detector can be used in conjunctions with a sweep equipment, e.g. Rhode & Swarz polyscopes. This will illustrate the symmetry and bandwidth of the antenna.

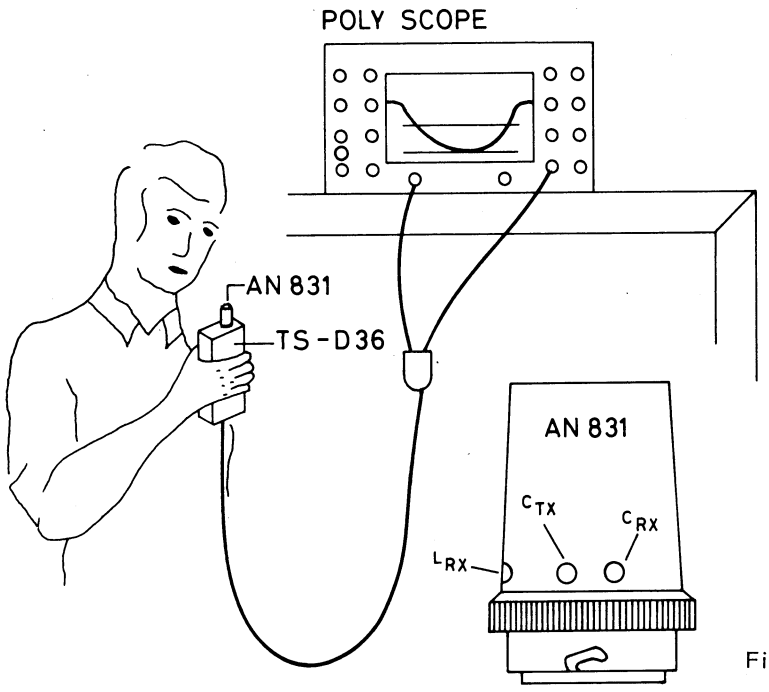

Fig. 3.

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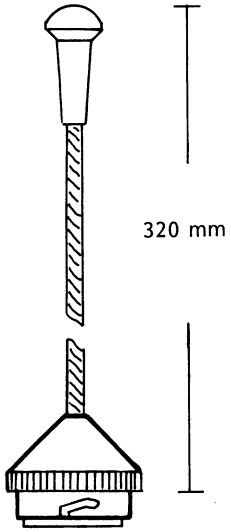
WHIP ANTENNA AN832

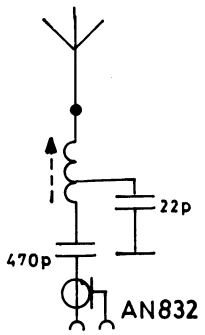
AN832 is a shorted flexible λ/8 whip antenna for STORNOPHONE 800 adjustable to frequencies in the 68 - 88 MHz band.

The antenna consists of a flexible whip, which is electrically extended by an adjustable inductor with a suitable capacitance for correct impedance matching.

At the end of the series inductor is inserted an isolating capacitor ensuring that DC voltage will not be present on the radiating element during transmit.

AN832 can be used in conjunction with both local and remote controlled equipment.





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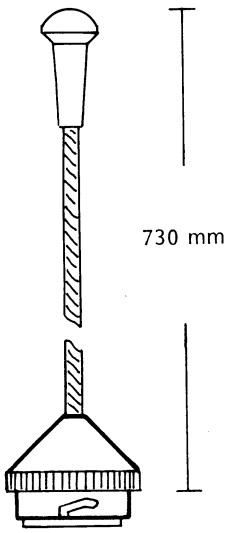
WHIP ANTENNA AN833

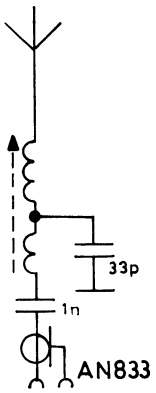
AN833 is a shortened flexible λ/4 whip antenna for STORNOPHONE 800 factory adjusted to cover the frequency band 68 - 88 MHz.

The antenna consists of a flexible whip, which is electrically extended by an adjustable inductor with a tap for a suitable shunt capacitor to obtain correct impedance matching.

The inductor is adjustable to compensate production spread.

At the end of the inductor is inserted an isolating capacitor ensuring that DC voltage will not be present on the radiating element during transmit.





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ADJUSTMENT PROCEDURE

AN832, AN833, AN812, AN813, AN862

ADJUSTMENT PROCEDURE for min. VSWR.
(AN862 is not to be adjusted, but the bandwidth must be checked.)

AN833 is adjusted to 78 MHz.
AN813 is adjusted to 160 MHz.
AN862 is adjusted to 445 MHz.
AN832 / AN812 is adjusted to the mean frequency for TX/RX.

1. Instruments:

CQP800 Rho-Detector type TS-C36: Storno code no. U95B0476.
RF generator with Amplitude Modulation (> 80%).
AF voltmeter; $Z_{in} \geq 1$ MΩ; Sensitivity better than 30 mV f.s.d.
Adjustment tool; Storno code no. 17.0053.
Calibrated load mismatch VSWR 2 : 1.
Code nr. U95B0516

2. TEST SET-UP.

The cables from the Rho-Detector are connected to the RF generator and to the AF voltmeter as shown in fig. 1.

AM modulate the RF generator and set the frequency as stated above.

Adjust the RF generator output for a suitable deflection on the AF voltmeter.

Note the deflection on the AF voltmeter with VSWR ref. 2 : 1 connected to the Rho-Detector.

The antenna is connected to the CQP800 Rho-Detector TS-C36 (fig. 1), which is held by your right hand in the normal speaking position.

The trimmers are adjusted through the holes in the antenna housing (fig. 2, antenna cap) to minimum deflection on the AF voltmeter.

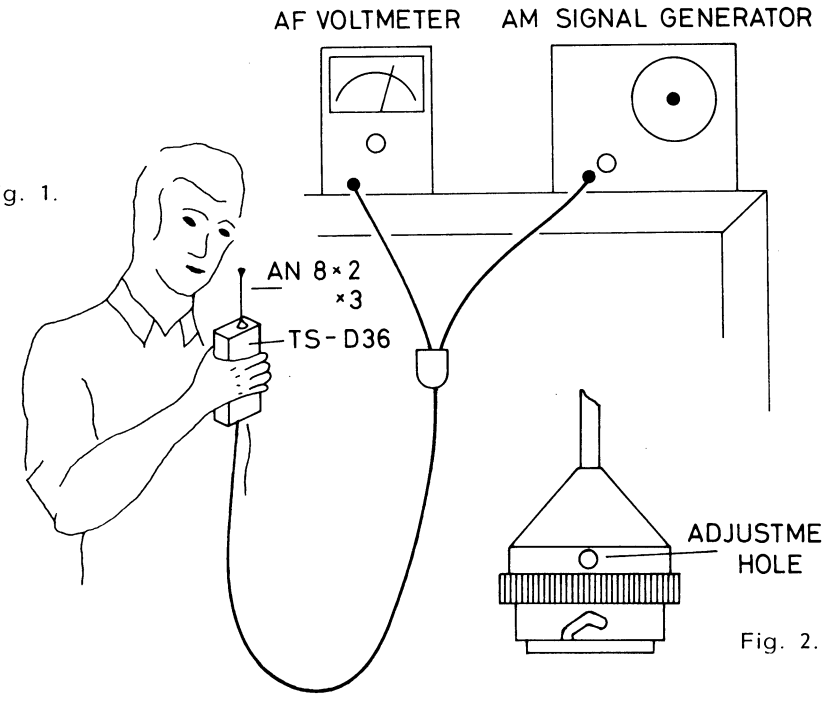

Fig. 1.

Fig. 2.

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Note the AF voltmeter deflection at the specified frequency bandwidth limits for constant RF generator output.

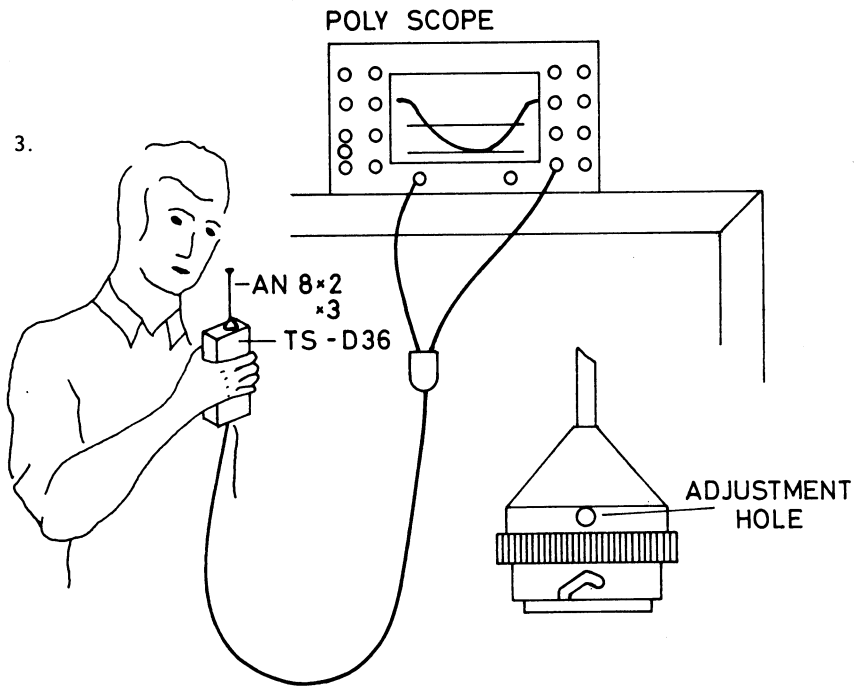
The deflection must not exceed that noted for VSWR 2 : 1.

Note:

The Rho-Detector can be used in conjunction with a sweep equipment e.g. Rhode & Swarz Poly scopes.

This will illustrate the symmetry and the bandwidth of the antenna (see fig. 3).

Fig. 3.



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STORNOPHONE 800 ANTENNAS
Technical Specifications

	Frequency range MHz	Nominal impedance Ω	Bandwidth (VSWR ≤ 2) MHz	Max. difference between TX - RX freq. MHz	Typical gain performance rel. to λ/4 whip dB	Length mm	Weight g	Remarks
AN831 * Compact	68- 88	50	0.7	6	-11.5	36	38	Contains solid state aut. tuning device TXpos; I_{DC} = 10 mA
AN832 * Shortened λ/8 whip	68- 88	50	6	6	-7	320	44	
AN833 ** Shortened λ/4 whip	68- 88	50	>20	>20	-2.5	730	62	
AN811 * Compact	146-174	50	2.5	10	-5	36	38	Contains solid state aut. tuning device TXpos; I_{DC} = 10 mA
AN812 * Shortened λ/8 whip	146-174	50	9	9	-3	206	40	
AN813 ** λ/4 whip	146-174	50	>30	>30	0	510	50	
AN814 *	146-160	50	14	14	1) -6 hand held	105	20	1) -14 dB TXpos. -19 dB RXpos. Clipped to revers.
AN861 * Compact	420-470	50	10	10	-2	36	38	
AN862 ** λ/4 whip	420-470	50	>50	>50	0	160	35	
AN863 ** Heliflex	420-470	50	50	50	-2	65	47	
AN841 * Heliflex	TX: 105-108 RX: 136-148	50	TX: 2,8 RX: 11.5	50		160	60	Contains solid state aut. tuning device TX pos: 1 DC=10mA

* Adjustable to working frequencies.

** Factory adjusted.

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Storno

CQP830
CIRCUIT DESCRIPTION

Transmitter Circuit (see block diagram)

The transmitter is bilt up of several modules, each of which is completely enclosed (shielded) and has connector pins protruding from the bottom of the module. All the modules are then mounted onto a mother board that is common to both transmitter and receiver circuits. The transmitter section consists of the following modules:

XO812	Crystal Oscillator
AA802	Modulation Amplifier
FN803	Modulation Filter for 20/25 kHz channel separation
or FN804	Modulation Filter for 12.5 kHz channel separation
PM811	1st Phase Modulator
PM831	2nd Phase Modulator
FD831	1st Frequency Doubler
FD832	2nd Frequency Doubler
BP831	Band Pass Filter
PA831	1st Power Amplifier
PA832	2nd Power Amplifier and Antenna Switch
FN831	Antenna Filter
AD801	ADC Circuit
VR801	Voltage Regulator

Modulation Amplifier AA802 and FN803/FN804

The modulation amplifier function is carried out by the Modulation Amplifier, AA802 in conjunction with a Modulation Filter, FN803 or FN804. The microphone signal is applied to an operational amplifier, the degree of negative feedback, and thus the amplifier gain, can be adjusted by means of an external resistor. Microphone sensitivity can then be adjusted to suit individual requirements. In radio sets with built-in tone transmitters or sequential tone transmitters, the microphone amplifier is disabled by the tone key.

The amplified AF signal is applied to a limiter via a differentiating network. The limiter is likewise an operational amplifier utilising negative feedback. Following the limiter is an integration network and an active lowpass filter where the active element is another operational amplifier. The active filter removes any harmonics of the original input signal that arise during limiting action, and it also keeps the frequency excursions within the tolerances required for the channel spacing used in the particular equipment. An extra limiter is inserted between the integration network and the active lowpass filter to prevent strong input signals of low frequencies from overloading the filter.

Transmitter Oscillator XO812

The transmitter exciter signal is generated by a crystal, Colpitts-type oscillator operating on the crystal's fundamental frequency, which will be in the range of 17 to 22 MHz. The oscillator starts when the channel selector completes the circuit path to chassis ground. The collector circuit is tuned by a variable capacitance diode which also detunes the resonant circuit whenever the channel switch breaks the ground connection. Thus several oscillators can be tied in parallel without mutual loading effects. The output signal is capacitively taken off the tank circuit. The maximum number of channels is 12, with all oscillators placed in an oscillator panel.

Phase Modulator PM811/PM831

The PM811 Phase Modulator consists of an input- and an output buffer plus a phase modulator stage. The exciter signal from the oscillator is fed to the input buffer stage. This amplifier, with fol-

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lowing π network, ensures a constant sine wave signal to the phase modulator. The modulator is a transistor amplifier stage where the modulating audio signal is applied to the emitter, which is RF decoupled. The modulation signal varies the transconductance (gm) of the amplifier and thus the phase angle (φ) of the RF signal at its output. To function properly, the modulator must work into a constant load and is therefore followed by a buffer stage whose output signal is applied to an additional phase modulator, PM831, whose circuitry is similar to PM811. The output from PM831 is taken off from a capacitive voltage divider and works into a buffer amplifier at the input of FD831.

Multiplier Chain FD831 and FD832

The multiplier chain consists of two frequency doubler stages, FD831 and FD832. In addition to the input buffer, the FD831 module also includes an amplifier whose output is tuned to the second harmonic of the input frequency. The FD832 module has only one amplifier, a doubler whose two output LC circuits likewise are tuned to the second harmonic of the input frequency. The final frequency is thus four times the oscillator frequency.

Band Pass Filter BP831

To ensure suppression of the undesired harmonics that arise in the frequency multiplying process, the multiplier chain is terminated by a double tuned band pass filter, the BP831.

Power Amplifier PA831 and PA832

The output power from the multiplier chain (approx. 10 mW) is amplified to the required antenna power (0.1 to 1.5 W) in a three-stage amplifier composed of the PA831 and the PA832 modules.

PA831 contains two amplifier stages. The collector voltage to the first transistor is supplied via the ADC Circuit, and is variable. If more gain is required to drive the following PA832 stage, the collector supply (ADC) voltage will rise. On the other hand, if the drive signal is more than enough, the ADC voltage will drop.

PA832 contains the transmitter final amplifier plus a circuit for electronically switching the antenna between the transmitter and the receiver. Collector current for the second transistor in PA831 passes through the switching diodes, whereby they can be consired to be virtual short circuits. This connects the Power Amplifier output to the antenna while short circuiting the receiver input. When receiving, the diodes become reverse biased, effectively isolating the transmitter from the antenna while connecting the antenna to the receiver input.

ADC Circuit AD801

The transmitter output current is kept very nearly constant by means of the ADC Circuit. The voltage drop across a small resistor (1.2 ohms) in the output transistor's collector return is monitored by the ADC stage, which then regulates the collector voltage to the first transistor amplifier in the PA831 stage with the net effect of cancelling any variations and thus keeping the RF output at a constant value. The amount of current through the output stage, and thus the output power, can be set by means of a resistor mounted on the mother board.

Antenna Filter FN831

A nine-pole, lowpass filter having a cutoff frequency of 180 MHz is inserted between the transmitter output and the antenna. The filter suppresses any harmonics created in PA832.

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Receiver Circuit (see block diagram)

The receiver is a double conversion superheterodyne using intermediate frequencies of 21.4 MHz and 103.5 kHz. Channel selectivity is achieved by means of a crystal filter in the first IF circuit. The radiotelephone can be fitted with up to 12 channels, one oscillator per channel. All the oscillators are arranged in parallel on a special oscillator panel which also contains the transmitter oscillators. The receiver employs an electronic squelch circuit whose threshold can be set with a resistor on the mother board. There is a pushbutton on the control panel for cancelling the squelch.

The receiver consists of the following modules:

RC831	Receiver Converter
XO831	Crystal Oscillator
XF803	Crystal Filter for 20/25 kHz channel separation
or XF804	Crystal Filter for 12.5 kHz channel separation
IC801	IF Converter
IA801	1st IF Amplifier
IA802	2nd IF Amplifier and Discriminator
SQ801a	Squelch Circuit
AA801	AF Amplifier
VR801	Voltage Regulator

Receiver Converter RC831

The RC831 converts the frequency of the antenna signal to the 1st IF frequency of 21.4 MHz. The incoming signal path from the antenna is through the Antenna Filter, FN831, and then via the antenna switching circuit in PA832 to the input of the RC831. The signal then passes through a two-element bandpass filter to a field effect transistor (J-FET) operating as a grounded gate amplifier. After amplification, the signal passes through a three-element VHF filter consisting of L3, L4 and L5. This filter is what mainly determines the selectivity of the converter. The signal is taken off at a 50-ohm tap and fed to the mixer via L6, a transformer that serves as an adjustment for achieving optimal sensitivity/gain. The local oscillator signal from the XO module(s), after passing through a two-element bandpass filter, is applied to the mixer gate. The bandpass filter ensures sufficient attenuation of any harmonics present. The mixer transistor is also a J-FET, this time in a grounded source configuration.

The IF signal is taken off via a combination autotransformer/L network to match the impedance of the following crystal filter.

Oscillator XO831

The local oscillator signal of 90 to 110 MHz is generated in the Hartley type crystal oscillator where the transistor operates as a grounded base amplifier, the oscillator starts when the channel selector switch completes the emitter circuit path to chassis ground. The collector circuit is tuned by a variable capacitance diode which also detunes the resonant circuit whenever the channel switch breaks the ground connection. Thus several oscillators can be tied in parallel without mutual loading effects. The output signal is capacitively taken off the tank circuit.

The local oscillator signal frequency lies 21.4 MHz over the antenna frequency and the formula for calculating the crystal frequency is therefore:

$$f_x = f_a + 21.4 \text{ MHz}$$

(where f_x = crystal frequency and f_a = antenna frequency)

Crystal Filter XF803 and XF804

The Crystal Filter unit comprises an eight-pole monolithic crystal filter and an impedance matching transformer for matching the output to the impedance of the following IF converter. Practically all of the receiver selectivity is achieved in the crystal filter.

XF803 is employed in equipment with 20/25 kHz channel spacing.
XF804 is employed in equipment with 12.5 kHz channel spacing.

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IF Converter IC801

The first IF frequency (21.4 MHz) is converted to the second IF frequency (103.5 kHz) in this module, which contains an amplifier, a mixer and an oscillator. The output signal is taken off from a center tap on the coil in the mixer transistor's collector circuit and applied to an intermediate frequency amplifier, IA801.

IF Amplifier and Discriminator IA801 and IA802

The first Intermediate Frequency Amplifier, IA801, consists of two differential amplifiers in cascade. The output signal is applied to the second Intermediate Frequency Amplifier, IA802, which contains a 103.5 kHz bandpass filter, a quadrature detector, a lowpass filter and an audio frequency amplifier.

The IF amplifier, detector and AF amplifier are all included in one integrated circuit.

The balanced quadrature detector has excellent AM suppression and contains only one tuned circuit. Inserted between the detector and the AF amplifier is an active lowpass filter which removes any superimposed IF signal. The detector bandwidth and the audio amplifier output voltage can be regulated by means of two external resistors on the mother board (AF output at 1000 Hz = 110 mV).

LF Amplifier AA801

The audio frequency signal from IA802 is fed to the AA801 AF Amplifier where it becomes amplified to the desired audio power level. First the signal passes through an active high-pass filter that rejects any low noise frequencies. Next comes an integration network which gives the required de-emphasis. An integrated circuit containing two separate amplifiers makes up the amplifier and output stages. The volume control is inserted between these two amplifiers. The upper frequency limit of the output amplifier can be set for either 12.5 kHz or 20/25 kHz channel spacing by means of an external connection between two of the module pins.

The Squelch Circuit can block the AF signal path by grounding the squelch terminal (5). When the squelch output goes positive again, the audio amplifier will operate normally.

Squelch Circuit SQ801a

The receiver Squelch Circuit operates automatically, according to the noise content of the antenna signal. Weak signals contain greater noise than acceptable signal levels. The output AF signal from IA802 is also present at the input to SQ801a, where it must first pass through an active highpass filter that suppresses frequencies under 7 kHz. Higher frequencies become amplified, then detected and whenever the signal-to-noise ratio is objectionable, the detected noise signal will be sufficient to turn off the audio amplifiers by depriving them of their collector voltage. With an acceptable signal strength at the antenna, the noise content will be too low to trigger the squelch, and the positive collector supply (+ V_{cc}) will be available to the audio amplifiers, allowing them to operate normally. An external resistor sets the squelch to open the path for a signal-to-noise ratio of $\geq$ 12 dB SINAD. A pushbutton on the control head allows manual cancelling of the squelch function.

Power Supply and Voltage Regulator VR801

Because of variations in the battery voltage as the battery discharges, two VR801 type Voltage Regulators are employed to supply many of the transmitter and receiver circuits in the CQP800 with a constant 7.5 V potential. The regulators are short circuit protected.

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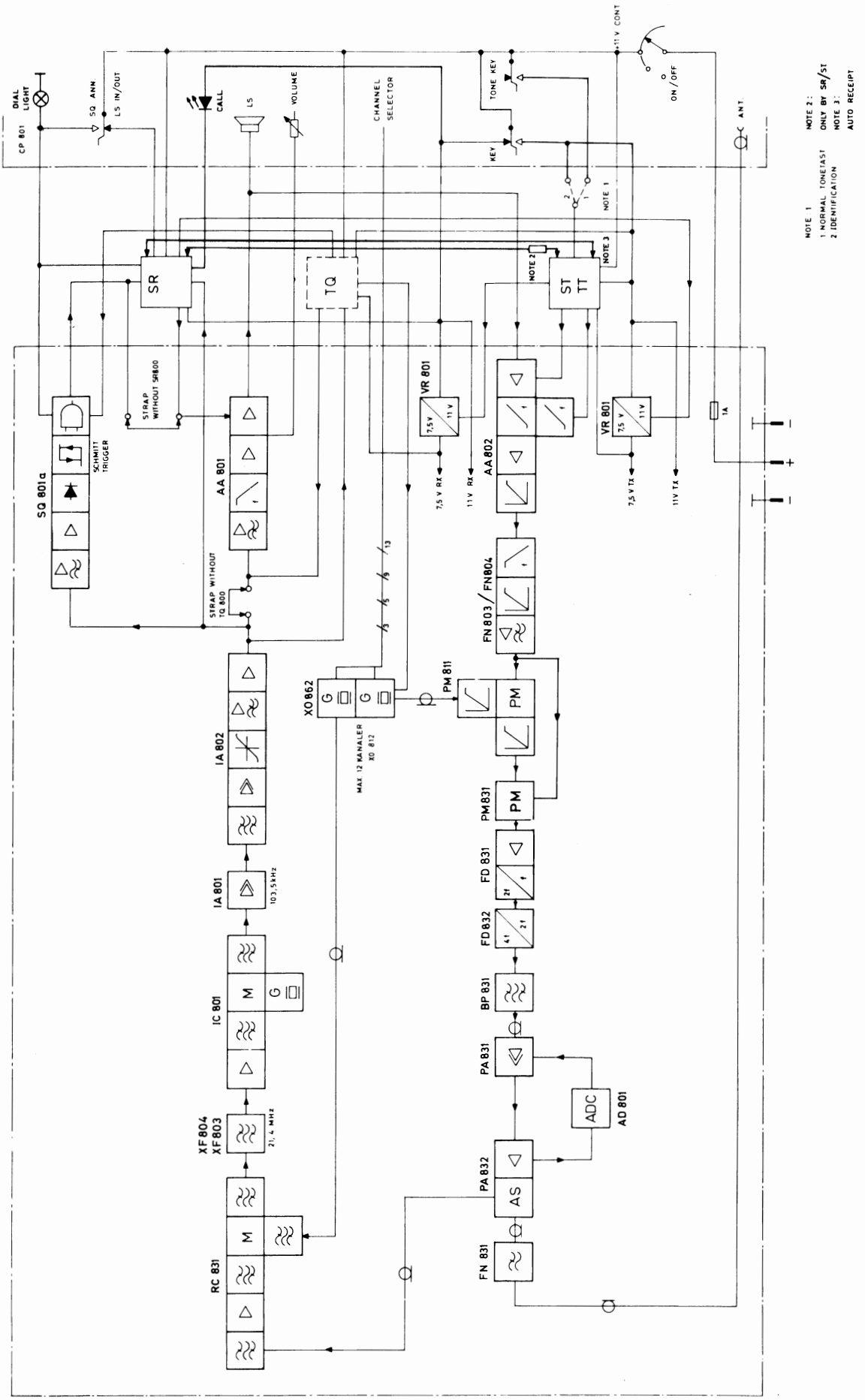

BLOCK DIAGRAM CQP830

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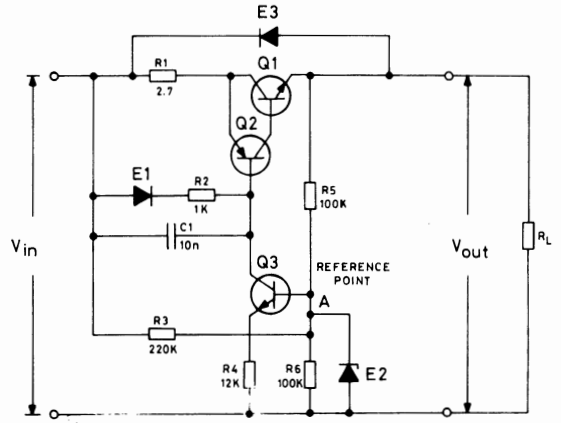
INTRINSICALLY SAFE BATTERY BU805

General

Battery unit BU805 is intended for applications requiring intrinsic safety i.e. for use of STORNOPHONE800 radiotelephones in explosive atmospheres as encountered in coal-mines, the petrol-chemical industri etc.

The battery unit contains 11 nickel-cadmium, rechargeable, cylindrical cells of 225 mA capacity. The unit also contains two cascaded active current limiters. The intrinsically safe properties of the battery are entirely governed by the function of these limiters.

Limiter Circuit Description



LIMITER CIRCUIT

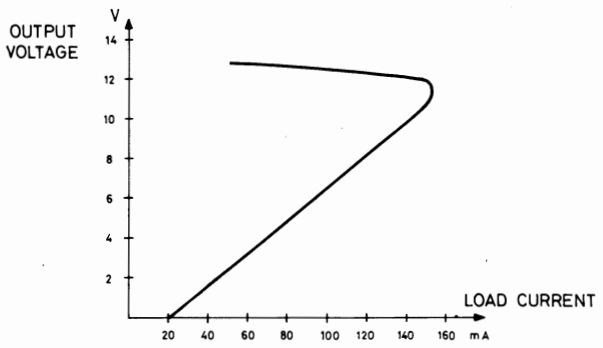
The circuit diagram of a single limiter unit is shown in fig. 1. Transistor Q1 is the series element and is furnished with a heat-sink to cope with dissipation at severe overvoltages (1.65 times nominal).

Diode E1 compensates the base-emitter voltage of Q2, and since both are operating at low currents (less than 1 mA) good ambient temperature tracking is also achieved.

When the voltage drop across resistor R2 exceeds the voltage drop across R1 then the transistor pair Q2 and Q1 will be turned on and the output voltage will be nearly equal to the input voltage. Under these conditions the bias at point "A" is determined by the two resistors R3 and R5 together with the third resistor R6 and the input voltage. This bias applied to Q3 establishes an emitter-collector current, which passes mainly through the network E1-R2 thus causing a voltage drop across R2. This voltage drop, as mentioned earlier, ensures that the compound transistor pair Q2, Q1 are turned on.

Upon application of a load, the load current passes mainly through the series element Q1 and entirely through the low value measuring resistor R1. As the load increases the voltage drop across R1 rises and eventually Q2 and Q1 begin to cut-off. When Q1 begins to cut-off the output voltage begins to fall and also the bias to point "A". In the limiting case when the output voltage is zero (short-circuit load) the bias at point "A" is determined by the potential divider R3 and R5 in parallel with R6.

As the current limiting effect of Q1, Q2 is approximately proportional with the voltage drop across R2, this again is proportional to the bias voltage at "A". This means that by suitable choise of R3, R5, and R6, the maximum current limiting value and the short circuit current limiting value for the circuit is established independently of each other, i.e. a fold-back characteristic is obtained.



TYPICAL CURRENT LIMITER FOLDBACK CHARACTERISTIC

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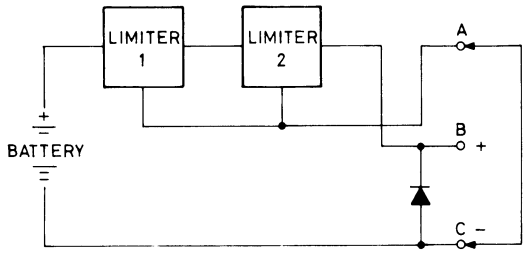
To prevent the fold-back point from increasing with overvoltage at the input, zener diode E2 is included in the circuit. Normally this diode is not conducting, however, on overvoltage (> +10% nominal), it begins to conduct and prevents the fold-back point from increasing.

In practice two limiters are connected in cascade. The limiter which is nearest the load receives an input voltage slightly less than the battery voltage due to voltage drop in the first limiter. This means that the fold-back point for the pair is slightly less than for the single unit.



CASCADE CONNECTION OF LIMITERS

The limiters function only when the two outer battery terminals are shunted together. With the battery removed from the equipment the cells are unloaded.

Charging

Each limiter is bridged by a power diode, thus permitting charging at the 5 hour rate of 45 mAh for a period of 7 hours.

The BU805 must be charged in battery charger type CU804 or CU805.

Specifications

Nominal battery voltage

10.8 V

Nominal battery capacity

225 mAh.

Number of cells

11

Maximum short circuit current

$\leq$ 40 mA

Maximum Load current

150 mA

Dimensions

63 mm x 32 mm x 94 mm

Weight

320 g

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ADJUSTMENT PROCEDURE
CQP830

The following measuring instruments are required for tracing faults in and making adjustments to the transmitter/receiver circuits:

Control Unit C35	code 95B0363, including
Test cable	code 19B0027
Test cable adaptor	code 41.0206
Antenna connector adaptor	code 41.0201
RF Test probe	code 95.0059
DC ampere meter	10mA/100mA/1A
DC Voltmeter	Zin = > 0,5 M Ω
AC Voltmeter	Zin = > 2M Ω//50pF
FM signal generator	68 - 88 MHz
AF generator	Z_{out} = 600 Ω
RF Wattmeter	0 - 2 W
Deviation meter	
Distortion meter	
Oscilloscope	
Power supply	0 - 20 V/1A Preset current limiter 0-0,5 A
Frequency counter	

OPERATING CONTROL UNIT C35

The control unit and test cable C35 are designed for testing and adjusting STORNOPHONE 800. The instruments connect to the unit and remain connected during the procedure.

The front panel of the unit is divided into three parts.

1. The **TEST CONTROLS** are used to control the radio circuits.
2. The **BFO** is a 21,4 MHz crystal controlled oscillator.
3. The **INSTRUMENT TERMINAL** is used for measuring instrument connections.

Connections on the rear panel.

TEST PLUG	34-way connector for the test cable.
POWER SUPPLY	Jacks for power supply.
CURRENT MONITOR	Jacks for current monitor.

Connections on the front panel.

RF PROBE	Jacks for RF probe
DCVM	Jacks for DC voltmeter.
AF PROBE	BNC connector for AF probe.

Probe consists of shielded leads to be connected whenever measuring of audio is desired.

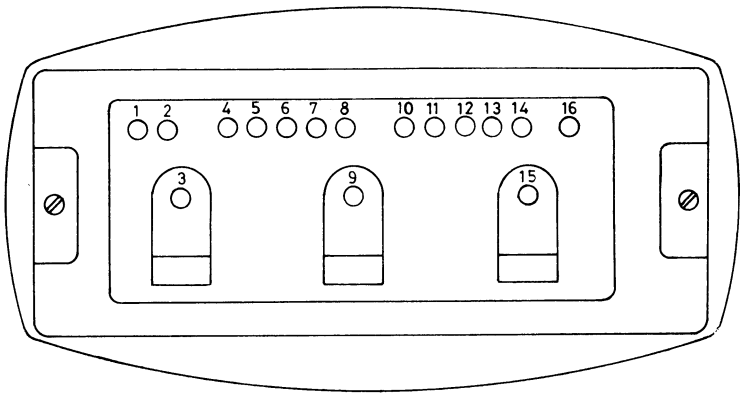
DEVM(AF)	BNC connector for the AF output of the deviation meter.
ACVM	BNC connector for AF voltmeter, distortiometer and oscilloscope.
MOD INPUT	BNC connector for AF generator.

Toggle switches

SQ OFF	Disables the squelch circuit of the receiver (loudspeaker continously open).
KEY	Switches the transmitter on, the receiver off, and connects the AF generator input jack to the **LS/MICR** switch.
TONE KEY	Transmitter key for radio sets with tone transmitter.
RX GATE	Switches the receiver's +7,5 V on/off.
TX GATE	Switches the transmitter's +7,5 V on/off.

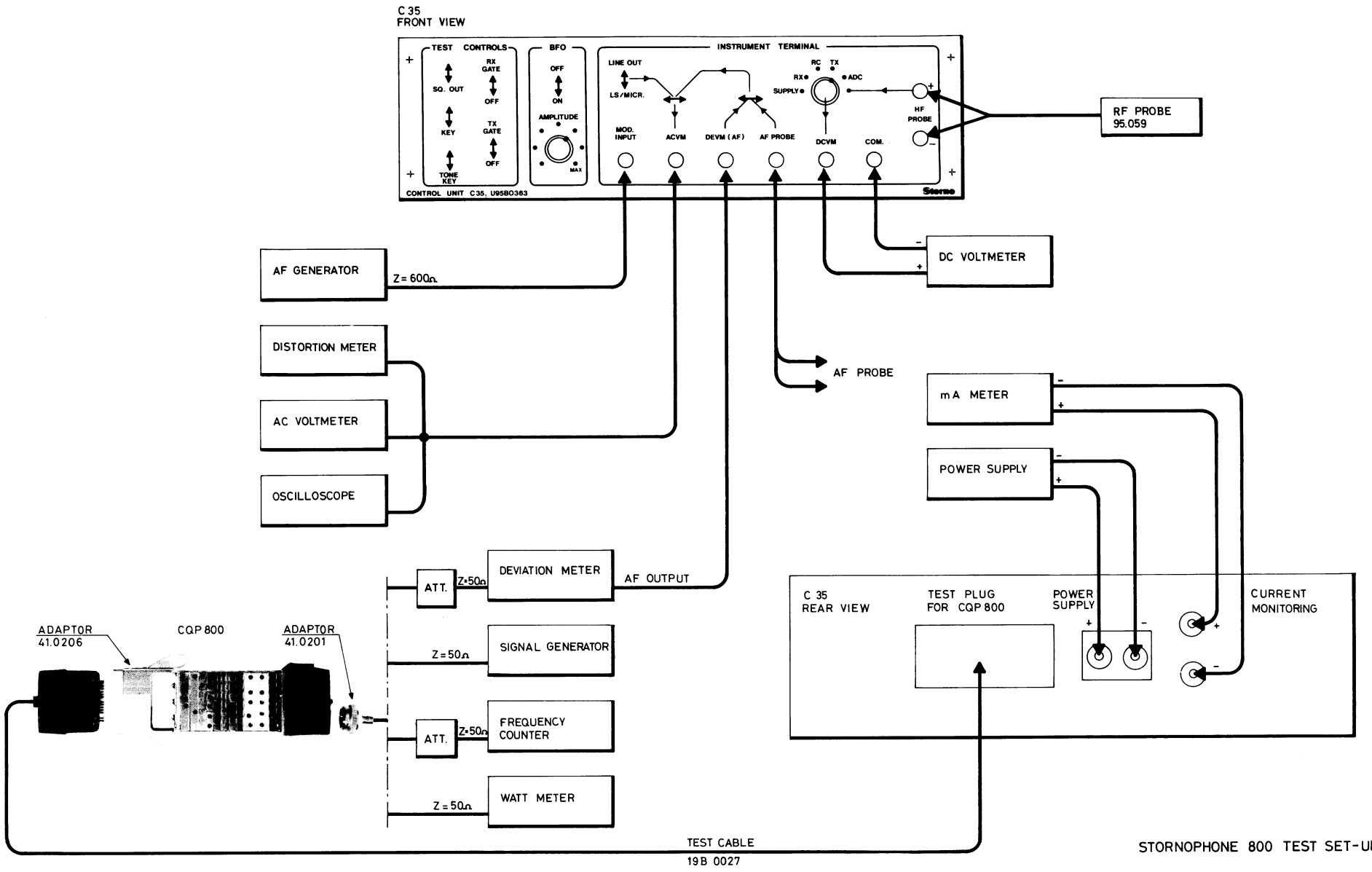
ON-OFF	21, 4 MHz crystal controlled **BFO** on/off.
LINE OUT LS/MICR	Switches the AC voltmeter between the **LINE OUT** and the **LS/MICR**.
ACVM switch	Switches the AC voltmeter between the **LINE OUT - LS/MICR** switch and **DEVM (AF) - AF PROBE** switch.
DEVM switch	Switches the AC voltmeter input between the **DEVM** (AF) and the **AF PROBE** (AC voltmeter).
DCVM switch	6-position **DC** voltmeter switch. 1. **SUPPLY** Voltage 2. RX +7, 5 V stabilized RX voltage. 3. RC Receiver converter test point. 4. TX +7, 5 V stabilized TX voltage. 5. **ADC** voltage 6. **RF PROBE**
AMPLITUDE	**BFO** output attenuator

Test point	Function
1	+7, 5V TX stabilized
2	+7, 5V RX regulator gate
3	DC ground (connected to point 15)
4	ADC voltage
5	Audio output - microphone input
6	Tone Key
7	+7, 5V TX regulator gate
8	$+V_B$ Battery voltage measured after the fuse.
9	+11 V Battery
10	+11 V TX
11	+7, 5 V RX stabilized
12	Squelch disable
13	Receiver converter test point
14	21, 4 MHz BFO signal input
15	DC ground (connected to point 3)
16	Discriminator and Receiver line output.



BOTTOM VIEW

CQP800 Test Point Location
Bottom View



STORNOPHONE 800 TEST SET-UP

D402.093

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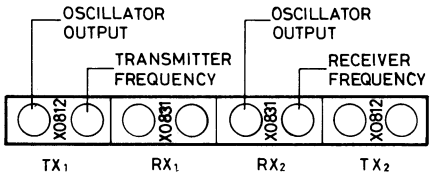
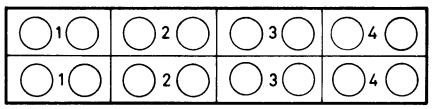
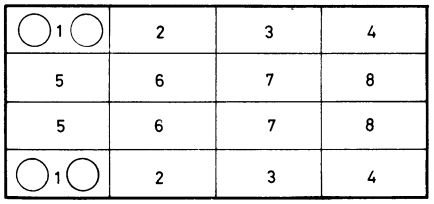
LOCATION OF OSCILLATORS



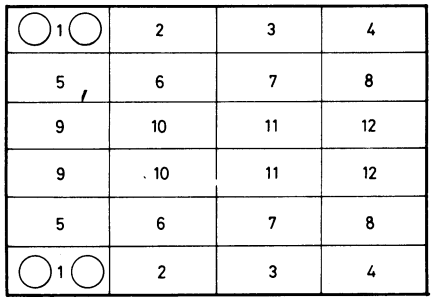
2 CHANNELS (CH803)



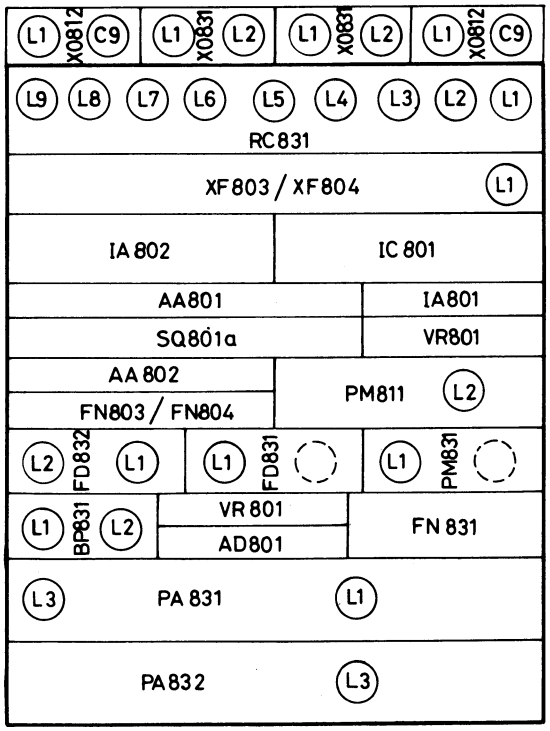
4 CHANNELS (CH804)



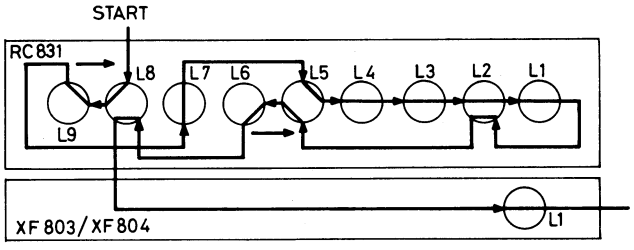
8 CHANNELS (CH 805)



12 CHANNELS (CH806)



CQP 830



RC831 L8, L9 : Maximum voltage (Vgs)
L1, L2, L3, L4, L5, L6 : Maximum sensitivity
L7 : Minimum distortion
XF800 L1 : Minimum distortion

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TRANSMITTER ADJUSTMENT

For location of components see page 10.

Before starting adjustment of the transmitter, check the resistor (R6) located between pin 4 and 6 of AD801.

6,8 k Ω for 0,1 to 0,5 W output power
4,7 k Ω for 1,0 W output power
3,3 k Ω for 1,5 W output power

A second resistor R7 is paralleled with R6 for fine adjustment of the output power.

Checking Supply Voltage and Current Drain.

1. Select the channel closest to the center frequency, if more than one.
   Set the DCVM switch to SUPPLY.
   Connect a wattmeter to the antenna connector.
   Adjust the power supply to 11 V. (12 V for 1,5 W transmitter).
   Set the current limiter to 0,5 A.
2. KEY the transmitter.
   Read the current drain on the mA meter.
   Current drain without output: approx 70 mA.
   Current drain with output, < 400 mA.
3. Unplug the oscillator and read the current drain.
   Requirement: < 70 mA

4. Set the DCVM switch to TX.
   Read the TX stabilized voltage.
   Requirement: 7,5 V ± 0,15 V

Crystal Oscillator Output Adjustment

5. Set the DCVM switch to RF PROBE
   KEY the transmitter.
   Connect the RF probe to pin 2 on PM811 and hold the probe's metal housing against chassis.
   Adjust L1 in XO812 for maximum DC voltage, approx. 0,8 V.
   Repeat the adjustment on all channels.

Adjustment of Frequency Multipliers and Power Amplifiers.

Select center transmitting channel, if more than one.
Set the tuning slugs in PM811, PM831, FD831, FD832, and BP831 to the approximate position.

High frequency (> 78 MHz)=lower position.

Low frequency (< 78 MHz)= inner position.

Medium frequency (∿ 78 MHz)= middle position.

KEY the transmitter.

6. Adjust the following coils and capacitors for maximum current drain as seen on the mA meter using an insulated trimming tool:

   L1 in FD831

   L1 and L2 in FD832

   L1 and L3 in PA831

Adjust L3 in PA832 for maximum power output.

7. Set DCVM switch to ADC.

   Adjust L1 in FD831 for minimum ADC voltage.
   Adjust L1 and L2 in FD832 for minimum ADC voltage.
   Adjust L1 and L2 in BP831 for minimum ADC voltage.
   Adjust L1 in PA831 for minimum ADC voltage.
   Adjust L3 in PA831 for maximum power output.
   Adjust L3 in PA832 for maximum power output.

   Repeat the adjustments under 6 for minimum ADC voltage and maximum power output until no further improvement is obtainable.

   Check the power output on all channels.

To increase the power output a resistor (R7) may be connected in parallel with R6.

Read the ADC voltage.
Requirement: 4 V to 10 V.
Typical ADC voltage at 1 W: 5 V.
Typical ADC voltage at 1, 5 W: 8 V.

8. Read the total current drain.
Requirements:
0, 5W output power: approx . 220 mA.
1, 0W output power: approx. 350 mA.
1, 5W output power: approx.500 mA.

Transmitter Frequency Adjustment

9. Connect a frequency counter through an attenuator to the antenna connector.
Set the KEY switch down.
Adjust C9 in XO812 to the channel frequency.
Repeat the adjustment on all channels.
Requirement at 25^{o} ± 0, 5 x 10^{-6}.

Checking and Adjustment of Modulator

10. Connect the deviation meter through an attenuator to the antenna connector.
Set the **DEVM (AF) - AF PROBE** switch to **DEVM (AF)**.
Set the **ACVM** switch to **DEVM (AF)**.
Establish a connection from the output of FN800 (pin 7) to the inputs of PM811 (pin 4) and PM831 (pin 3). (see fig. page 11).
KEY the transmitter.
Set the AF generator to 1000 Hz and adjust the output to give a transmitter frequency deviation of approx. ± 3 kHz.
The output should be below clipping level as seen at the AF output of the deviation meter.
Adjust L2 in PM811 and L2 in PM831 for minimum distortion.
Remove the connection from FN800 to the modulator inputs.

11. Set the tone generator output to 30 mV.
Check that Δ f max. is not exceeded at frequencies between 300 Hz and 3000 Hz.
If necessary adjust R11//R10 - R13 (see page 10).
Set the tone generator output to 0, 7 x ΔF max. at 1000 Hz.
± 3, 5 kHz for 25 kHz channel spacing.
± 2, 8 kHz for 20 kHz channel spacing.
± 1, 75 kHz for 12, 5 kHz channel spacing.
Check the total harmonic distortion at the output of the deviation meter.
Requirement: THD < 7% (without de-emphasis)

RECEIVER ADJUSTMENT

For location of components see page 10.

Supply voltage and current drain

Before making adjustments to the receiver circuits check the discriminator bandwidth resistor between pin 1 and pin 3 of IA802.

CQP833 - R3 = 5, 6 k Ω
CQP834 - R3 = 27 k Ω

1. Set the DCVM switch to SUPPLY
Adjust the power supply to 11 V.
Set the current limiter to 0, 1 A.
2. Read the current drain
I_{total} : < 100 mA
3. Set the DCVM switch to RX.
Read the stabilized RX voltage.
Requirement: 7, 5 V ± 0, 15 V.

Adjustment of Receiver.

4. Set the trimming slugs in L1, L2, L3, and L4 in RC831 to the outer position for frequencies below 78 MHz.
Set the slugs to the inner position for frequencies above 78 MHz.
Set slugs in L5, L6, L7, L8, and L9 in RC831 to the middle position.
Set the **DCVM** switch to **RC**.
Adjust L1 in all receiver oscillators for maximum **DC** voltage.
Set the channel selector to the channel closest to the center frequency, if more than one.

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Adjust L8 in RC831 for maximum DC voltage.
Adjust L9 in RC831 for maximum DC voltage.
Adjust L8 in RC831 for maximum DC voltage.
When removing the oscillator the DC voltage should fall at least 0,1 V.

5. Set the signal generator to the receiver frequency.
Modulate the generator with 1 kHz to a frequency deviation of 0,7 x Δ f max.
±3,5 kHz for 25 kHz channel spacing
±2,8 kHz for 20 kHz channel spacing
±1,75 kHz for 12,5 kHz channel spacing

Set **SQ OUT** switch down.
Set **LINE OUT - LS/MICR** down.
Set **ACVM** switch to **LS/MICR**
Adjust the signal generator output to 12 dB SINAD.
Turn the volume switch to the 3rd position. (approx. 0,5 on the ACVM, no clipping).

As the receiver sensitivity increases during the adjustment, the signal generator output must be reduced to maintain 12 dB SINAD.
Adjust L7 in RC831 for best signal to noise ratio at approx. 12 dB SINAD.
Detune L5.
Adjust L4 in RC831 for minimum distortion.
This is the ONLY adjustment of L4.
The following coils are adjusted for best signal to noise ratio in this order:

L3, RC831
L2, RC831
L1, RC831
L2, RC831
L5, RC831
L6, RC831

Repeat the adjustment of L5 and L6 until no further improvement is obtained.
Readjust L8 in RC831 for maximum voltage on **DCVM** (approx. 2,0 V).
Readjust L3 in RC831 for best signal to noise ratio.

6. Set the signal generator output to approx. 100 µV e.m.f.
Adjust L7 in RC831 and L1 in XF800 for minimum distortion.

Receiver sensitivity measurement.

EIA (Electronic Industrie's Association) Standard, definition:
The SINAD sensitivity of a receiver is the minimum input signal that will provide at least 50% of the receivers's rated audio output power with 12dB signal +noise +distortion to noise + distortion.

Method of measurement.

The purpose of the measurement is to define the ratio of one condition to another.

The first condition is the one where a modulated RF-signal drives the receiver into full limiting. The audio output is measured with the distortion meter (in the CAL position) and, disregarding the amplitude of the audio, this is adjusted to read 100 on the meter scale; this is our reference condition consisting of signal+noise+distortion, where 'signal' is the modulation of the RF, 'noise' is the lowest possible amount achieved from that particular receiver, when receiving a strong carrier, and 'distortion' is the modulation being slightly distorted in passing through the receiver.

The second condition is the one where the signal (modulation) is removed with a notch filter and the RF-signal is lowered in amplitude until the remaining noise and distortion increases to 12 dB below the first condition, as read on the distortion meter scale. This corresponds to a reading of 25%, 25 being 12 dB below 100, which was our reference condition.
(100-6dB=50, 50-6dB=25).

In practice our first condition is achieved by feeding a minimum of 1000µV of RF-signal modulated with 1000Hz at 0.7 x Δf max. to the receiver. The audio output (which must be at least 50% of the receiver's audio rating) is measured with the distortion meter in position CAL and adjusted with potentiometer ADJ. FSD. to a reading of 100. The notch filter is then inserted in series with the audio by pressing one of the buttons marked in %.

Storno

The meter needle immeadiately drops to indicate a low value, this being the receiver's inherent audio distortion.
By backing off the attenuator of the RF-generator, thereby lowering the RF-input to the receiver, the noise will eventually increase; the attenuator being adjusted for a reading on the distortion meter scale of 25%.

At this stage it must be ensured that the increased noise and the signal (with the notch filter switched out while checking) still equals 100 on the meter scale.

The RF-generator's calibrated attenuator now shows the value of RF-signal required to achieve a 12 dB ratio between signal+noise+distortion and noise+distortion, i.e. 12dB SINAD sensitivity.

7. The sensitivity must be minimum 1,0 µ V e.m.f.
   Typical value: 0,5 µ V e.m.f.
   Changing the supply voltage from 9,6 V to 15 V should not influence the sensitivity obtained at 11 volt.
   If more than one channel is provided, the sensitivity check should be repeated on all channels.

Oscillator Frequency Adjustment.

8. Set the signal generator to the receiver frequency using the frequency counter.
   Remove the signal generator modulation and set the output to approx. 100 µ V e.m.f.
   Turn the **BFO** on.
   Adjust **BFO AMPLITUDE** to produce a clear beat tone.
   Set **ACVM** switch to **LINE OUT**.
   Adjust L2 in XO831 for zero beat as seen on the oscilloscope.

   If more than one channel is provided the adjustment should be repeated on all channels.
   When adjustments are completed, turn the **BFO OFF**.

Checking Receiver Audio Line Output.

Modulate the signal generator with 1 kHz and 0,7 x Δ f max.

± 3,5kHz for 25kHz channel spacing.
± 2,8kHz for 20kHz channel spacing.
± 1,75kHz for 12,5kHz channel spacing.

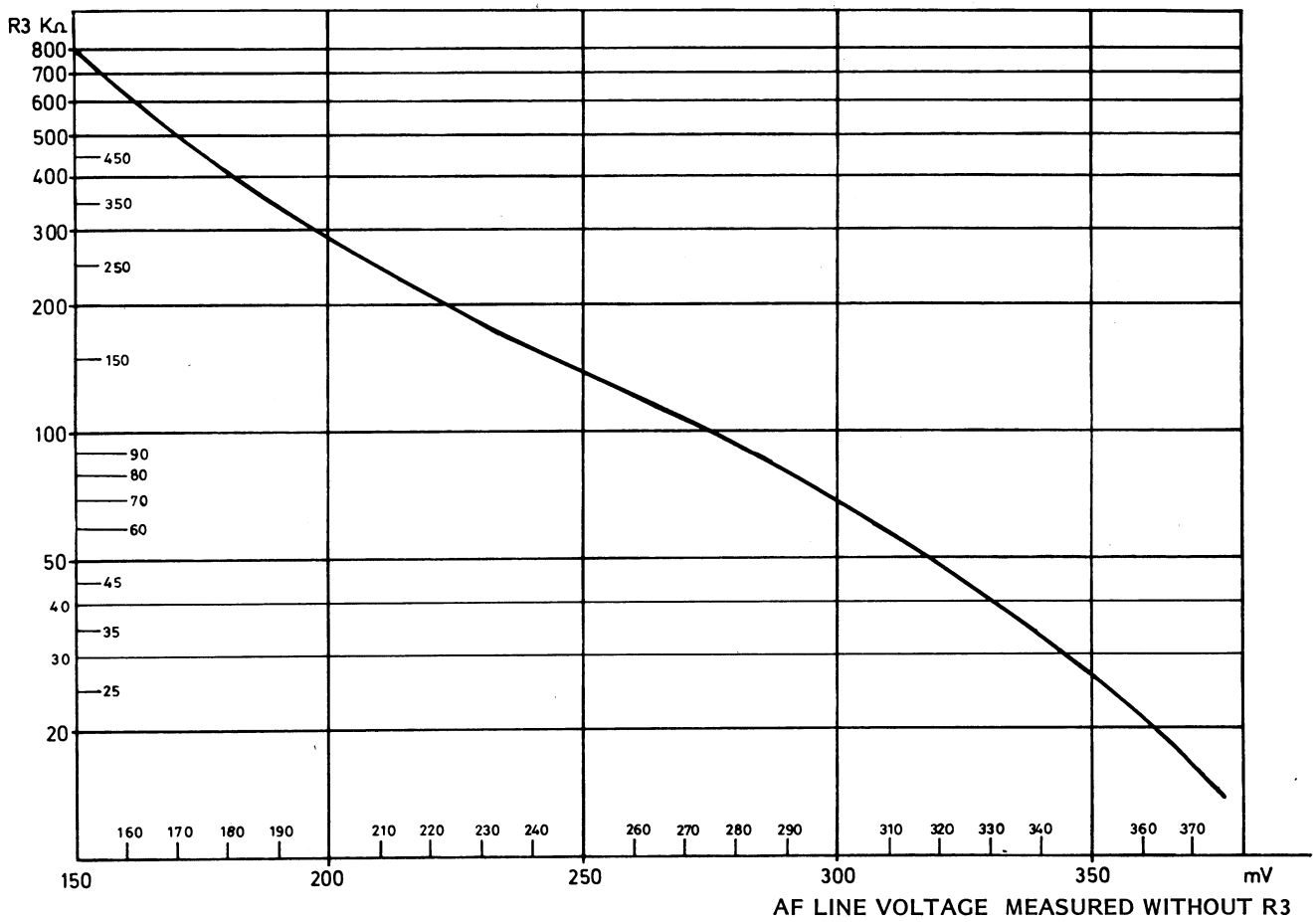
9. Set the signal generator output to approx. 100 µ V e.m.f.
   Switch the **ACVM** to **LINE OUT**.
   Read the AF Line voltage.
   Requirement: 110 mV ± 3 dB.
   If necessary connect a resistor R3 in parallel with R2 (IA802, pin 5-6) until 110 mV is obtained. (see page 10).
   The graph page 9 indicates the value of the resistor, which should be the closest higher standard value.

Checking the AF Frequency Response.

10. Set the signal generator output to approx. 100 µ V e.m.f.
    Set **LINE OUT - LS/MICR** switch down.
    Turn the volume switch to the 4th position.
    Read the AF voltage on the ACVM (reference)
    Set the modulation frequency to 300 Hz.
    AF voltage: -10 dB ± 2 dB to 100 Hz.
    Set the modulation frequency to 3000 Hz.
    AF voltage: +10 dB ± 2 dB rel. to 1000 Hz.
11. Turn the volume switch to the 5th position.
    Check the total harmonic distortion at 1000 Hz.
    Requirement
    CQP833, THD = < 7%
    CQP834, THD = < 8%

Adjustment Checking of the Squelch Function.

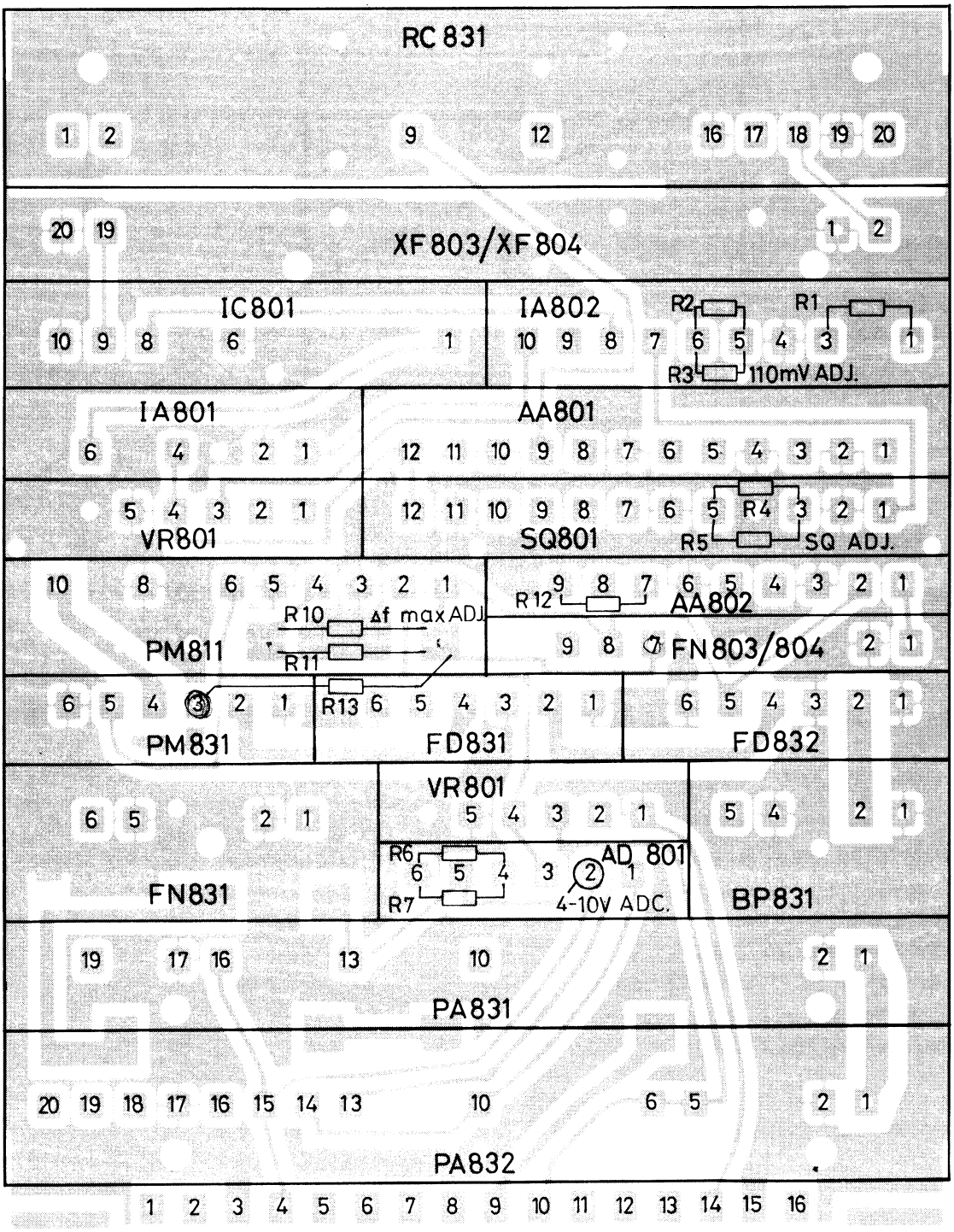
12. Modulate the signal generator with 1 kHz and 0,7 x Δ f max.
    Set the volume to the 5th position.
    Set the **SQ OUT** switch up.
    Increase the RF-generator output until the signal opens the squelch.
    Requirement: 10 to 12 dB SINAD.
    Decrease the value of R4 if SINAD is less than 10 dB.
    Increase the value of R4 if SINAD is more than 12 dB.



Checking the Overall Receiver Current Drain.

13. Set the **DCVM** switch to **SUPPLY**.
    Set the supply voltage to 11 V.
    Disconnect the signal generator.
    Read the current drain on the mA meter.
    Requirement: < 7,5 mA.
    Set the **SQ OUT** switch down.
    Set the volume switch to the 5th position.
    Read the current drain on the mA meter.
    Requirement: < 70 mA.

Storno


RC 831
1 2 9 12 16 17 18 19 20
20 19 XF 803/XF 804 1 2
IC801
10 9 8 6 1
IA802
R2
R1
10 9 8 7 6 5 4 3 1
R3
110mV ADJ.
IA801
6 4 2 1
AA801
12 11 10 9 8 7 6 5 4 3 2 1
5 4 3 2 1
VR801
12 11 10 9 8 7 6 5 R4 3 2 1
SQ801
R5
SQ ADJ.
10 8 6 5 4 3 2 1
R10
Δf max ADJ.
PM811
R11
R12
9 8 7 6 5 4 3 2 1
AA802
9 8 7 FN803/804 2 1
6 5 4 3 2 1
R13
PM831
6 5 4 3 2 1
FD831
6 5 4 3 2 1
FD832
VR801
5 4 3 2 1
6 5 2 1
R6
6 5 4
3 2 1
AD 801
R7
4-10V ADC.
5 4 2 1
FN831
BP831
19 17 16 13 10 2 1
PA831
20 19 18 17 16 15 14 13 10 6 5 2 1
PA832
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Storno

SUMMARY
TRANSMITTER ADJUSTMENT
CQP830

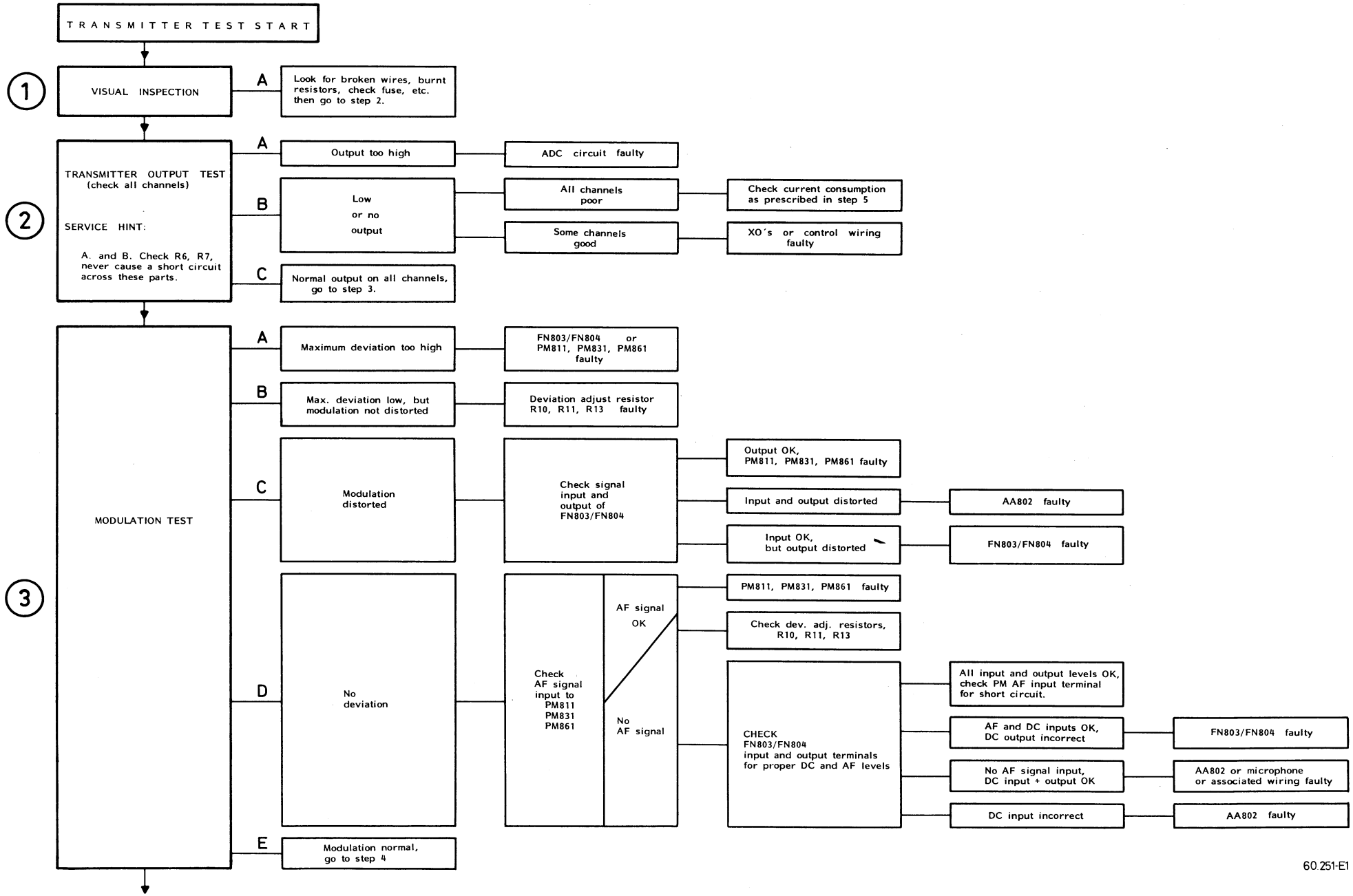
	TEST	ADJUST	INSTRUMENT	READING
1	Supply voltage	Power supply	Voltmeter	11 V
2	Current drain		mA meter	70 - 400 mA
3	Current drain without oscillator		mA meter	< 70 mA
4	+ 7,5 V TX		Voltmeter	+7,5 V ± 0,15 V
5	Oscillator output	XO812 - L1	95.059 + VM	maximum
6	Current drain	FD831 - L1, FD832 - L1, L2 BP831 - L1, L2 PA831 - L1, L3	mA meter	maximum
7	Power Output ADC voltage	FD831 - L1 FD832 - L1, L2 BP831 - L1, L2 PA831 - L1, L3 PA832 - L3	Wattmeter Voltmeter	maximum power output 0,5 - 1,5 W minimum ADC voltage 4 - 10 V
8	Current drain		mA meter	0,5 W - approx. 220 mA 1,0 W - approx. 350 mA 1,5 W - approx. 500 mA
9	Frequency	XO811 - L2	Frequency Counter	$f_{ant} \pm 0,5 \times 10^{-6}$
10	Modulator	 PM811 - L2 PM831 - L2	AF Generator Deviation meter Distortion meter	 minimum distortion
11	30 mV AF input Modulation distortion	 R13 R11 - R10	AF Generator Deviation meter Distortion meter	 0,7 x Δ F max. THD = < 7%

Storno

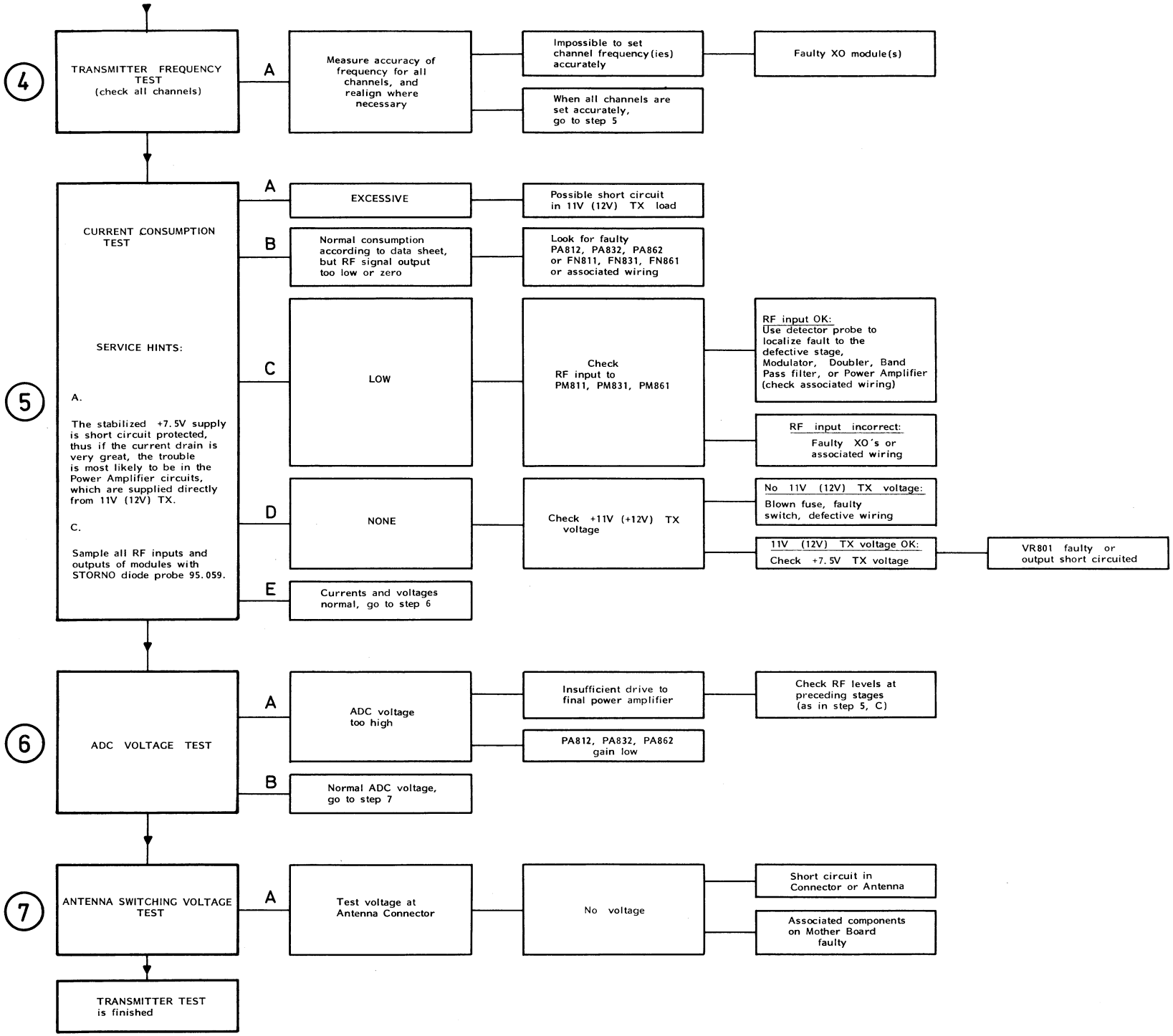
SUMMARY
RECEIVER ADJUSTMENT
CQP830

	TEST	ADJUST	INSTRUMENT	READING
1	Supply voltage	Power supply	DC voltmeter	11 V
2	Current drain	Check	mA meter	< 100 mA
3	+ 7,5 V RX	Check	Voltmeter	+ 7,5 V ± 0,15 V
4	RC test point without oscillator	XO831 - L1 RC831 - L8.L9.L8	DC voltmeter	maximum - 0,1 V
5	Receiver sensitivity	RC831 - L7, L4 L3, L2, L1, L2 L5, L6 RC831 - L8 L3	RF Generator Distortion meter DC voltmeter Distortion meter	minimum distortion maximum minimum
6		RC831 - L7 XF800 - L1	RF Generator (high output)	minimum distortion
7	Sensitivity	Check		< 10 µ V e.m.f.
8	Frequency	XO831 - L2	RF Generator 21,4 MHz BFO Oscilloscope	zero beat
9	Line output	IA802 (R3)	RF Generator AC voltmeter	110 mV AF
10	AF response	Check	RF Generator AC Voltmeter	300 Hz: -10 ± 2 dB 1000 Hz: 0 dB 3000 Hz: + 10 ± 2 dB
11	Distortion	Check	Distortion meter	CQP833: < 7% CQP834: < 8%
12	Squelch	R4	RF generator	opens at 10-12 dB SINAD
13	Current drain	Volume to pos. 5	mA meter	no signal, Sq. off < 7 mA no signal, Sq. on < 70 mA

TROUBLESHOOTING SEQUENCE FOR CQP 800
TO LOCALIZE FAULTS TO THE DEFFECTIVE MODULE



60.251-E1


4
TRANSMITTER FREQUENCY TEST
(check all channels)
A
Measure accuracy of frequency for all channels, and realign where necessary
Impossible to set channel frequency(ies) accurately
Faulty XO module(s)
When all channels are set accurately, go to step 5
5
CURRENT CONSUMPTION TEST
SERVICE HINTS:
A.
The stabilized +7.5V supply is short circuit protected, thus if the current drain is very great, the trouble is most likely to be in the Power Amplifier circuits, which are supplied directly from 11V (12V) TX.
C.
Sample all RF inputs and outputs of modules with STORNO diode probe 95.059.
A
EXCESSIVE
Possible short circuit in 11V (12V) TX load
B
Normal consumption according to data sheet, but RF signal output too low or zero
Look for faulty PA812, PA832, PA862 or FN811, FN831, FN861 or associated wiring
C
LOW
Check RF input to PM811, PM831, PM861
RF input OK:
Use detector probe to localize fault to the defective stage, Modulator, Doubler, Band Pass filter, or Power Amplifier (check associated wiring)
RF input incorrect:
Faulty XO's or associated wiring
D
NONE
Check +11V (+12V) TX voltage
No 11V (12V) TX voltage:
Blown fuse, faulty switch, defective wiring
11V (12V) TX voltage OK:
Check +7.5V TX voltage
VR801 faulty or output short circuited
E
Currents and voltages normal, go to step 6
6
ADC VOLTAGE TEST
A
ADC voltage too high
Insufficient drive to final power amplifier
Check RF levels at preceding stages (as in step 5, C)
PA812, PA832, PA862 gain low
B
Normal ADC voltage, go to step 7
7
ANTENNA SWITCHING VOLTAGE TEST
A
Test voltage at Antenna Connector
No voltage
Short circuit in Connector or Antenna
Associated components on Mother Board faulty
TRANSMITTER TEST is finished

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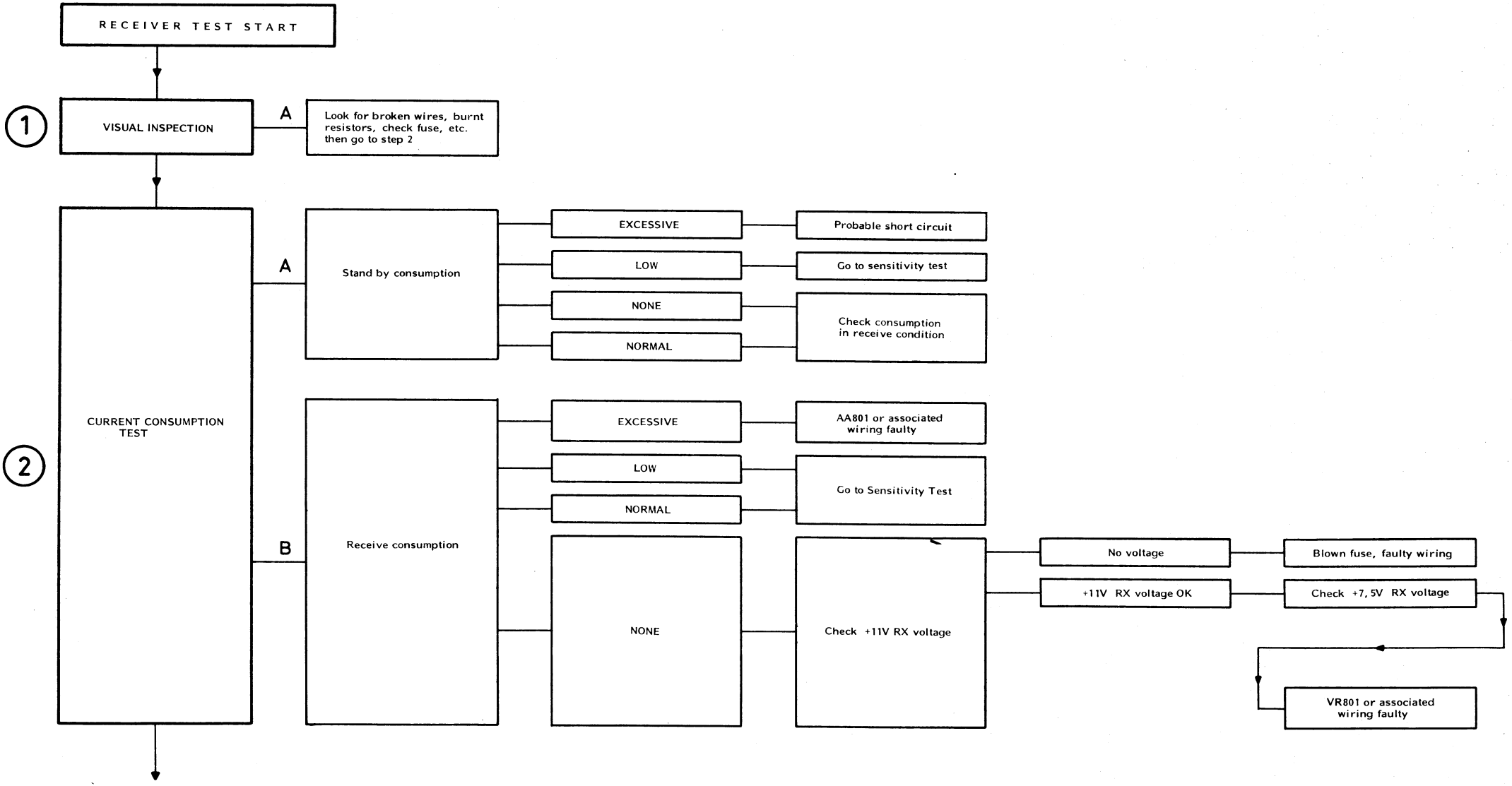
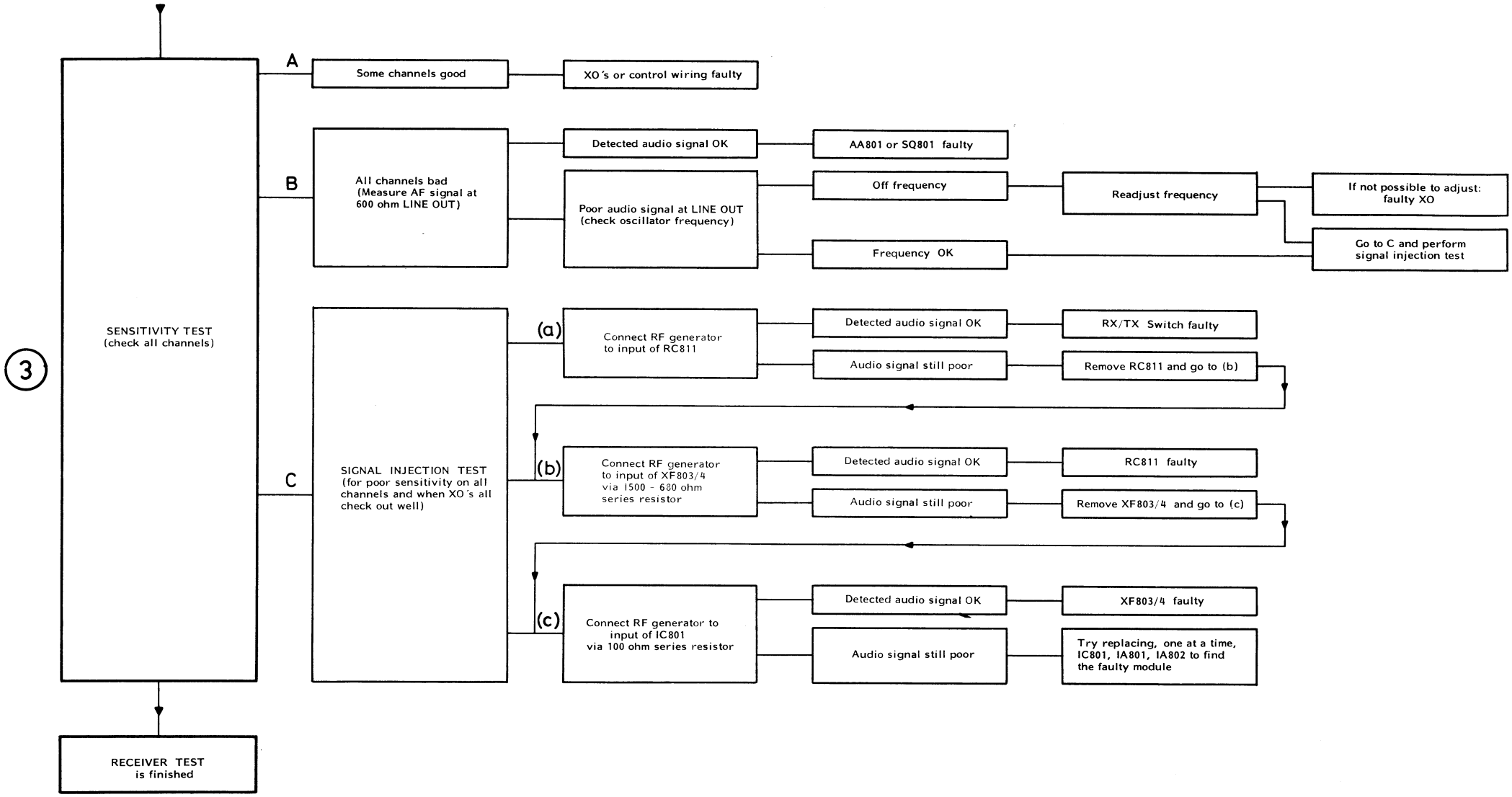
TROUBLESHOOTING SEQUENCE FOR CQP800

TO LOCALIZE FAULTS TO THE DEFECTIVE MODULE




3
SENSITIVITY TEST
(check all channels)
A
Some channels good
XO's or control wiring faulty
B
All channels bad
(Measure AF signal at
600 ohm LINE OUT)
Detected audio signal OK
AA801 or SQ801 faulty
Poor audio signal at LINE OUT
(check oscillator frequency)
Off frequency
Readjust frequency
If not possible to adjust:
faulty XO
Frequency OK
Go to C and perform
signal injection test
C
SIGNAL INJECTION TEST
(for poor sensitivity on all
channels and when XO's all
check out well)
(a)
Connect RF generator
to input of RC811
Detected audio signal OK
RX/TX Switch faulty
Audio signal still poor
Remove RC811 and go to (b)
(b)
Connect RF generator
to input of XF803/4
via 1500 - 680 ohm
series resistor
Detected audio signal OK
RC811 faulty
Audio signal still poor
Remove XF803/4 and go to (c)
(c)
Connect RF generator to
input of IC801
via 100 ohm series resistor
Detected audio signal OK
XF803/4 faulty
Audio signal still poor
Try replacing, one at a time,
IC801, IA801, IA802 to find
the faulty module
RECEIVER TEST
is finished

GRAPHICAL SYMBOLS USED IN STORNO CIRCUIT DIAGRAMS

Resistors (R)


Resistor


Resistor with fixed tap


Variable resistor


Resistor with movable tap

Varistor (voltage-dependent resistor)

Temperature-dependent resistor with negative temperature coefficient


Light-sensitive resistor (Photosensitive resistor)

Capacitors (C)


Capacitor


Variable capacitor


Trimmer capacitor


Feedthrough capacitor


Electrolytic capacitor

Coils (L)

RF coil, air core


Coupled RF coils, air core


RF coil with core


RF coil with adjustable core


AF choke

Transformers (T)

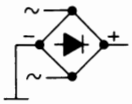

Transformer with adjustable RF cores


Transformer with iron core


Transformer with screen connected to chassis

Diodes (E)


Diode


Bridge rectifier


Series-connected stabilizer diodes within one case


Light-sensitive diode (Photosensitive diode)


Light-emitting diode


Zener diode (unidirectional)


Zener diode (bidirectional)


Tunnel diode


Varactor diode (capacitance diode)


Controlled rectifier, PNPN (N-thyristor)


Controlled rectifier, NPNP (P-thyristor)

Transistors (Q)


Transistor, PNP

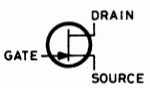

Transistor, NPN


Light-sensitive transistor


Unipolar transistor with N-type base

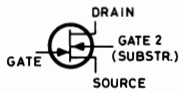

Unipolar transistor with P-type base

Junction Field Effect Transistors (JFET)



N-channel JFET


P-channel JFET



N-channel dual gate JFET


P-channel dual gate JFET

N-channel JFET tetrode

P-channel JFET tetrode

Insulated Gate Field Effect Transistors (IGFET or MOS)

N-channel IGFET (MOS)

P-channel IGFET (MOS)

N-channel dual gate IGFET (MOS)

P-channel dual gate IGFET (MOS)

Integrated Circuits (IC)

Several integrated circuits contained within one case are designated by one common number followed by an identifying letter (a, b, c etc.). Thus, circuits IC1a, IC1b and IC1c are contained within one case.

Gates

AND gate

OR gate

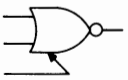
NAND gate

NOR gate

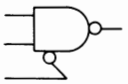
GRAPHICAL SYMBOLS USED IN STORNO CIRCUIT DIAGRAMS

Gates, continued

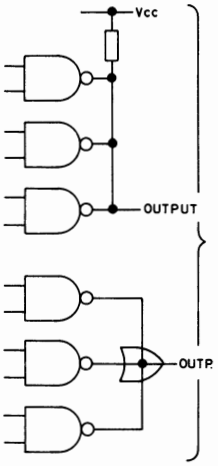
Exclusive OR gate



NOR gate with expander input (high)



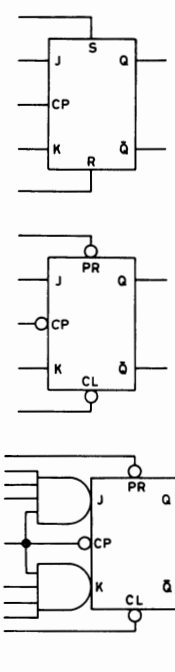
NAND gate with expander input (low)



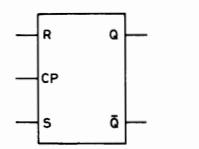
Wired OR (combined OR outputs) (presentation at top is used in detailed diagrams; presentation below is used in functional diagrams)

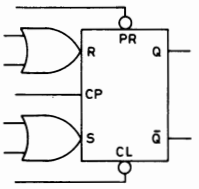
Flip-flops

Abbreviations used: S = Set
R = Reset
CP = Clock Pulse
PR = Preset
CL = Clear

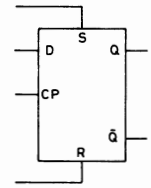


J-K Flip-flops



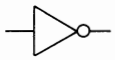


R-S Flip-flops



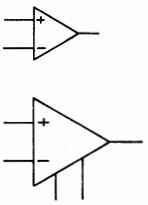
D Flip-flop

Inverters



Inverter

Operational Amplifiers

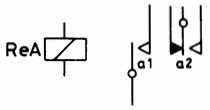


Operational amplifiers

Relays (RE)

Single-coil relay

Dual-coil relay



Relay with make contacts and change-over contacts

Relay with direction of winding indicated. Dot indicates two coils wound in the same direction

Polarized relay

Coil for slow-release relay

Coil for slow-acting relay

Contacts

Contacts are always shown in their non-operated positions unless otherwise specified

Make contacts

Break contacts

Change-over contacts

Change-over contacts, centre off

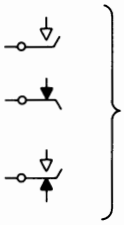
Make contacts, delayed operation

Make contacts, delayed release

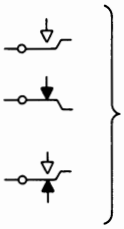
Mechanically coupled make contacts

Switches and Keys (O)

On/off switch

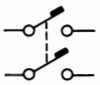


Locking keys or switches; push on, push off

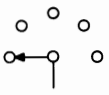


Non-locking self-releasing keys or switches

Locking mutually releasing keys or switches (in row of push-buttons etc.)



Self-releasing switch (overcurrent switch etc.)



Rotary switch

GRAPHICAL SYMBOLS USED IN STORNO CIRCUIT DIAGRAMS

Lamps (V)

Indicator lamp

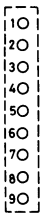
Neon lamp

Fuses and Cut-outs (S)

Fuse

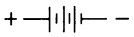
Circuit-breaker

Tag Strips (KL)



Tag strip - dashed frame may be wholly or partly omitted

Batteries (BT)



Battery

Feedthrough Filters (F)

Feedthrough filter

Ferrite Beads (FB)

Ferrite bead

Crystals (X)

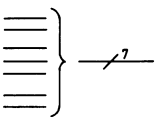
Crystal

Cables and Wires (W)

Usual conductor

Three conductors

Eight conductors



Shift from multiple-line to single-line presentation

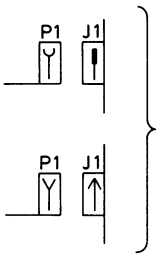
Screened wire

Coaxial cable

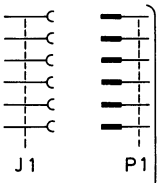
Connectors (J and P)

Female connector (socket). Lower symbol discontinued

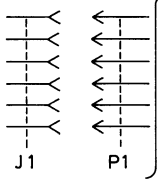
Male connector (plug). Lower symbol discontinued



Schematic symbols for multi-wire connectors. (Upper symbol will gradually supersede lower symbol)
Multi-wire connectors are always designated "J" when permanently mounted on a cabinet or unit etc., "P" when fitted to cables



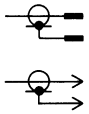
Detail symbols for multi-wire connectors. (Upper symbol will gradually supersede lower symbol)



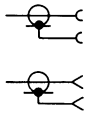
Where both connectors are fitted to cables, male connector is designated "P" and female connector "J"

Coaxial plug

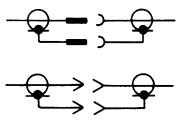
Coaxial socket



Coaxial plug for floating screen



Coaxial socket for floating screen



Coaxial plug with mating socket

Loudspeakers (LS)

Loudspeaker

Telephones (TEL)

Telephone

Single headphone (earphone)

Double headphone (headset)

Microphones (M)

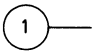
Meters etc.

Indicating instrument

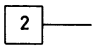
Balancing instrument

Inkwriter, recording instrument

Test Points



DC test point



AC test point

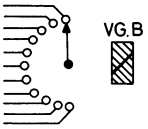
Replaceable Connections

Cross-field connection (jumper)

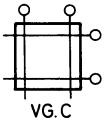
Strap

Selectors (VG)

Schematic symbol for rotary selector with designation of number of contact points



Detail symbol for rotary selector



Co-ordinate selector

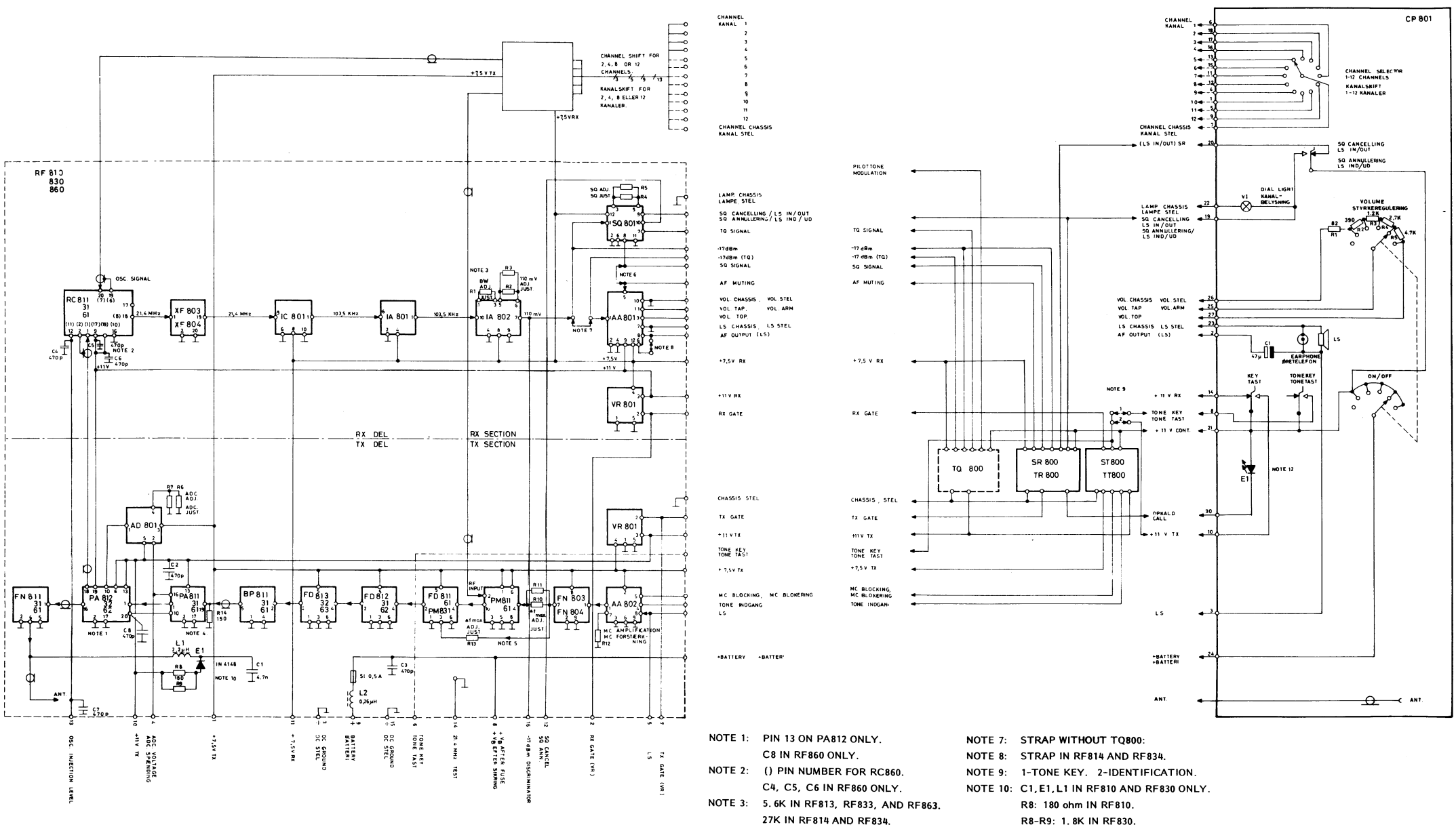
Storno

Storno

			Cabinets														RF814-IS + RF813-IS 10.3345	RF834-IS + RF833-IS 10.3347	RF863-IS 10.3348	CH803 10.2710	CH804 10.2711	CH805 10.2712	CH806 10.2713	CP801-IS 10.3349	CP802-IS 10.3350	BATTERY LOCK 17.0084	2 x Dummy Chassis 20 11.0991
			102890-16	102890-18	102890-19	102890-21	102890-24	102890-25	102890-26	102890-27	102890-28	102890-29	102890-31	102890-34	102890-35	102890-38											
CQP813 + CQP814	C1 x 2	SI	x														x			x				x		x	
–	C1 x 4	–		x													x				x			x		x	
–	C1 x 8	–			x												x					x		x		x	
–	C1 x 12	–						x									x						x	x		x	
–	C2 x 2	IS	x														x			x					x	x	
–	C2 x 4	–		x													x				x				x	x	
–	C2 x 8	–			x												x					x			x	x	
–	C2 x 12	–						x									x						x		x	x	
–	C1 x 2T	IS							x								x			x				x	x	x	x
–	C1 x 4T	–								x							x				x			x	x	x	x
–	C1 x 8T	–										x					x					x		x	x	x	x
–	C1 x 12T	–												x			x						x	x	x	x	x
–	C2 x 2T	IS							x								x			x					x	x	x
–	C2 x 4T	–								x							x				x				x	x	x
–	C2 x 8T	–										x					x					x			x	x	x
–	C2 x 12T	–												x			x						x		x	x	x
CQP833 + CQP834	C1 x 2	IS	x															x		x				x		x	
–	C1 x 4	–		x														x			x			x		x	
–	C1 x 8	–			x													x				x		x		x	
–	C1 x 12	–						x										x					x	x		x	
–	C2 x 2	IS	x															x		x					x	x	
–	C2 x 4	–		x														x			x				x	x	
–	C2 x 8	–			x													x				x			x	x	
–	C2 x 12	–						x										x					x		x	x	
–	C1 x 2T	IS							x									x		x				x		x	x
–	C1 x 4T	–								x								x			x			x		x	x
–	C1 x 8T	–										x						x				x		x		x	x
–	C1 x 12T	–												x				x					x	x		x	x
–	C2 x 2T	IS							x									x		x					x	x	x
–	C2 x 4T	–								x								x			x				x	x	x
–	C2 x 8T	–										x						x				x			x	x	x
–	C2 x 12T	–												x				x					x		x	x	x
CQP863	C1 x 2	IS			x														x	x				x		x	
–	C1 x 4	–				x													x		x			x		x	
–	C1 x 8	–					x												x			x		x		x	
–	C1 x 12	–								x									x				x	x		x	
–	C2 x 2	IS			x														x	x					x	x	
–	C2 x 4	–				x													x		x				x	x	
–	C2 x 8	–					x												x			x			x	x	
–	C2 x 12	–								x									x				x		x	x	
–	C1 x 2T	IS							x										x	x				x		x	x
–	C1 x 4T	–										x							x		x			x		x	x
–	C1 x 8T	–												x					x			x		x		x	x
–	C1 x 12T	–														x			x				x	x		x	x
–	C2 x 2T	IS							x										x	x					x	x	x
–	C2 x 4T	–										x							x		x				x	x	x
–	C2 x 8T	–												x					x			x			x	x	x
–	C2 x 12T	–														x			x				x		x	x	x

STORNOPHONE 800-IS INTRINSICALLY SAFE REFERENCE GUIDE

60.288-E1



NOTE 1: PIN 13 ON PA812 ONLY.
C8 IN RF860 ONLY.

NOTE 2: () PIN NUMBER FOR RC860.
C4, C5, C6 IN RF860 ONLY.

NOTE 3: 5.6K IN RF813, RF833, AND RF863.
27K IN RF814 AND RF834.

NOTE4: PIN 14 AND R14 IN PA861 ONLY.

NOTE 5: R13 IN RF830 ONLY.

NOTE 6: STRAP WITHOUT SR/TR800.

NOTE 7: STRAP WITHOUT TQ800:

NOTE 8: STRAP IN RF814 AND RF834.

NOTE 9: 1-TONE KEY. 2-IDENTIFICATION.

NOTE 10: C1, E1, L1 IN RF810 AND RF830 ONLY.
R8: 180 ohm IN RF810.
R8-R9: 1.8K IN RF830.
R9 IN RF830 ONLY.

NOTE 11: R14 IN RF860 ONLY.

NOTE 12: E1 EMPLOYED WITH TONE EQUIPMENT ONLY.

SYSTEM LAY-OUT
SYSTEMDIAGRAM
CQP 800
D401.726

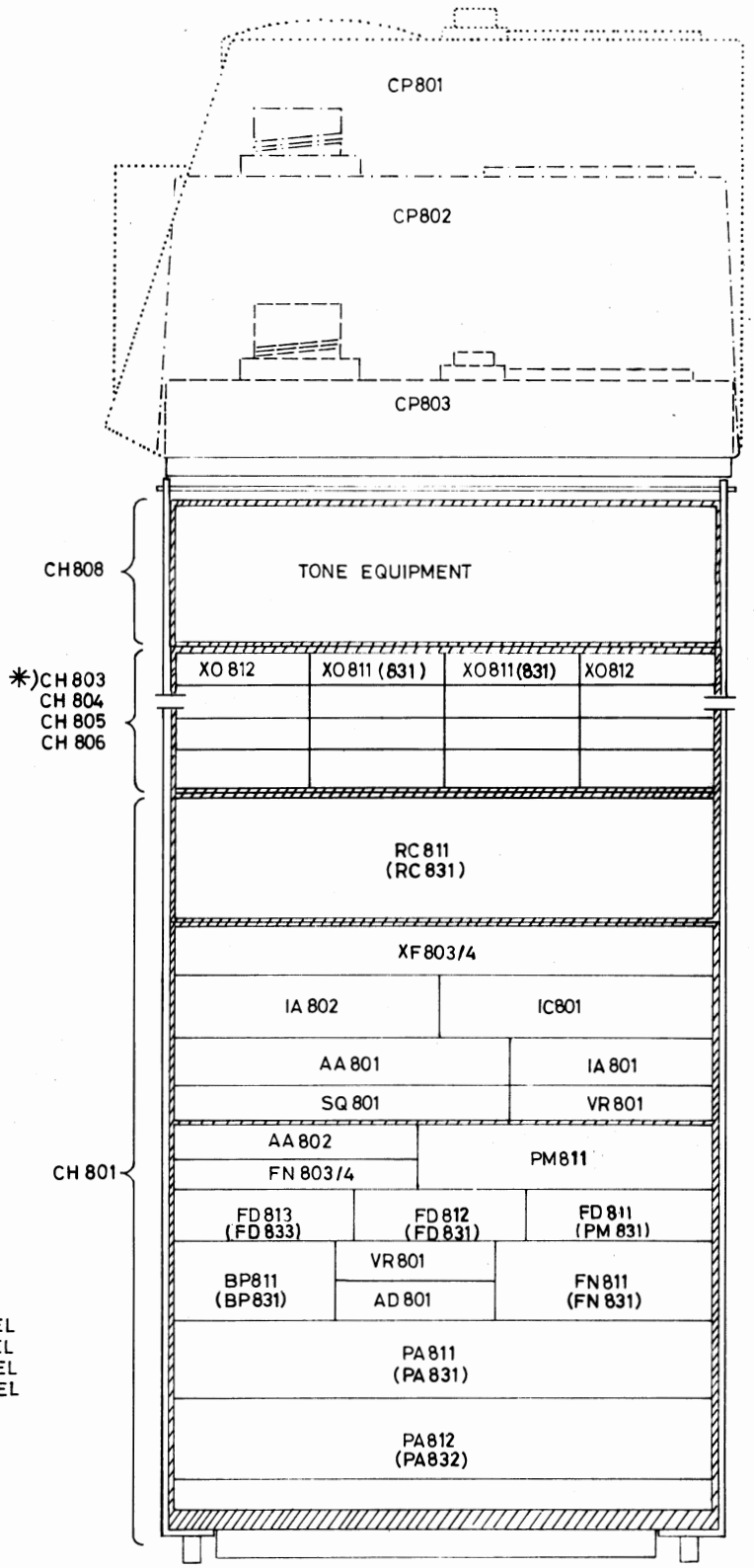
TYPE	Nº	CODE	DATA
			Modules CQP833-IS and CQP834-IS
		10.2687	AA801 Audio amplifier
		10.2688	AA802 Audio amplifier
		10.3037	BP831 Band pass filter
		10.2835	CH801 Chassis assembly
		10.3035	FD831 Frequency doubler
		10.3036	FD832 Frequency doubler
833-IS		10.3352	FN803-IS Filter network
834-IS		10.3353	FN804-IS Filter network
		10.2685	IA801 IF-amplifier
		10.2808	IA802 IF-amplifier/discriminator
		10.2686	IC801 IF-converter
		10.3039	PA831 Power amplifier
		10.3040	PA832 Power amplifier
		10.2676	PM811 Phase modulator
		10.3034	PM831 Phase modulator
		10.3355	RC831-IS Receiver converter
		10.2689	SQ801a Squelch unit
		10.3351	VR801-IS Voltage regulator
833-IS		10.2692	XF803 Crystal filter
834-IS		10.2693	XF804 Crystal filter
		10.2709	XO812 Crystal oscillator
		10.3067	XO831 Crystal oscillator
X2		10.2710	CH803 Oscillator chassis 2 channels
X4		10.2711	CH804 Oscillator chassis 4 channels
X8		10.2712	CH805 Oscillator chassis 8 channels
X12		10.2713	CH806 Oscillator chassis 12 channels
C1		10.3349	CP801-IS Local control head
C2		10.3350	CP802-IS Extended control head
			Components mounted on CH801
	C3	74.5161	470 pF -20 +80% ceram PL 63 V
	C7	74.5161	470 pF -20 +80% ceram PL 63 V
833-IS	R1	80.5058	5.6 KΩ 5% carbon film 1/10 W
834-IS	R1	80.5066	27 KΩ 5% " " 1/10 W
	R2	80.5081	470 KΩ 5% " " 1/10 W
	R3	80.50xx	ADJ 5% " " 1/10 W
	R4	80.50xx	ADJ 5% " " 1/10 W
	R6	80.50xx	ADJ 5% " " 1/10 W
	R7	80.50xx	ADJ 5% " " 1/10 W
	R10	80.50xx	ADJ 5% " " 1/10 W
	R11	80.50xx	ADJ 5% " " 1/10 W
	R12	80.5060	8.2 KΩ 5% " " 1/10 W
	R13	80.50xx	ADJ 5% " " 1/10 W
	L2	62.0614	0.26 µH RF choke

Storno

TYPE	Nº	CODE	DATA

STORNOPHONE CQP830-IS

Storno

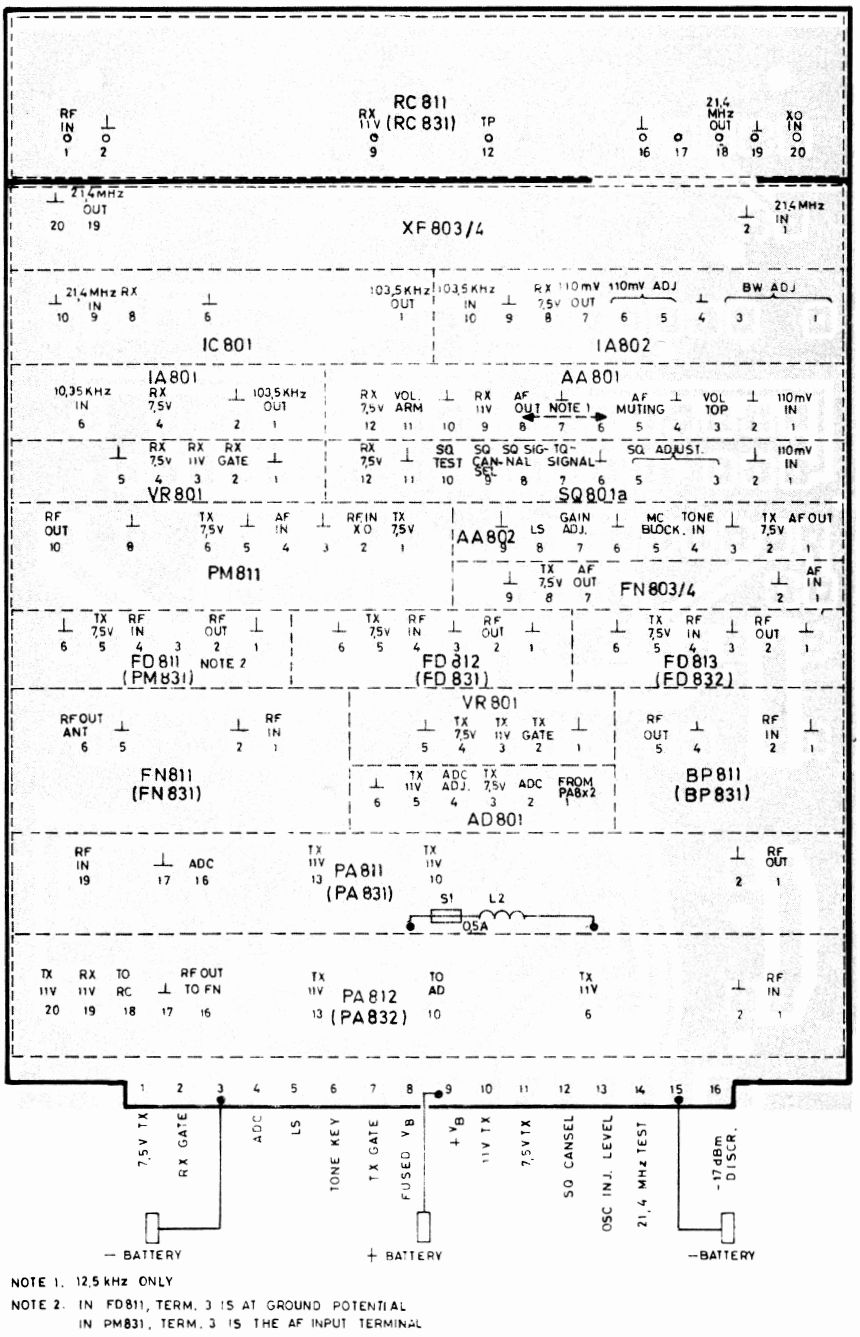


*) CH 803 = 2 CHANNEL
CH 804 = 4 CHANNEL
CH 805 = 8 CHANNEL
CH 806 = 12 CHANNEL

MODULE LOCATION CQP810, CQP830

D402.074

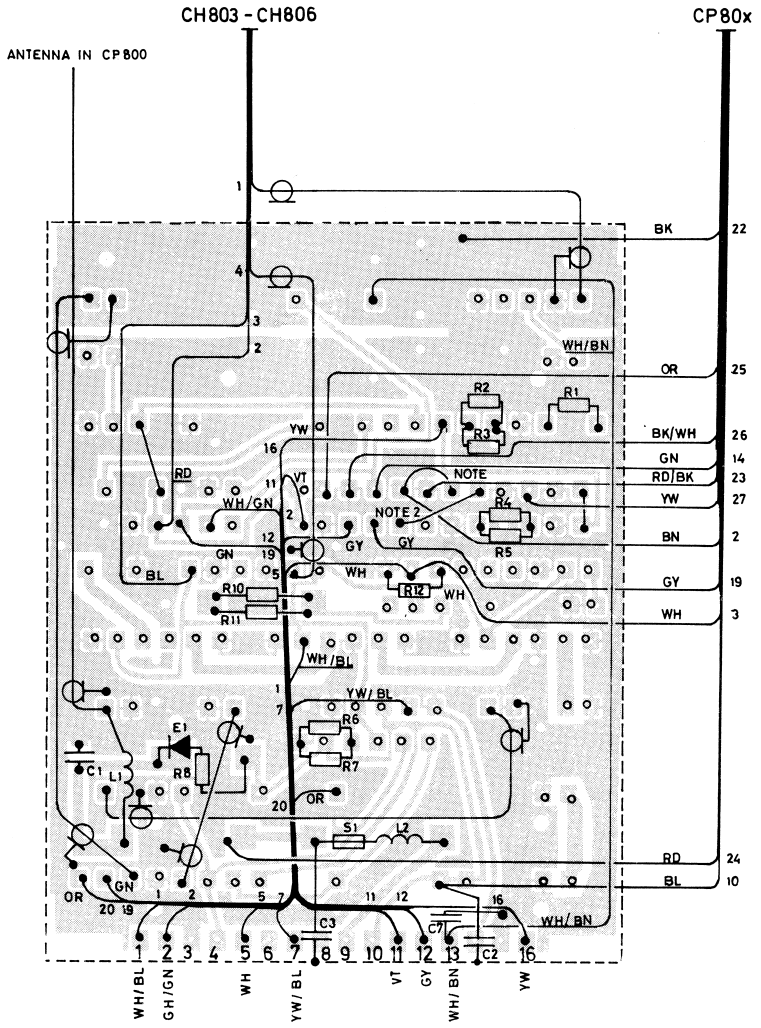
Storno



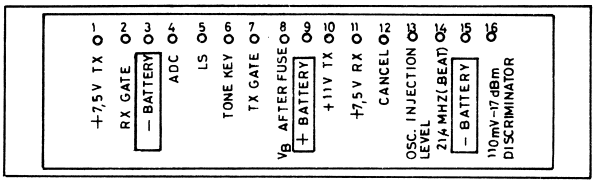
PIN LOCATION CQP810, CQP830

D402.068

Storno

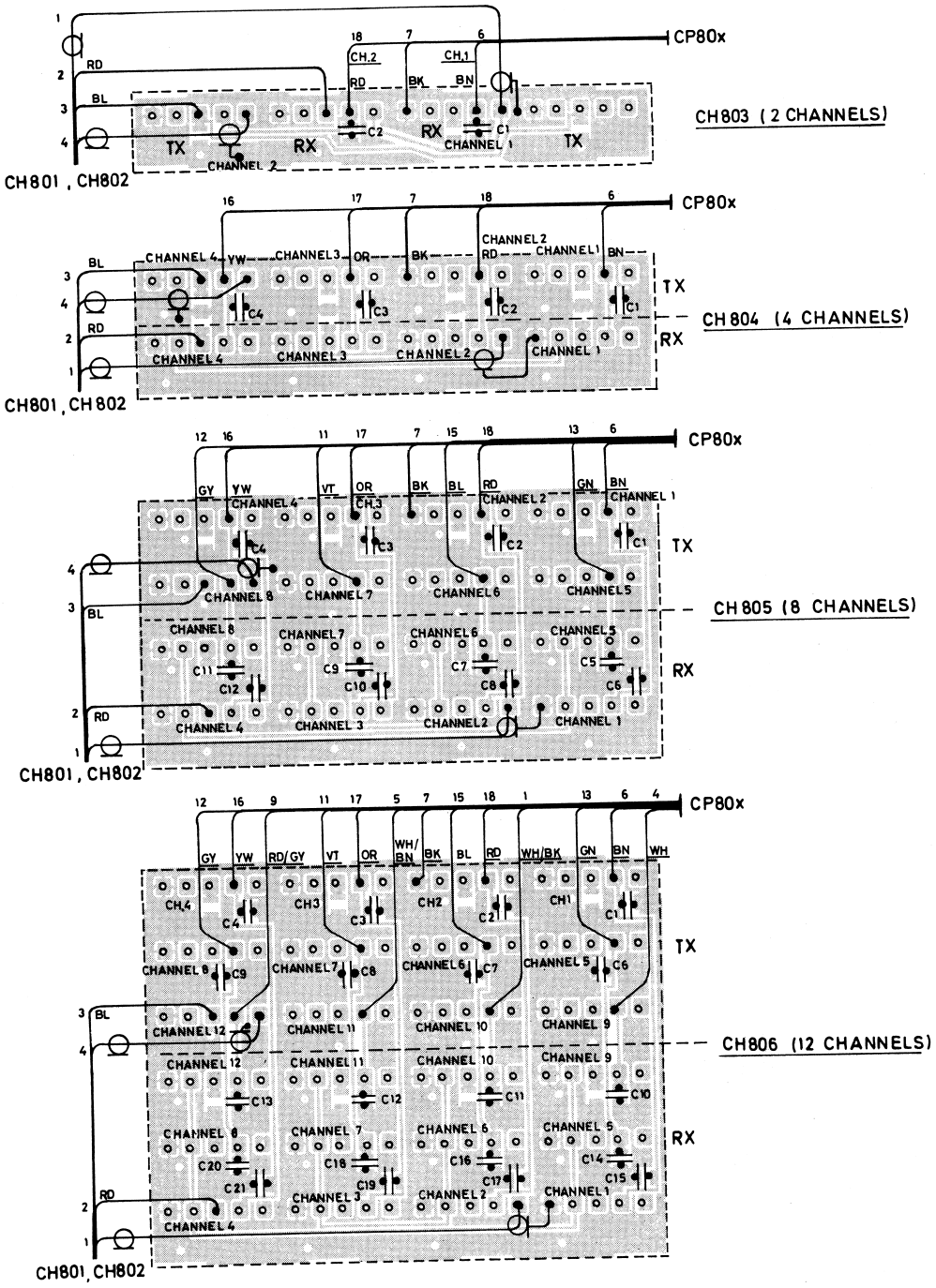


NOTE. 12,5 kHz ONLY
NOTE 2. REMOVE WHEN USING SR801/802



WIRING DIAGRAM CQP810, CQP830

D402.073/2



WIRING DIAGRAM CH803, CH804, CH805, CH806

D402.070

Storno

TYPE	Nº	CODE	DATA
CP801-IS		10.3349-00	Control Panel (Intrinsically Safe)
	C1	79.0003	47 µF/10 Ω moulded assy. 16 V
	R1	80.5048	820 Ω 5% carbon film 1/10 W
	R2	80.5056	3.9 KΩ 5% " " 1/10 W
	R3	80.5062	1.2 KΩ 5% " " 1/10 W
	R4	80.5066	2.7 KΩ 5% " " 1/10 W
	R5	80.5069	4.7 KΩ 5% " " 1/10 W
	E1	99.5306	Light emitting diode 1.6 V
	O1	47.0596	Switch assembly, channel
	O2	47.5077	Micro switch, key
	O3	47.5070	Micro switch, LS/SQ/Dial Light
	O4	47.5077	Micro switch, tone
	O5	47.0597	Switch assembly, volume
	J1	41.0199	Connector, antenna
	J2	41.5160	Connector, earphone

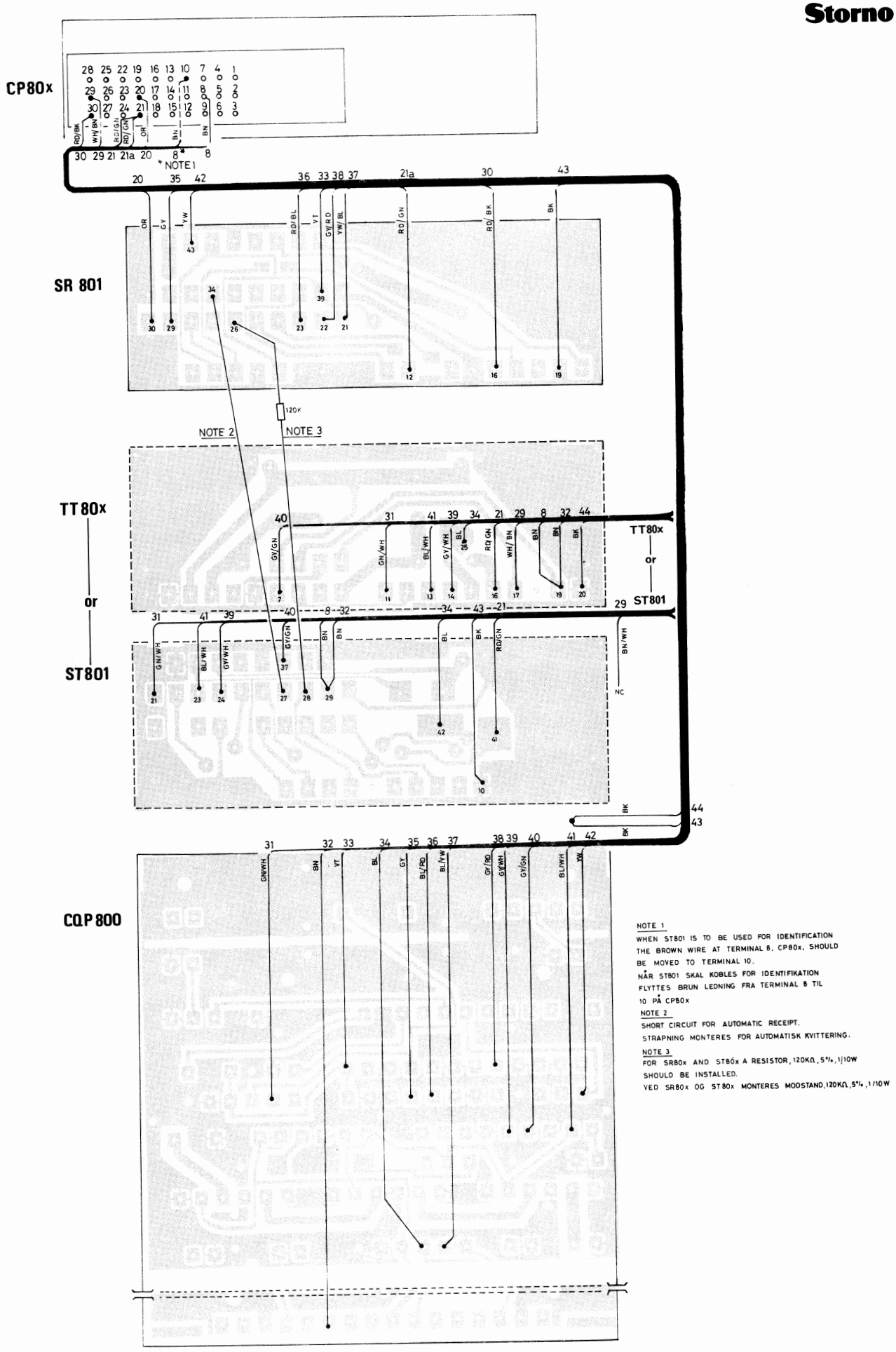
Storno

TYPE	Nº	CODE	DATA

CONTROL HEAD CP801-IS

X402.400

Storno



NOTE 1
WHEN ST801 IS TO BE USED FOR IDENTIFICATION THE BROWN WIRE AT TERMINAL 8, CP80x, SHOULD BE MOVED TO TERMINAL 10.
NÅR ST801 SKAL KOBLES FOR IDENTIFIKATION FLYTTES BRUN LEDNING FRA TERMINAL 8 TIL 10 PÅ CP80x

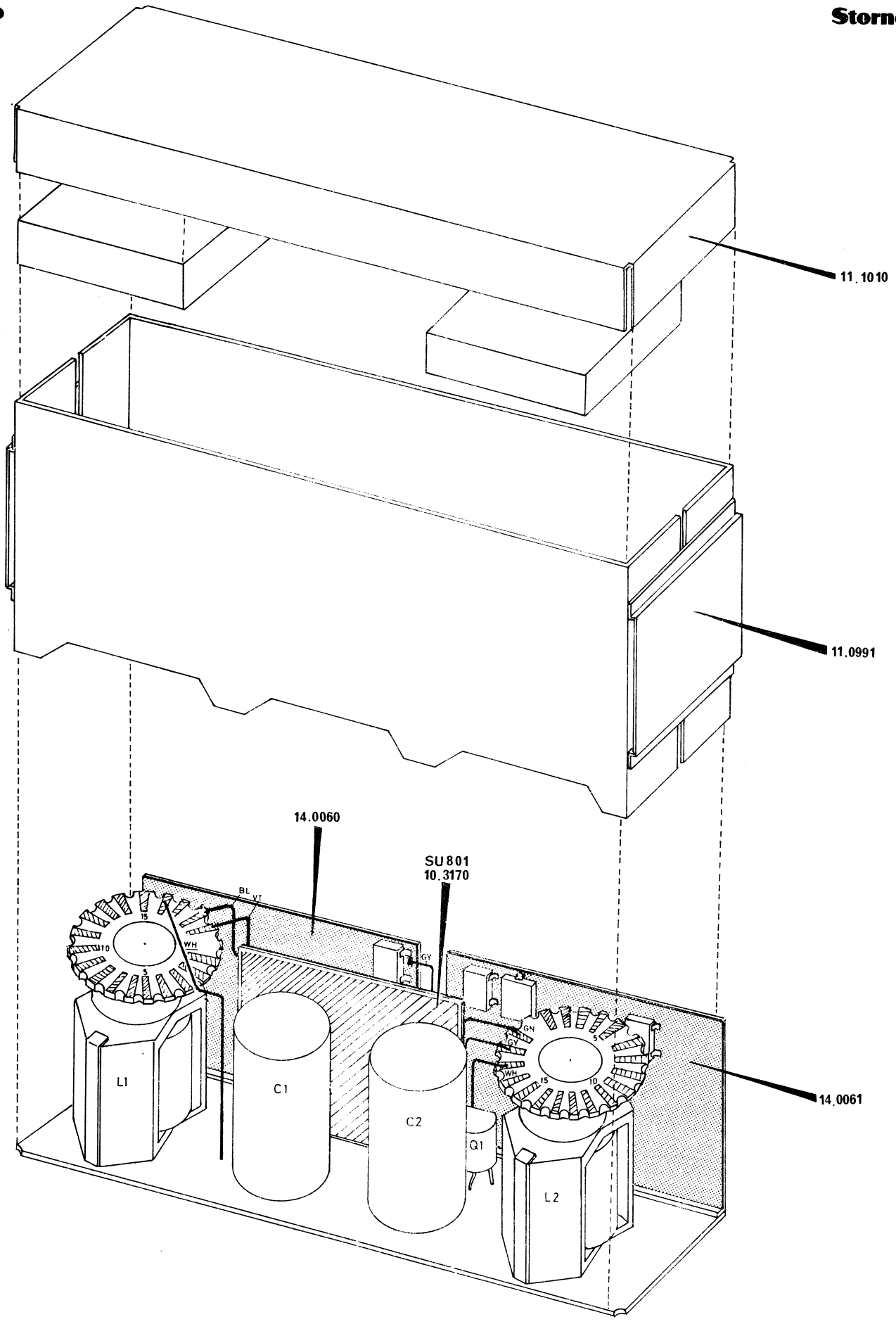
NOTE 2
SHORT CIRCUIT FOR AUTOMATIC RECEIPT.
STRAPNING MONTERES FOR AUTOMATISK KVITTERING.

NOTE 3
FOR SR80x AND ST80x A RESISTOR, 120KΩ, 5%, 1/10W SHOULD BE INSTALLED.
VED SR80x OG ST80x MONTERES MODSTAND, 120KΩ, 5%, 1/10W

TONE EQUIPMENT WIRING CQP800

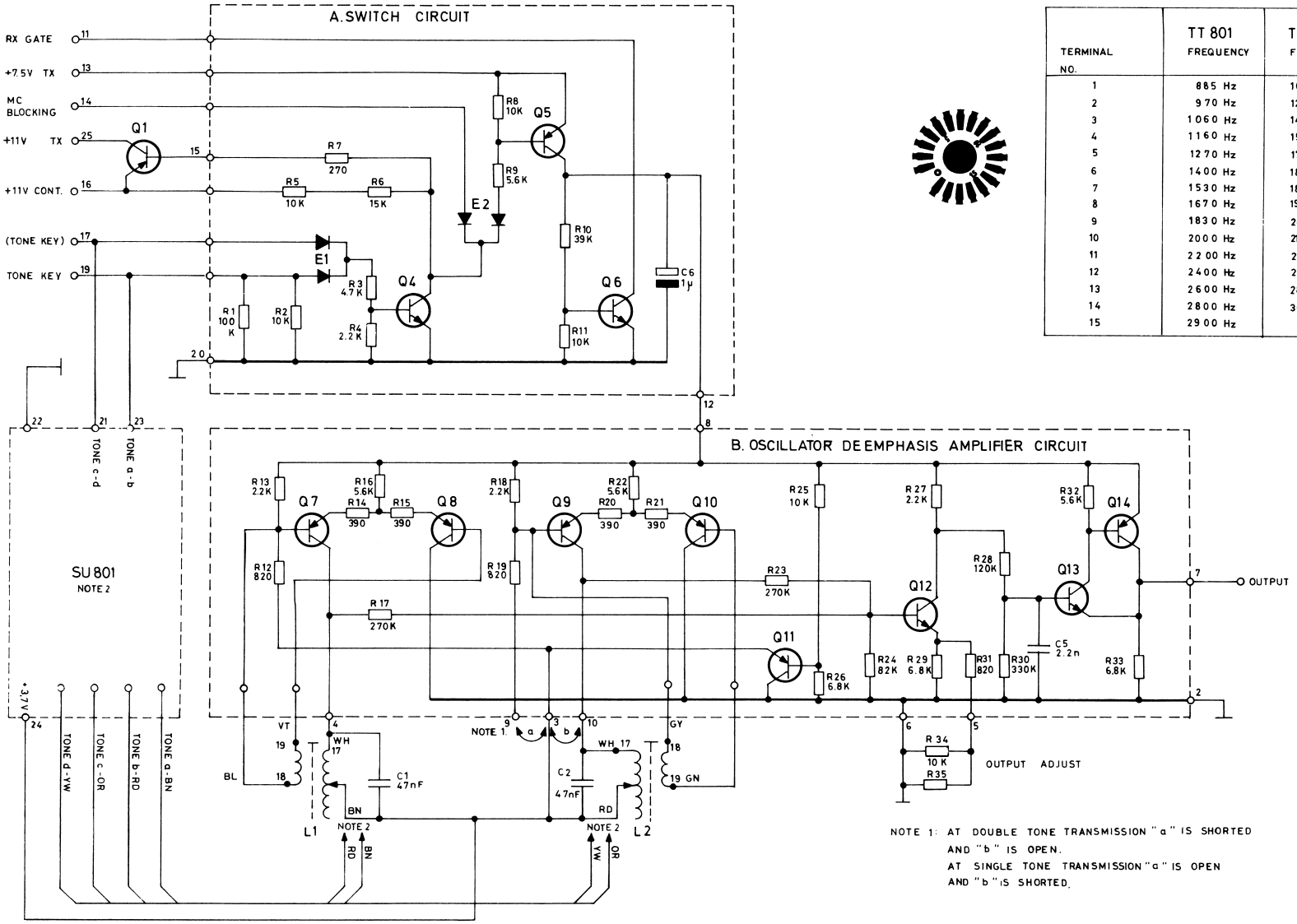
D402.141

Storno



TONE TRANSMITTER TT801

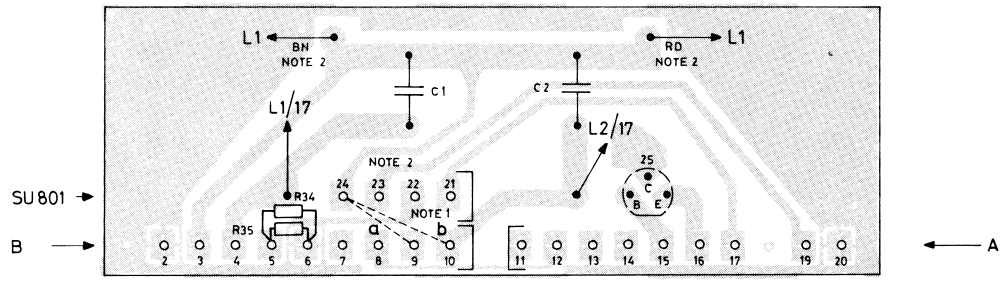
Storno



TERMINAL NO.	TT 801 FREQUENCY	TT 802 FREQUENCY
1	885 Hz	1010 Hz
2	970 Hz	1240 Hz
3	1060 Hz	1435 Hz
4	1160 Hz	1520 Hz
5	1270 Hz	1750 Hz
6	1400 Hz	1800 Hz
7	1530 Hz	1860 Hz
8	1670 Hz	1980 Hz
9	1830 Hz	2000 Hz
10	2000 Hz	2135 Hz
11	2200 Hz	2280 Hz
12	2400 Hz	2450 Hz
13	2600 Hz	2812 Hz
14	2800 Hz	3047 Hz
15	2900 Hz	

NOTE 1: AT DOUBLE TONE TRANSMISSION "a" IS SHORTED AND "b" IS OPEN.
AT SINGLE TONE TRANSMISSION "a" IS OPEN AND "b" IS SHORTED.

NOTE 2
SU 801 CAN BE USED IN REMOTE CONTROLLED EQUIPMENT ONLY. REMOVE BROWN AND RED WIRE FROM TONE COIL WHEN INSTALLING SU 801.



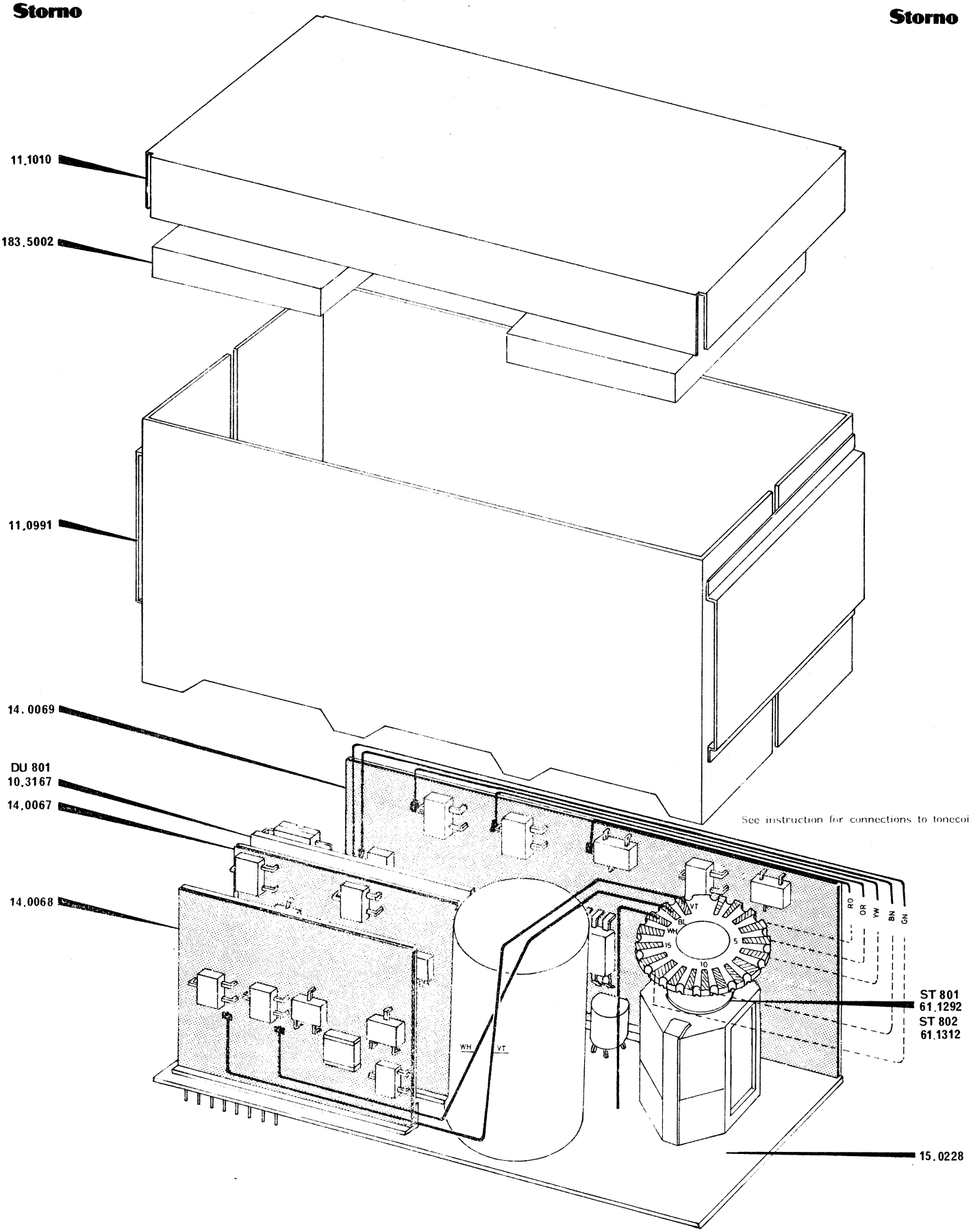
BOTTOM VIEW

TONE TRANSMITTER TT801, TT802

D402.043

Storno

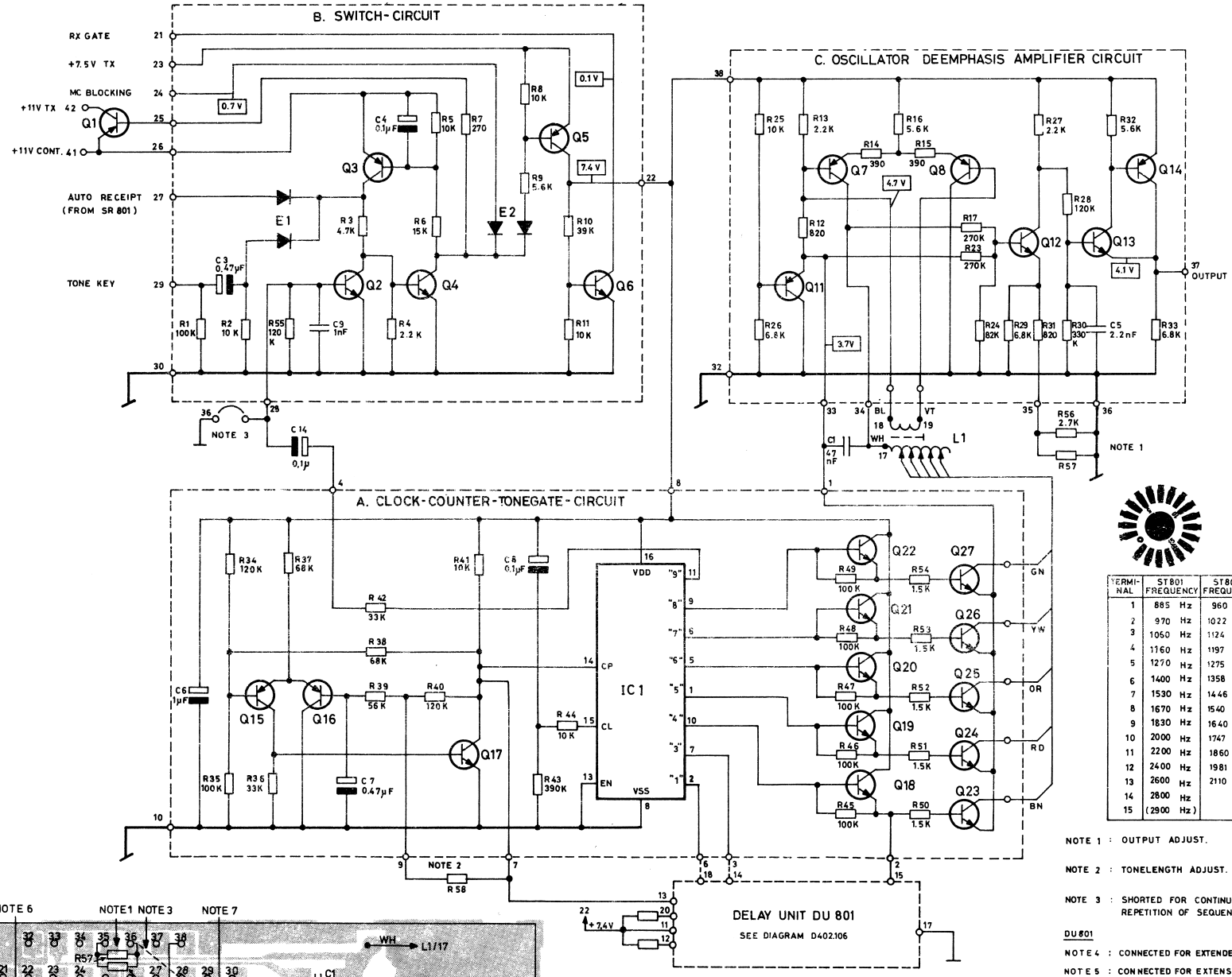
Storno



SEQUENTIAL TONE TRANSMITTER ST801, -ST802

I 402.144

Storno



TERMINAL	ST801 FREQUENCY	ST802 FREQUENCY
1	885 Hz	960 Hz
2	970 Hz	1022 Hz
3	1060 Hz	1124 Hz
4	1160 Hz	1197 Hz
5	1270 Hz	1275 Hz
6	1400 Hz	1358 Hz
7	1530 Hz	1446 Hz
8	1670 Hz	1540 Hz
9	1830 Hz	1640 Hz
10	2000 Hz	1747 Hz
11	2200 Hz	1860 Hz
12	2400 Hz	1981 Hz
13	2600 Hz	2110 Hz
14	2800 Hz	
15	(2900 Hz)	

NOTE 1 : OUTPUT ADJUST.

NOTE 2 : TONELENGTH ADJUST.

NOTE 3 : SHORTED FOR CONTINUOUS REPETITION OF SEQUENCE.

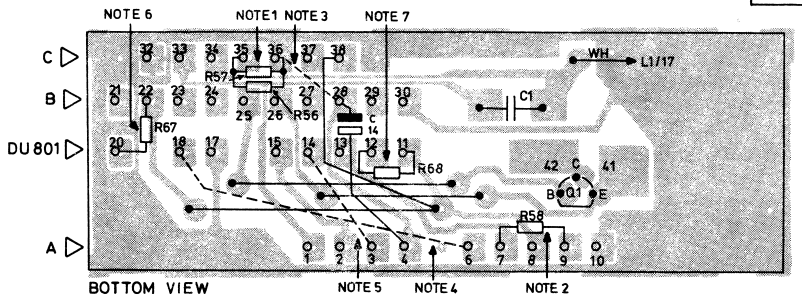
DU 801

NOTE 4 : CONNECTED FOR EXTENDED DELAY OF FIRST TONE.

NOTE 5 : CONNECTED FOR EXTENSION OF THE FIRST TONE.

NOTE 6 : DELAY ADJUSTMENT

NOTE 7 : FIRST TONE LENGTH ADJUSTMENT



SEQUENTIAL TONE TRANSMITTER ST801, -ST802

D 402.042/3

TYPE	NO.	CODE	DATA
ST801		10.3081	Sequential Tone Transmitter
ST802		10.3227	Sequential Tone Transmitter
	A	14.0069	Clock / counter / gates, subassembly
	B	14.0067	Switch circuit, subassembly
	C	14.0068	Oscillator / amplifier, subassembly
		15.0228	Motherboard, subassembly
	C1	76.5122	47 nF 2% polystyr TB 20V
	C2	73.5130	0.1 µF -20% +50% tantal 20V
	R56	80.5054	2.7KΩ 5% carbon film 0.1W
	R57	80.50xx	Adjusted 5% " " 0.1W
	R58	80.50xx	Adjusted 5% " " 0.1W
ST801	L1	61.1292	Tone coil
ST802	L1	61.1312	Tone coil
	Q1	99.5285	BC636 Transistor

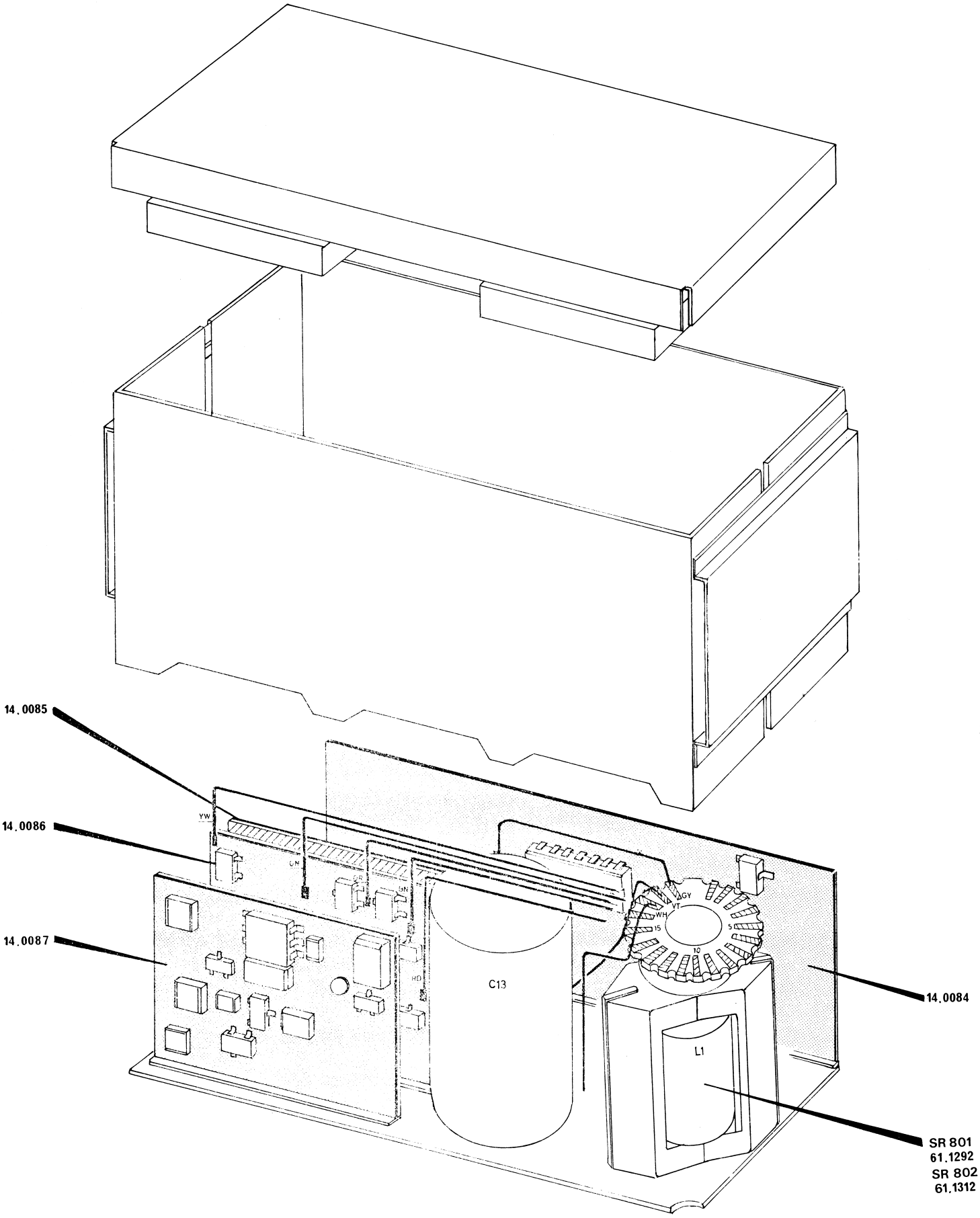
Storno

TYPE	NO.	CODE	DATA

SEQUENTIAL TONE TRANSMITTER ST801, ST802

X402.154/2

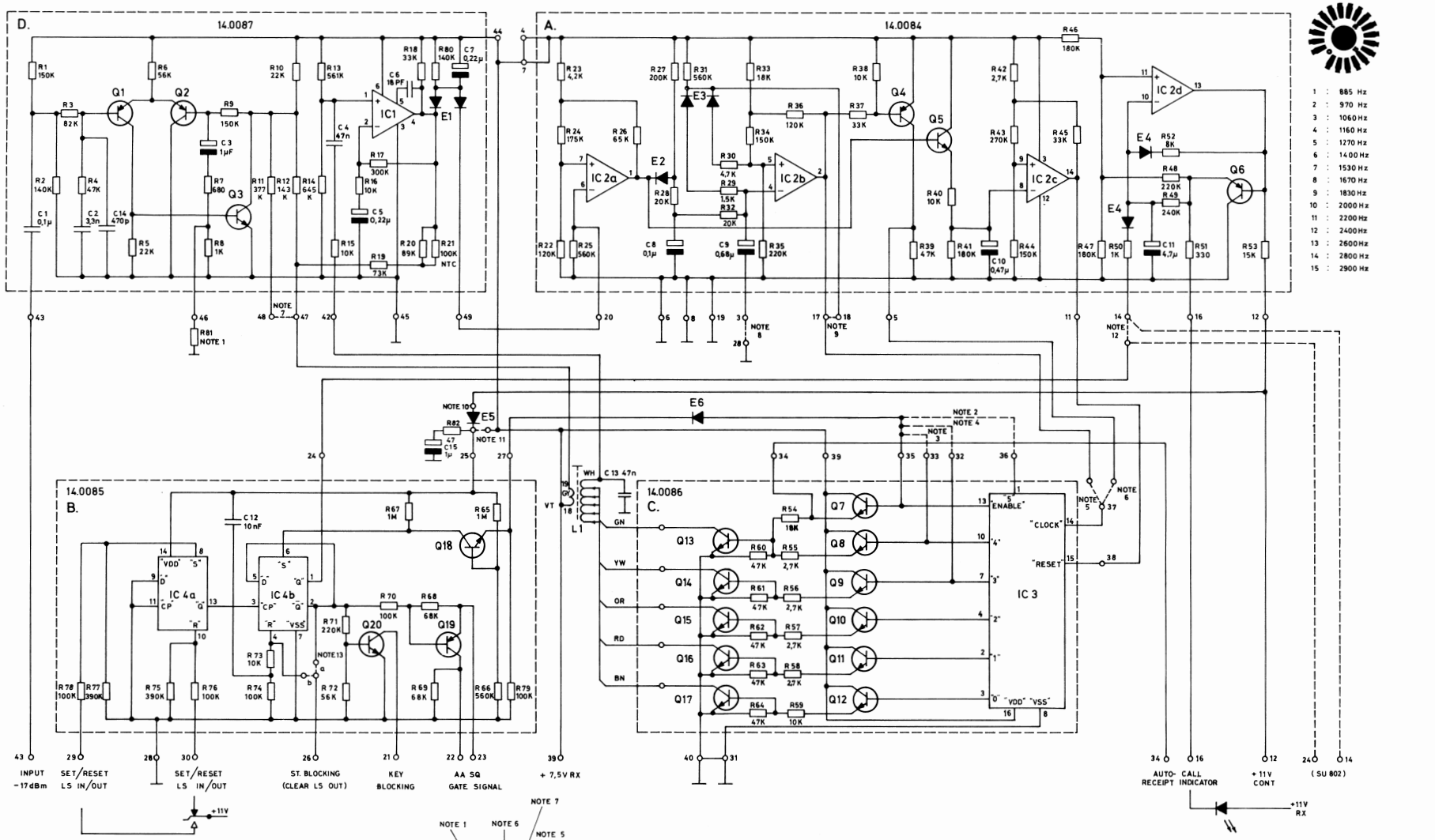
Storno

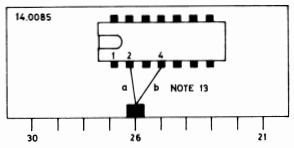


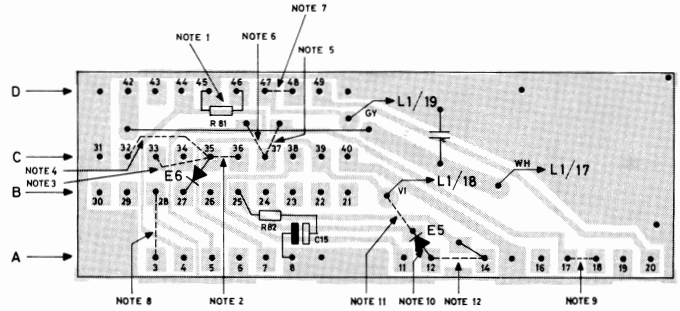
SEQUENTIAL TONE RECEIVER SR801, -SR802

I402.142

Storno







NOTE 1 : SENSITIVITY ADJUST.
NOTE 2 : SHORTED FOR 5 TONE SEQUENCE CALL AND FOR DOUBLE TONE CALL.
NOTE 3 : SHORTED FOR 4 TONE SEQUENCE CALL.
NOTE 4 : SHORTED FOR 3 TONE SEQUENCE CALL.
NOTE 5 : SHORTED FOR SEQUENCE CALL.
NOTE 6,7,8 AND 9 : SHORTED FOR DOUBLE TONE CALL.
NOTE 10 : REMOVE IN CRP 800.
NOTE 11 : SHORTED IN CRP 800.
NOTE 12 : OPEN IN CRP 800 WITH SU 802.
NOTE 13 : IN CRP 800 WITH SU 802 CONNECTION TO TERMINAL 26 IS MOVED FROM a TO b.

SEQUENTIAL TONE RECEIVER SR801

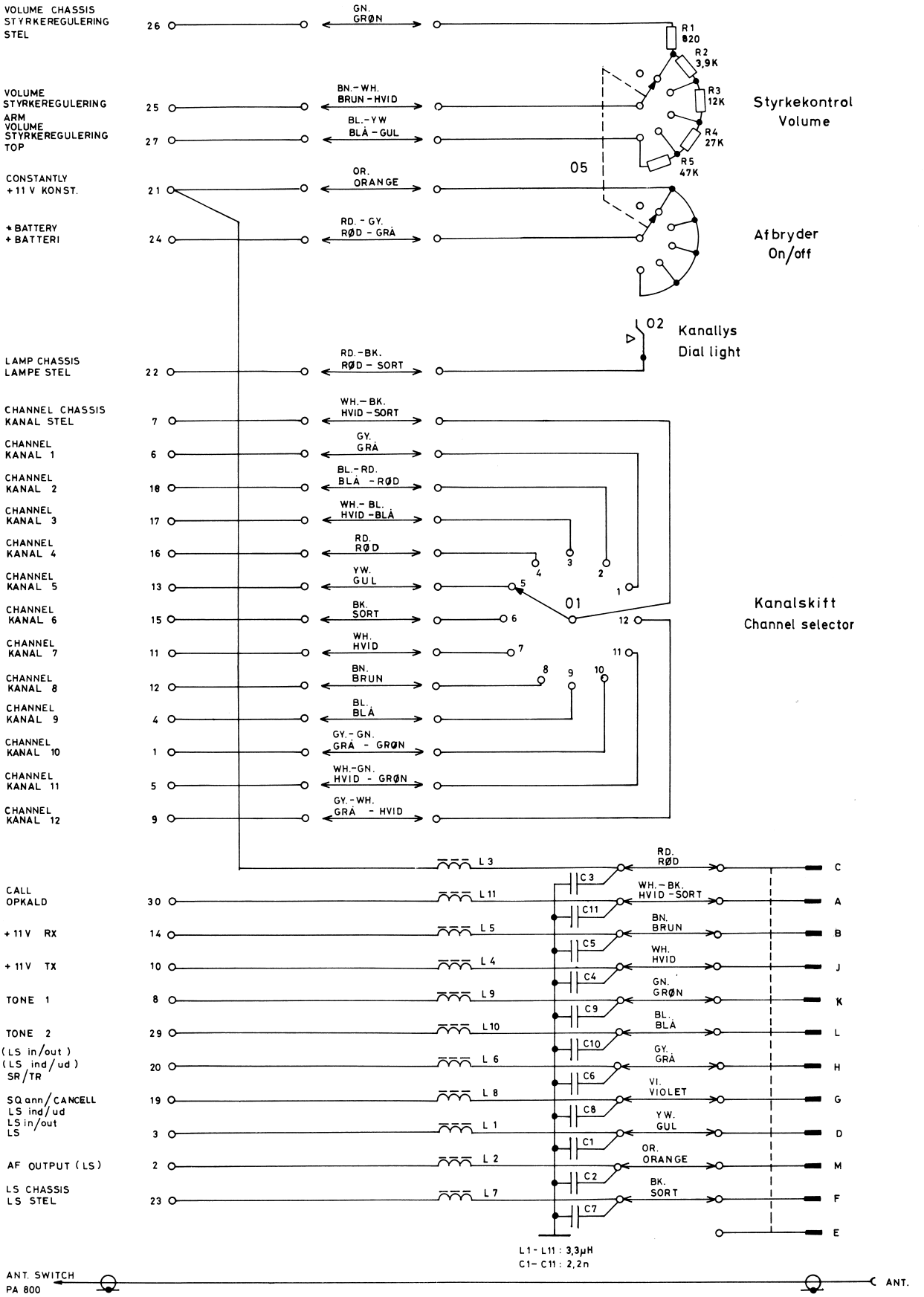
D402.097/4

TYPE	NO.	CODE	DATA
SR801		10.3079	Sequential Tone Receiver
SR802		10.3226	Sequential Tone Receiver
	A	14.0084-01	Schmitt trigger, Clock and Clear delay Subassembly
	B	14.0085	LS in/out, read-out, subassembly
	C	14.0086	Counter, gates, subassembly
	D	14.0087	Amplifier, Q-multiplier, subassembly
		15.0231	Motherboard, subassembly
	C13	76.5122	47 nF 2% polystyr TB 20V
	C15	73.5135	1 µF -20 + 50% tantal 16V
	R81	80.50xx	Adjusted 5% carbon film 0.1W
	R82	80.5033	47Ω 5% " " 0.1W
SR801	L1	61.1292	Tone coil
SR802	L1	61.1312	Tone coil
	E5	99.5237	IN4148 Diode
	E6	99.5237	IN4148 Diode

Storno

TYPE	NO.	CODE	DATA

SEQUENTIAL TONE RECEIVER SR801, SR802



CONTROL PANEL CP802-IS

D402.358

TYPE	Nº	CODE	DATA
CP802-IS		10.3350-00	Remote Control Head (Intrinsically Safe)
	C1	74.5278	2.2 nF 20% ceram CP 50 V
	C2	74.5278	2.2 nF 20% " CP 50 V
	C3	74.5278	2.2 nF 20% " CP 50 V
	C4	74.5278	2.2 nF 20% " CP 50 V
	C5	74.5278	2.2 nF 20% " CP 50 V
	C6	74.5278	2.2 nF 20% " CP 50 V
	C7	74.5278	2.2 nF 20% " CP 50 V
	C8	74.5278	2.2 nF 20% " CP 50 V
	C9	74.5278	2.2 nF 20% " CP 50 V
	C10	74.5278	2.2 nF 20% " CP 50 V
	C11	74.5278	2.2 nF 20% " CP 50 V
	R1	80.5048	820 Ω 5% carbon film 1/10 W
	R2	80.5056	3.9 Ω 5% " " 1/10 W
	R3	80.5062	1.2 KΩ 5% " " 1/10 W
	R4	80.5066	2.7 KΩ 5% " " 1/10 W
	R5	80.5069	4.7 KΩ 5% " " 1/10 W
	O1	47.0613	Channel switch
	O5	47.0611	Volume switch
	J1	41.0199	Antenna Connector
	J2	41.5085	Multiwire Connector for CB800

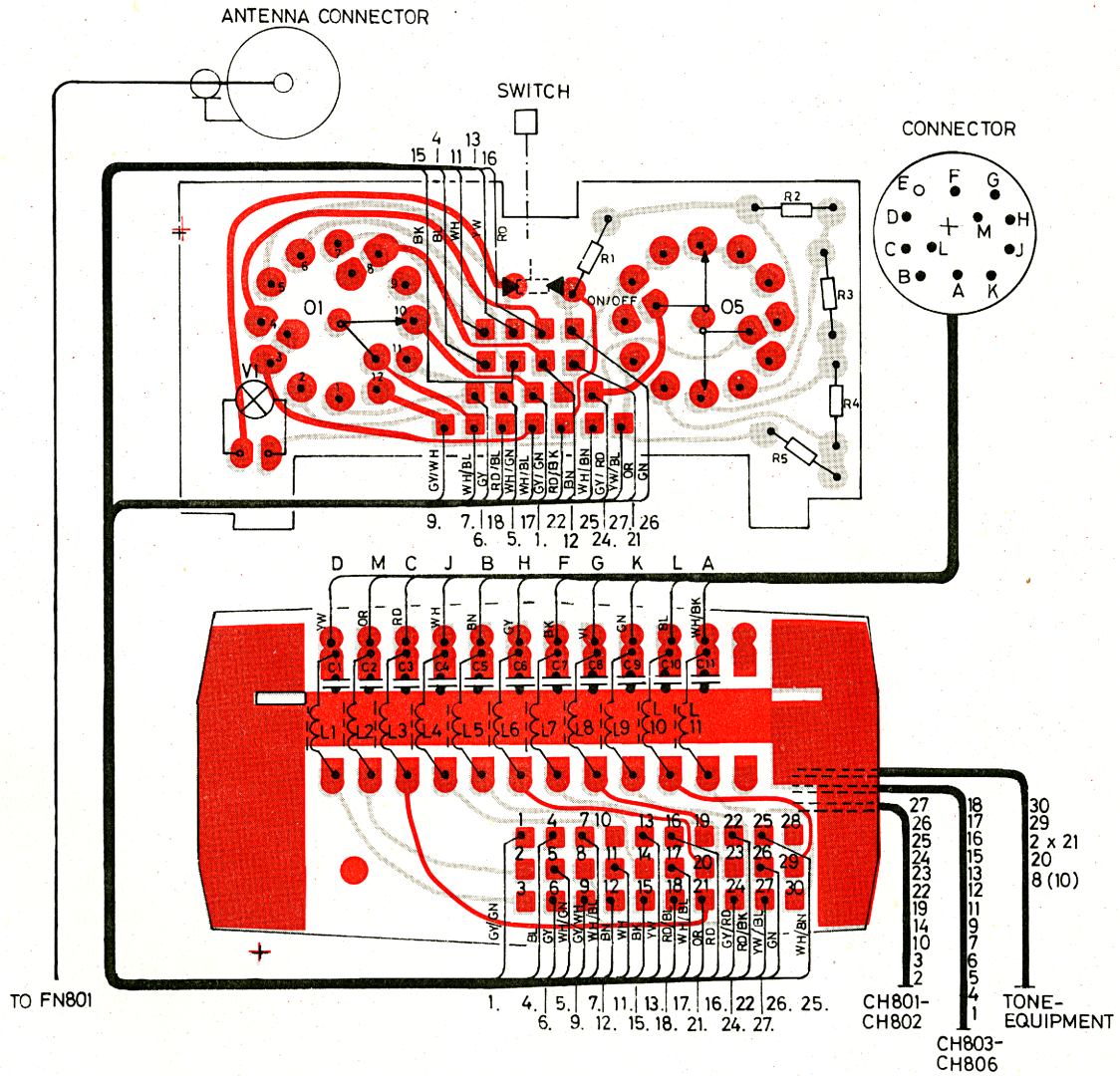
Storno

TYPE	Nº	CODE	DATA

CONTROL HEAD CP802-IS

X402.399

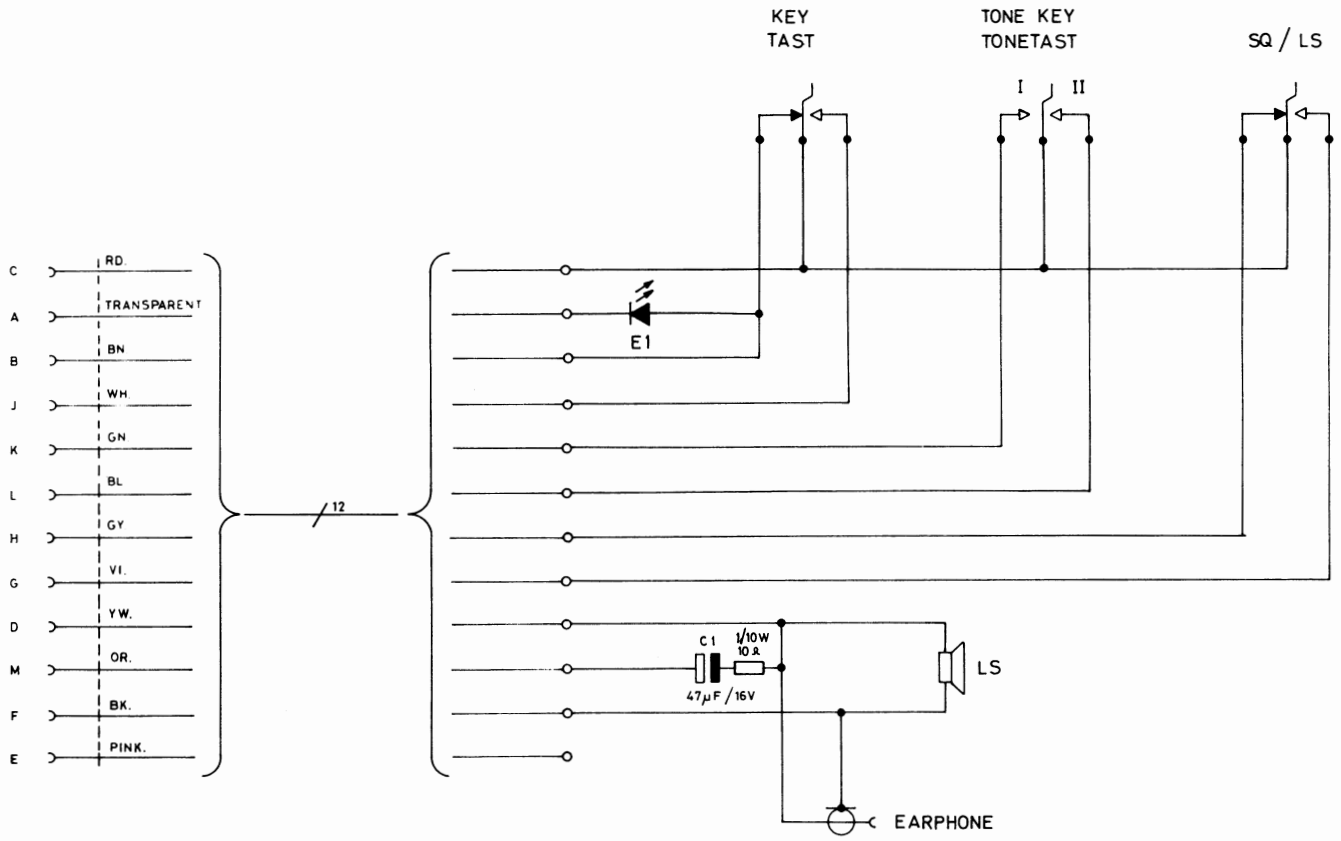
Storno



WIRING DIAGRAM CP802.

D 402.133

Storno



CONTROL UNIT CB802 - IS

D 402.359

TYPE	Nº	CODE	DATA
		10.3358	Control Unit CB802-IS
	C1	79.0003	47 µF/10 Ω Moulded assy. 16 V
	R1	80.5076	180 KΩ 5% carbon film 0.1 W
	E1	99.5306	LED 1.6 V; 20 mA
		41.5160	Earphone Socket
		47.0614	SQ/LS Switch assembly
		47.5033	Key switch
		47.5079	Tone Key Button I
		47.5079	Tone Key Button II

Storno

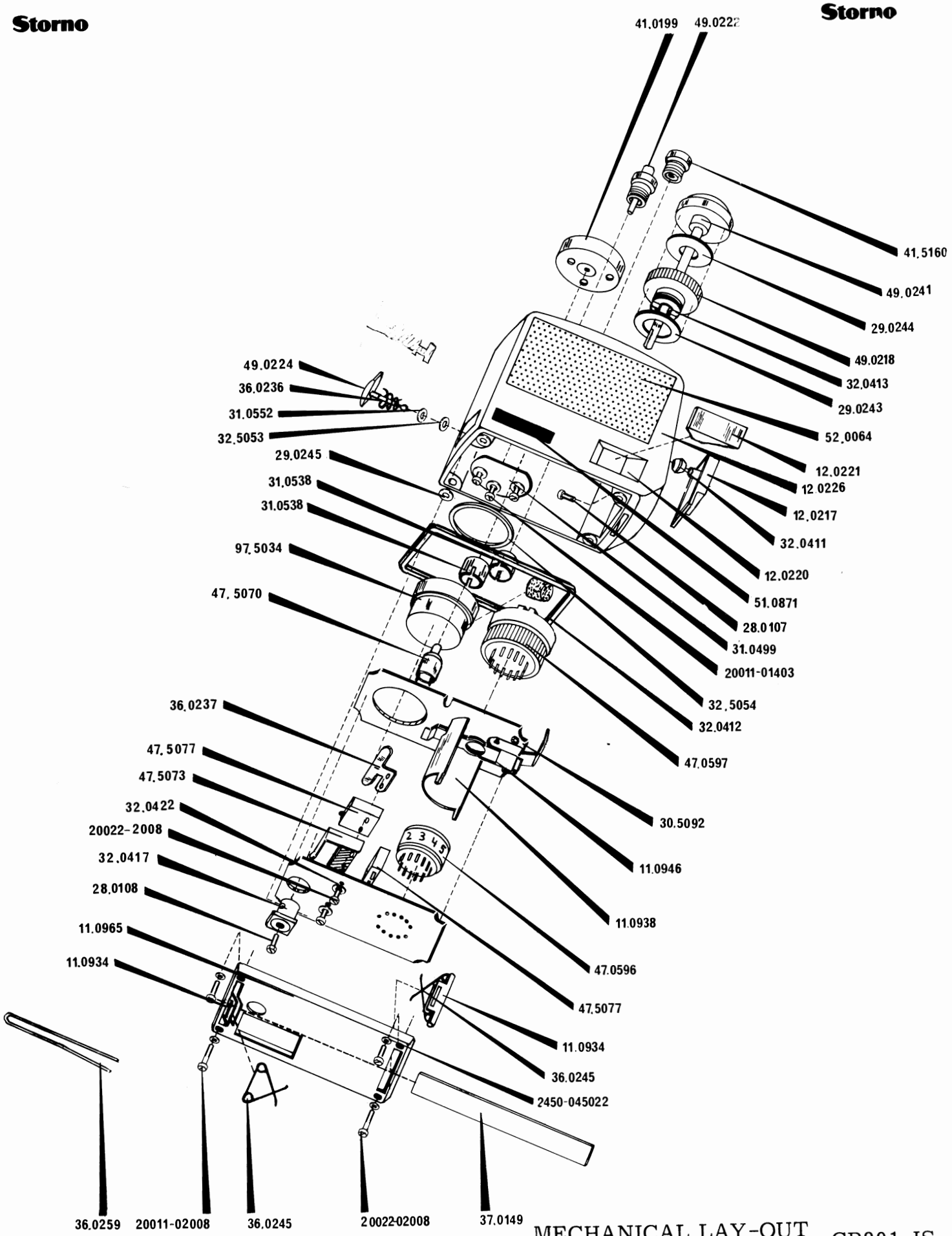
TYPE	Nº	CODE	DATA

CONTROL UNIT CB802-IS

X402.380

Storno

Storno

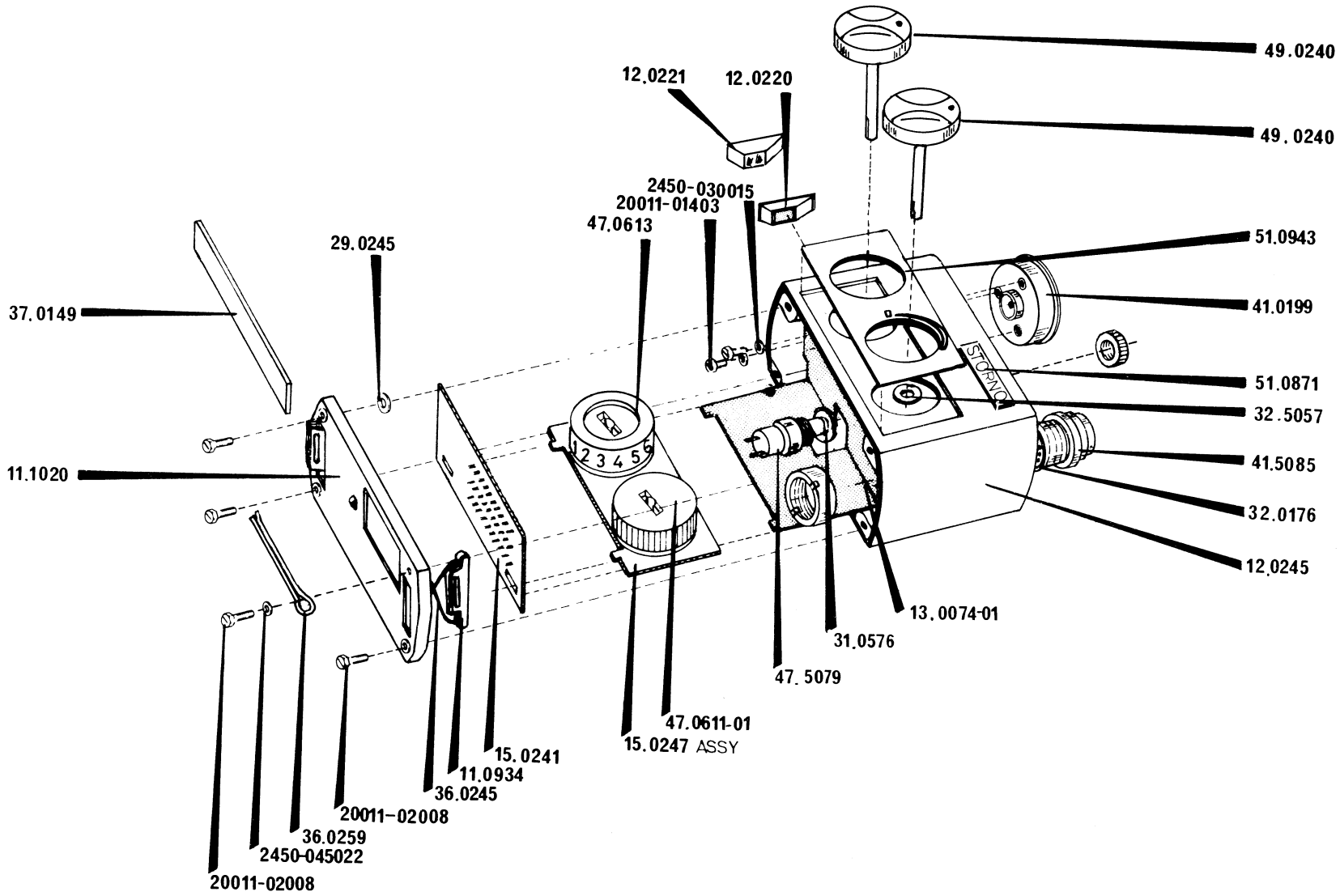


MECHANICAL LAY-OUT
CONTROL HEAD

CP801-IS

M405.067

Storno

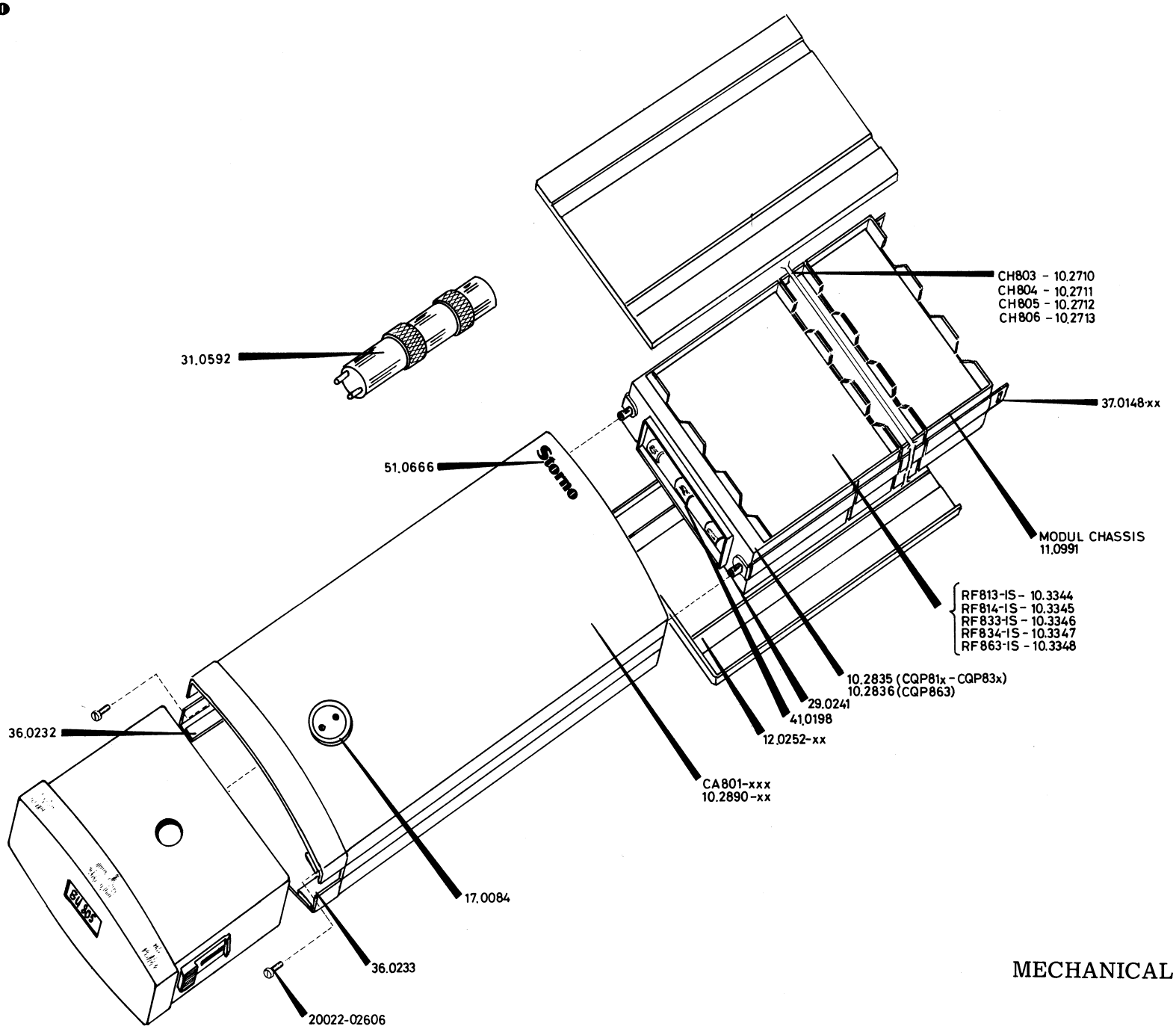


MECHANICAL LAY-OUT
CONTROL HEAD

CP802-IS

M405.068

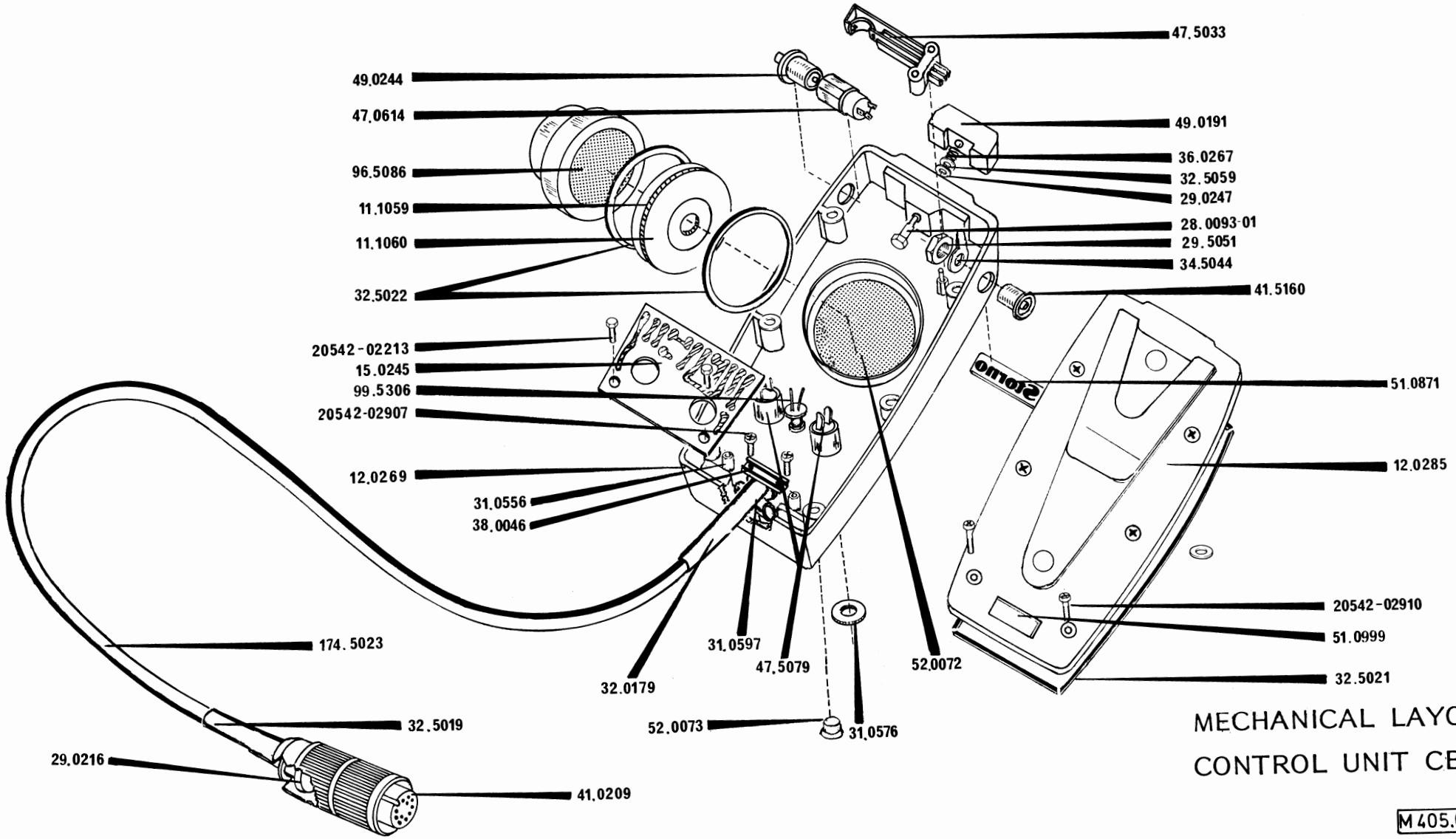
Storno



MECHANICAL LAY-OUT CA800-IS

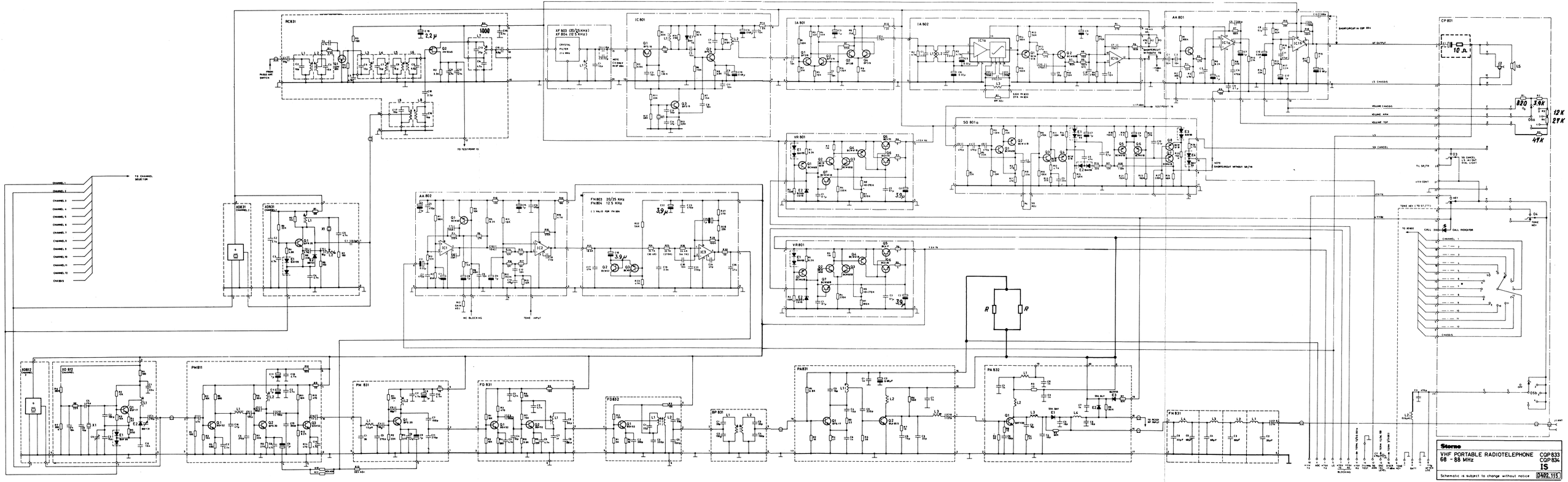
M405.069

Storno



MECHANICAL LAYOUT
CONTROL UNIT CB802.

M 405.058/4


RC831
XF 803 (20/25 KHz)
XF 804 (12.5 KHz)
IC 801
IA 801
IA 802
AA 801
CP 801
SO 801 a
VR 801
XO831
XO 812
PM811
PM 831
FD 831
FD832
BP 831
PA831
PA 832
FN 831
AA 802
FN 803 20/25 KHz
FN 804 12.5 KHz
TO CHANNEL SELECTOR
CHANNEL 1
CHANNEL 2
CHANNEL 3
CHANNEL 4
CHANNEL 5
CHANNEL 6
CHANNEL 7
CHANNEL 8
CHANNEL 9
CHANNEL 10
CHANNEL 11
CHANNEL 12
CHANNELS
TO TESTPOINT 15
TO TESTPOINT 16
MC BLOCK HG
TONE INPUT
R
R
12K
27K
47K
Sterne
VHF PORTABLE RADIOTELEPHONE
68 - 88 MHz
COP833
COP834
IS
Schematic is subject to change without notice
D402.115

Storno
RADIO COMMUNICATION SYSTEMS

ALIGNMENT CARD

SERIES 800