

**PORTABLE RADIOTELEPHONE
MODEL STORNOPHONE 800U
TYPE CQP863U-IS 0.2W
420 - 470MHz**

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STORNOPHONE 800U-IS 1W and 0.2W

TECHNICAL SPECIFICATIONS

TYPE CQP 800			813U-IS	814U-IS	833U-IS	834U-IS	863U-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		-25 ⁰ C - +55 ⁰ C -30 ⁰ C - +60 ⁰ C				
	Operating range						
	Functioning						
TRANSMITTER	RF output	W	0.2 - 1		0.2 - 1		0.2 - 1
	Modulation		Phase (PM)				
	AF response		+6dB 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:						
	12dB SINAD (EIA)	uV	0.5		0.5		0.7
	20dB S/N (FTZ)	uV	0.6		0.6		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		-6dB pr. octave deemphasis				
Phase modulation		300-3000	300-2400	300-3000	300-2400	300-3000	
BATTERY	Type of battery		BU809 (1W) , BU805 (0.2W)				
	Min. voltage		10.0V				
	Nom. voltage		12.4V				
	Max. voltage		15.3V				
	Max. RF output power		1.0W				

STORNOPHONE 800U-IS 0.2W

INTRINSICALLY SAFE VERSION

General

This handbook refers to the intrinsically safe radiotelephone model STORNOPHONE 800U-IS and is intended to supplement the contents of the descriptions of the standard editions of the equipment.

Introduction

The intrinsically safe Stornophone 800U-IS equipment is intended for radiocommunication in hazardous areas where flameable concentration of gases and vapours may be present. The Stornophone 800U-IS is a special version of the standard handheld or 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 CQP813U-IS 0.2W
 Type CQP814U-IS 0.2W

Radioset for 4-metre band: Type CQP833U-IS 0.2W
 Type CQP834U-IS 0.2W

Radioset for 0.7-metre band: Type CQP863U-IS 0.2W

Battery type BU805

Antennas

2-metre band: AN815, AN816
 4-metre band: AN834
 0.7-metre band: AN864, AN865

Control Units

All frequency bands: CB804-IS, CB805-IS
 2-metre band: CB812-IS
 4-metre band: CB831-IS
 0.7-metre band: CB861-IS

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 for setting the transmitter power, located between pin 10 and 16 of PA8x1.
VR801-IS	value of C2 has been changed to 3.3uF.
FN803/4-IS	values of C18 and C22 have been changed to 3.3uF.
RC811-IS	value of C19 has been changed to 0.39uF. value of R4 has been changed to 1Kohm.
RC831-IS	value of C19 has been changed to 0.39uF. value of R4 has been changed to 1Kohm.
RC861-IS	value of C19 has been changed to 0.39uF. value of R11 has been changed to 1Kohm.
CA80x-IS	a battery lock for BU805 has been provided.

Tone Equipment

ST801-IS	Sequential tone transmitter ZVEI
ST802-IS	Sequential tone transmitter CCIR
SR801-IS	Sequential tone receiver ZVEI
SR802-IS	Sequential tone receiver CCIR

Control Head

CB808-IS	A 15ohm resistor has been inserted in series with C1 the two being encapsulated in moulded epoxy. The values of R1, R2, R3, R4, and R5 (volume control) have been changed to 47kohm, 27kohm, 12kohm, 3.9kohm, and 820 ohm, respectively. R6, 47kohm, has been added. The dial lamp V1 has been removed.
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The transmitter output power has been reduced to 0.2W causing the transmitter current drain to be $\leq 150\text{mA}$.

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, rechargeable, cylindrical cells of 225mA 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

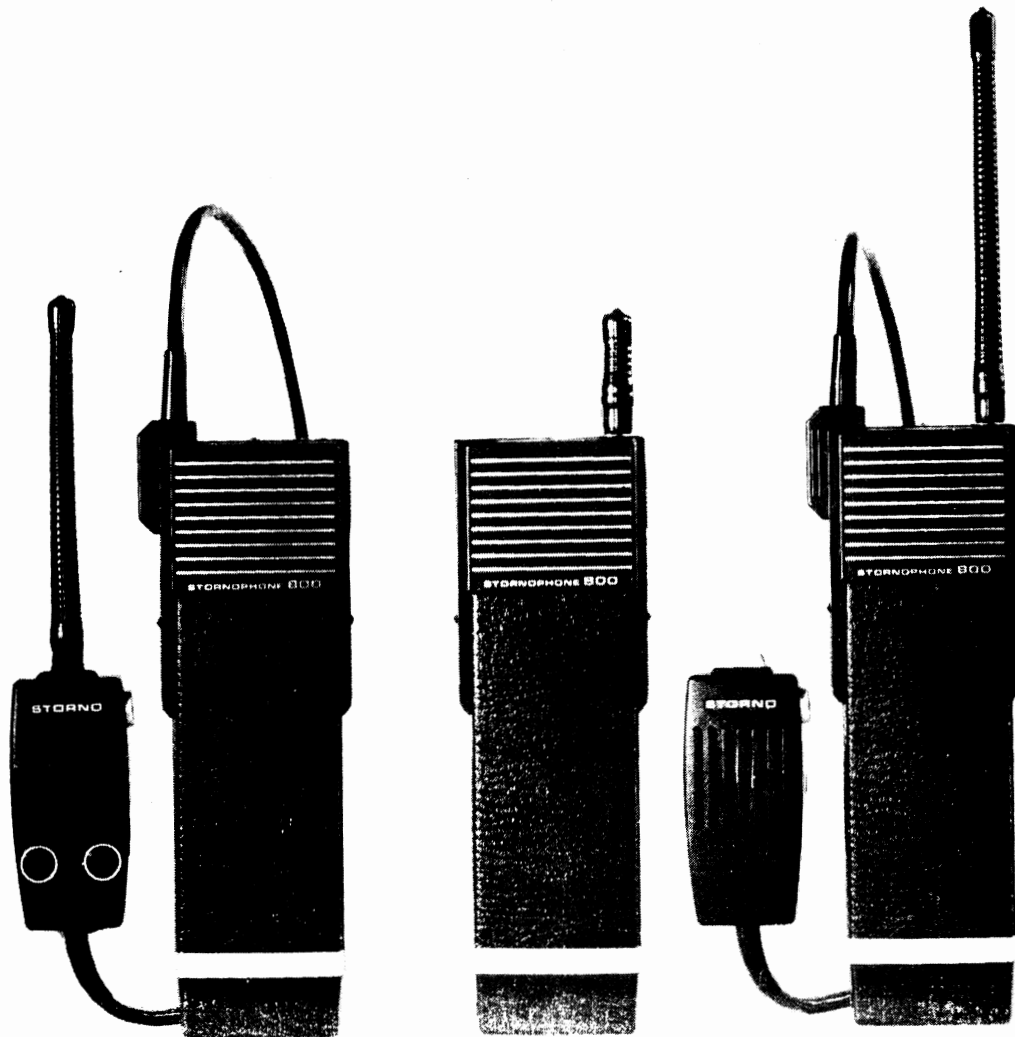
Before the Stornophone 800U-IS is operated in hazardous areas, the user must be fully aware of the conditions of use. Failure to observe these conditions will invalidate the certificate of intrinsic safety.

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.

STORNOPHONE 800U

GENERAL DESCRIPTION AND OPERATING INSTRUCTIONS



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

The CQP800U may be either local controlled or remote controlled, 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 four sections, beginning from the bottom these are:

- 1) the battery
- 2) the transmitter and receiver modules
- 3) the tone equipment
- 4) the control head

Local control

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

Remote control

On remote controlled radios a control unit containing the transmitter key, tone key, and loudspeaker/squelch buttons, the speaker/microphone and an earphone socket, is connected to the set by means of a cable. Connecting the control unit automatically operates a switch which transfers the functions of the control head to the control unit.

Control units with the following functions are available:

- CB804 Contains loudspeaker/microphone, transmitter key, and a combined dial light-squelch cancelling button.
- CB805 Contains loudspeaker/microphone, transmitter key, tone key I, tone key II, a combined dial light-squelch cancel-loudspeaker in/out button, call indicator, and ear-phone socket.
- CB812 Contains loudspeaker/microphone, transmitter key, tone key I, tone key II, a combined dial light-squelch cancel-loudspeaker in/out-button, call indicator, and a threaded antenna socket. The unit is used for equipment operating in the 146 - 174 MHz band.
- CB831 Contains loudspeaker/microphone, transmitter key, tone key I, tone key II, a combined dial light-squelch cancel-loudspeaker in/out-button, call indicator, and a threaded antenna socket. The unit is used for equipment operating in the 68 - 88 MHz band.
- CB861 Contains loudspeaker/microphone, transmitter key, tone key I, tone key II, a combined dial light-squelch cancel-loudspeaker in/out-button, call indicator, and a threaded antenna socket. The unit is used for equipment operating in the 420-470 MHz band.

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

Type	CQP833U	CQP834U
4 m band (VHF)	68 - 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 1.0 W or 1.0 to 3.0 W	
Type	CQP813U	CQP814U
2 m band (VHF)	146 - 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 1.0 W or 1.0 to 3.0 W	
Type	CQP863U	
0.7 m band (UHF)	420 - 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 or 1.0 to 3.0 W	

The length of a particular equipment will depend upon the number of channels, battery size, whether it includes tone equipment or not.

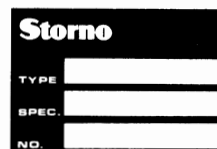
Type specification is as follows:

Specification	code
0.1 - 1.0 W RF output power	1
1.0 - 3.0 W RF output power	3
Universal control head	C8
2 channels	X2
4 channels	X4
8 channels	X8
12 channels	X12
Tone equipment	T

Thus a 3 W, four-channel radiotelephone with universal control head and selective calling would be designated:

3 C8 X4 T

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

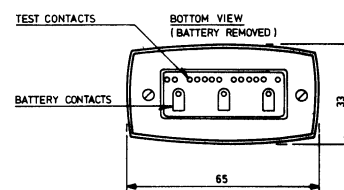
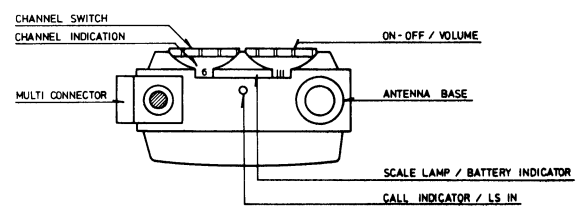
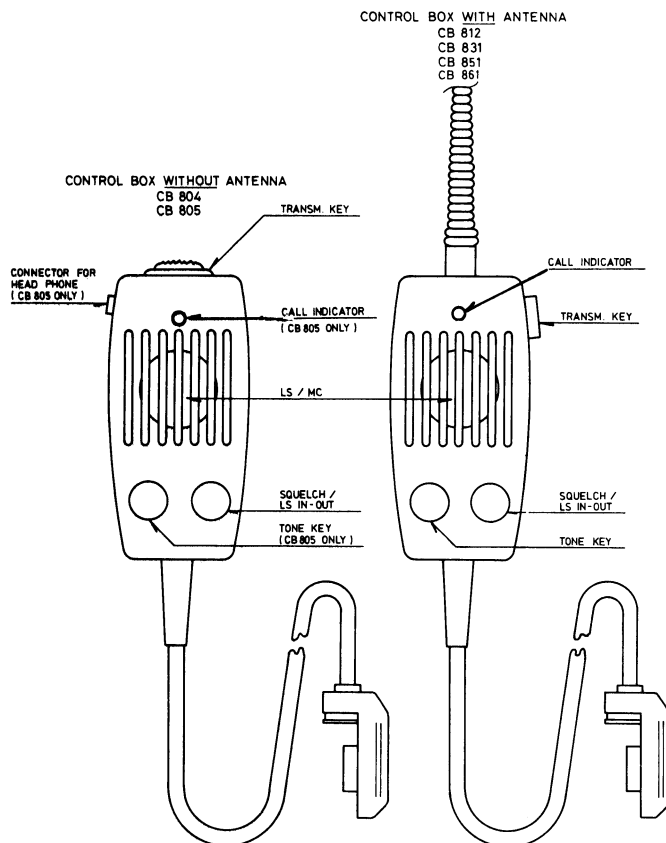
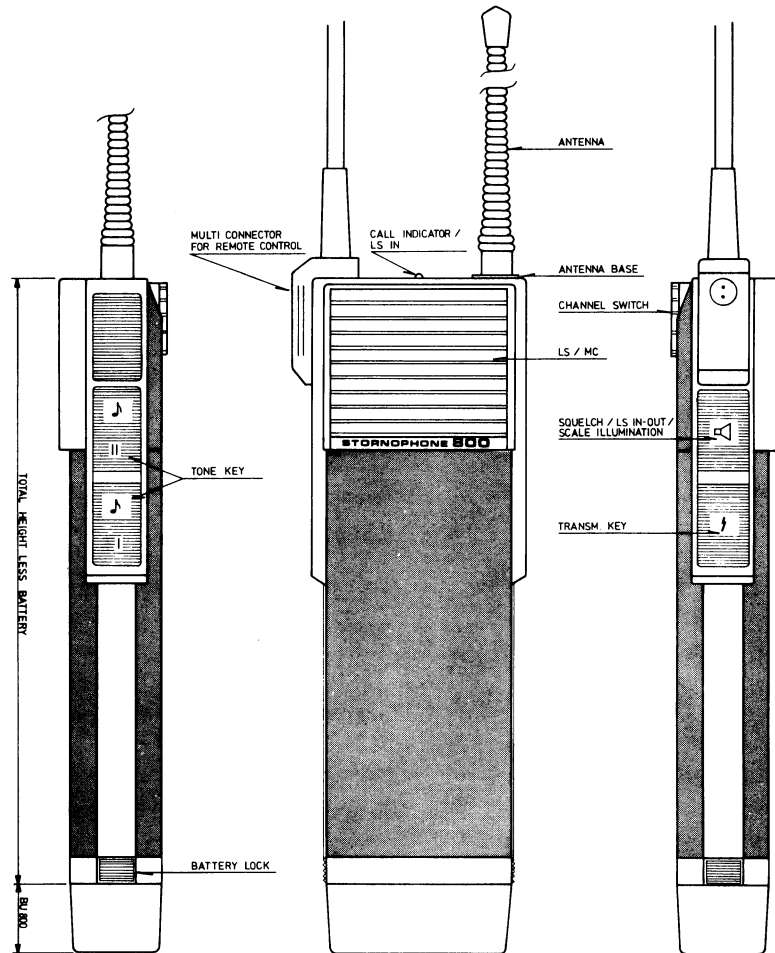


OPERATING INSTRUCTIONS

Local controlled equipments are fitted with CP808 control heads which interconnect with the various transmitter and receiver modules, channel switch an tone equipment, where applicable, via an internal wiring harness.

The following functions are incorporated in the CP808:

1. push button for keying the transmitter
2. push button for tone keying, tone I
3. push button for tone keying, tone II
4. push button for squelch cancelling - LS in/out -dial light
5. dial-type knob for volume control and on/off switch
6. 12-position dial-type channel knob
7. call indicator
8. hinged lid for access to the antenna tuning circuit
9. socket for remote control unit
10. socket cover
11. threaded antenna socket



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

Receiving (without selective calling)

Turn the radiotelephone on by turning the volume control counter clockwise.

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

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

Receiving (with selective calling)

Adjusting the sound level is done as in the sets without tone equipment except that it is necessary to press the SQ/LS button momentarily to switch on the loudspeaker before opening the squelch circuit.

After the setting of the volume control again press the SQ/LS button momentarily to switch off the loudspeaker.

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)

To initiate a call, 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)

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

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 radiotelephone off by turning the volume control completely clockwise, i. e. the O on the dial is visible.

ACCESSORIES

Antennas

The following antennas are developed for use with the STORNOPHONE 800 U series radiotelephones and can be attached to either the control head or the control unit.

AN834	200 mm Heliflex Antenna	68 - 88 MHz.
AN815	500 mm Whip Antenna	68 - 88 MHz and 146 - 174 MHz.
AN816	150 mm Heliflex Antenna	146 - 174 MHz.
AN864	46 mm Heliflex Antenna	420 - 470 MHz.
AN865	155 mm Whip Antenna	420 - 470 MHz.

All antennas are fitted with a threaded bolt that fits the antenna socket on the control head and on control units type CB812, CB831, and CB861.

Batteries

To power the equipment the following battery types are available:

BU802/BU808	nickel-cadmium (NiCd) battery, 10.8 V, 225 mAh.
BU807	nickel-cadmium (NiCd) battery, 10.8 V, 450 mAh.

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

Battery Chargers

Available battery chargers:

- CU801 Charging unit with two outlets for BU802, automatic type.
- CU802 Charging unit with ten outlets for BU802, automatic type.
- CU804 Charging unit with one outlet.
A switch selects high or low charging current as to charge the different battery types.
- CU805 Charging unit with six outlets and built-in timer; for all types of batteries.

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

Earphone

In conjunction with control unit CB805 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. The lower positions of the volume control are intended as settings for earphone reception.

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 CQP800U are as follows:

- TT801 single or double tone transmitter, tone frequencies from 885 Hz to 2900 Hz.
- TT802 single or double tone transmitter, tone frequencies from 1010 Hz to 3047 Hz.
- ST801 four or five tone sequential tone transmitter, tone frequencies from 885 Hz to 2800 Hz.
- ST802 four or five tone sequential tone transmitter, tone frequencies from 960 Hz to 2110 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).
- SR802 four or five tone sequential tone receiver, tone frequencies from 960 Hz to 2110 Hz.
- TQ802 three, four, or five tone sequential tone transmitter/receiver, tone frequencies from 885 Hz to 2800 Hz. By means of a plug-in module, SU808, the TQ802 can detect group calls.
- TQ803 three, four, or five tone sequential tone transmitter/receiver, tone frequencies from 960 Hz to 2110 Hz. By means of a plug-in module, SU808, the TQ803 can detect group calls.

Carrying Devices

The following devices are available for carrying the CQP800U:

- CK801a carrying harness for all types of equipment, mounting hardware, short and long straps, belt and clamps.
- CK802 screw mounted pocket clip.
- CK803a shoulder strap with retainer for remote control unit.
(for remote control, only).

GENERAL DESCRIPTION AND OPERATING INSTRUCTIONS

INTRINSICALLY SAFE RADIOTELEPHONE

STORNOPHONE 800U-IS

INTRODUCTION

The intrinsically safe radiotelephone type CQP800U-IS is intended for radiocommunication in hazardous areas where flameable concentration of gases and vapours may be present.

ITEMS OF THE EQUIPMENT

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

Category A - Items approved for use in hazardous environment

Radioset for 2-metre band:

CQP813U-IS 1 W
CQP814U-IS 1 W

Radioset for 4-metre band:

CQP833U-IS 1 W
CQP834U-IS 1 W

Radioset for 0.7 metre band:

CQP863U-IS 1 W
CQP853U-IS 1 W

Radioset midband:

CQP8414U-IS 1 W

Battery type BU809

Antennas

2-metre band: AN815, AN816
4-metre band: AN834
0.7-metre band: AN864, AN865
Midband: AN816

Control Units

All frequency bands: CB804-IS, CB805-IS
2-metre band: CB812-IS
4-metre band: CB831-IS
0.7 metre band: CB861-IS, CB851-IS
Midband: only CB804-IS, CB805-IS

Category B Items for use outside hazardous areas only

Key for locking the battery, code 17.0086-00
Battery charger type CU806.

CONSTRUCTION

The CQP800U may be either local controlled or remote controlled, 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 four sections, beginning from the bottom these are:

- 1) the battery
- 2) the transmitter and receiver modules
- 3) the tone equipment
- 4) the control head

LOCAL CONTROL

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

REMOTE CONTROL

On remote controlled radios a control unit containing the transmitter key, tone key, and loudspeaker/ squelch buttons, the speaker/microphone and an earphone socket, is connected to the set by means of a cable. Connecting the control unit automatically operates a switch which transfers the functions of the control head to the control unit.

Control units with the following functions are available:

- CB804-IS Contains loudspeaker/microphone, transmitter key, and a squelch cancelling button.
- CB805-IS Contains loudspeaker/microphone, transmitter key, tone key I, tone key II, a combined squelch cancel-loudspeaker in/out button, call indicator, and earphone socket.
- CB812-IS Contains loudspeaker/microphone, transmitter key, tone key I, tone key II, a combined squelch cancel-loudspeaker in/out-button, call indicator, and a threaded antenna socket. The unit is used for equipment operating in the 146-174 MHz band.
- CB831-IS Contains loudspeaker/microphone, transmitter key, tone key I, tone key II, a combined squelch cancel-loudspeaker in/out-button, call indicator, and a threaded antenna socket. The unit is used for equipment operating in the 68-88 MHz band.
- CB861-IS Contains loudspeaker/microphone, transmitter key, tone key I, tone key II, a combined squelch cancel-loudspeaker in/out-button,

call indicator, and a threaded antenna socket. The unit is used for equipment operating in the 420-470 MHz band.

- CB851-IS Contains loudspeaker/microphone, transmitter key, tone key I, tone key II, a combined squelch cancel-loudspeaker in/out-button, call indicator, and a threaded antenna socket. The unit is used for equipment operating in the 370-420 MHz band.

The length of a particular equipment will depend upon the number of channels, and whether it includes tone equipment or not.

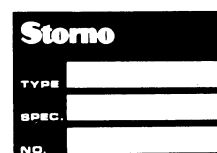
Type specification is as follows:

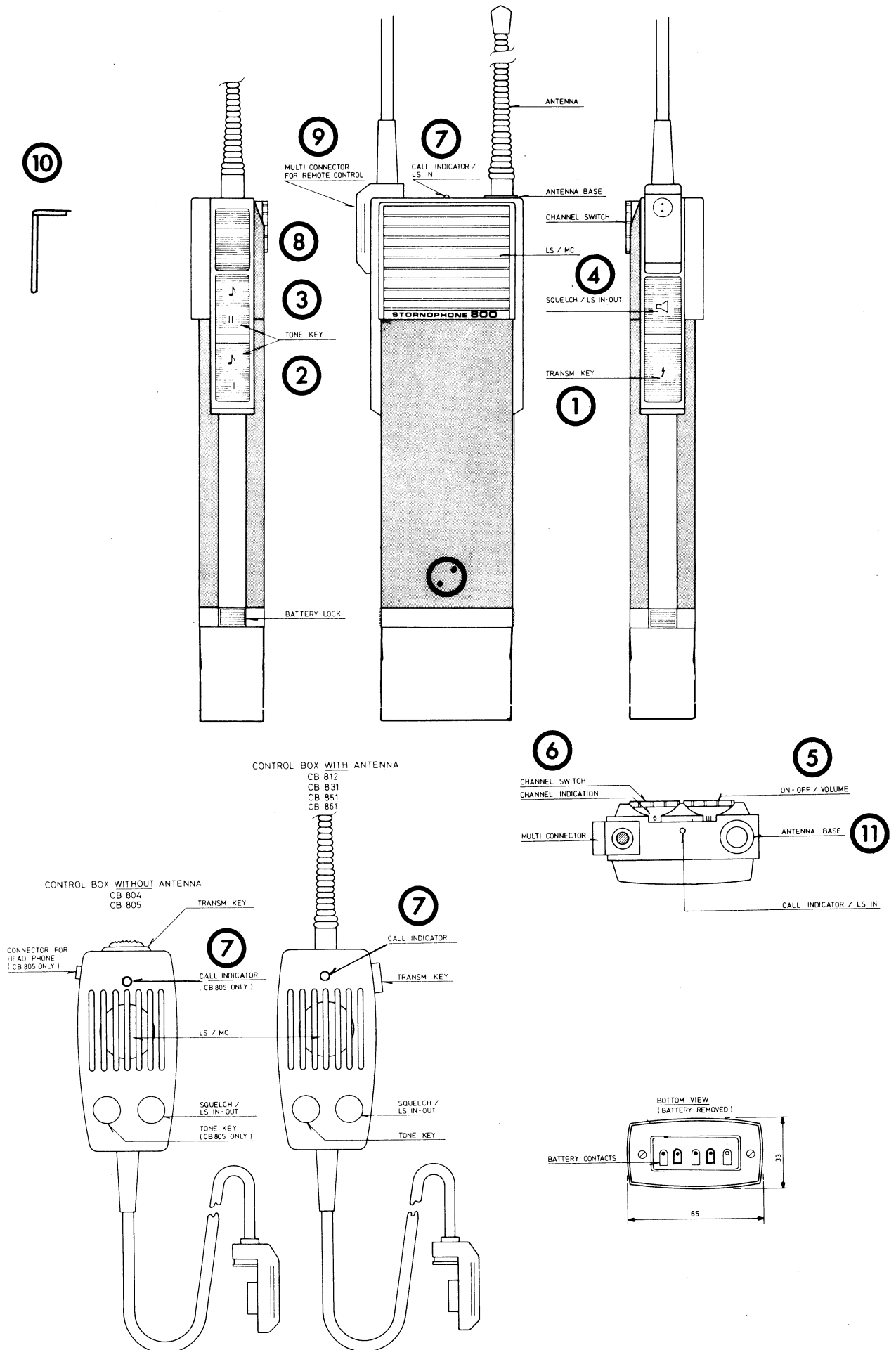
Specification	code
0.1-1.0 W RF output power	1
Universal control head CP808-IS	C8
2 channels	X2
4 channels	X4
8 channels	X8
12 channels	X12
Tone equipment	T

Thus a 1 W , four-channel radiotelephone with universal control head and selective calling would be designated:

1 C8 X4T

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





OPERATING INSTRUCTIONS

Local controlled equipments are fitted with CP808 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 CP808:

1. push button for keying the transmitter
2. push button for tone keying, tone I
3. push button for tone keying, tone II
4. push button for squelch cancelling-LS in/out.
5. dial-type knob for volume control and on/off switch.
6. 12-position dial-type channel knob
7. call indicator
8. hinged lid for access to the antenna tuning circuit
9. socket for remote control unit
10. socket cover
11. threaded antenna base

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

RECEIVING (WITHOUT SELECTIVE CALLING)

Turn the radiotelephone on by turning the volume control counter clockwise.

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

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

RECEIVING (WITH SELECTIVE CALLING)

Adjusting the sound level is done as in the sets without tone equipment except that it is necessary to press the SQ/LS button momentarily to switch on the loudspeaker before opening the squelch circuit.

After the setting of the volume control again press the SQ/LS button momentarily to switch off the loudspeaker.

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)

To initiate a call, 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)

Turn on the loudspeaker with the LS IN/OUT button, do not transmit until the channel is free. 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 radiotelephone off by turning the volume control completely clockwise, i.e. the O on the dial is

visible. NB; In the case of 0.2W equipments powered by BU805 then the ordinary transmit key must be pressed together with the appropriate tonekey.

ACCESSORIES

ANTENNA

The following antennas are approved for use with intrinsically safe radiotelephones type CQP800U-IS and can be attached to either the control head CP808-IS or the control unit.

AN834	200 mm Heliflex Antenna	68 - 88 MHz
AN815	500 mm Whip Antenna	68 - 88 MHz
		and 146-174 MHz
AN816	150 mm Heliflex Antenna	146-174 MHz
		and Midband
AN864	46 mm Heliflex Antenna	420-470 MHz
		and 370-420 MHz
AN865	155 mm Whip Antenna	420-470 MHz
		and 370-420 MHz

All antennas are fitted with a threaded bolt that fits the antenna socket on the control head and on the control units type CB812-IS, CB831-IS, CB861-IS or CB851-IS.

BATTERY

To power the equipment only battery type BU809 is approved for the 1W version (NB; reverse polarity for safety reasons and BU805 for the 0.2 W versions.

The BU809 battery is encased in a high-impact cast plastic cassette with snap locks which automatically secures the battery when slid into place. A battery lock on the cabinet ensures that the battery cannot be removed when the equipment is used in the danger area.

Electrically the battery contains a cell pack of 11 NiCd cylindrial button cells and four fold-back current limiters.

A detailed description of the unit and its properties is enclosed separately.

BATTERY CHARGER

CU806 Charger for 6 batteries type BU809. This charger is built for quick charging, 4.5 hour rate followed by trickle charging. The battery charger can be operated from either a 110 V or a 220 V AC mains.

The corresponding charger for BU805 is CU805, this unit has identical characteristics as CU806 except for reverse polarity.

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 CQP800U are as follows:

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

ST802-IS four or five tone sequential tone transmitter, tone frequencies, from 960 Hz to 2110 Hz.

SR801-IS 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).

SR802-IS four or five tone sequential tone receiver, tone frequencies from 960 Hz to 2110 Hz.

CARRYING DEVICES

The following devices are available for carrying the CQP800U:

CK801a carrying harness for all types of equipment, mounting hardware, short and long straps, belt and clamps.

CK802 screw mounted pocket clip.

CK803a shoulder strap with retainer for remote control unit.
(for remote control, only).

CONDITIONS OF USE

Before the Stornophone 800U-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 appropriate intrinsically safe battery types BU805 or BU809 may 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 B must not be brought into or used in the danger area.
- d. The equipment complies with the following specifications:
 1. VDE 0170/171 category Sch i/ Ex is G5
 2. BASEFA SFA3012: 1972 Category EExibIICT4

MECHANICAL AND CIRCUIT DESCRIPTION

INTRINSICALLY SAFE RADIOTELEPHONE

STORNOPHONE 800U-IS 1 W

The main parts of radiotelephone type CQP800U-IS 1W is arranged as segregated areas and from the bottom these are:

- Battery Connector
- High power 360 mA zone
- Barrier zone
- Low power 150 mA zone
- Crystal oscillator chassis
- Optional tone equipment
- Control panel CP808.

The radiounits are housed in a cabinet type CA80x-IS whose surface is covered by protective leather. The bottom end is designed to hold the battery and has a battery lock which can be opened with a key.

The battery connects to the circuits via five spring contacts and the supply lines are all decoupled by RF filter circuits.

The high power units of the transmitter are separated from the remaining part by a barrier zone in which are mounted zener diodes on the receiver and transmitter supply lines in order to avoid overvoltage.

In this zone is also an enable circuit which is operated by the 7.5 V TX. This circuit enables the 360 mA supply from the battery to the high power modules of the transmitter.

The low power zone contains the remaining parts of the transmitter and the receiver.

Both transmitter and receiver are separate chassis units acting as motherboards for the modules.

The crystal oscillator chassis may contain up to 12 receiver oscillators and up to 12 transmitter oscillators.

The tone equipment modules are selfcontained units that mount between the oscillator chassis and the control head at the top.

All units are stacked and held together by rails, one in each side, passing through ducts and fastened to the control head.

The interconnection of the units are by means of cable looms that run on the wiring side of the motherboards and where passing the barrier zone through a conduit.

The intrinsically safe battery, type BU809, consists of two sections, a regulator section and a battery cell pack held together by two screws.

The cell pack contains 11 NiCd button cells mounted between glass fibre printed wiring boards and potted in quartz-filled polyurethane. Two contacts on the regulator engage with sockets on the cell pack.

The regulator section contains a 150 mA current limiter and a 360 mA current limiter. These limiters have fold-back characteristics and each consists of two cascaded limiter circuits.

The battery can only be charged in battery charger type CU806.

For description of the transmitter, and receiver circuits refer to circuit description of the CQP810U, CQP830U, CQP860U or CQP850U.

CQP860U-IS

CIRCUIT DESCRIPTION

Transmitter Circuit (see block diagram)

The transmitter is built 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.

The transmitter section consists of the following modules:

XO812	Crystal Oscillator
AA802	Modulation Amplifier
FN803-IS	Modulation Filter for 20/25kHz channel separation
PM861	Phase Modulator
FD861	1st Frequency Doubler
FD862	2nd Frequency Doubler
FD863	3rd Frequency doubler
BP861	Band Pass Filter
PA863	1st Power Amplifier
PA862a	2nd Power Amplifier and Antenna Switch
or	
AS861	Antenna Switch (0.2W)
FN861	Antenna Filter
AD801	ADC Circuit
VR801-IS	Voltage Regulator

Modulation Amplifier AA802 and FN803-IS

The modulation amplifier function is carried out by the Modulation Amplifier, AA802 in conjunction with a Modulation Filter, FN803-IS. 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 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 52.50 to 58.75MHz. 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 PM861

The 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 following π network, ensures a constant sine wave signal to the phase modulator. The modu-

lator 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 (g_m) 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 sufficient in amplitude to drive the following stage, a frequency doubler.

Multiplier Chain FD861 and FD862, FD863

The multiplier chain consists of three very similar frequency doubler stages. Each frequency doubler operates as a grounded emitter transistor amplifier followed by two inductively coupled LC circuits that are tuned to the second harmonic of the input frequency.

Band Pass Filter BP861

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 BP861.

Power Amplifier PA863 and PA862a or AS861

The output power from the multiplier chain (approx. 15mW) is amplified to the required antenna power in the PA863.

PA863 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 PA862a, the collector supply (ADC) voltage will rise. On the other hand, if the drive signal is more than enough, the ADC voltage will drop.

PA862a 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 PA863 passes through the switching diodes, whereby they can be considered 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.

In 0.2W transmitters the PA862a is replaced by AS861 which contains the antenna switch circuit only.

ADC Circuit AD801 (1W versions only)

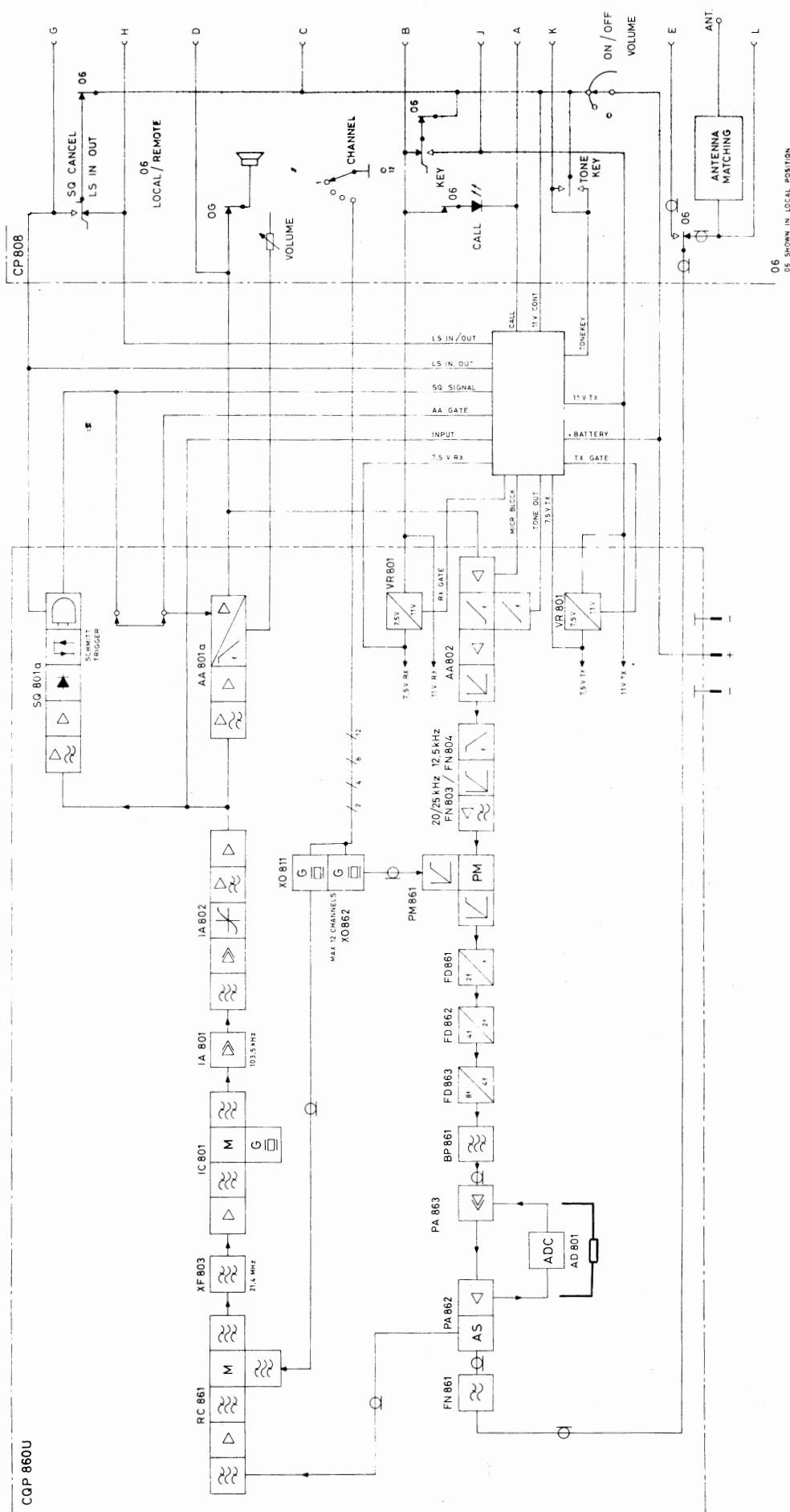
This circuit is omitted in 0.2W transmitters and replaced by two voltage dropping resistors. The transmitter output current is kept very nearly constant by means of the ADC Circuit. The voltage drop across a small resistor in the output transistor's collector return is monitored by the ADC stage, which then regulates the collector voltage to the first transistor amplifier in the PA863 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 FN861

A nine-pole, lowpass filter having a cutoff frequency of 470MHz is inserted between the transmitter output and the antenna. The filter suppresses any harmonics created in PA862a. A 21.4MHz band stop filter at the FN861 input prevents any signals close to the intermediate frequency from reaching the receiver circuits.

Receiver Circuit (see block diagram)

The receiver is a double conversion superhetrodyne using intermediate frequencies of 21.4MHz and 103.5kHz. 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 for cancelling the squelch on the control head or the control unit, whichever is used.

The receiver consists of the following modules:

RC861-IS	Receiver Converter
XO811	Crystal Oscillator
XF803	Crystal Filter for 20/25kHz channel separation
IC801	IF Converter
IA801	1st IF Amplifier
IA802	2nd IF Amplifier and Discriminator
SQ801a	Squelch Circuit
AA801a-IS	AF Amplifier
VR801-IS	Voltage Regulator

Receiver Converter RC861-IS

The RC861-IS converts the frequency of the antenna signal to the 1st IF frequency of 21.4MHz. The incoming signal path from the antenna is through the Antenna Filter, FN861, and then via the antenna switching circuit to the input of the RC861-IS. The signal then passes through a two-element bandpass filter to a transistor operating as a grounded base amplifier. After amplification, the signal passes through a three-element UHF filter. This filter is what mainly determines the r.f. selectivity of the converter. The signal is taken off at a 50ohm tap and fed to the mixer via L7, 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 lowpass filter, proceeds to a frequency tripler. The filter allows only the oscillator signal to reach the tripler. The signal from the tripler output is then applied to the gate of the mixer transistor, which is a field effect transistor operating in the

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 XO811

The local oscillator signal of 124 to 153MHz 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 21.4MHz under the antenna frequency and the formula for calculating the crystal frequency is therefore:

$$f_x = \frac{f_a - 21.4}{3} \text{ MHz}$$

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

Crystal Filter XF803

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 20/25kHz channel spacing.

IF Converter IC801

The first IF frequency (21.4MHz) is converted to the second IF frequency (103.5kHz) 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 103.5kHz 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 1000Hz= 110mV).

AF Amplifier AA801a-IS

The audio frequency signal from IA802 is fed to the AA801a-IS AF Amplifier where it becomes amplified to the desired audio power level. First the signal passes through an active highpass filter that rejects any pilot tones and low frequencies (noise). Next comes an integrated circuit containing two separate amplifiers which make up the preamplifier and output stage. The volume control is inserted between these two amplifiers.

The preamplifier also operates as an active low-pass filter suppressing frequencies above 3000Hz and the output amplifier gives the required receiver de-emphasis (integration).

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 7kHz. 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 amplifier. 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 ≥ 12 dB SINAD. A pushbutton on the control head/control unit allows manual cancelling of the squelch function.

Power Supply and Voltage Regulator VR801-IS

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

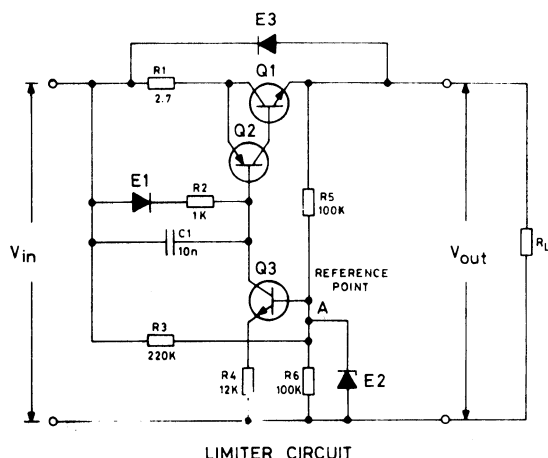
INTRINSICALLY SAFE BATTERY BU805

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



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).

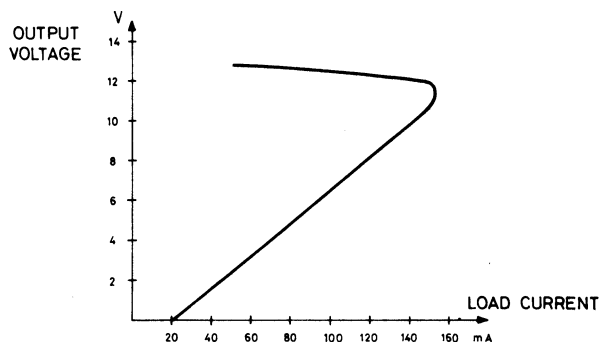
Diode E1 compensates the base-emitter voltage of Q2, and since both are operating at low currents (less than 1 mA) good ambient temperature tracking is also achieved.

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 determin-

ed 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.

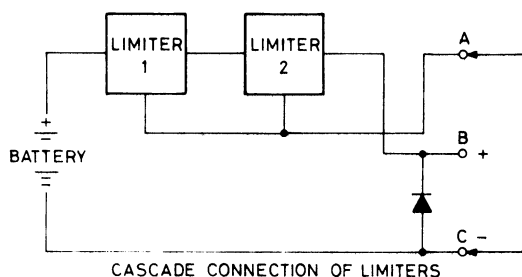
As the current limiting effect of Q1, Q2 is approximately proportional with the voltage drop across R2, this again is proportional to the bias voltage at "A". This means that by suitable choice of R3, R5, and R6, the maximum current limiting value and the short circuit current limiting value for the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



TYPICAL CURRENT LIMITER FOLDBACK CHARACTERISTIC

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.



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

≤ 40 mA

Maximum Load current

150 mA

Dimensions

63 mm x 32 mm x 94 mm

Weight

320 g

INTRINSICALLY SAFE BATTERY

TYPE BU809

GENERAL

Battery unit BU809 is intended for applications requiring intrinsic safety, i.e. for use of STORNOPHONE 800-IS (1W) in explosive atmospheres encountered in coal mines, petrochemical industries and the like.

The battery unit consists of two sub-units. The first sub-unit is the cell unit, containing 11 nickel-cadmium, rechargeable, cylindrical cells of 225mAh capacity. The middle value open circuit voltage of the cell unit is approx. 13.6V.

In order to provide mechanical stability the cells are mounted between two glass-fibre circuit boards which are then placed in an ABS (plastic) housing. The entire housing is then filled with a flame retarding, polyurethan, moulding compound with quartz filler which provides further mechanical stability and improves heat dissipation capability.

The cell unit is provided with a connector which engages with the second unit, i.e. the active current limiter unit. The intrinsically safe properties of the battery are entirely governed by the function of these limiter circuits.

In order to provide sufficient DC power to the radio equipment without exceeding thermal or current limits, the limiter consists of two double, cascaded current limiting circuits with separate outputs and output enabling circuits. The two limiting circuits are designed as fold-back limiters and are realised as thick film units for good thermal performance. The limiting levels are chosen as 360mA for the high power section of the radio set, and 150mA for the low power section of the radio set. Intrinsic segregation of the two sections of the radio set is maintained within the set by means of a so-called "barrier zone".

The thick film circuits are placed in an ABS housing which is also filled with same polyurethan compound as the cell unit for mechanical stability and good thermal dissipation properties.

Finally the two are locked together by screws which are locked by sealing compound.

CIRCUITS FUNCTION

Fig. 1 shows the circuits diagram of one of the cascaded limiter units. As indicated by the note on the diagram the fold-back limit is set to either 360mA or 150mA by strapping resistors R2/R10 in or out of the circuit.

Since each half circuit is identical, the limiting action of limiter Q1, Q2, Q3 will be treated in detail.

Diode E2 compensates the base-emitter voltage of Q2, and since both are operating at low currents (less than 2mA) good temperature tracking is ensured.

When the voltage drop across resistor R3 exceeds the voltage drop across R1 then the transistor pair Q2 and Q1 will be turned on and the output voltage " V_2 " will be nearly equal to the input voltage " V_1 ". Under these conditions the bias point "A" is determined by the two resistors R4 and R7 together with the third resistor R8 and the input voltage V_1 . R4 and R7 will, very nearly, be in parallel (ignoring voltage drop across Q1) and together with R8 perform as a voltage divider giving a bias " V_A " at point A, which establishes an emitter current in Q3. Q3's collector current, which is very nearly equal to the emitter current, passes mainly through the network E2 - R3 thus causing a voltage drop across R3. This voltage drop, as mentioned ear-

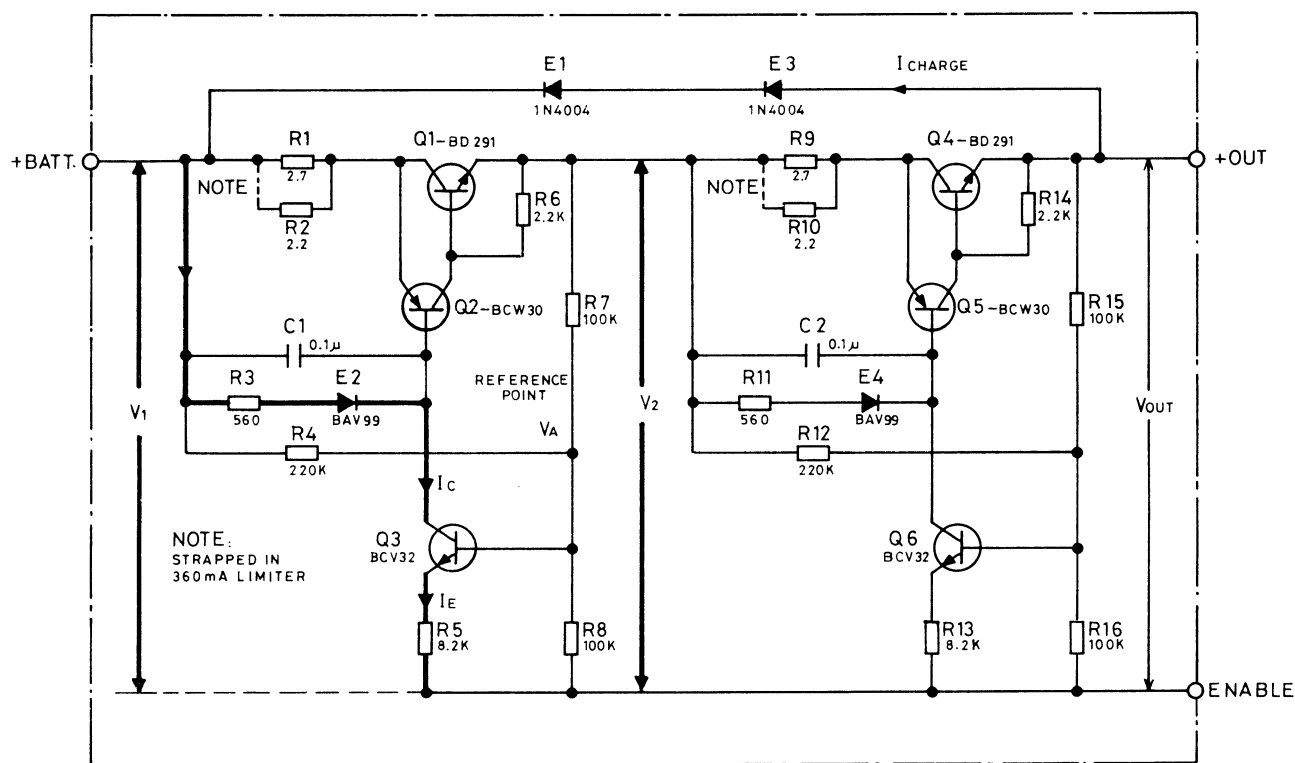


FIG. 1. BU809 CURRENT LIMITER

lier, ensures that the compound transistor pair Q2, Q1 are turned on, thus causing the output voltage V_2 to be very nearly equal to the input voltage V_1 .

Upon application of a load " R_L ", 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 V_2 begins to fall and the bias delivered by resistor R7 to point "A" also falls. In the limiting case when output voltage V_2 is zero (short-circuit load) the bias at point "A" is determined by the potential divider R4 and R7 in parallel with R8.

As mentioned earlier, the current limiting effect of Q1, Q2 is approximately proportional with the voltage drop across R3. This voltage drop is again approximately proportional to the bias voltage " V_A ".

This means that by suitable choice of R4, R7 and R8, the maximum current limiting value for the circuit, and the short circuit current limiting value for the circuit can be established independently of each other, i.e. a fold-back characteristic is obtained.

MEASURED CHARACTERISTICS

Fig. 2 illustrates the nominal fold-back characteristic of the 150mA limiter circuit.

Fig. 3 illustrates the corresponding characteristic of the the 360mA circuit. The limiting action is essentially instantaneous and independent of the load.

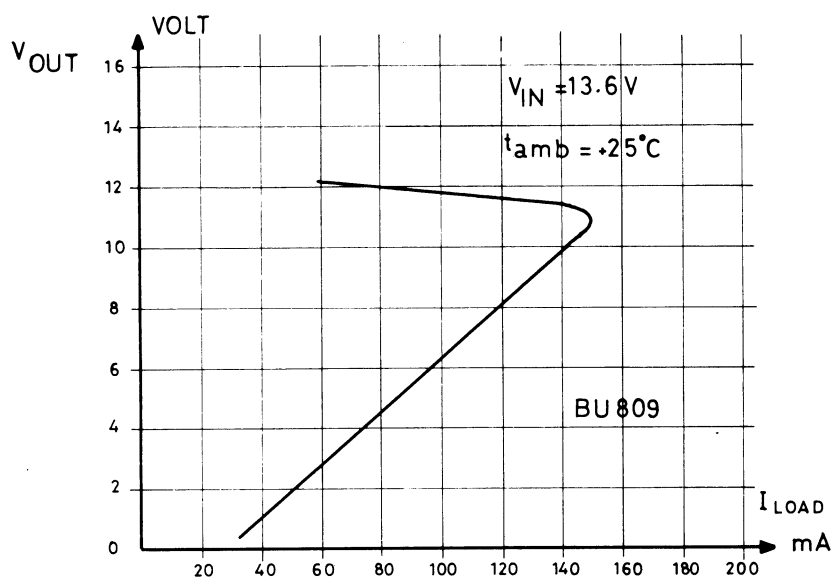


FIG.2. TYPICAL 150 mA LIMITER CHARACTERISTIC

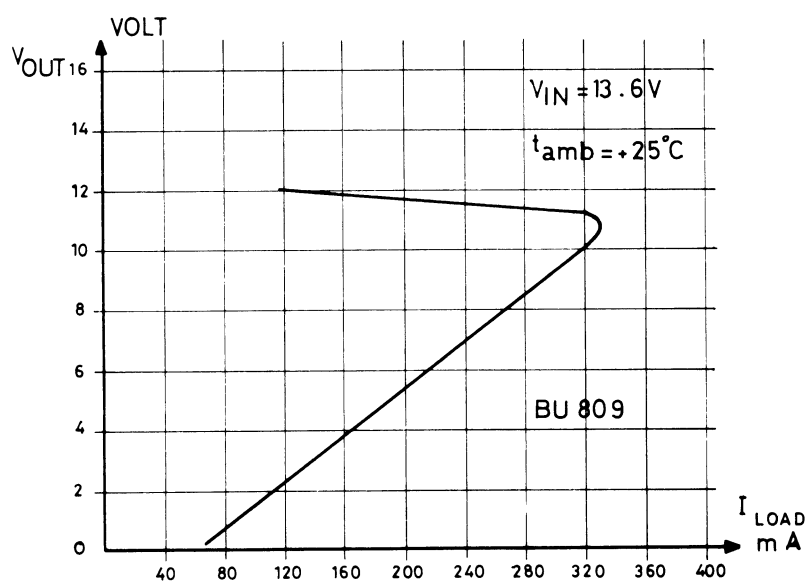


FIG.3. TYPICAL 360mA LIMITER CHARACTERISTIC

ENABLE CIRCUIT

Since each limiter circuit has an own shunt consumption of approx. 1mA the battery is provided with an enable terminal for each circuit. This prevents the limiter from self-discharging the cells.

Fig. 4 illustrates the enable function - these functions are also used for circuit switching.

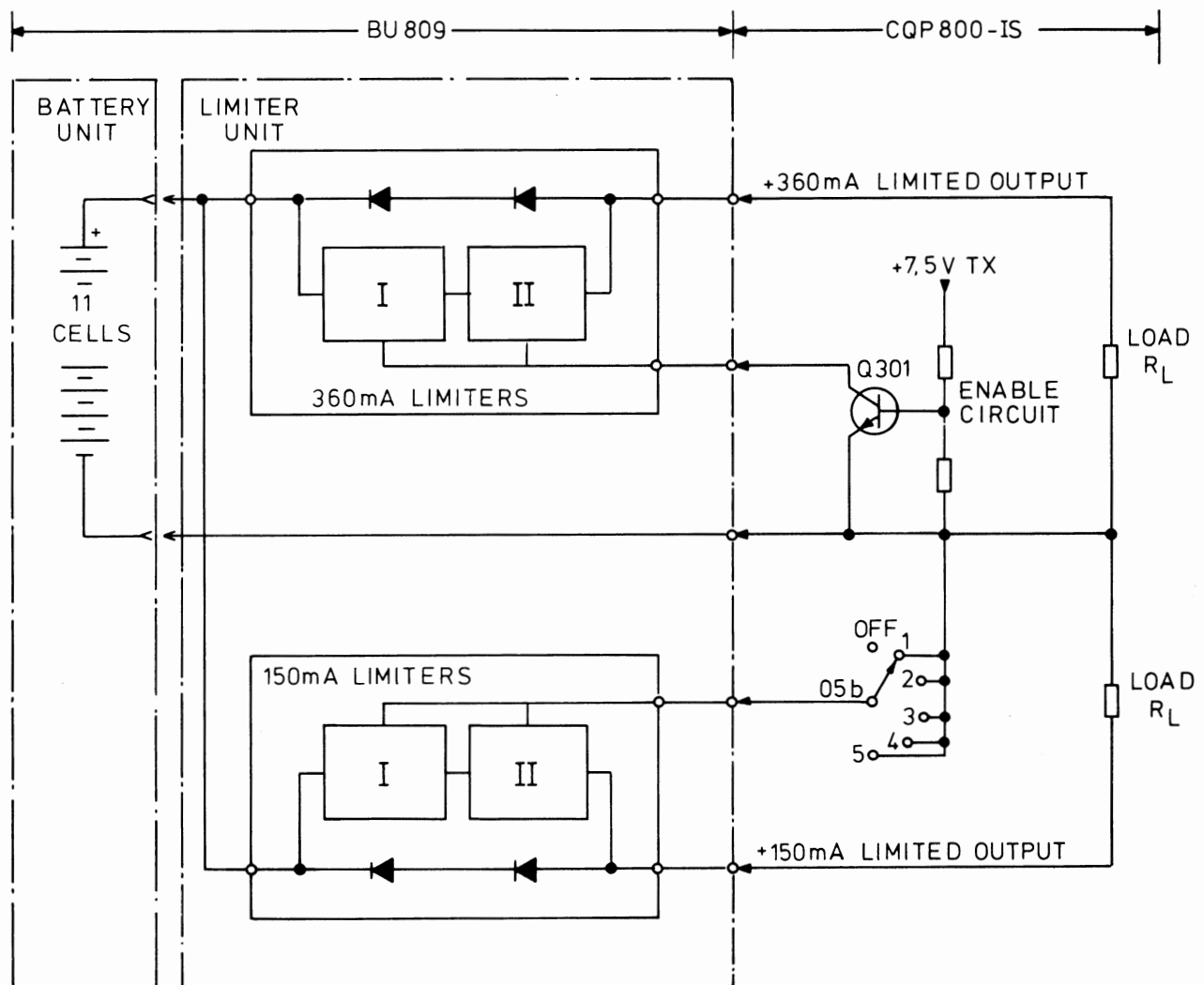


FIG.4. ENABLE FUNCTION

CHARGING

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

TECHNICAL SPECIFICATIONSNominal battery voltage

13.6V

Nominal battery capacity

225mAh

Number of cells

11

Maximum short circuit current

150mA output: Less than 40mA

360mA output: Less than 70mA

Maximum load current

150mA

360mA

Dimensions

94 x 63 x 32

Weight

BATTERY CHARGER CU806

General

The battery charger CU806 is powered from the mains and has 6 charging outlets for BU809 batteries. The charger is designed as a desk apparatus, but may be installed on a wall.

The electronic circuits of CU806 are built on one printed circuit board common to the power supply and the outlets.

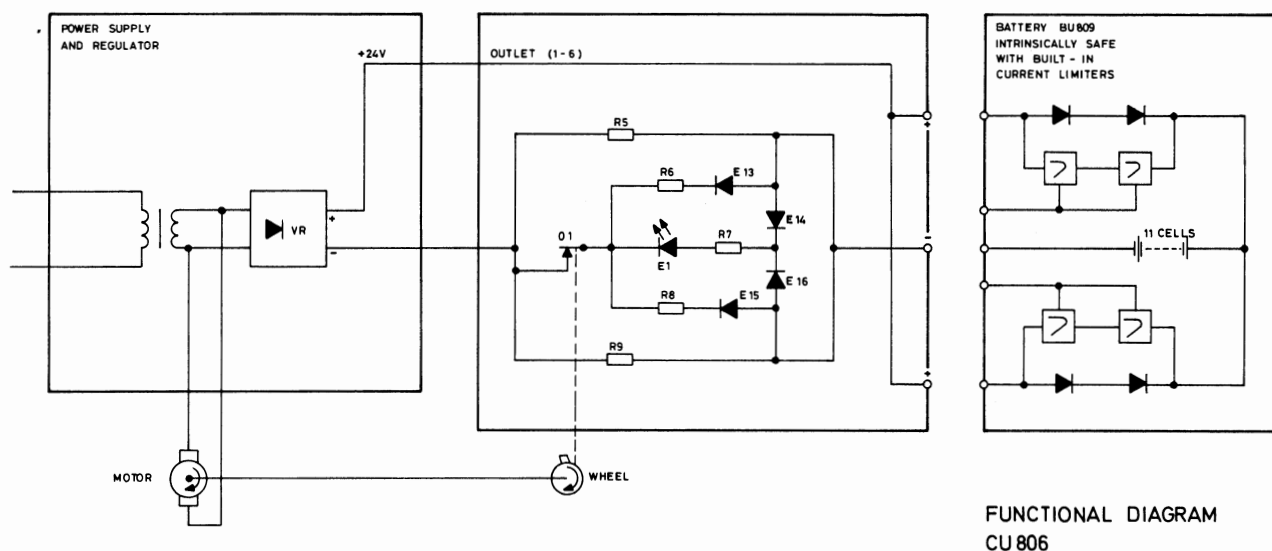
Method of Charging and Operating Instructions.

The synchronous motor drives 6 timing wheels which actuate microswitches at the end of the charging time. The switches are in series with the charging circuits and the charging indicators (LED), one for each of the outlets.

When the microswitch interrupts, the charging indicator extinguishes and the current to the battery is switched to trickle charge. The friction transmission of the 6 wheels can be set independent of each other so the charging time on each outlet can be adjusted from 0 to 4½ hour. The charging indicator is only lit with the battery inserted and with the wheel set to the desired charging time.

It is recommended to select a charging time corresponding approximately to the consumed battery capacity; e.g. a battery assumed to

be half discharged should be given half charging time, i.e. 2 1/4 hour. Thereby a longer life time in the form of a larger number of discharge/charge cycles is achieved. The CU806 is short circuit proof, and no



discharging of the batteries inserted takes place via the charger's circuits without mains voltage applied. It must be noticed that highest battery capacity is reached when charging at nominal ambient temperature (20°C).

For the trickle charge there is no time limits.

Mode of Operation

The batteries are charged with a constant 24V DC supply, IC1.

The intrinsic safe battery, BU809, is charged via all series resistors and two series diodes in parallel with the built-in regulator circuit.

When microswitch O1 interrupts, the trickle charge current flows through R5 or R9. This principle of operation ensures that the battery receive correct charging current independant of the charging outlets.

Technical Specifications

Number of Outlets

6 outlets for BU809 (outlets cannot be coded for other types of batteries).

Nominal Mains Supply Voltage

110V, 120V, 220V, or 240V; 50Hz.

Tolerance $\pm 10\%$

Consumption, measured at nom. mains voltage

35W with 6 x BU807

8W no load condition.

Charging Temperature Range

Nominal ambient temperature: +20°C

Ambient temperature range: +5°C to +35°C

Charging Time

Max. 4½ hour for a completely discharged battery. The charging time is adjustable from 0 to 4½ hour for each outlet, independantly of each other.

Charging Current, Typical Value

70mA

Trickle Charge Current, Typical Value

13mA

Battery Capacity

Typical 100% battery capacity is reached after 4½ hours of charging at nominal temperature.

Dimensions

360 x 160 x 95mm

Weight

4,2Kg.

SEQUENTIAL TONE RECEIVER SR801

General

SR801 is a sequential, or double, tone receiver used to receive a 3, 4, or 5 tone sequence signal or a double tone signal. The unit is composed of 4 thick-film modules with plug-in pins, placed on a common motherboard. The electrical division appears from the block diagram. The tone frequencies used are the Sorno series from 885 Hz to 2900 Hz, and the required tone combination is selected by soldering colour coded wires to tags on the tone coil. A corresponding tone sequence signal (or double tone signal) will, after cessation of the last tone, be registered as follows:

Key lock function is disabled, terminal 21.

LS locking is disabled, terminal 22.

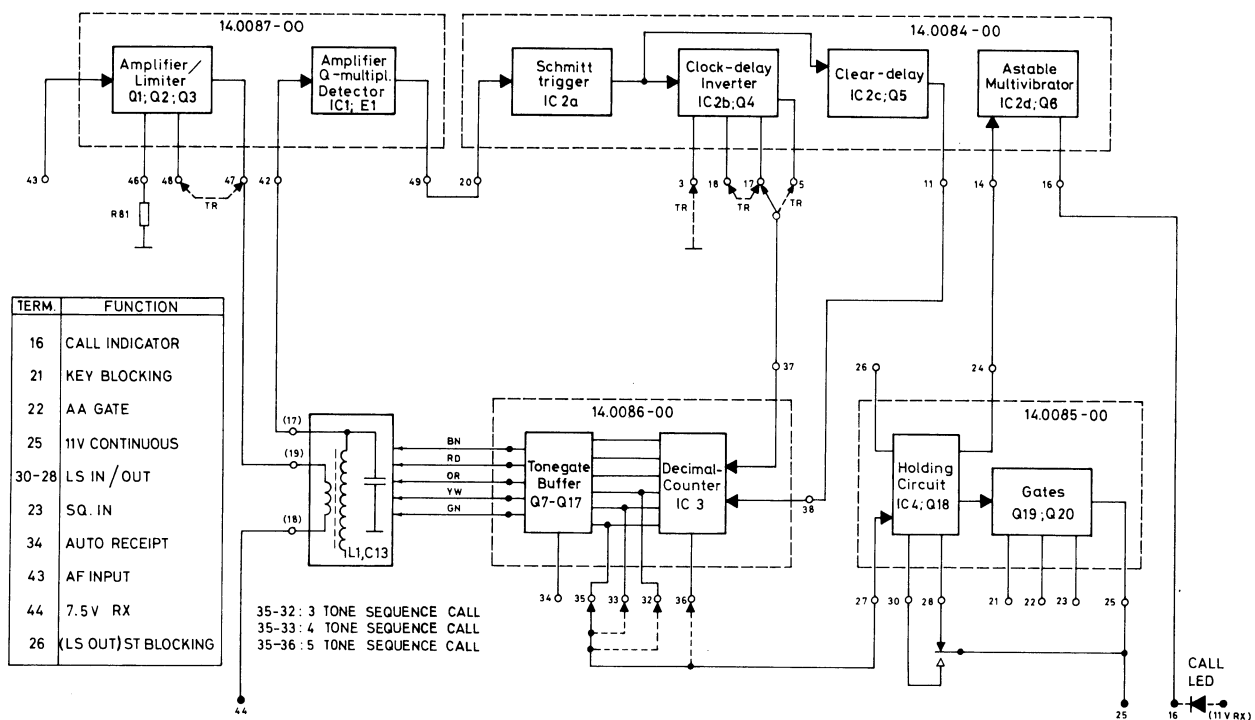
Optical indication (LED), terminal 16.

The above-mentioned functions are cancelled manually by operating the LS in/out button.

Mode of Operation

When receiving a tone sequence signal on terminal 43, corresponding to the tone combination on the tone coil, the mode of operation is as follows:

1st tone in the sequence signal is amplified and, if necessary, limited in the input stage, and the signal is applied to the selection circuit via the coupling winding. The 1st tone terminal is selected in stand-by through tone gate Q17. Next the tone signal is amplified in the combined amplifier and Q-multiplier and applied to the Schmitt-trigger (ST) IC2a via detector E1. The rectified signal will activate the ST and the positive going edge at the ST output, when activated, is inverted and delayed approx. 17ms in the clock-delay circuit (CP-delay) IC2b through the buffer Q4. This enables the counter before the 1st tone is applied at the output of the CP-delay. At the end of the 1st tone, the ST re-



turns to stand-by. The positive pulse at the output of the CP-delay is applied to the inverter Q4, as well as to the decimal counter IC3. The counter steps forward and enables the second tone gate via the buffer transistor, whose collector is connected to tone coil L1.

The sequential tone receiver is now ready to receive the 2nd tone and remains in this position for approx. 80 ms, according to the CL-delay. If the 2nd tone is not received within this period, the counter is reset and enables the 1st tone gate again. If tones 2, 3, 4, and 5 are received, the procedure is as described above. At the end of the 5th tone, the buffer Q7 output releases a signal for receipt, terminal 34, and locking circuit IC4, and then key - and LS blocking functions are cancelled. Simultaneously a visual call indication at terminal 16 is established. SR801 can also be coded to respond to 3 and 4 tone sequential calls.

Double Tone Signal

SR801 will receive a double tone when strapped in accordance with the notes on the diagram. The brown, orange, and the green wires are soldered to the tag having the highest of the desired tones, in the same way the red and the yellow wires are soldered to the tag having the lower.

The highest tone frequency in the double tone signal is selected, amplified, rectified and activates the ST. The integration period in the CP-delay is increased to approx. 140 ms, which is the period "felt" on the tone frequency, before IC2b and inverter Q4 generates a clock pulse, which enables the 2nd tone gate. The procedure for the lower tone frequency in the double tone signal is the same as for the first tone described above. The integration period per signal element is obtained by IC2b discharging the integration capacitor via diode E3, making the circuit operate as an astable multivibrator. After the 5th clock pulse, the call is recognized as described for a five tone sequential call.

Circuit Description

Input Amplifier and Limiter

The circuit includes the transistors Q1, Q2, and Q3 with associated components.

The received tone signal is linearized by the RC-circuits R3, C14, and C2. The input characteristic corresponds to an RC-function with falling characteristic and $f_c = 1000$ Hz, summed with a +6 dB/octave, rising characteristic, within the frequency range 885 Hz to 3 kHz.

Then the tone signal is amplified in the differential amplifier Q1, Q2, and Q3. Amplitude limiting is introduced for signal levels above the min. sensitivity (approx. 55 mV). Via R12 the signal is applied to the resonant circuit.

For SR801, when connected as double tone receiver, the resistors R11 and R12 are connected in parallel in order to increase the signal voltage across the band pass filter. The sensitivity can be adjusted with R81 to compensate component tolerance.

Selection Circuit

The band pass filter consists of tone coil L1 and capacitor C13.

The signal from the input amplifier is applied to the parallel tuned circuit via a separate winding. The colour coded wires from the tone gates connect the tone coil taps in parallel with capacitor C13.

Amplifier, Q multiplier and Detector

The circuit consists of the operational amplifier IC1, the diode pair E1 with associated components.

The selected tone signal from the band pass filter is amplified in operational amplifier IC1, and passes to detector E1. The amplification is constant and determined by the ratio between R17 and R16. Via R19, R20, and R21 part of the amplified tone signal is fed back to the coupling winding in phase with the received signal, thereby increasing the bandfilter Q-factor to approx. 32.

Simultaneously an NTC resistance R21 inserted in the feedback circuit is compensating the temperature variation of the Q-factor.

The amplified tone signal is rectified by the biased diode part of E1 and is filtered by C7. The resultant DC-level is applied to Schmitt-trigger IC2a via the other diode part of E1.

Schmitt Trigger

The Schmitt Trigger (ST) is composed of comparator IC2a and the reference level is determined by the voltage dividers R22, R23, R24, and R26.

The rectified tone signal reduces the DC-voltage at the inverting input of the comparator. When the level is below the reference voltage, IC2a turns off, and the DC output changes from approx. 0 V to 7 V.

Clock Delay

The circuit is composed of comparator IC2b, diode pair E2 and E3, Q4 and associated components. In stand-by, the output of the ST is 0 V, because of which C8 (9) is discharged via E2, and the output of IC2b is in stand-by approx. 7 V. The reference level is determined by the voltage dividers R33, R34, R35, and R36 and applied to the non-inverting input of IC2b.

When the ST is activated, diode E2 will be reverse biased and C8 (9) will charge via resistors R27 and R28. The moment the increasing voltage on C8 (9) reaches the reference level, IC2b will turn ON and the output voltage falls to approx. 0 V. The time it takes C8 to charge up to the reference level corresponds to the clock-delay, which is approx. 17 ms. At the end of the tone the ST turns ON, and C8 (9) is discharged via E2 and R28 (R32) causing the positive edge of the output pulse of IC2b to be delayed in proportion to the shift of the ST. This will eliminate the effect of drop-outs in the received signal, if any.

When SR801 is connected as double tone receiver, the inverted clock pulse for the counter is taken from the collector of Q4, and the output of IC2b is connected to diode pair E3. The clock-delay is increased to approx. 140 ms, by connecting C9. When the charging of C8 and C9 reaches the reference voltage, IC2b turns ON, as described before, and a positive going edge on the collector of Q4 is produced, which toggles counter IC3, enabling the following tone gate.

Simultaneously capacitors C8 and C9 are discharged via diode E3 and resistor R29, to a level determined by the voltage dividers E3, R30, R33, and R34 and then IC2b goes OFF again and diode E3 is reverse biased. The width of the clock pulse, which

practically is determined by R30 and C9, is approx. 5 ms. In case the ST indicates the presence of a new tone, the sequence is as described above.

Clear Delay

The circuit is composed of transistor Q5, comparator IC2c and associated components. In stand-by Q5 is OFF, as the control voltage from the ST is 0 V, because of which the charge on C10 also is 0. When the ST turns OFF, C10 is charged via Q5 and R40. When the voltage of C10 reaches the reference level, IC2c switches state.

The negative going DC-shift from approx. 7 V to 0 V at the output of IC2c enables counter IC3, which then is ready to receive clock-pulses from the clock-delay. The clear delay circuit operates similarly to the Clock Delay circuit. As long as the ST is activated, Q5 will maintain the charging on C10. At the end of the last tone, the ST turns ON, and Q5 OFF as the emitter will be biased by the charge of C10. The discharging time of C10 is determined by R41, which in approx. 80 ms reduces the capacitor charge to the reference level at the non-inverting input of IC2c.

When IC2c turns OFF, i.e. returns to stand-by and clears counter IC3, 1st tone gate is simultaneously enabled and the tone receiver ready to receive a new sequential tone call. As the interval between tones is much less than the above-mentioned 80 ms, the Clear Delay will remain ON throughout the tone sequence.

Counter, Buffer, and Tone Gate

The circuit contains decimal counter IC3, buffer transistors Q7 to Q12 and tone gate Q13 to Q17 with associated components.

The integrated decimal counter IC3 is controlled from the clock-delay and clear-delay, respectively. Output "0", which controls first tone gate, is enabled when the tone receiver is in stand-by (cleared). The other tone gates 2, 3, 4, and 5 are connected to counter output "1", "2", "3", and "4". During a sequential tone call a positive pulse appears at the clock-delay output after each tone, which makes the counter enable the succeeding tone gate. This procedure can be seen from the time diagram of a 5-tone

sequential call. Approx. 80 ms after the end of the tone sequence, the clear-delay resets the counter.

The counter outputs are applied to the basis of buffer transistors Q7 - Q12, which drives the tone gate transistors Q13 - Q17. These transistors have their collectors connected to the tone coil taps. In order to reduce the stand-by power consumption a special transistor is used for first tone gate.

The counter can be strapped for calls with 3, 4, and 5 tones in sequence, by connecting terminal 35 (enable) to terminal 32, 33, or 36, respectively, turning Q7 ON at the end of the last tone, and simultaneously toggling locking circuit IC4. The emitter of Q7 is connected to terminal 34 on the motherboard, (autoreceipt), where a 80 ms pulse will be available after each tone call. In connexion with ST801 this pulse may give an automatic receipt. Likewise Q7 will enable the last tone gate Q13, so that the selection circuit is "tuned" during the abovementioned reset time.

Locking Circuit, Loudspeaker IN/OUT

The locking circuit used is "dual flip-flop" IC4 and Q18, connected as DC-converter, and associated components.

When the battery voltage is turned ON, the locking circuit will be forced into state "LS out" by the positive pulse transferred to the "reset" input of the flip-flop via C12. At the end of the last tone the positive call pulse from the counter will be amplified by Q18, whose collector is connected to the "set" input of the locking circuit. The outputs of the locking circuit Q and \bar{Q} , change state and applies a control signal to the visual indication generator IC2d, buffer transistor Q20, and gate transistor Q19, respectively. After a tone call the locking circuit can be activated as well as cancelled manually by pressing "LS in/out". One part of IC4 is coupled as an R/S flip-flop to prevent switch bouncing from the LS in/out button operate the LS in/out function. To block the sequential tone generator, the locking circuit \bar{Q} output is available at terminal 26.

Output Buffer and SQ Gate

The circuit consists of the transistors Q19, and Q20, with associated components. In stand-by Q20 is ON and short-circuits terminal 21 to chassis (0 V).

After a tone call, or after manually having activated the locking circuit, Q20 turns OFF and the ground connexion is cancelled, and then the transmitter can be operated. Gate transistor Q19's collector is connected to AA801 via terminal 22. The control voltage for Q19 comes from the locking circuit and the squelch, respectively. In order to cancel the blocking of AA801, the locking circuit must be activated (visual indication active), and at the same time the squelch signal for received carrier must be present. The DC-level appearing at the collector of Q19 corresponds to the squelch signal voltage.

Visual Indication

The generator comprises comparator IC2d, buffer transistor Q6, and diode pair E4 with associated components, the whole forming an astable multivibrator with "duty cycle" 1 : 20. The active element in the multivibrator is IC2d, and Q6 is used as buffer for the light emitting diode. In stand-by the charge on C11 is neutral and determined by diode part E4, which is shorted to chassis by IC4b's Q output. Activating locking circuit IC4b reverses the bias of E4 and C11 is charged through R49 to the reference level determined by the voltage dividers R46, R47, and R48 at the non-inverting input of IC2d. The comparator turns ON and activates Q6, and at the same time the capacitor C11 is discharged via R52 and E4.

If the locking circuit is reset with "LS in/out", the astable multivibrator is blocked via E4 and R50.

Supply Voltage

In SR801 are used the three different supply voltages, 7,5 V stabilized RX, 11 V battery RX, and 11 V continuous battery, respectively.

The stabilized 7,5 V RX is used in the receiver unit of the SR, because of the DC-stability, the reference

levels and power consumption. Likewise the 11 V RX battery voltage is used to supply the light emitting diode avoiding loading of VR801 RX, and being switched simultaneously with 7.5 V RX.

As the locking circuit is to "remember" its information, irrespective of the CQP being in RX or TX position, the supply voltage 11 V cont. is used for this circuit.

As the supply voltage can disappear briefly, when adjusting the volume control of the station (the switch is of the type break before make), a holding circuit is applied, keeping the voltage sturdy when adjusting the volume control.

Technical Specifications

Supply Voltage

9 - 15 V (nominal 11 V) battery
7.5 V \pm 2 % stabilized

Current Consumption

Stand-by: < 3.5 mA
On (LED): < 5 mA (at 11 V)

Temperature Range

Operating range: -25°C to +60°C
Function range : -30°C to +70°C

Input Impedance

> 30 K Ω

Generator Impedance

\leq 600 Ω

Input frequency characteristic

Corresponding to an RC-function with decreasing characteristic and $f_0 = 1000$ Hz, summed to a +6 dB/octave increasing characteristic.

Frequency Accuracy

$\leq \pm 0.3$ %

Selectivity

Frequencies differing from f_0 by 1.4 % or more are unable to trigger the tone receiver.

The tone receiver is not sensitive to adjacent tones or other tones of the same standard series.

Tone Frequencies

Hz	DIGIT	Terminal
885	TR	1
970	x	2
1060	1	3
1160	2	4
1270	3	5
1400	4	6
1530	5	7
1670	6	8
1830	7	9
2000	8	10
2200	9	11
2400	0	12
2600	Repeat	13
2800	Alarm	14
2900	TR	15

Distortion

The tone receiver will respond to signals with ≤ 20 % distortion.

Reset Time

< 100 ms; > 60 ms

Signal to noise conditions

The tone receiver will accept a noise level corresponding to SINAD = 5 dB as measured in the speech channel of the CQP800.

Sequential Tone Receiver

Signalling Code

Sequence of 3, 4, or 5 tone bursts of minimum 55 ms.

Signal Input Level

110 mV \pm 6 dB

Response Time

< 45 ms; > 20 ms

Double Tone Receiver

Signalling Code

Two simultaneous tones

Signal Input Level

55 mV per tone \pm 3 dB.

Amplitude level difference between tones < 1 dB proportional to the nominal characteristic.

Response Time

> 500 ms

< 1000 ms

Output Functions

Optical Indicator Control Signal

ON: 30 ms

OFF: 580 ms

AF Blocking

Cancelling: 6 to 15 V DC, squelch controlled.

Transmitter Blocking

Cancelling: 0 to 5 V DC, $R_i > 1 \text{ M}\Omega$

Auto Receipt

$\geq 5 \text{ V DC}$, $I_{\text{max.}} = 5 \text{ mA}$ for 60 to 100 ms.

Manual cancelling of the AF blocking (LS in) establishes the output functions as above except the auto receipt.

Switching the LS off establishes the following functions:

1. The optical call indication is cancelled.
2. Key blocking signal: 0.3 V DC; $I_{\text{max.}} 0.5 \text{ mA}$.
3. AF blocking signal: 0.4 V DC; $R_i = 68 \text{ K}\Omega$.

Dimensions

20 mm x 55 mm x 21 mm

Weight

45 g.

SEQUENTIAL TONE TRANSMITTER ST801 AND ST802

General

ST801 and ST802 are sequential tone transmitters designed for use in systems of the CQP800 family.

The only difference between the two units is the tone series, which is the STORNO series (885Hz to 2800Hz) for ST801, and the CCIR series (960Hz to 2110Hz) for ST802.

The unit is composed of 3 thick film modules with plug in pins for a common "motherboard"; the electrical division appears from the block diagram. Upon activation of the tone key ST80x generates a 3, 4 or 5 tone sequential signal using 14 tones frequencies in the Storno-Series, ST801, or 13 tone frequencies in the CCIR series.

The tone combination is selected by soldering wires to the tone coil, and the duration of each tone burst can be adjusted to 70 ± 15 ms (ST801) or 100 ± 15 ms (ST802). The delay between the tone key being depressed and release of the first tone burst will range from 300 ms to 440 ms depending on whether the first or the first and second tone is omitted for 4 tone and 3 tone sequence signal, respectively. The transmitter remains on for approx. 650 ms, even if the tone key is activated for a shorter or a longer time.

While the tone transmitter is keyed the following control functions are established.

Microphone amplifier blocking, terminal 24

Receiver blocking, terminal 21.

The above mentioned blocking signals are suspended at the end of the last tone, when ST80x returns to stand by.

As well the interval, before transmitting the tone modulation, as the 1st tone burst can be extended by introducing DU801 in ST801.

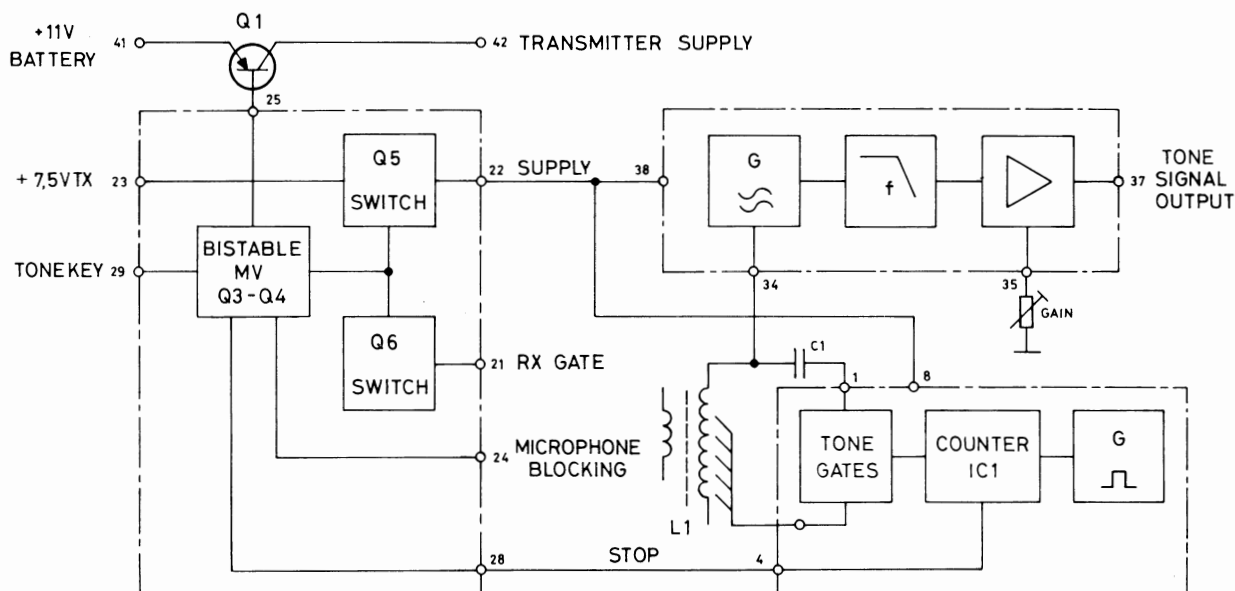
Mode of Operation

ref. block diagram ST801.

The colour coded wires are soldered to the terminal disc on the tone coil according to the selected combination.

When the tone key is depressed the mode of operation is as follows:

The positive going edge from the tone key activates the holding circuit, which switches 7,5V TX to the oscillator and clock generator module, while keying the RF transmitter via Q1.



Control signals for microphone amplifier blocking (terminal 24) and receiver blocking (terminal 21) are also established.

Even if the tone key is activated in a shorter or a longer time, the transmitter is keyed in approx. 650 ms, until the holding circuit is reset at the end of the last tone. If terminal 29 is connected directly to the transmitter key, ST80x is wired for identification, as a sequential signal is transmitted, each time the transmitter is keyed. If terminal 28 is connected to 0 volt, ST80x is wired for continuous repetition of the sequential signal, as the reset pulse to the holding circuit is short circuited.

By connecting terminal 27 to SR801 automatical receipt is obtained, as SR801, after a received call, releases a control voltage that will activate the holding circuit in ST80x.

The clock generator starts running when the 7,5V TX is switched on and feeds clock pulses to the counter with a period time of 70 ± 15 ms (ST801) and 100 ± 15 ms (ST802).

At the 5th clock pulse the 1st gate transistor enables the oscillator via the brown wire to the tone coil.

The 6th - 7th - 8th - 9th clock pulse respectively opens the gate transistors to accomplish the sequential signal.

The counter's 1st and 3rd output is used to extend the delay before the release of the first tone and to extend the duration of the 1st tone; this requires the delay unit DU801 to be inserted in the ST80x.

After the initial delay the 5 tone gates are enabled one by one. For 3 or 4 tone sequential signals, the first or the last of the 5 periodes in the signal can be selected.

The oscillator signal is amplified and de-emphasized before fed to the output of the sequential tone transmitter (terminal 37). The de-emphasis characteristic follows an RC function with a transistor frequency of 1000Hz, corresponding to the modulation characteristic for tone signalling used by Storno. The output voltage can be adjusted by an external resistor.

CIRCUIT DESCRIPTION

Start-Stop circuit and Key switch

The circuit consists of transistors Q1, Q2, Q3, Q4, and Q6 plus the double diodes E1 and E2 with associated components. In stand by all transistors are OFF. Operating the tone key connects positive voltage to terminal 29 and a positive pulse is fed through C3 and one half of diode E1 to the RS flip-flop, consisting of Q3 and Q4. The flip-flop switches state and remains in this position, even if the tone key is released.

Q4 draws Q1 as well as Q5 into saturation. Q1 switches the battery voltage to the RF transmitter ON and Q5 is regulated supply voltage to the oscillator, clock generator and counter.

One half of the diode E2 feeds the saturation potential of Q4 to terminal 24 for microphone amplifier blocking. The regulated voltage is applied to Q6, which saturates and via terminal 21 blocks the voltage regulator of the receiver. At the end of the 5th tone the counter releases a positive voltage to the base of Q2; this resets the flip-flop and the circuit returns to stand by.

The capacitor C4 secures that the start-stop circuit is not activated unintentionally when the station is turned on.

Oscillator

The oscillator is built as a Hartley-oscillator with a differential amplifier as active element, the feed back to the bases of Q7 and Q8 is taken from a separate winding on the tone coil. Q11 produces a bias (approx. 3.7V) to hold the disabled gate transistors effectively OFF.

Output amplifier and de-emphasizing

The signal from the oscillator is amplified by Q12, Q13, and Q14. The amplification can be adjusted by an external resistor between terminal 35 and chassis.

The desired frequency characteristic (6 dB / octave de-emphasis, $f_c = 1000\text{Hz}$) is obtained by R28, R30, and C5.

Clock pulse generator

The transistors Q15, Q16, Q17, and C7 are built as an astable multivibrator, whose leading edges are used as clock pulses for the counter circuit.

The period time can be adjusted with an external resistor between terminal 7 and 9.

Counter - and gate circuits

The circuit consists of decade counter IC1, buffer transistors Q18 - Q22, gate transistors Q23 - Q27 with associated components.

When the tone key is depressed capacitor C8 will charge and produce a positive CLEAR pulse for the counter.

The outputs of the decade counter will go to "1" determined by the period time of the clock generator. The output level is amplified by the buffer transistors and fed to the gate transistors, whose collectors are connected to the tap of the tone coil thus producing the respective tones in the sequential signal.

The delay of the 1st tone is approx. 300 msec. corresponding with the 4 first clock pulses after the tone key being depressed, as the 1st gate transistor is connected to the 4th output of the decade counter.

The 10th clock pulse is used as "stop-pulse" to the start-stop circuit.

Technical Specification

Supply Voltage

battery : 9-15V (nominal 11V)
regulated : 7.5V \pm 2%

Current Consumption

stand by 11V and 7.5V : < 0.1 mA
activated 11V : approx. 40 mA
(transmitter switch)
activated 7.5V : < 10 mA

Temperature Range

working range : -25°C to +60°C
function range : -30°C to +70°C

Output Impedance : < 200 Ω

Loading Impedance : $\geq 2\text{K}\Omega$ // 10 nF

Output Signal ST801 : 3 - 4 or 5 tones in bursts of 70 \pm 25 ms duration.
The delay of the 1st tone is min. 300 ms.

Output Signal ST802 : 3 - 4 or 5 tones in bursts of 100 ms duration. The delay of the 1st tone is min. 430 ms.

Output Level ST801, 970Hz

112 mV RMS (adjustable)

Frequency Response

6 dB pr. octave de-emphasis; $F_c = 1000\text{Hz}$
tolerance : ± 1 dB

Output Level ST802, 1022Hz

109 mV RMS (adjustable)

Distortion : < 3%

Tone Frequencies ST801

885 - 970 - 1060 - 1270 - 1400 - 1530 - 1670 - 1830 - 2000 - 2200 - 2400 - 2600 - 2800Hz.

Tone Frequencies ST802

960 - 1022 - 1224 - 1197 - 1275 - 1358 - 1446 - 1540 - 1640 - 1747 - 1860 - 1981 - 2110Hz.

Frequency Deviation

typical deviation (2) : $\leq 1\%$
maximal deviation : $\leq 1.4\%$
relative frequency accuracy : < 0.3%
adjustment tolerance : < 0.1%
frequency stability : < 1%

Control Functions in CQP800

receipt	: ST80x can be activated by SR80x
auto. keying time	: ST801: 650 ms. ST802: 930 ms. ($V_{BATT} - 0.5V / 0.5A$)
RX blocking	: Chassis potential for re- ceiver blocking (0.1V / 0.5 mA)
Mic. blocking	: Chassis potential for microphone amplifier blocking (1V / 0.2 mA)

Mechanical Specification

Dimensions

width	: 20 mm
length	: 55 mm
height	: 21 mm

Weight	: 40 g
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Description
of pilotone equipment in CQP860-6999

The pilotone facility in CQP860 comprises the following units:

1. TQ801a pilotone generator which generates pilottones with frequencies between 71,9Hz and 136,5Hz.
2. Crystal oscillator XO865 which can be modulated with the pilotone delivering a frequency modulated signal.
3. Connection unit SU800-6999/02 which attenuates the pilotone level from TQ801a to suit XO865.
4. CH80X-6999 is standard CH80X on which are mounted diodes and resistors for adjustment of the pilotone frequency deviation for each of the crystal oscillators XO865. Adjustment procedure is described in T129723.

SEQUENTIAL TONE RECEIVER SR801

General

SR801 is a sequential, or double, tone receiver used to receive a 3, 4, or 5 tone sequence signal or a double tone signal. The unit is composed of 4 thick-film modules with plug-in pins, placed on a common motherboard. The electrical division appears from the block diagram. The tone frequencies used are the Storno series from 885 Hz to 2900 Hz, and the required tone combination is selected by soldering colour coded wires to tags on the tone coil. A corresponding tone sequence signal (or double tone signal) will, after cessation of the last tone, be registered as follows:

Key lock function is disabled, terminal 21.

LS locking is disabled, terminal 22.

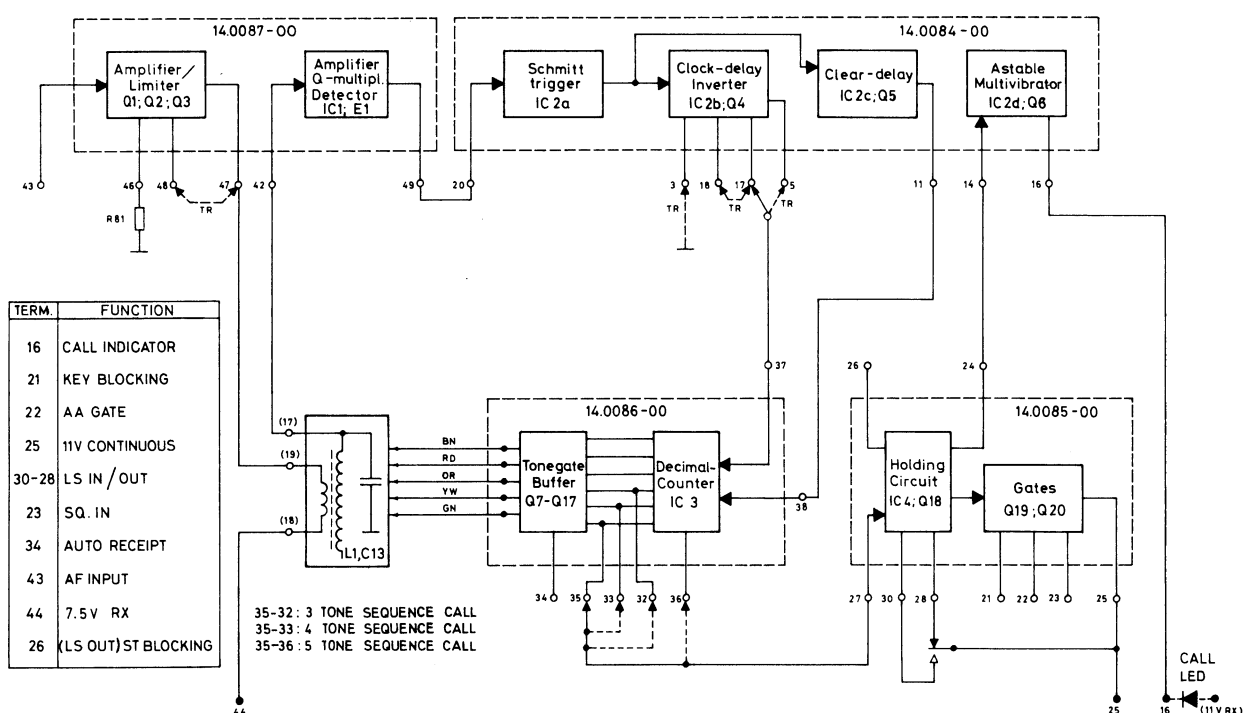
Optical indication (LED), terminal 16.

The above-mentioned functions are cancelled manually by operating the LS in/out button.

Mode of Operation

When receiving a tone sequence signal on terminal 43, corresponding to the tone combination on the tone coil, the mode of operation is as follows:

1st tone in the sequence signal is amplified and, if necessary, limited in the input stage, and the signal is applied to the selection circuit via the coupling winding. The 1st tone terminal is selected in standby through tone gate Q17. Next the tone signal is amplified in the combined amplifier and Q-multiplier and applied to the Schmitt-trigger (ST) IC2a via detector E1. The rectified signal will activate the ST and the positive going edge at the ST output, when activated, is inverted and delayed approx. 17ms in the clock-delay circuit (CP-delay) IC2b through the buffer Q4. This enables the counter before the 1st tone is applied at the output of the CP-delay. At the end of the 1st tone, the ST re-



turns to stand-by. The positive pulse at the output of the CP-delay is applied to the inverter Q4, as well as to the decimal counter IC3. The counter steps forward and enables the second tone gate via the buffer transistor, whose collector is connected to tone coil L1.

The sequential tone receiver is now ready to receive the 2nd tone and remains in this position for approx. 80 ms, according to the CL-delay. If the 2nd tone is not received within this period, the counter is reset and enables the 1st tone gate again. If tones 2, 3, 4, and 5 are received, the procedure is as described above. At the end of the 5th tone, the buffer Q7 output releases a signal for receipt, terminal 34, and locking circuit IC4, and then key - and LS blocking functions are cancelled. Simultaneously a visual call indication at terminal 16 is established. SR801 can also be coded to respond to 3 and 4 tone sequential calls.

Double Tone Signal

SR801 will receive a double tone when strapped in accordance with the notes on the diagram. The brown, orange, and the green wires are soldered to the tag having the highest of the desired tones, in the same way the red and the yellow wires are soldered to the tag having the lower.

The highest tone frequency in the double tone signal is selected, amplified, rectified and activates the ST. The integration period in the CP-delay is increased to approx. 140 ms, which is the period "felt" on the tone frequency, before IC2b and inverter Q4 generate a clock pulse, which enables the 2nd tone gate. The procedure for the lower tone frequency in the double tone signal is the same as for the first tone described above. The integration period per signal element is obtained by IC2b discharging the integration capacitor via diode E3, making the circuit operate as an astable multivibrator. After the 5th clock pulse, the call is recognized as described for a five tone sequential call.

Circuit Description

Input Amplifier and Limiter

The circuit includes the transistors Q1, Q2, and Q3 with associated components.

The received tone signal is linearized by the RC-circuits R3, C14, and C2. The input characteristic corresponds to an RC-function with falling characteristic and $f_c = 1000$ Hz, summed with a +6 dB/octave, rising characteristic, within the frequency range 885 Hz to 3 kHz.

Then the tone signal is amplified in the differential amplifier Q1, Q2, and Q3. Amplitude limiting is introduced for signal levels above the min. sensitivity (approx. 55 mV). Via R12 the signal is applied to the resonant circuit.

For SR801, when connected as double tone receiver, the resistors R11 and R12 are connected in parallel in order to increase the signal voltage across the band pass filter. The sensitivity can be adjusted with R81 to compensate component tolerance.

Selection Circuit

The band pass filter consists of tone coil L1 and capacitor C13.

The signal from the input amplifier is applied to the parallel tuned circuit via a separate winding. The colour coded wires from the tone gates connect the tone coil taps in parallel with capacitor C13.

Amplifier, Q multiplier and Detector

The circuit consists of the operational amplifier IC1, the diode pair E1 with associated components.

The selected tone signal from the band pass filter is amplified in operational amplifier IC1, and passes to detector E1. The amplification is constant and determined by the ratio between R17 and R16. Via R19, R20, and R21 part of the amplified tone signal is fed back to the coupling winding in phase with the received signal, thereby increasing the bandfilter Q-factor to approx. 32.

Simultaneously an NTC resistance R21 inserted in the feedback circuit is compensating the temperature variation of the Q-factor.

The amplified tone signal is rectified by the biased diode part of E1 and is filtered by C7. The resultant DC-level is applied to Schmitt-trigger IC2a via the other diode part of E1.

Schmitt Trigger

The Schmitt Trigger (ST) is composed of comparator IC2a and the reference level is determined by the voltage dividers R22, R23, R24, and R26.

The rectified tone signal reduces the DC-voltage at the inverting input of the comparator. When the level is below the reference voltage, IC2a turns off, and the DC output changes from approx. 0 V to 7 V.

Clock Delay

The circuit is composed of comparator IC2b, diode pair E2 and E3, Q4 and associated components. In stand-by, the output of the ST is 0 V, because of which C8 (9) is discharged via E2, and the output of IC2b is in stand-by approx. 7 V. The reference level is determined by the voltage dividers R33, R34, R35, and R36 and applied to the non-inverting input of IC2b.

When the ST is activated, diode E2 will be reverse biased and C8 (9) will charge via resistors R27 and R28. The moment the increasing voltage on C8 (9) reaches the reference level, IC2b will turn ON and the output voltage falls to approx. 0 V. The time it takes C8 to charge up to the reference level corresponds to the clock-delay, which is approx. 17 ms. At the end of the tone the ST turns ON, and C8 (9) is discharged via E2 and R28 (R32) causing the positive edge of the output pulse of IC2b to be delayed in proportion to the shift of the ST. This will eliminate the effect of drop-outs in the received signal, if any.

When SR801 is connected as double tone receiver, the inverted clock pulse for the counter is taken from the collector of Q4, and the output of IC2b is connected to diode pair E3. The clock-delay is increased to approx. 140 ms, by connecting C9. When the charging of C8 and C9 reaches the reference voltage, IC2b turns ON, as described before, and a positive going edge on the collector of Q4 is produced, which toggles counter IC3, enabling the following tone gate.

Simultaneously capacitors C8 and C9 are discharged via diode E3 and resistor R29, to a level determined by the voltage dividers E3, R30, R33, and R34 and then IC2b goes OFF again and diode E3 is reverse biased. The width of the clock pulse, which

practically is determined by R30 and C9, is approx. 5 ms. In case the ST indicates the presence of a new tone, the sequence is as described above.

Clear Delay

The circuit is composed of transistor Q5, comparator IC2c and associated components. In stand-by Q5 is OFF, as the control voltage from the ST is 0 V, because of which the charge on C10 also is 0. When the ST turns OFF, C10 is charged via Q5 and R40. When the voltage of C10 reaches the reference level, IC2c switches state.

The negative going DC-shift from approx. 7 V to 0 V at the output of IC2c enables counter IC3, which then is ready to receive clock-pulses from the clock-delay. The clear delay circuit operates similarly to the Clock Delay circuit. As long as the ST is activated, Q5 will maintain the charging on C10. At the end of the last tone, the ST turns ON, and Q5 OFF as the emitter will be biased by the charge of C10. The discharging time of C10 is determined by R41, which in approx. 80 ms reduces the capacitor charge to the reference level at the non-inverting input of IC2c.

When IC2c turns OFF, i.e. returns to stand-by and clears counter IC3, 1st tone gate is simultaneously enabled and the tone receiver ready to receive a new sequential tone call. As the interval between tones is much less than the above-mentioned 80 ms, the Clear Delay will remain ON throughout the tone sequence.

Counter, Buffer, and Tone Gate

The circuit contains decimal counter IC3, buffer transistors Q7 to Q12 and tone gate Q13 to Q17 with associated components.

The integrated decimal counter IC3 is controlled from the clock-delay and clear-delay, respectively. Output "0", which controls first tone gate, is enabled when the tone receiver is in stand-by (cleared). The other tone gates 2, 3, 4, and 5 are connected to counter output "1", "2", "3", and "4". During a sequential tone call a positive pulse appears at the clock-delay output after each tone, which makes the counter enable the succeeding tone gate. This procedure can be seen from the time diagram of a 5-tone

levels and power consumption. Likewise the 11 V RX battery voltage is used to supply the light emitting diode avoiding loading of VR801 RX, and being switched simultaneously with 7.5 V RX.

As the locking circuit is to "remember" its information, irrespective of the CQP being in RX or TX position, the supply voltage 11 V cont. is used for this circuit.

Technical Specifications

Supply Voltage

9 - 15 V (nominal 11 V) battery
7.5 V \pm 2 % stabilized

Current Consumption

Stand-by: < 3.5 mA
On (LED): < 5 mA (at 11 V)

Temperature Range

Operating range: -25°C to +60°C
Function range : -30°C to + 70°C

Input Impedance

> 30 K Ω

Generator Impedance

\leq 600 Ω

Input frequency characteristic

Corresponding to an RC-function with decreasing characteristic and $f_0 = 1000$ Hz, summed to a +6 dB/octave increasing characteristic.

Frequency Accuracy

$\leq \pm 0.3$ %

Selectivity

Frequencies differing from f_0 by 1.4 % or more are unable to trigger the tone receiver.

The tone receiver is not sensitive to adjacent tones or other tones of the same standard series.

As the supply voltage can disappear briefly, when adjusting the volume control of the station (the switch is of the type break before make), a holding circuit is applied, keeping the voltage sturdy when adjusting the volume control.

Tone Frequencies

Hz	DIGIT	Terminal
885	TR	1
970	x	2
1060	1	3
1160	2	4
1270	3	5
1400	4	6
1530	5	7
1670	6	8
1830	7	9
2000	8	10
2200	9	11
2400	0	12
2600	Repeat	13
2800	Alarm	14
2900	TR	15

Distortion

The tone receiver will respond to signals with ≤ 20 % distortion.

Reset Time

< 100 ms; > 60 ms

Signal to noise conditions

The tone receiver will accept a noise level corresponding to SINAD = 5 dB as measured in the speech channel of the CQP800.

Sequential Tone Receiver**Signalling Code**

Sequence of 3, 4, or 5 tone bursts of minimum 55 ms.

Signal Input Level

110 mV \pm 6 dB

Response Time

< 45 ms; > 20 ms

Double Tone Receiver**Signalling Code**

Two simultaneous tones

Signal Input Level

55 mV per tone \pm 3 dB.

Amplitude level difference between tones < 1 dB proportional to the nominal characteristic.

Response Time

> 500 ms

< 1000 ms

Output Functions**Optical Indicator Control Signal**

ON: 30 ms

OFF: 580 ms

AF Blocking

Cancelling: 6 to 15 V DC, squelch controlled.

Transmitter Blocking

Cancelling: 0 to 5 V DC, $R_i > 1 \text{ M}\Omega$

Auto Receipt

$\geq 5 \text{ V DC}$, $I_{\text{max.}} = 5 \text{ mA}$ for 60 to 100 ms.

Manual cancelling of the AF blocking (LS in) establishes the output functions as above except the auto receipt.

Switching the LS off establishes the following functions:

1. The optical call indication is cancelled.
2. Key blocking signal: 0.3 V DC; $I_{\text{max.}} 0.5 \text{ mA}$.
3. AF blocking signal: 0.4 V DC; $R_i = 68 \text{ K}\Omega$.

Dimensions

20 mm x 55 mm x 21 mm

Weight

45 g.

CQP800U-IS 0.2W ADJUSTMENT PROCEDURE

Adjustment of the CQP800U-IS is similar to the STORNOPHONE 800U ADJUSTMENT PROCEDURE with the following amendments:

Selecting the resistor to adjust the transmitter current drain and power output.

The intrinsically safe version of the STORNOPHONE 800U has no 4DC circuit to protect the power stage and to regulate the power output. Instead a resistor is used to drop the supply to the first stage of the driver unit (PA8x1). The dropping resistor is composed of two 1/10W resistors of 470ohm and 560ohm in parallel and soldered to pin 2 and pin 5 normally used by the AD801. The final adjustment of the power output and the current drain is performed by replacing one or both of these resistors.

Adjusting the multiplier chain and PA stages

Connect the CQP800U-IS through a BNC-adaptor, type SI805, to a wattmeter.

Set the channel selector to a channel close to the center frequency, if more than one.

To ease the alignment turn all tuning slugs in the units PM811/PM861 – FD811/PM831/FD861 – FD813/FD832/FD863 – BP811/BP831/BP861 to their innermost position for low channel frequencies, their middle positions for medium channel frequencies, and outermost position for high channel frequencies. This procedure must be followed strictly for CQP830U-IS as it is possible to resonate FD832 at the third harmonic (approx. 66MHz) for oscillator frequencies around 22MHz.

Units FD811/FD812 – FD812/FD831/FD862 – FD813 – FD832/FD863 – BP8x1 are first adjusted for maximum current drain. Then the coils PA8x1 and PA8x2 are adjusted for maximum power output. The multipliers are now adjusted for minimum supply voltage to the first driver (set the voltage selector on C35 to ADC), and the PA8x1 and PA8x2 are adjusted for maximum power output. To obtain a clear peak, when adjusting the first doubler stage, it may be necessary to detune the second doubler stage. Check the supply voltage to be 11V (no current limiting).

Normally the RF output power will be less than specified (0.2W) and the total transmitter current drain will be less than 170mA.

By changing the dropping resistors mentioned in the beginning of this description the current drain is adjusted to 170mA \pm 5mA.

Set the power supply current limiter to 170mA and select a pair of resistors that folds the supply voltage back to 10.5V.

Finally the multiplier chain and the PA stages are realigned.

Requirements: $P_{out} = 0.2W$
 $I_{max} = 170mA$

For adjustment of modulation and receiver, refer to the STORNOPHONE 800U Adjustment Procedure.

Pilot Tone Unit TQ801

The pilot tone unit contains a combined tone transmitter and tone receiver for the Stornophone 800 radiotelephone.

The unit consists of a chassis with a motherboard for four subassemblies.

When used as a pilot tone transmitter, the unit generates a low frequency signal for modulation of the transmitter.

Used as a pilot tone receiver the unit, when receiving a pilot tone modulated RF carrier, provide a logic control signal for the squelch circuit.

A 5-position switch on the motherboard is set to one of the 5 frequencies to which the unit has been adjusted. The 5 frequencies are to be selected from a series of 8 in the frequency range 71.9 Hz to 136 Hz. The receiving frequency and the generated frequency are identical.

Circuit Description

Pilot tone receiving mode.

A third order active filter suppresses the speech modulation contents of the input signal. The pilot tone modulation is applied to a limiter stage ensuring a constant drive for the band pass selection circuit. This circuit, which is a second order active filter of the state variable type, determines the tone to which the receiver responds. The selected signal is applied to a detector followed by a DC amplifier. The TQ signal output will assume a low state output ($\sim 0V$), when a tone of the correct frequency is received.

A third order high pass filter suppresses the tone modulation before the speech modulation is applied to the terminal connecting to the AF output amplifier.

Pilot tone transmitting mode.

When keying the transmitter, battery voltage is applied to the transmitter key terminal (24) on the TQ801. The voltage turns diode E7 on thereby opening a regenerative feed-back loop. The charging of C13 injects a pulse into the circuit ensuring a rapid start of oscillations. The generated signal is applied to the pilot tone terminal (39).

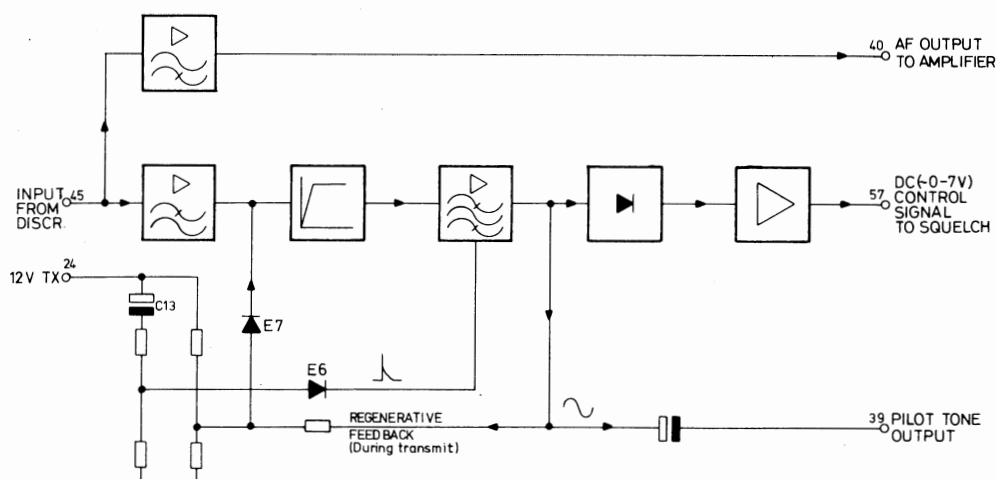
Regarding the mechanical construction the unit is divided into three thick film circuits and one printed circuit, all with plug-in pins for a common motherboard. Thick film circuit 14.0043 contains the low pass and the high pass filters, the limiter and the detector.

Thick film circuit 14.0047 and 14.0049 together with the printed circuit 15.0139 composes the band pass filter.

In order to achieve a frequency tolerance of 0.05% the series resistors R34 - R38 placed on thick film 14.0049 is adjusted during an operational test.

The frequency determining part of TQ801 is subassembly 15.0139 consisting of an epoxy glass fibre printed circuit on which six metal film resistors, 2 polystyrene capacitors and ten pins are mounted.

The five frequencies are to be selected from the series below and the corresponding resistor values are given.



Frequency Hz	period μ sec.	Code no	Description
71.9	13908.2	89.5044-00	191 k Ω 1% metalfilm 0.25 W
82.5	12121.2	89.5041-00	143 k Ω 1% metalfilm 0.25 W
94.8	10548.5	89.5040-00	105 k Ω 1% metalfilm 0.25 W
103.5	9661.8	89.5039-00	93.1 k Ω 1% metalfilm 0.25 W
110.9	9017.1	89.5038-00	80.6 k Ω 1% metalfilm 0.25 W
118.8	8417.5	89.5037-00	71.5 k Ω 1% metalfilm 0.25 W
127.3	7855.4	89.5049-00	61.9 k Ω 1% metalfilm 0.25 W
136.5	7326.0	89.5067-00	53.6 k Ω 1% metalfilm 0.25 W

Normally R27 will have the higher value and the following resistors decreasing values to R31 as the lower.

Technical Specifications

General

Tone frequencies (EIA - RS220)

71.9Hz, 82, 5Hz, 94, 8Hz, 103, 5Hz, 110, 9Hz, 118, 8Hz, 127, 3Hz, and 136, 5Hz.

Adjustment tolerance

$$\frac{\Delta}{f_0} = 0.05\%$$

Frequency stability

0.5%

Temperature range

-25°C - +60°C.

Polarity

Negative chassis

Dimensions

56.4mm x 14.3mm x 25.8mm

Tone transmitter

Supply voltage

9, 6V - 15V

Current drain

2 mA

Activating signal

Positive

Output impedance

600 Ω ; AC or DC coupling

Load

≥ 1 k Ω

Output level

2.2V \pm 1 dB ($R_L = 10$ k Ω)

Distortion

0.1%

Response time

5 ms.

Tone Receiver

Supply voltage

a: 9.6V - 15V

b: 7.5V stabilized

Current drain

0.6 mA

Activating signal

Continuous tone input

Selectivity

The tone receiver will react with certainty within a bandwidth of $\pm 1\%$, but not to the adjacent tone.

Signal to noise sensitivity

2 dB

Response time

100 ms

Activating input level

15.7 mV \pm 6 dB

Generator impedance of input signal

≤ 3 k Ω

Input impedance

30 k Ω

Input frequency response

Flat; linear

Output level

Not activated: 7 V; Internal resistance 10 k Ω

Activated: Disconnection; Internal resistance ≥ 10 k Ω

BESKRIVELSE

AF SAMMENKOBLINGSENHED SU800-6999/02

1. Enheden benyttes i CQP860 med pilottoneudstyr. Dens funktion er at sammenkoble TQ801 med XO865 og tilpasse pilottone-niveauet fra TQ801 til det ønskede frekvensssving samt give forspænding til kapacitetsdioderne i krystaloscillatorerne XO865.
2. Frekvenssvinget fra oscillatorerne skal justeres individuelt v.hj. af modstande anbragt på CH800.
3. Enheden er monteret i en CH8013.

DESCRIPTION

OF INTERFACE UNIT SU800-6999/02

1. The unit is used in CQP860 with pilot tone equipment. Its function is to interface TQ801 with XO865 and to adjust the pilot tone level from TQ801 to obtain the desired frequency deviation and to supply DC-voltage to the vari-cap-diodes in the crystal oscillators XO865.
2. The frequency deviation of the oscillators must be adjusted individually using resistors placed on CH800.
3. The unit is mounted in a CH8013.

ADJUSTMENT PROCEDURE

CQP800U-IS 1 W

The CQP800U-IS 1 W Intrinsically Safe radio-telephone set is mechanically different to other sets of the STORNOPHONE 800U series.

The adjustment procedures are, however, applicable also to the CQP800U-IS 1 W when the following is taken into account:

1. The Test Cable code No. 19B0034-00 must be used to connect the radioset to the test equipment.
2. The C35 Control Unit can only be used if it is modified.

TEST CABLE 19B0034-00

The test cable consists of a battery dummy (BU809) with built-in current limiters, a

BNC adaptor plug, two test clips, and a multicontact plug for the C35 Control Unit.

MODIFICATION OF CONTROL UNIT TS-C35

Included in the Test Cable 19B0034-00 is a red/gray wire with a connector contact. This wire is used to modify the TS-C35 as follows:

The wire is soldered to the KEY switch O2 on the free terminal opposite the gray wire, and the contact is inserted in J1-LL.

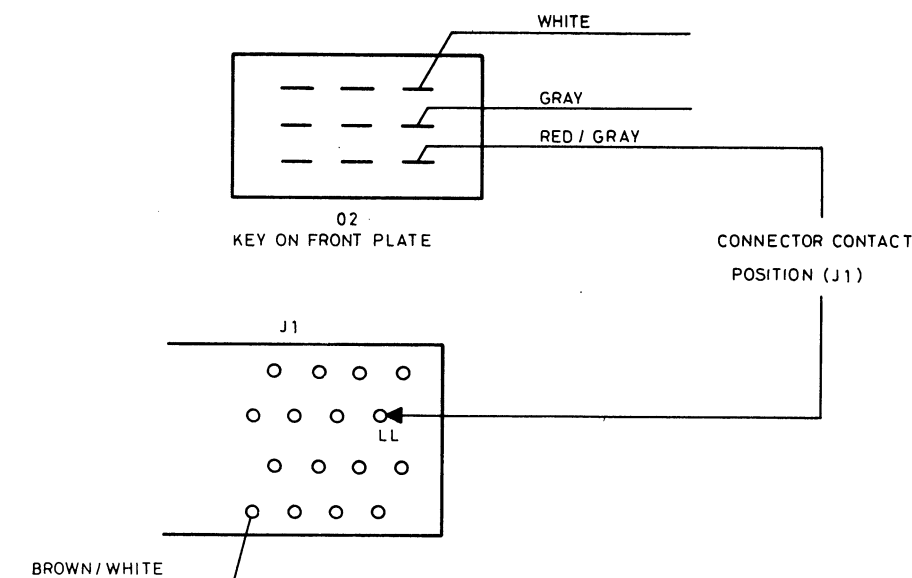


FIG. 1. MODIFICATION OF C35

11 V RX will, when the TS-C35 is used for testing a CQP800U-IS 1 W, be disconnected

when keying the transmitter while all other functions remain unchanged.

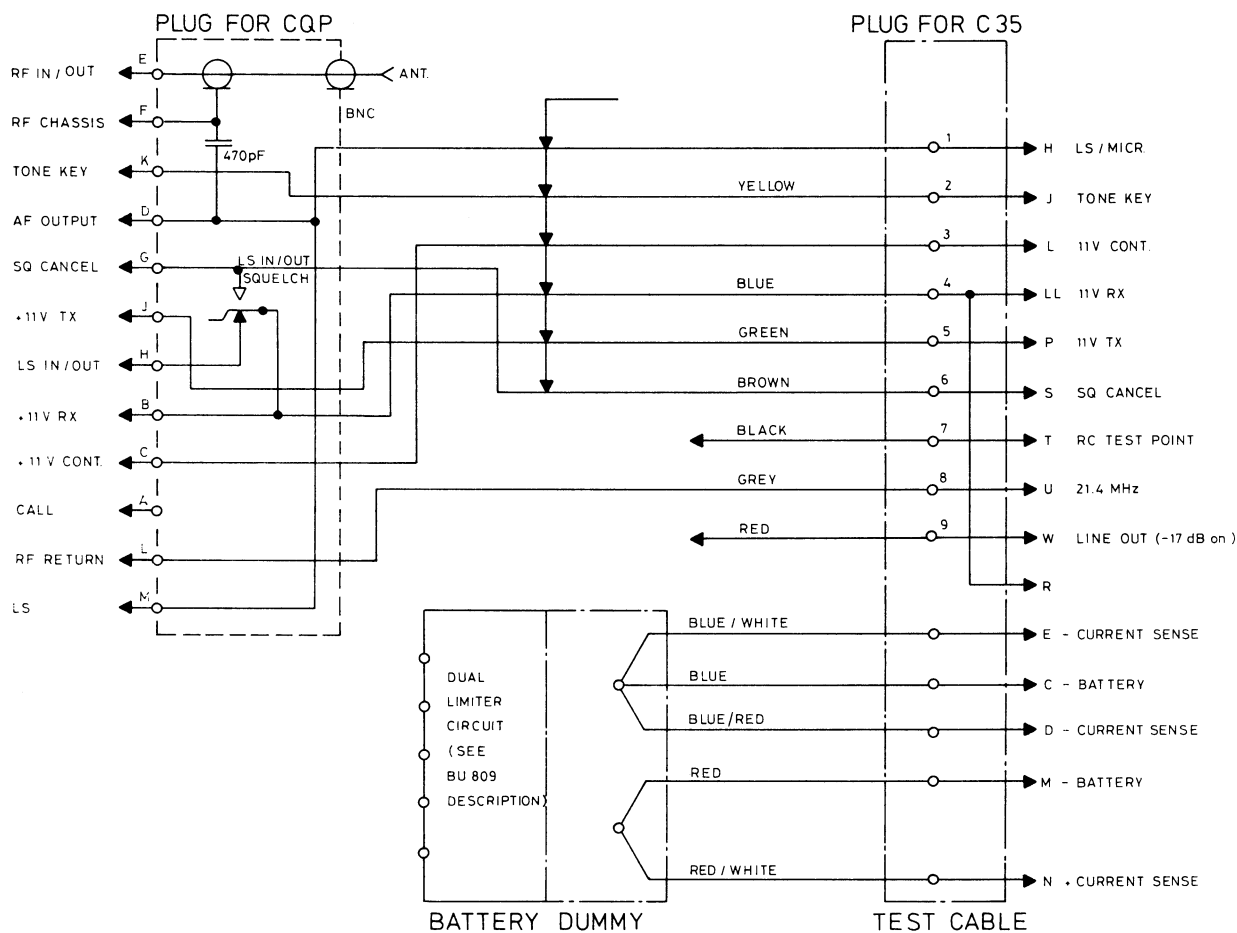


FIG. 2. TEST CABLE

19 B 0034-00

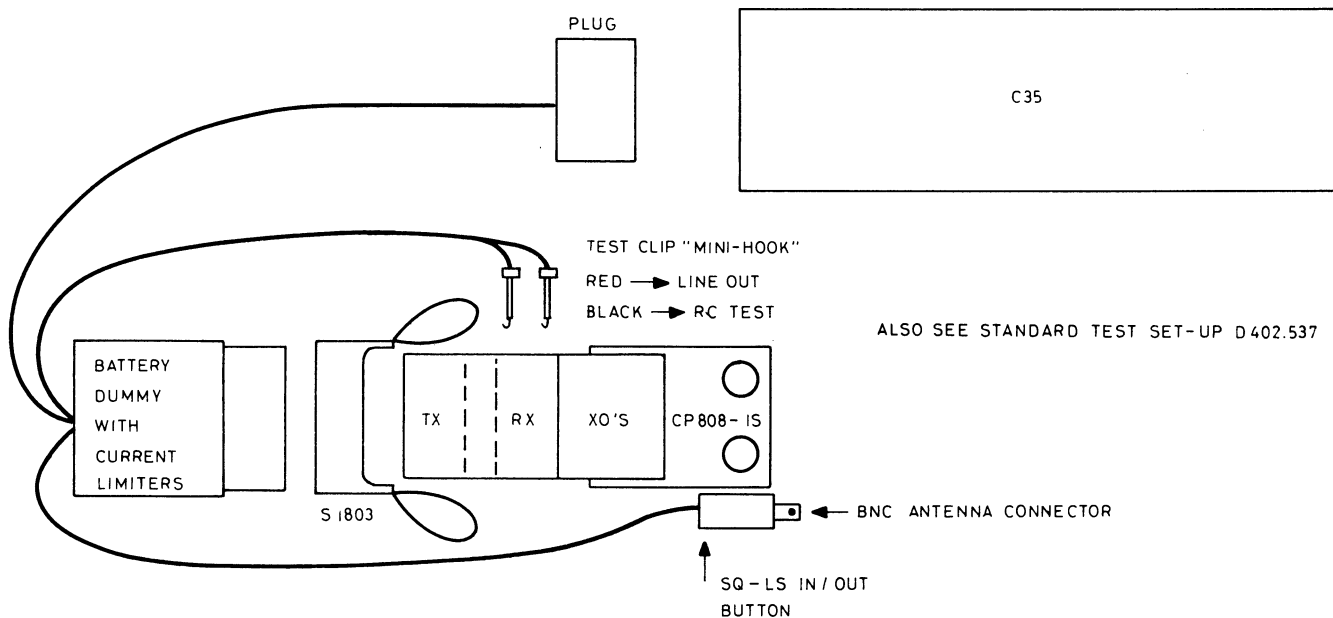


FIG. 3. CONNECTING TEST CABLE

ADJUSTMENT OF CQP800U-IS

The adjustment procedures are not changed except for the following test specifications:

The voltage on the Power Supply shall be set to 13.6 V which corresponds to 11 V after the current limiters in the battery dummy.

Current drain with the transmitter keyed shall be less than 400 mA.

The transmitter RF power is adjusted with R6 for 1 W \pm 1 dB.

With the transmitter adjusted for maximum RF power the current drain and RF power is measured. If either of the measured values are not within specifications a new value is selected for R6, and the procedure is repeated. Readjustment of the RF stages may be necessary when changing R6.

The AF power to the speaker is reduced because of the safety resistors in the circuitry. Typically the AF power delivered into a 25 ohm load is 160 mW.

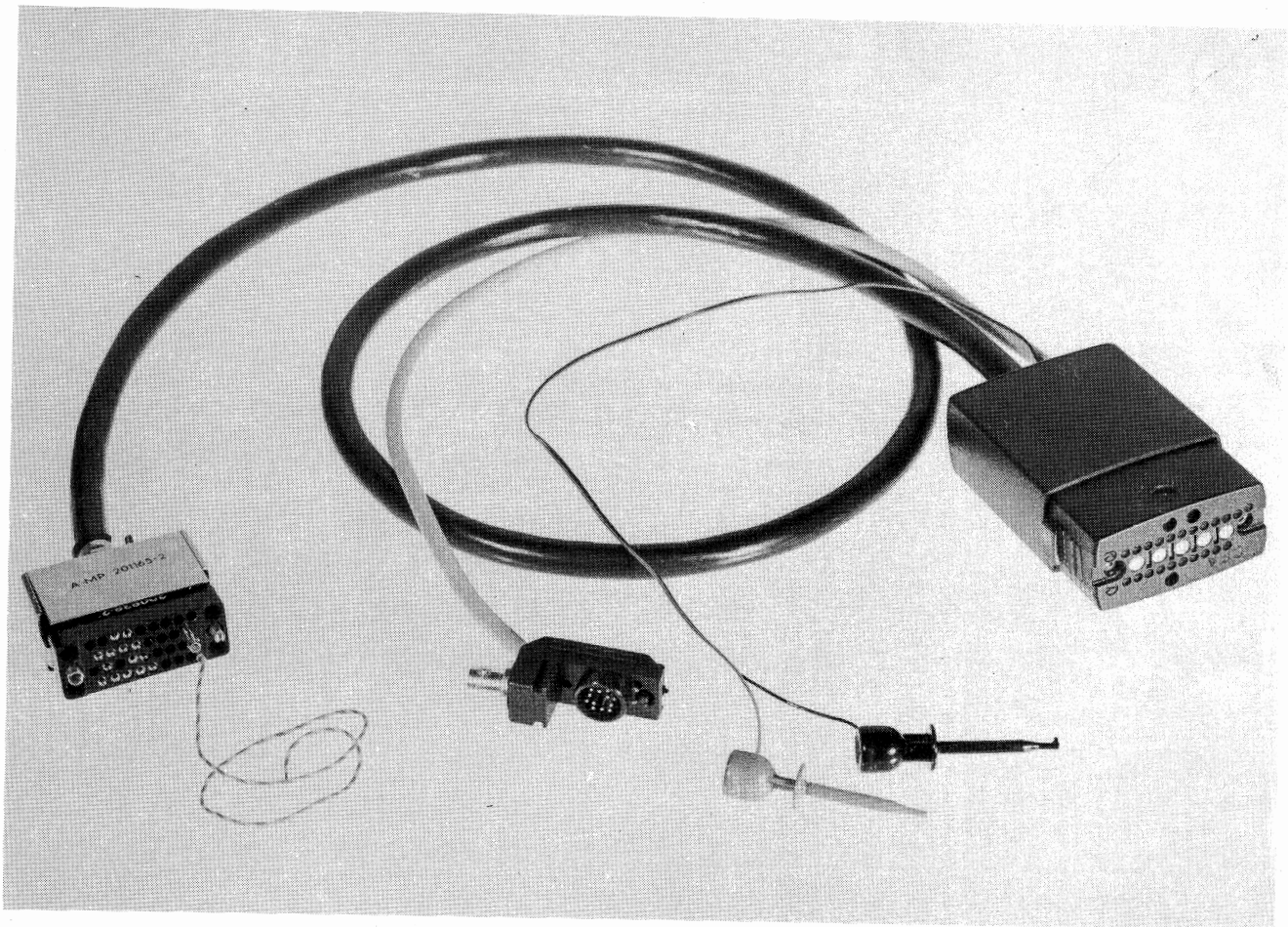


FIG. 4. TEST CABLE 19B0034-00

CQP860/860U

ADJUSTMENT PROCEDURE

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 SI801	code 19B0027
Test cable adaptor SI803	code 41. 0206
Measuring adaptor SI805	code 41. 0221
Antenna alignment unit TS-D37	code 95B0555
RF Test probe	code 95. 0059
DC ampere meter	10 mA/ 100 mA/1 A
DC voltmeter	$Z_{in} = > 0.5 \text{ M}\Omega$
AC voltmeter	$Z_{in} = > 2 \text{ M}\Omega // 50 \text{ pF}$
FM signal generator	420 - 470 MHz
AF generator	$Z_{out} = 600 \Omega$
RF wattmeter	0 - 3 W
Modulation meter	
Distortion meter	
Oscilloscope	
Power supply	0 - 20 V/1 A
	Preset current
	limiter 0 - 1 A
Frequency counter	
Trimming tools	17. 0035-10
	(17. 0053-00)
	17. 0012-00

OPERATING CONTROL UNIT C35

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

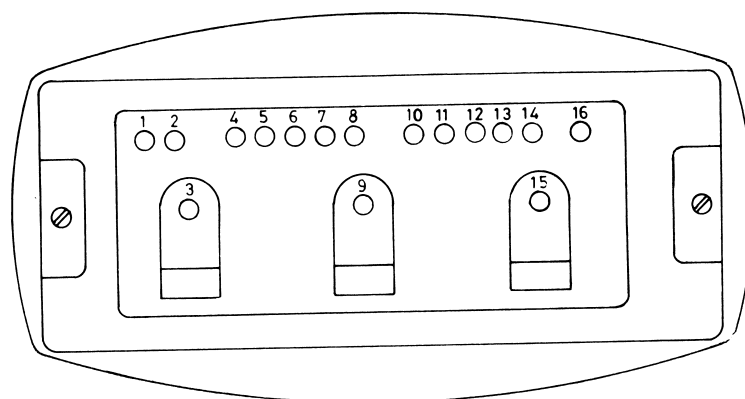
Connections on the front panel.

RF PROBE	Jacks for RF probe.
DCVM	Jacks for DC voltmeter.
AF PROBE	BNC connector for AF probe. Probe consist 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, distortion meter and oscilloscope.
MOD INPUT	BNC connector for AF generator.

Toggle switches

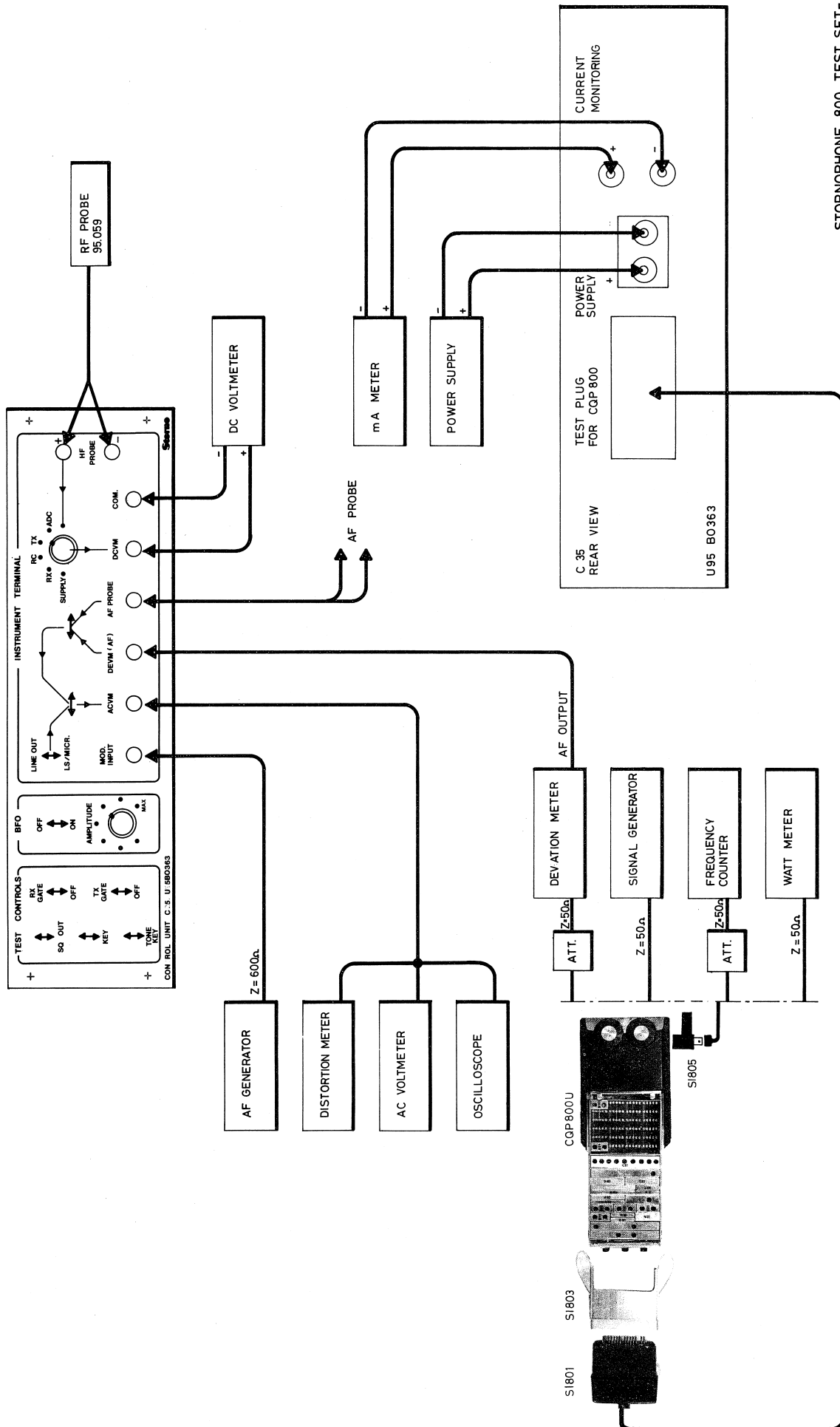
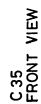
SQ OFF	Disables the squelch circuit of the receiver (loudspeaker continuously open).
KEY	Switches the transmitter on, the receiver off, and connects the AF generator input jack (J13) to the LS/MICR switch.
TONE KEY	Transmitter key for radio sets with tone transmitter.
RX GATE	Switches the transmitter's +7.5 V on/off.
TX GATE	Switches the transmitter's +7.5 V on/off.

		Test Point	Function
ON-OFF	21.4 MHz crystal controlled BFO on/off.	1	+7.5 V TX stabilized
LINE OUT	Switches the AC voltmeter between the receiver line output and the loudspeaker/microphone.	2	+7.5 V RX regulator gate
LS/MICR		3	DC ground (connected to point 15)
		4	ADC voltage
ACVM	Switches the AC voltmeter between the LINE OUT - LS/MICR switch and DEVM (AF) - AF PROBE switch.	5	Audio output - microphone input
switch		6	Tone Key
		7	+7.5 V TX regulator gate
DEVM(AF)	Switches the AC voltmeter input between the deviation meter and the AF probe.	8	+V _B Battery voltage measured after the fuse
switch		9	+11 V Battery
		10	+11 V TX
DEVM	6-position DC voltmeter switch.	11	+7.5 V RX stabilized
switch	1. SUPPLY Voltage	12	Squelch disable
	2. RX +7.5 V stabilized RX voltage.	13	Receiver converter test point
	3. RC Receiver converter test point.	14	21.4 MHz BFO signal input
	4. TX +7.5 V stabilized TX voltage.	15	DC ground (connected to point 3)
	5. ADC voltage	16	Discriminator and Receiver line output.
	6. RF PROBE		
AMPLITUDE	BFO output attenuator.		



BOTTOM VIEW

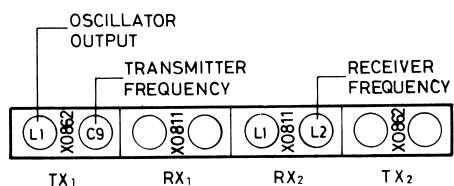
CQP800 TEST POINT LOCATION



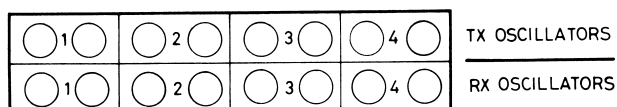
STORNOPHONE 800 TEST SET-UP

D402.537

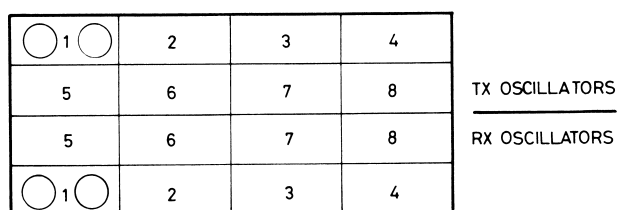
LOCATION OF OSCILLATORS



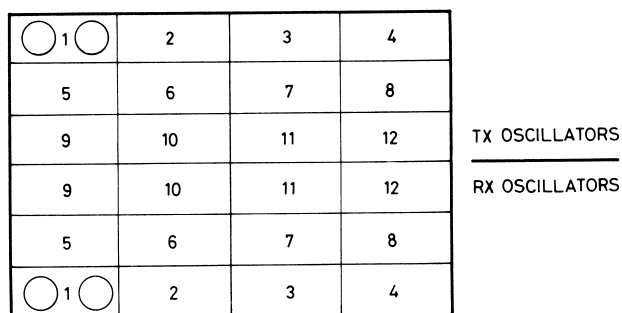
2 CHANNELS (CH803)



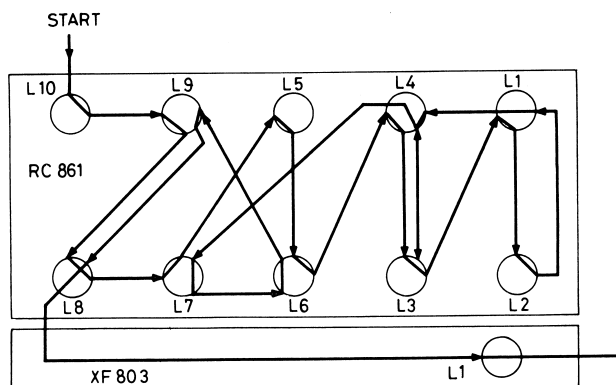
4 CHANNELS (CH804)



8 CHANNELS (CH 805)

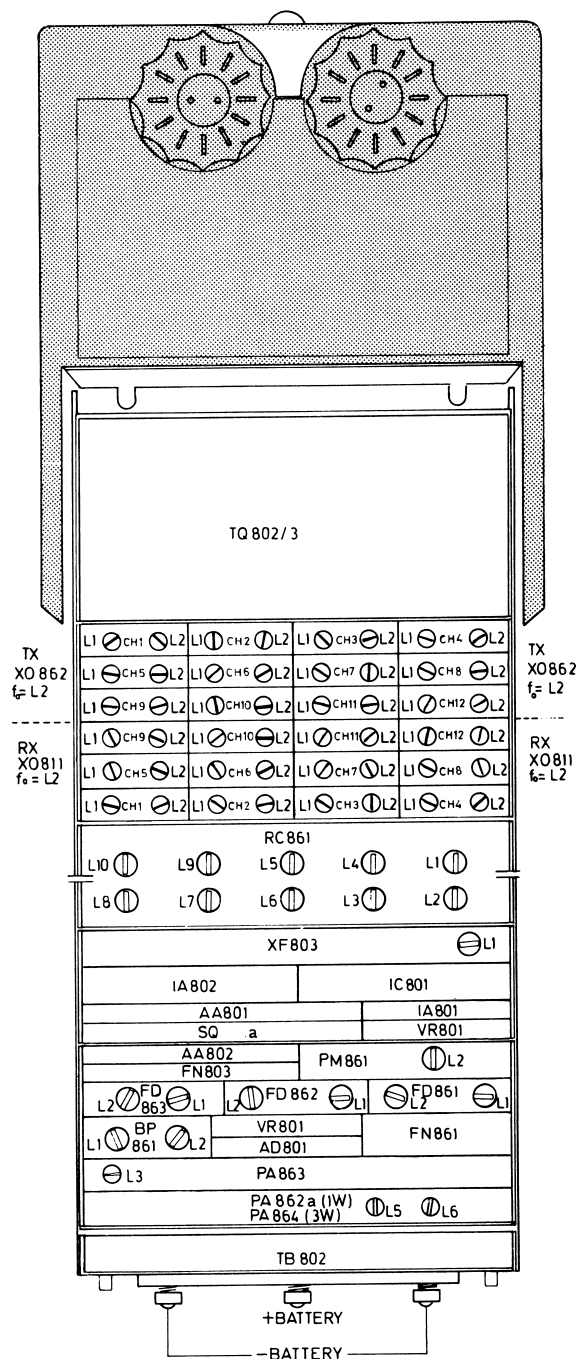


12 CHANNELS (CH806)



RC 861 L7, L9, L10 : Maximum voltage (Vgs)
L1, L2, L3, L4, L5, L6, L7 : Maximum sensitivity
L8 : Minimum distortion.

XF 803 L1 : Minimum distortion.



TRANSMITTER ADJUSTMENT

For location of components see page 11.

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

approx. 6.8 k Ω for 0.1 to 0.5 W output power

approx. 4.7 k Ω for 1 W output power.

approx. 2.7 k Ω for 3.0 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.
Set the current limiter to 1 A.
2. KEY the transmitter.
Read the current drain on the mA meter.
Current drain without output: approx. 70 mA.
Current drain with output: < 800 mA.
3. Unplug the oscillator and read the current drain.

Requirement: < 75 mA
4. Set the DCVM switch to TX.
Read the TX stabilized voltage.

Requirement: 7.5 V \pm 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 PM861 and hold the probe's metal housing against chassis.
Adjust L1 in XO862 for maximum DC voltage, approx. 0.8 V.
Repeat the adjustment on all channels.

Adjustment of Frequency Multiplier and Power Amplifiers

Select center transmitting channel, more than one.

Set the tuning slug in PM861, FD861, FD862, FD863, and BP861 to the approximate position.

High frequency (> 445 MHz) = upper position

Low frequency (< 445 MHz) = lower position

Medium frequency (\sim 445 MHz) = middle position.

KEY the transmitter

6. Adjust the following coils for maximum current drain as seen on the mA meter.

L1 and L2 in FD861

L1 and L2 in FD862

L1 and L2 in FD863

L1 and L2 in BP861

L3 in PA863

Adjust L5 and L6 in PA862a/PA864 for maximum power output.

7. Set DCVM switch to ADC.
Adjust L1 and L2 in FD861 for minimum ADC voltage.
Adjust L1 and L2 in FD862 for minimum ADC voltage.
Adjust L1 and L2 in FD863 for minimum ADC voltage.
Adjust L1 and L2 in BP861 for minimum ADC voltage.
Adjust L3 in PA863 for maximum output.
Adjust L5 and L6 in PA862a/PA864 for maximum output.
Repeat the adjustments under 6 for minimum ADC voltage and maximum power output until no further improvement is obtainable.

8. The output power level can be adjusted by connecting a resistor, R7, in parallel with R6 (see page 11).

The value of R7 is chosen in the following manner:

Nominal Output Power W.	Select R7 for total TX current consumption mA	Power Output Requirement W
0.5	220 ⁺²⁰ / ₋₀	0.5 W \pm 1 dB
1.0	380 ⁺⁴⁰ / ₋₀	1.0 W \pm 1 dB
3.0	750 ⁺⁵⁰ / ₋₀	3.0 W \pm 1 dB

The current adjustment must be made with the power stages fine tuned for maximum output.

Check the output power on all channels.

9. Read the ADC voltage.
Requirement : < 10 V
Typical ADC voltage at 1 W: 5 V
Typical ADC voltage at 3 W: 8 V

Transmitter Frequency Adjustment

10. Connect a frequency counter through an attenuator to the antenna connector.
Set the KEY switch down.
Adjust L2 in XO862 to the channel frequency.
Repeat the adjustment on all channels.
Requirement at 25°C: $\pm 0.5 \times 10^{-6}$.

Checking and Adjustment of Modulator.

11. Connect the deviation meter through an attenuator to the antenna connector.
Set the DEVVM (AF) - AF PROBE switch to DEVVM (AF).
Set the ACVM switch to DEVVM (AF).
Short circuit resistor combination R10//R11 see 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 PM861 for minimum distortion.
Remove the short circuit R10//R11.
12. Set the tone generator output to 6 mV.
Check that Δf max. is not exceeded at frequencies between 300 Hz and 3000 Hz.
If necessary adjust R11//R10. (see fig. page 11).
Set the generator output to $0.7 \times \Delta F$ max. at 1000 Hz.
 ± 3.5 kHz for 25 kHz channel spacing.
 ± 2.8 kHz for 20 kHz channel spacing.
Check the total harmonic distortion on the output of the deviation meter.
Requirement: THD < 7% (without de-emphasis).

RECEIVER ADJUSTMENT

For location of components see page 11.

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.

$$CQP863-R1 = 5.6 \text{ k}\Omega$$

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.

$$I_{\text{total}} : < 100 \text{ mA}$$

3. Set the DCVM switch to RX.
Read the stabilized RX voltage.
Requirement: $7.5 \text{ V} \pm 0.15 \text{ V}$.

Adjustment of Receiver Converter.

4. Set the trimming slugs of L1, L2, L3, L4, L5, and L6 in RC861 to the outer position.
Set the slugs of L7, L8, L9, and L10 to the middle position.

Crystal Oscillator Output Adjustment

Crystal oscillator XO811 is factory adjusted for maximum output into 50 Ω , and output coil L1 is not to be touched.

If the oscillator has been detuned disconnect coaxial cable from XO811 to RC861 at RC861 (terminal 9) and terminate it with a 47 Ω resistor.

Set the DCVM switch to RF PROBE. Tune L1 in XO811 to maximum output as measured with the RF probe connected across the 47 Ω resistor.

Repeat the adjustment on all channels.

Set the DCVM switch to RC.

NOTE: The helix circuits are sensitive to the adjustment tool.

Remove the tool before measuring the result of turning the slugs.

Set the channel selector to the channel closest the center frequency, if more than one.

Adjust L10 in RC861 for maximum DC voltage.

Adjust L9 in RC861 for maximum DC voltage.

Adjust L7 in RC861 for maximum DC voltage.

Set the RX Gate switch to OFF to disable the receiver 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 $0.7 \times \Delta f$ max.

- ± 3.5 kHz for 25 kHz channel spacing.
- ± 2.8 kHz for 20 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 2nd position (II) (approx. 0.5 V 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 L8 in RC861 for best signal to noise ratio.

Adjust L7 in RC861 for best signal to noise ratio.

Adjust L5 in RC861 for best signal to noise ratio.

This is the ONLY adjustment of L5.

The following coils are adjusted for best signal to noise ratio in this order:

L6, RC861

L4, RC861

L3, RC861

L1, RC861

L2, RC861

L1, RC861

L3, RC861

L4, RC861

Readjust L7 in RC861 for best signal to noise ratio.

Readjust L6 in RC861 for best signal to noise ratio.

Readjust L9 in RC861 for maximum DC voltage (2-3 V).

6. Set the signal generator output to approx. 100 μ V e.m.f.
Adjust L8 in RC861 and L1 in XF803 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 receiver's rated audio output power with 12 dB 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% being 12 dB below 100, which was our reference condition.

$$(100 - 6 \text{ dB} = 50, 50 - 6 \text{ dB} = 25).$$

In practice our first condition is achieved by feeding a minimum of 1000 μV of RF-signal modulated with 1000 Hz at $0.7 \times \Delta f \text{ max.}$ 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 %. The meter needle immediately 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. 12 dB SINAD sensitivity.

7. The sensitivity must be minimum 1.0 μV e.m.f.
Typical value: 0.7 μV e.m.f.
Changing the supply voltage from 9.6 V to 13.5 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.

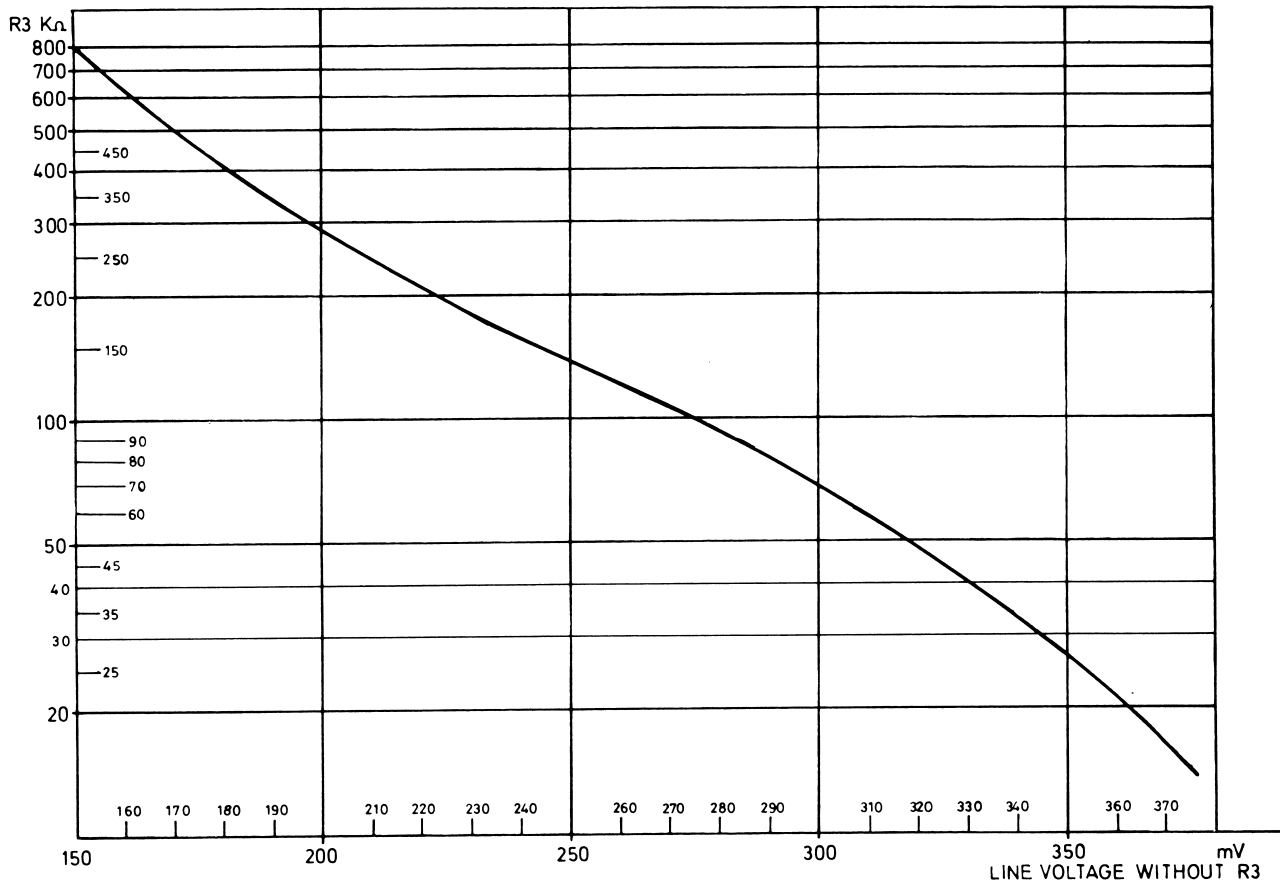
Oscillator Frequency Adjustment.

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 μV 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 XO811 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 Line Voltage

9. Modulate the signal generator with 1 kHz and $0.7 \times \Delta f \text{ max.}$
 $\pm 3.5 \text{ kHz}$ for 25 kHz channel spacing.
 $\pm 2.8 \text{ kHz}$ for 20 kHz channel spacing.
Set the signal generator output to 100 μV e.m.f.
Switch the ACVM to LINE OUT.
Read the AF Line Voltage.
Requirement: $110 \text{ mV}^{+1}_{-0} \text{ dB}$
If necessary change resistor value (R3) in parallel with R2 (IA802, pin 5-6) until 110 mV is obtained. The graph page 9 indicate the value of the resistor, which should be the closest higher standard value.



Checking the AF Frequency Response.

10. Set the signal generator output approx. to 100 μ V e.m.f.
Set LINE OUT - LS/MICR switch down.
Turn the volume switch to the 3rd position (III).
Read the AF voltage on the ACVM (reference).
Set the modulation frequency to 300 Hz.
AF voltage: $+9 \pm 2$ dB rel. to 1000 Hz.
Set the modulation frequency to 3000 Hz.
AF voltage -10 ± 2 dB rel. to 1000 Hz.

11. Turn the volume switch to the 4th position (III).
Check the total harmonic distortion at 1000 Hz.
Requirement: THD = < 7%.

Adjustment and Checking the Squelch Function.

12. Set the volume to the 4th position (III).
Set the SQ OUT switch up.
Increase the signal generator output until the squelch circuit opens the signal path.
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.

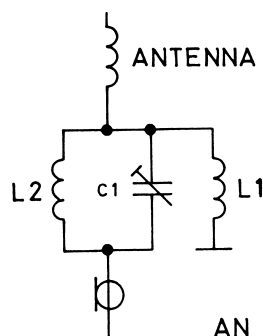
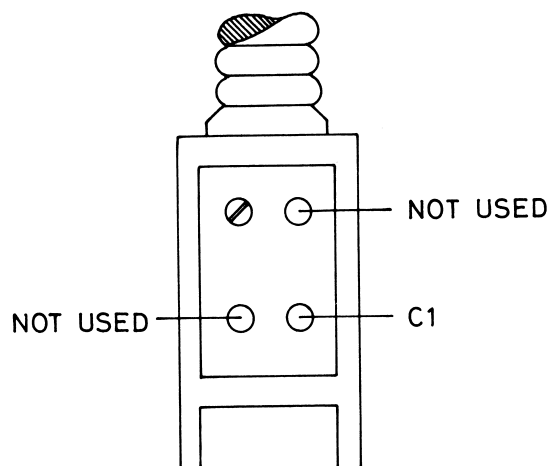
Checking the Overall Receiver Current Drain.

13. Set the DCVM switch to SUPPLY.
Set the supply voltage to 11 V.
Disconnect the signal generator.

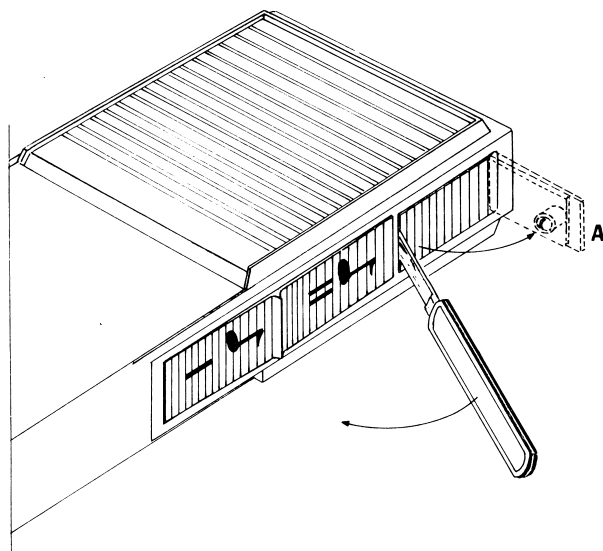
Read the current drain on the mA meter.
 Requirement: $< 9.5 \text{ mA} + \text{current drain of tone equipment.}$
 Set the SQ OUT switch down.
 Set the volume switch to the 4th position (III).
 Read the current drain.
 Requirement: $< 100 \text{ mA.}$

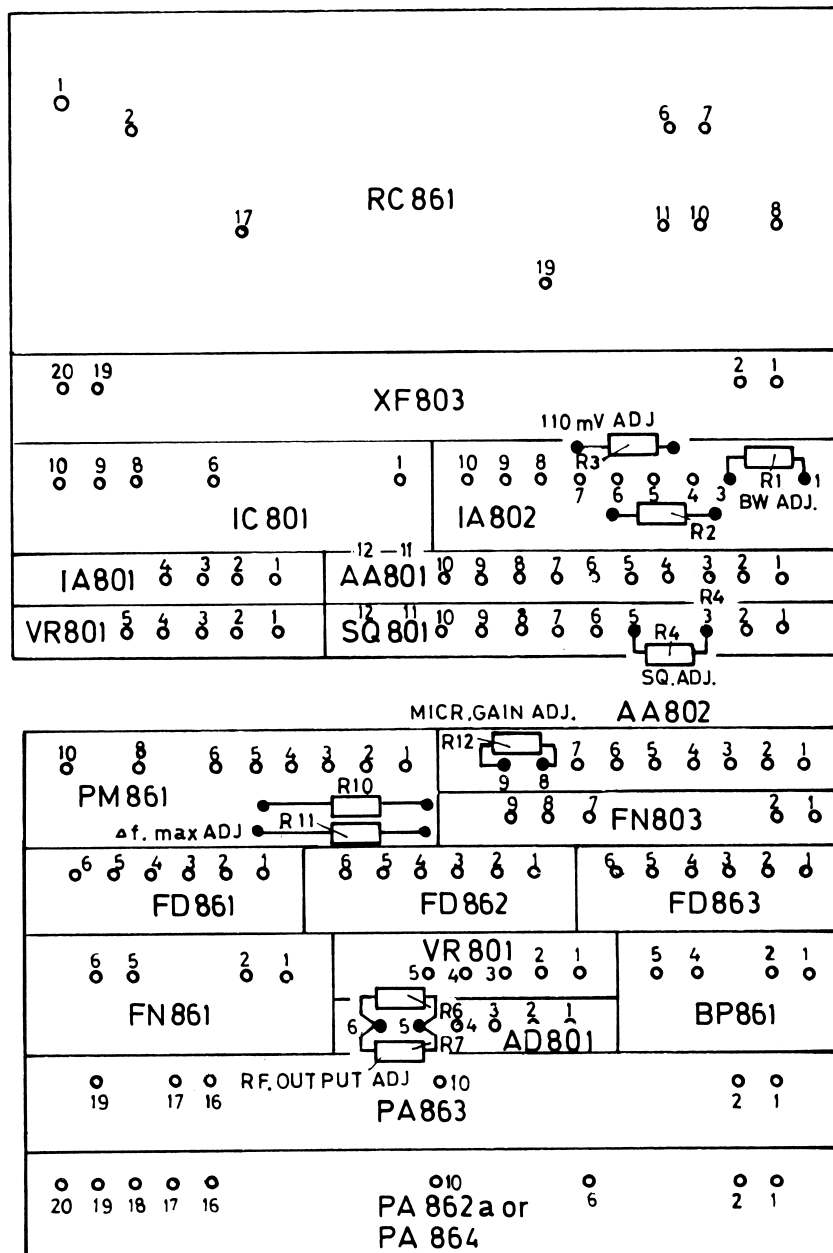
Antenna Network Adjustment

1. Mount cabinet and loudspeaker panel in position.
2. Screw antenna AN864 or AN865 in position.
3. Clip antenna alignment unit TS-D37, code 95B0555, in remote control multiplug on CP808.
4. Raise hinged cover "A" on control head CP808 and remove rubber gasket, thus giving access to the matching network's variable components.
5. Power equipment by means of a battery (f. ex. BU807) and hold in normal operating position.
 Key the transmitter.
6. Adjust C1 for maximum indication on TS-D37.
7. This completes the antenna network adjustment. Replace gasket and snap cover "A" back into position.



AN 864 AND AN 865
 MATCHING NETWORK





SUMMARY

TRANSMITTER ADJUSTMENT

CQP860U

	TEST	ADJUST	INSTRUMENT	READING
1	Supply voltage	Power supply	Voltmeter	11 V
2	Current drain	Check	mA meter	70 - 800 mA
3	Current drain without oscillator	Check	mA meter	< 75mA
4	+7.5 V TX	Check	Voltmeter	+7.5 V \pm 0.15 V
5	Oscillator output	XO862 - L1	95.059 + VM	maximum
6	Current drain	FD861 - L1, L2 FD862 - L1, L2 FD863 - L1, L2 BP861 - L1, L2 PA863 - L3	mA meter	maximum
7	Power output ADC voltage	FD861 - L1, L2 FD862 - L1, L2 FD863 - L1, L2 BP861 - L1, L2 PA863 - L3 or PA862a - L5, L6 PA864 - L5, L6	Voltmeter Wattmeter	minimum ADC voltage < 10V 0.1 - 1 W } maximum power 1 - 3 W } output
8	Current drain		mA meter	approx. 0.5 W - < 240mA approx. 1 W - < 420mA approx. 3.0 W - < 800mA
9	Frequency	XO862 L2	Frequency counter	$f_{ant} \pm 0.5 \times 10^{-6}$
10	Modulator	PM861 - L2	AF Generator Deviation meter Distortion meter	minimum distortion
11	6 mV AF input	R11 - R10	AF Generator Deviation meter Distortion meter	0.7 x ΔF max., $f_{mod} = 1$ kHz THD = < 7%
12	Antenna network	C1	TS-D37 code 95B0555	maximum indication

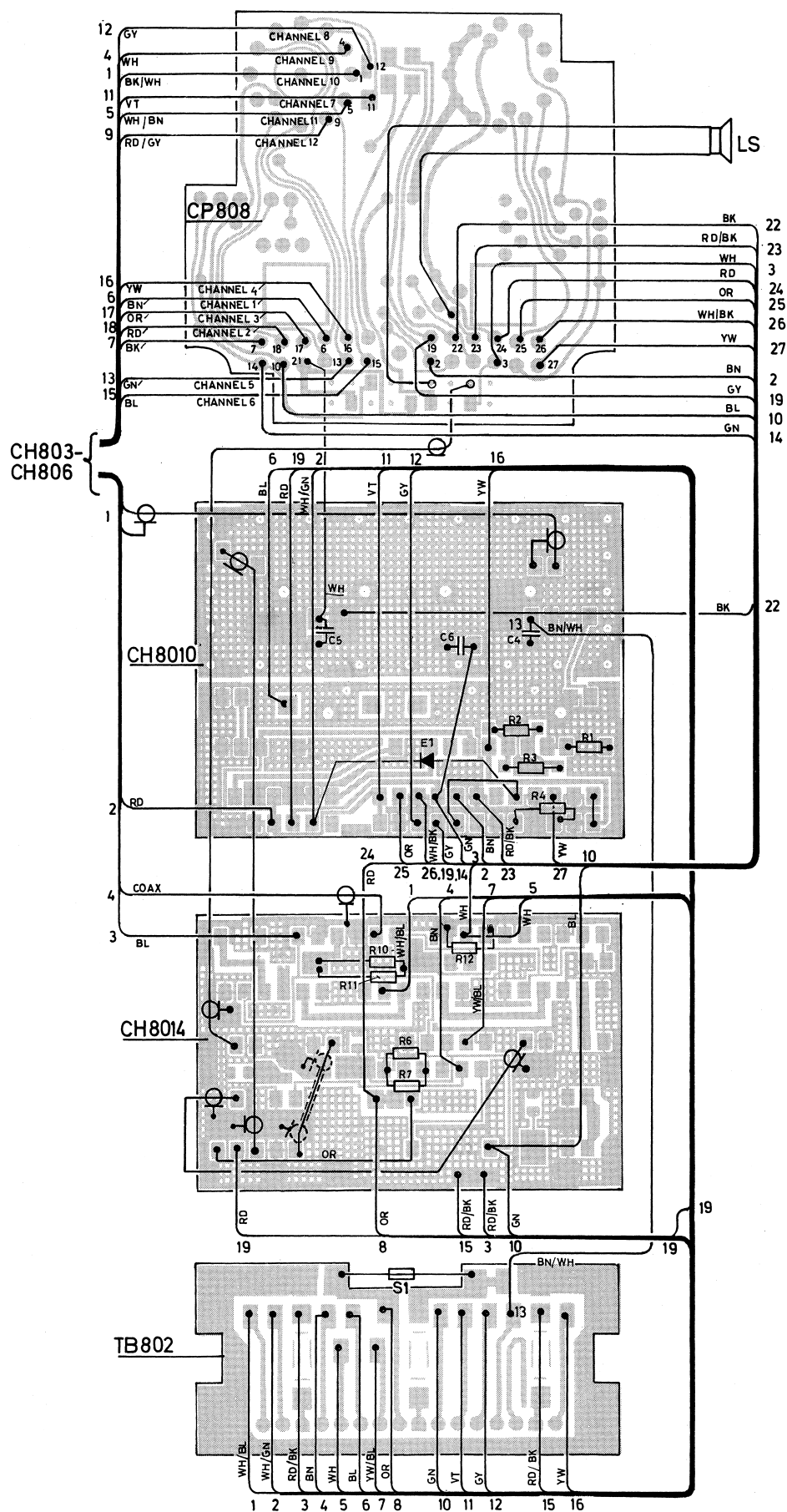
SUMMARY

RECEIVER ADJUSTMENT

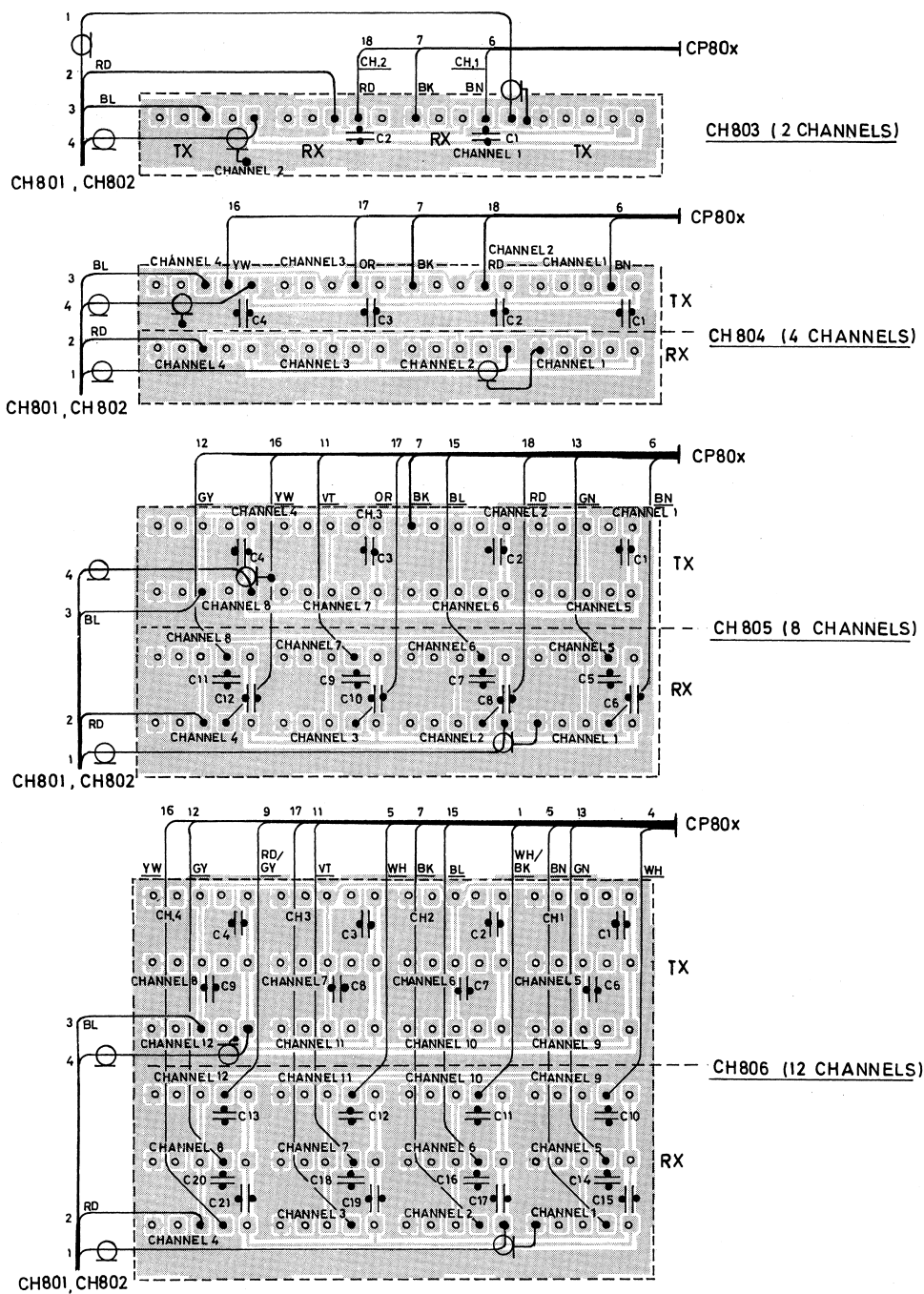
CQP860U

	TEST	ADJUST	INSTRUMENT	READING
1	Supply voltage	Power supply	DC voltmeter	11 V
2	+ 7.5 V RX	Check	Voltmeter	+ 7.5 V \pm 0.15 V
3	Current drain	Check	mA meter	< 100 mA
4	RC test point without oscillator	RC861 - L10, L9, L7	DC voltmeter	maximum -0.1 V
5	Receiver sensitivity	RC861 - L8, L7, L5 L3, L4	RF Generator Distortion meter	minimum distortion
		L6, L9	DC voltmeter Distortion meter	maximum minimum
6		RC861 - L8 XF803 - L1	RF Generator high output	minimum distortion
7	Sensitivity	Check		12 dB SINAD < 1.0 μ V e.m.f.
8	Frequency	XO811 - L2	RF Generator 21.4 MHz BFO oscilloscope	zero beat
9	Line output	IA802 (R3)	RF Generator (high output) AC voltmeter	110 mV AF
10	AF Response	Volume to 3rd position (III)	RF Generator (high output) AC Voltmeter	300 Hz: + 9 \pm 2 dB 1000 Hz: 0 dB 3000 Hz: -10 \pm 2 dB
11	Distortion	Check	Distortion meter	THD = < 7%
12	Squelch	R4	RF Generator	opens at 10 - 12 dB SINAD
13	Current drain	Volume to pos. 4 (IIII)	mA meter	no signal; Sq. off < 9.5 mA no signal; Sq. on <100mA

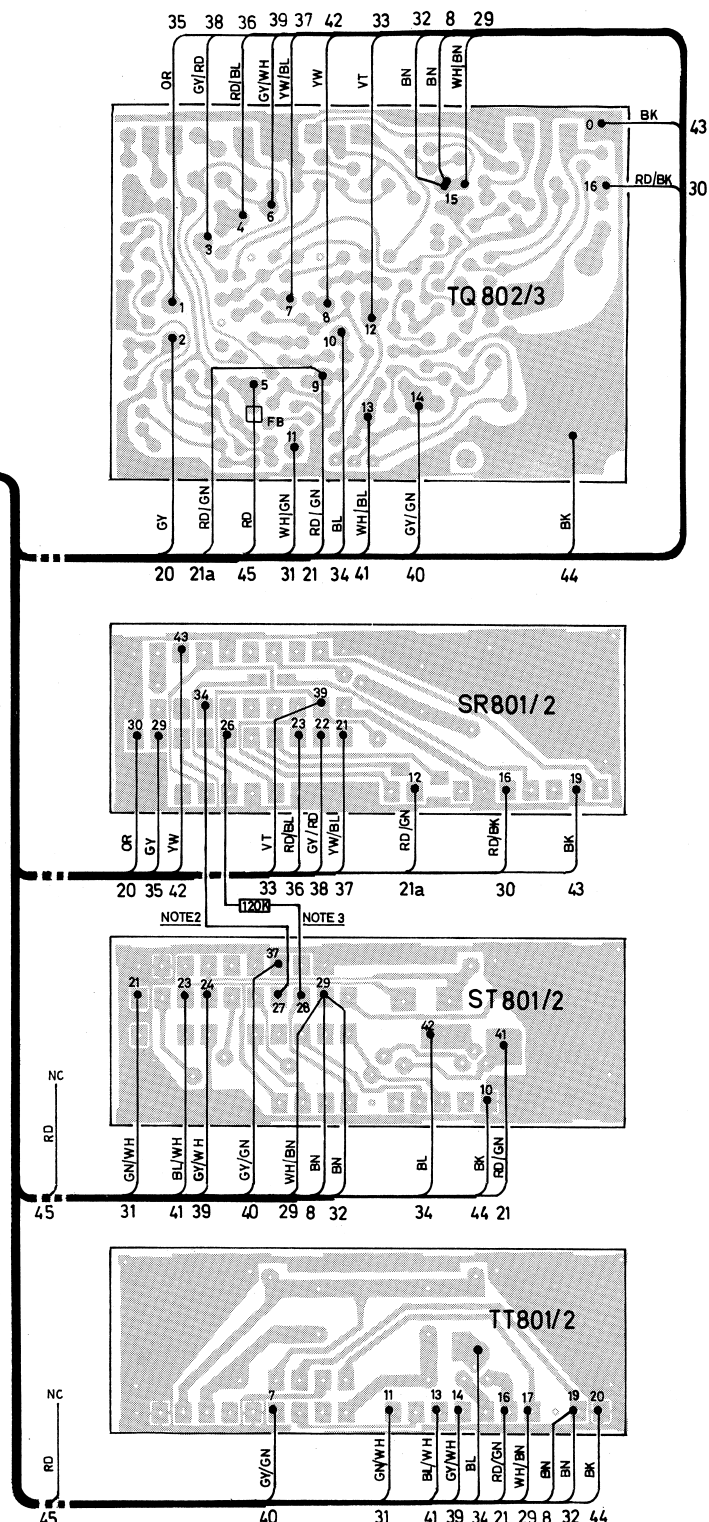




WIRING DIAGRAM CQP860U



WIRING DIAGRAM CH803, CH804, CH805, CH806

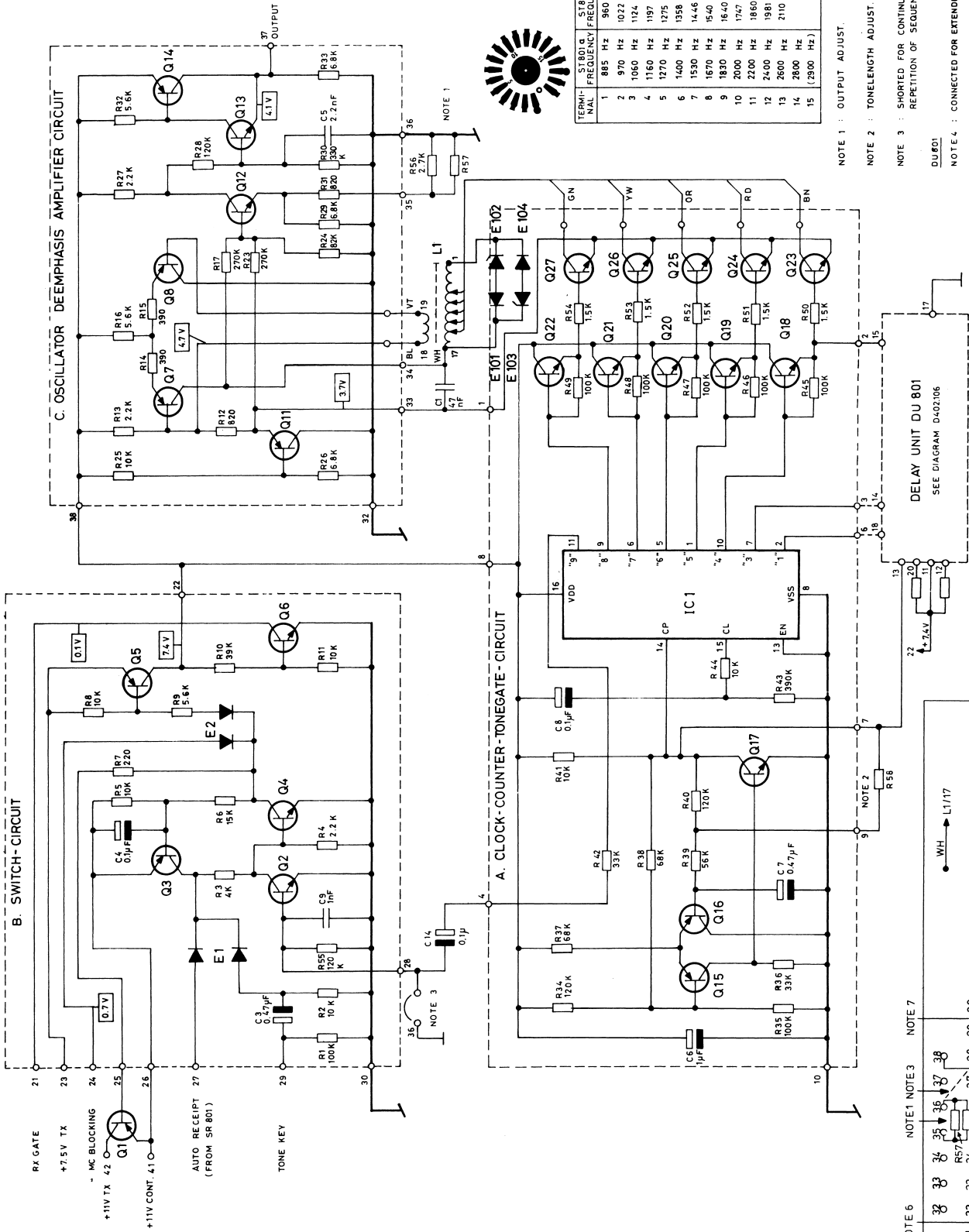


NOTE 1. WHEN ST801/2 IS TO BE USED FOR IDENTIFICATION
THE BROWN WIRE AT TERMINAL 8 CP808 SHOULD
BE MOVED TO TERMINAL 10.

NOTE 2. SHORT CIRCUIT FOR AUTOMATIC RECEIPT.

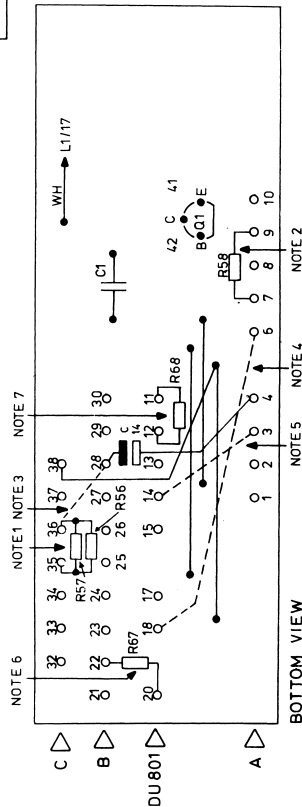
NOTE 3. FOR SR801/2 AND ST801/2 A RESISTOR, 120 K Ω , 5 $\frac{1}{2}$ W, 1/10W
IS INSTALLED.

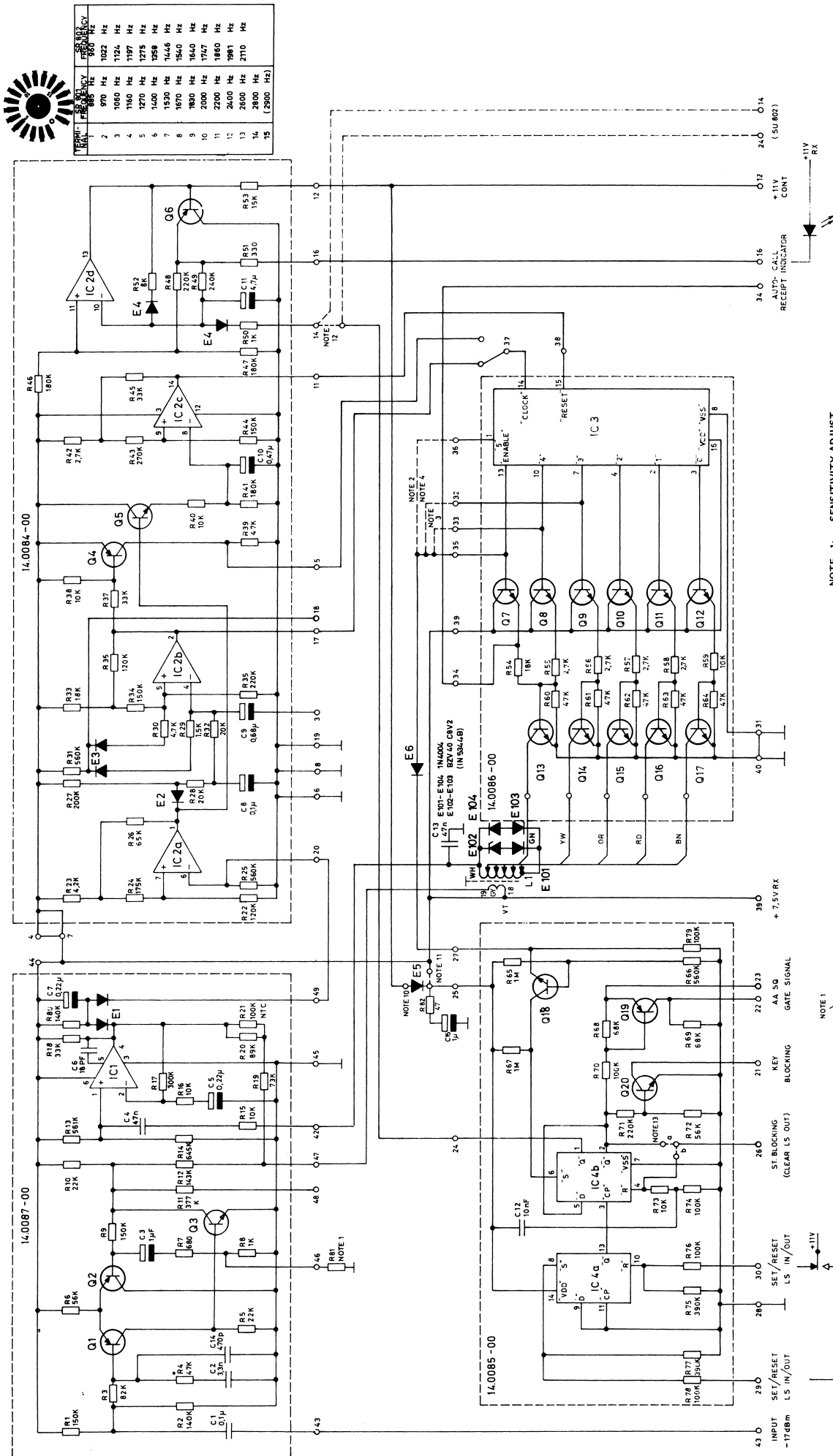
NOTE 4. DIODE ONLY TO BE INSTALLED IN CQP 863U WITH ST801



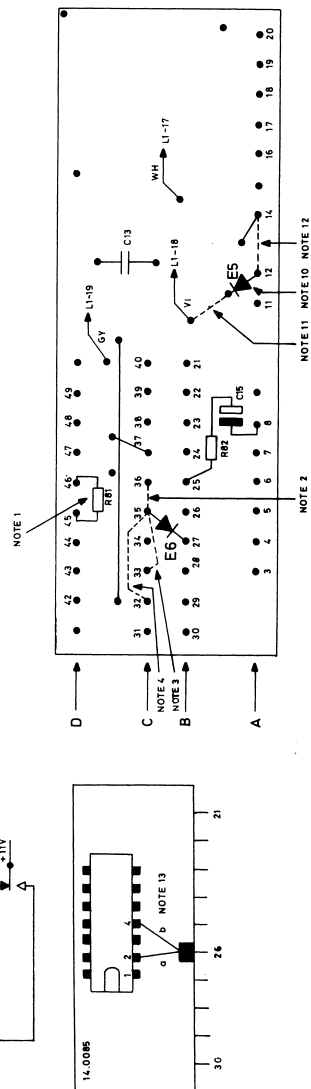
SEQUENTIAL TONE TRANSMITTER ST801a-ST802a - IS

D402.629





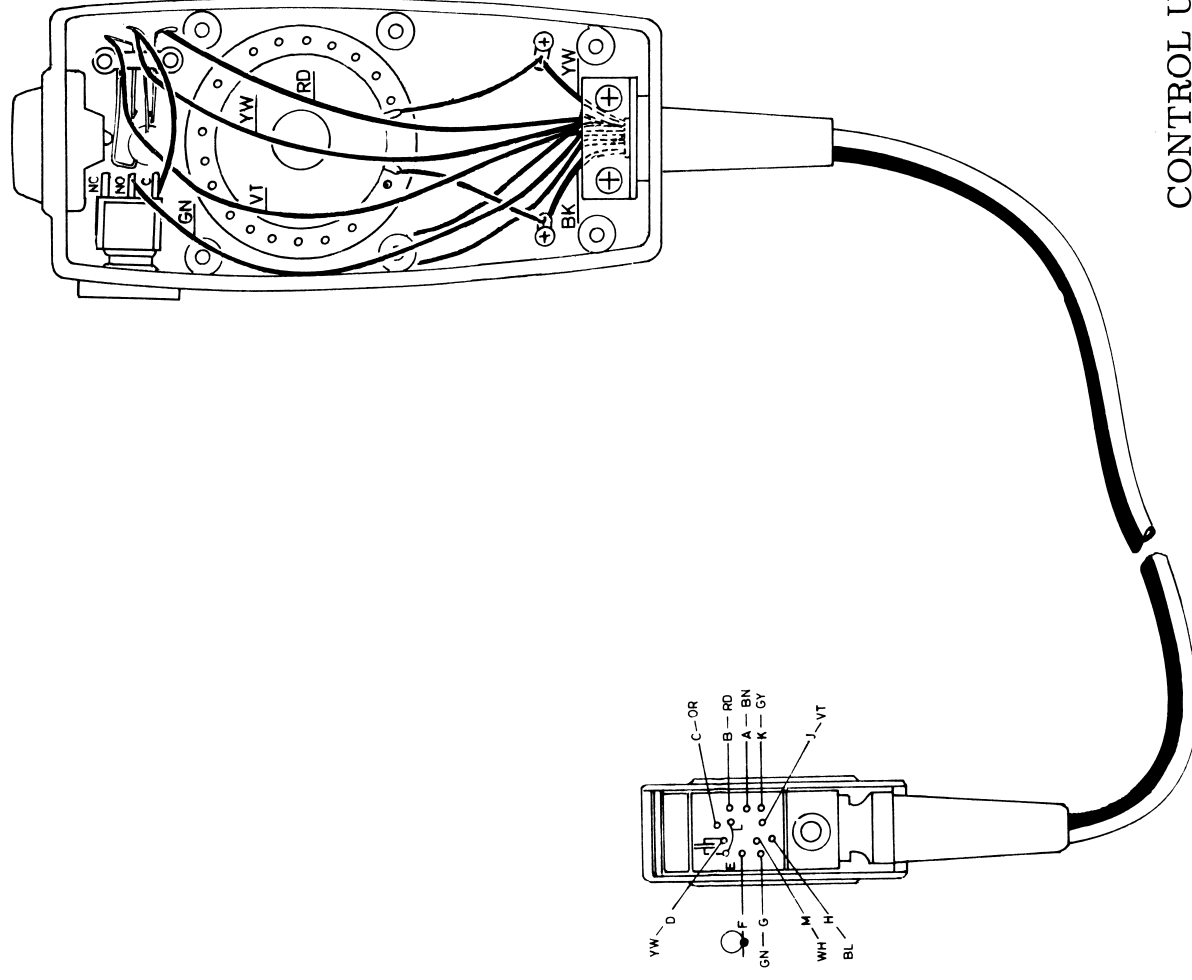
- NOTE 1: SENSITIVITY ADJUST
 NOTE 2: SHORTED FOR 5-TONE SEQUENCE CALL
 NOTE 3: SHORTED FOR 4-TONE SEQUENCE CALL
 NOTE 4: SHORTED FOR 3-TONE SEQUENCE CALL
 NOTE 10: REMOVE IN CRP800
 NOTE 11: SHORTED IN CRP800
 NOTE 12: OPEN IN CRP800 WITH SU802
 NOTE 13: IN CRP800 WITH SU802 THE CONNECTION TO TERMINAL 26 IS MOVED FROM a TO b.



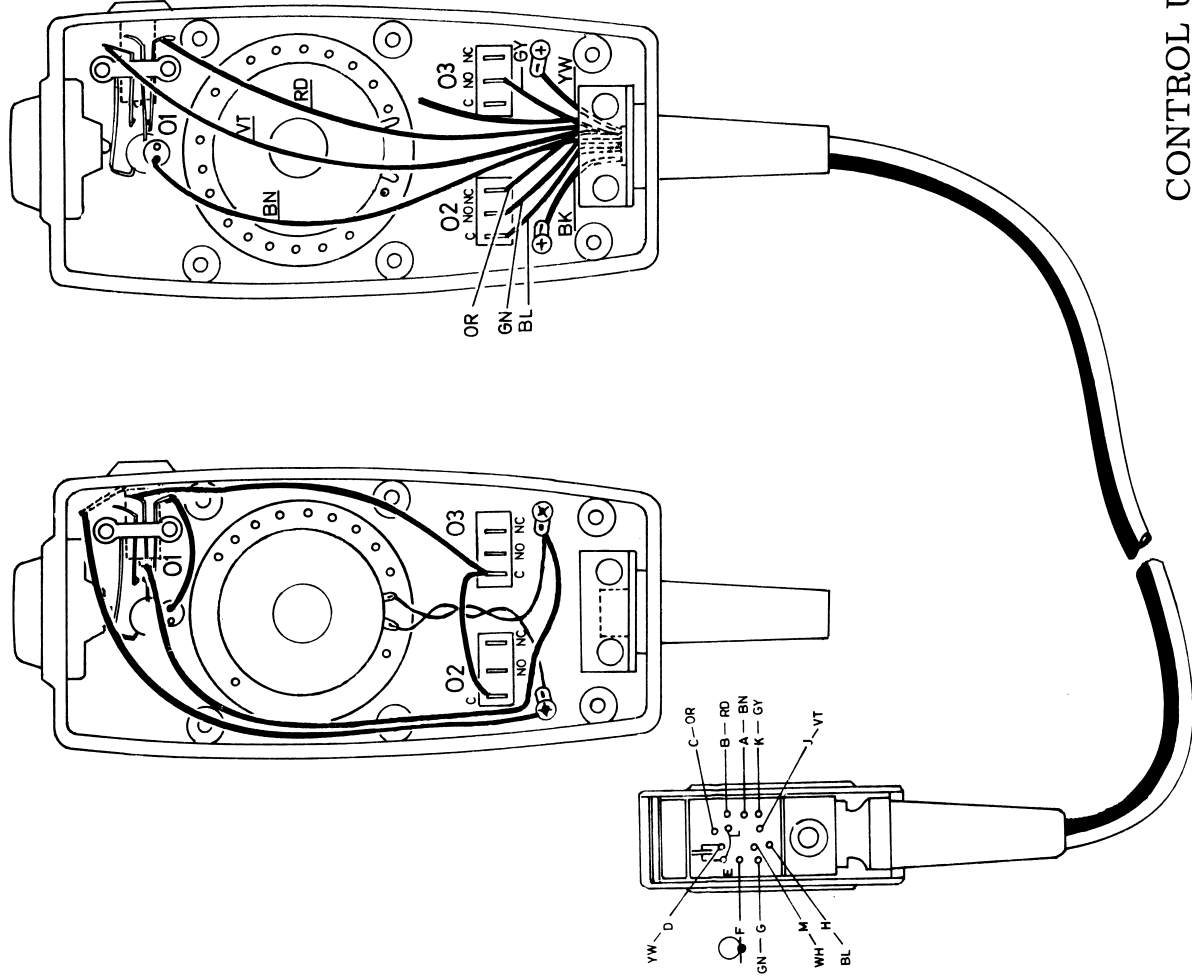
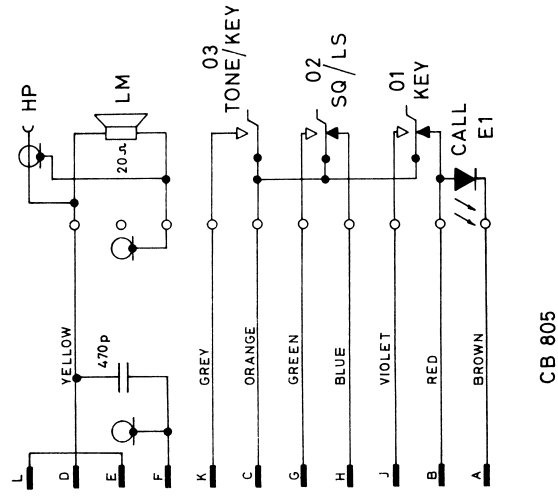
SEQUENTIAL TONE RECEIVER SR801-SR802-IS

D402.630

CB 804



CONTROL UNIT CB804



CONTROL UNIT CB805

D 402.526/2

Storno

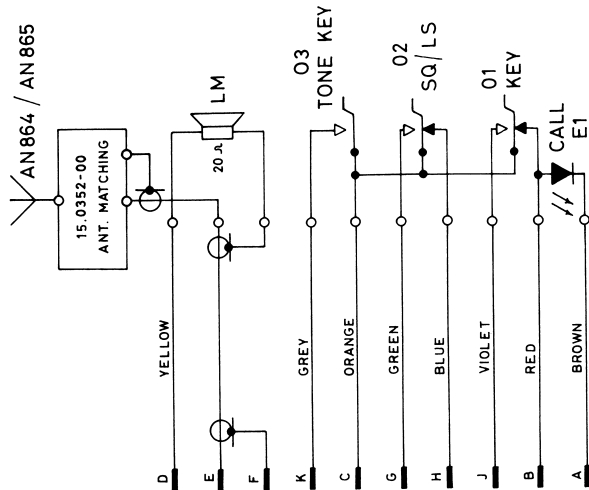
TYPE	Nº	CODE	DATA
CB805	01 02 03 LM	10. 3603 47. 5033 47. 0635 47. 0635 96. 5086	Control Unit Switch, Key Switch, SQ/LS Switch, Tone Key Microphone, dynamic 20 Ohm

Storno

TYPE	Nº	CODE	DATA

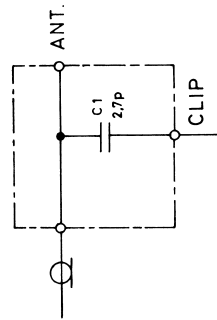
CONTROL UNIT CB805

X402. 565

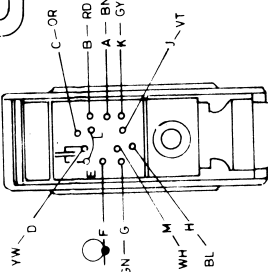
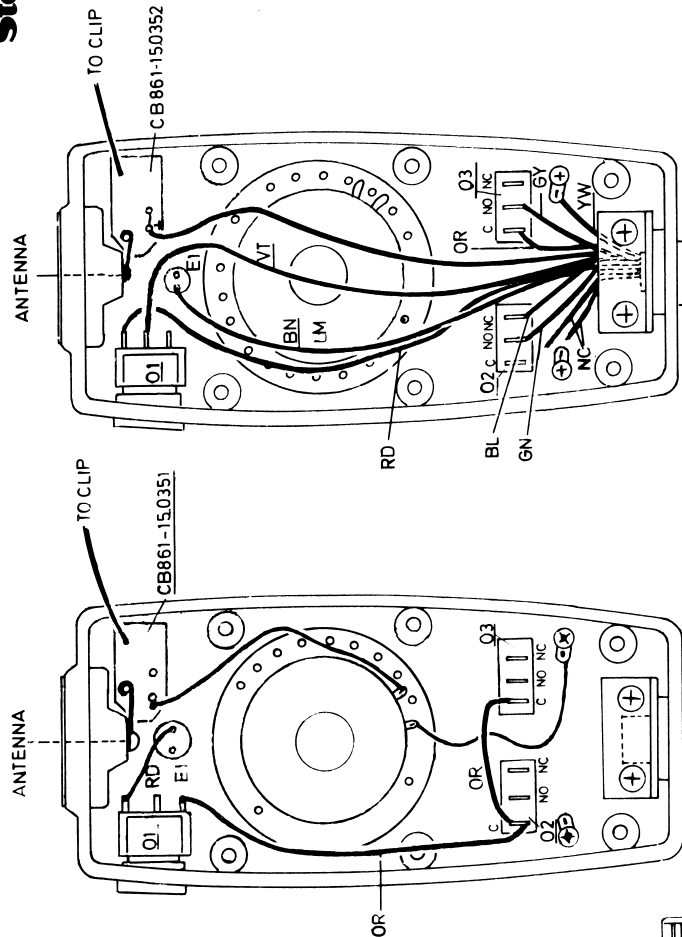
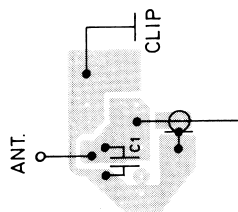


CB 861

CB 861 (420 - 470 MHz)



ANTENNA MATCHING NETWORK



CONTROL UNIT CB861

Storno

TYPE	Nº	CODE	DATA
CB861		10. 3607	Control Unit (420-470 MHz)
	01	47. 0635	Switch, Key
	02	47. 0635	Switch, LS/SQ
	03	47. 0635	Switch, Tone Key
	E1	99. 5339	Light Emitting Diode
	LM	96. 5086	Microphone, dynamic 20 Ohm
	C1	15. 0352	Antenna Matching Network
		74. 5300	2. 7pF ± 0. 25pF ceram PL 63V

Storno

TYPE	Nº	CODE	DATA

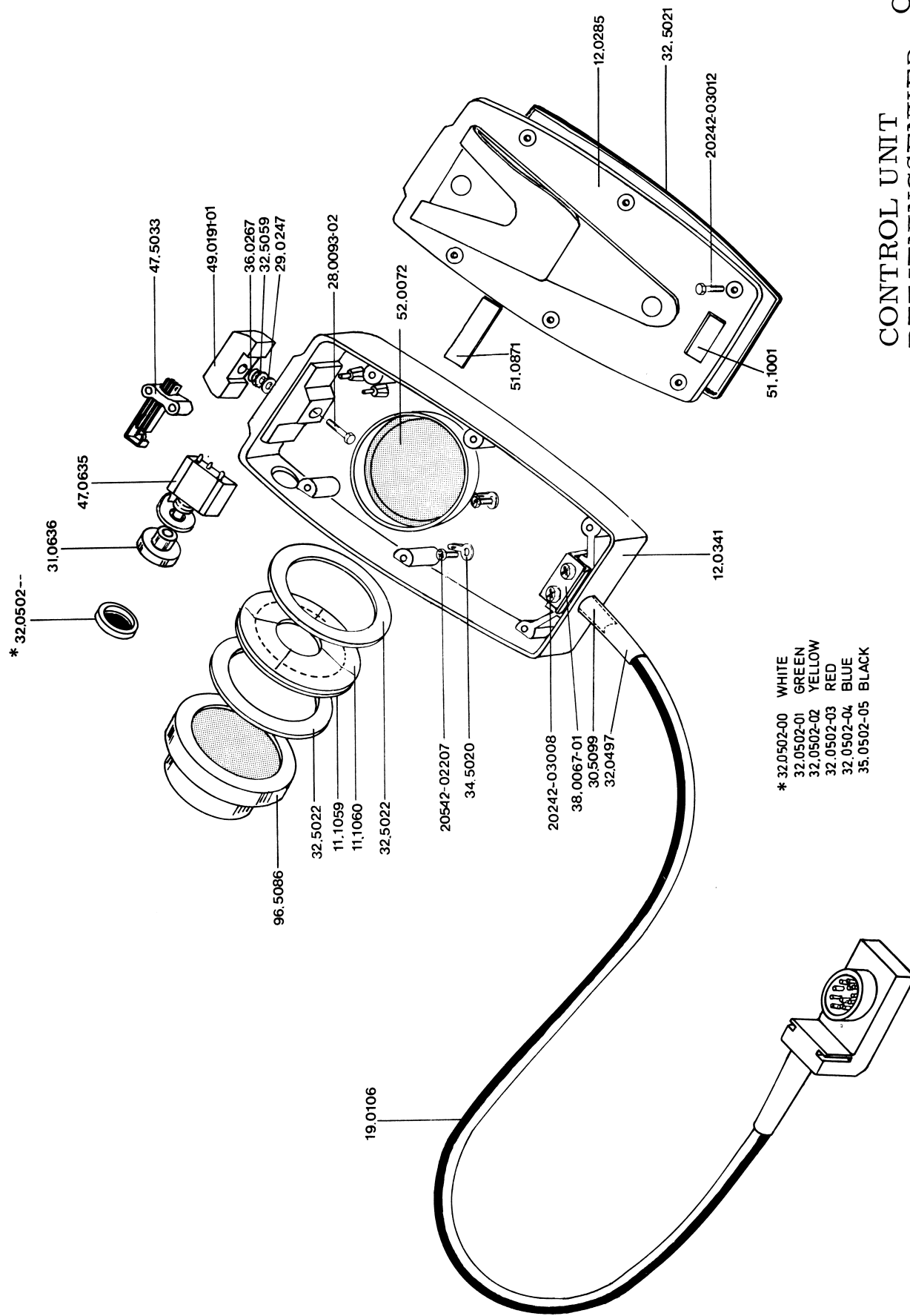
CONTROL UNIT CB861

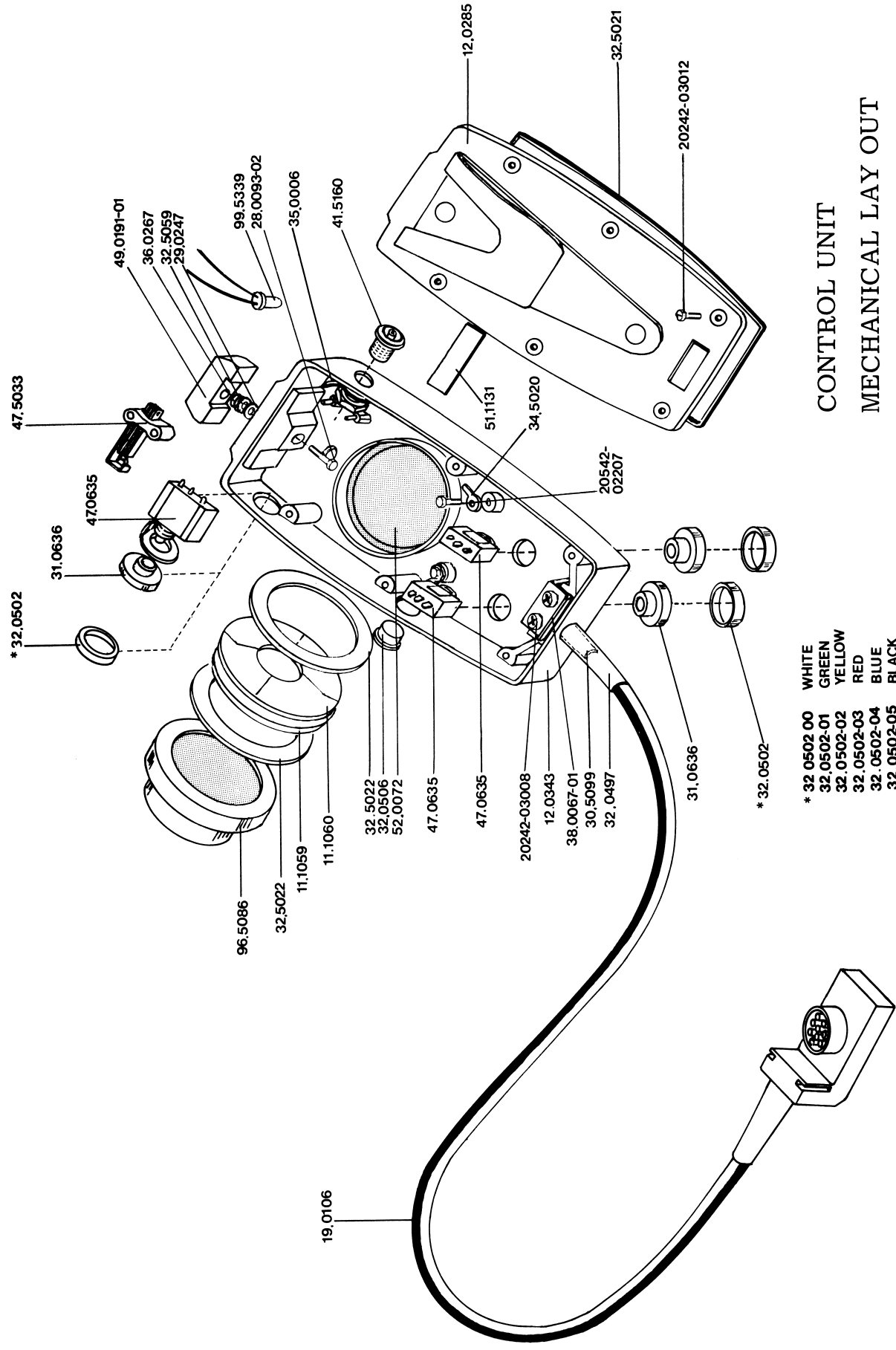
X402. 568

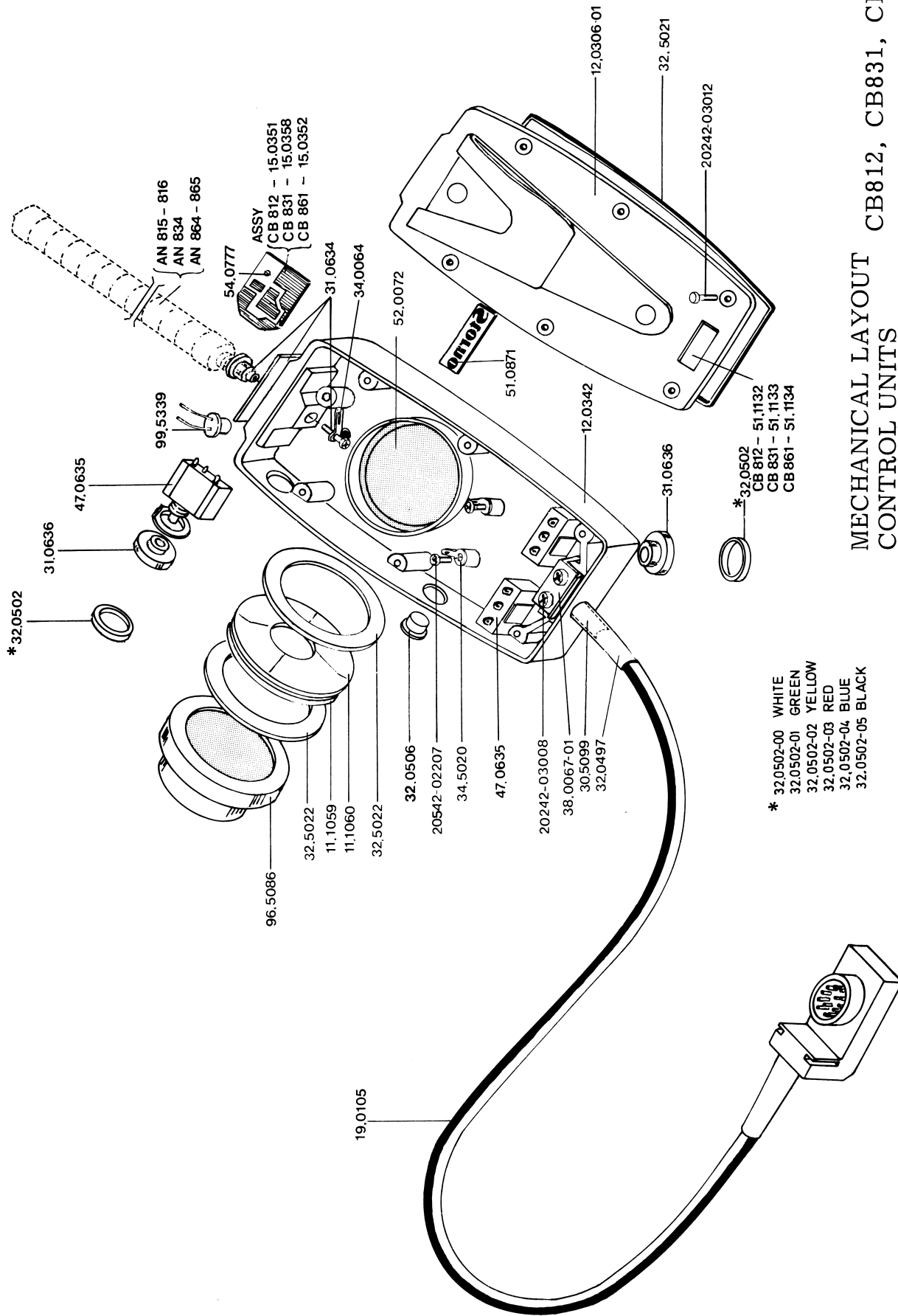
CONTROL UNIT BETJENINGSENHED

CB804

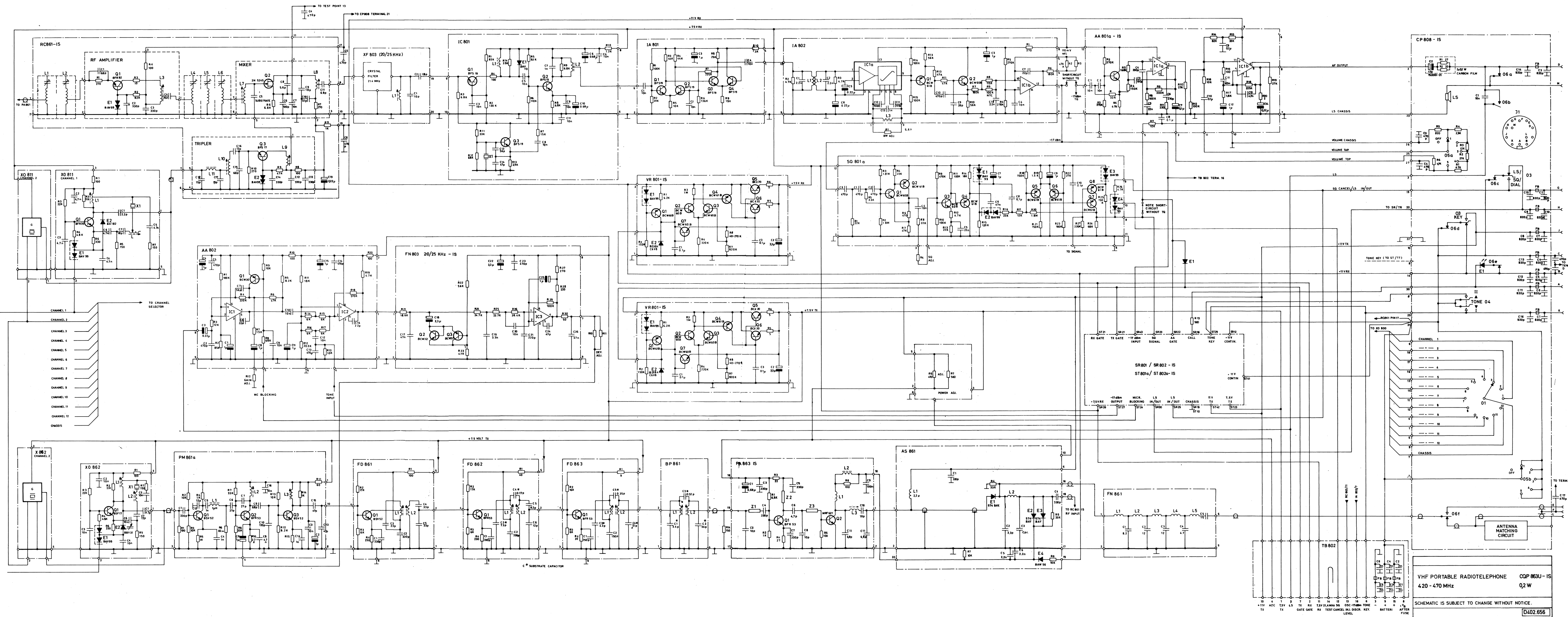
M405.086/2







MECHANICAL LAYOUT CB812, CB831, CB861
CONTROL UNITS



VHF PORTABLE RADIOTELEPHONE QCP 863U-IS
420 - 470 MHz 0.2 W

SCHEMATIC IS SUBJECT TO CHANGE WITHOUT NOTICE.

D402.656

ADJUSTMENT PROCEDURE

CQP863/CQP864U

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 SI801	Code 19B0027
Test cable adaptor SI803	Code 41.0206
Measuring adaptor SI805a	Code 41.0221-01
Loudspeaker 25 ohm	Code 97.5039
Antenna alignment unit TS-D37	Code 95B0555
RF test probe	Code 95.0059
DC ampere meter	10 mA/100 mA/1 A
DC voltmeter	$Z_{in} > 0.5 \text{ Mohm}$
AC voltmeter	$Z_{in} > 2 \text{ Mohm} // 50 \text{ pF}$

FM signal generator	420 - 470 MHz
AF generator	$Z_{out} = 600 \text{ ohm}$
RF wattmeter	0 - 3 W
Modulation meter	
Distortion meter	
Oscilloscope	
Power supply	0 - 20 V/1 A
	Preset current limiter 0 - 1 A
E-12 resistor box	code 95B0470
Power supply (only CQP864U)	0 - 10 V
Frequency counter	
Trimming tools	17.0035-10 (17.0053-00) 17.0012-00

OPERATING CONTROL UNIT C35

The control unit and test cable C35 are designed for testing and adjusting STORNOPHONE 800/800U. 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.

CONNECTION ON THE REAR PANEL

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

CURRENT MONITOR

AUDIO MONITOR	Jacks for current monitor. BNC connector for external 25 ohm loudspeaker
---------------	--

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.
DEV (AF)	BNC connector for the AF output of the deviation meter.
ACVM	BNC connector for the AF voltmeter, distortion meter and oscilloscope.

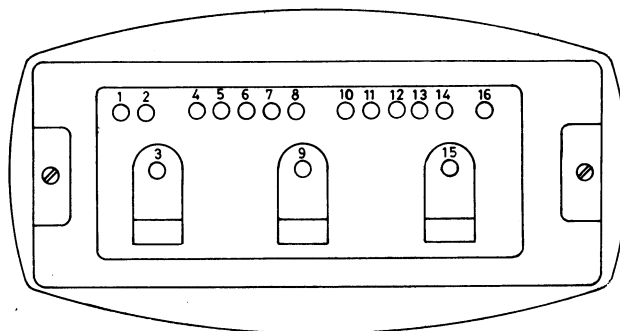
MOD INPUT	BNC connector for the AF generator.
TOGGLE SWITCHES	
SQ OFF	Disables the squelch circuit of the receiver (loudspeaker continuously open).
KEY	Switches the transmitter on, the receiver off, and connects the AF generator input jack to the LS/MICR switch.
TONE KEY	Transmitter key for radio sets 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	Switches the AC voltmeter between the LINE OUT and LS/MICR.
ACVM	Switches the AC voltmeter between the LINE OUT - LS/MICR switch and DEVM (AF) - AF PROBE switch.
DEVM (AF) switch	Switches the AC voltmeter input between the deviation meter and the AF probe.

SELECTORS AND CONTROLS

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.

LIST OF TEST POINTS

Test Point	Function
1	+7.5 V TX stabilized
2	+7.5 V RX regulator gate
3	DC ground (connected to point 15)
4	ADC voltage
5	Audio output - microphone input
6	Tone Key
7	+7.5 V 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 signal input
15	DC ground (connected to point 3)
16	Discriminator and receiver line output



BOTTOM VIEW

Fig. 1. TEST POINT LOCATION

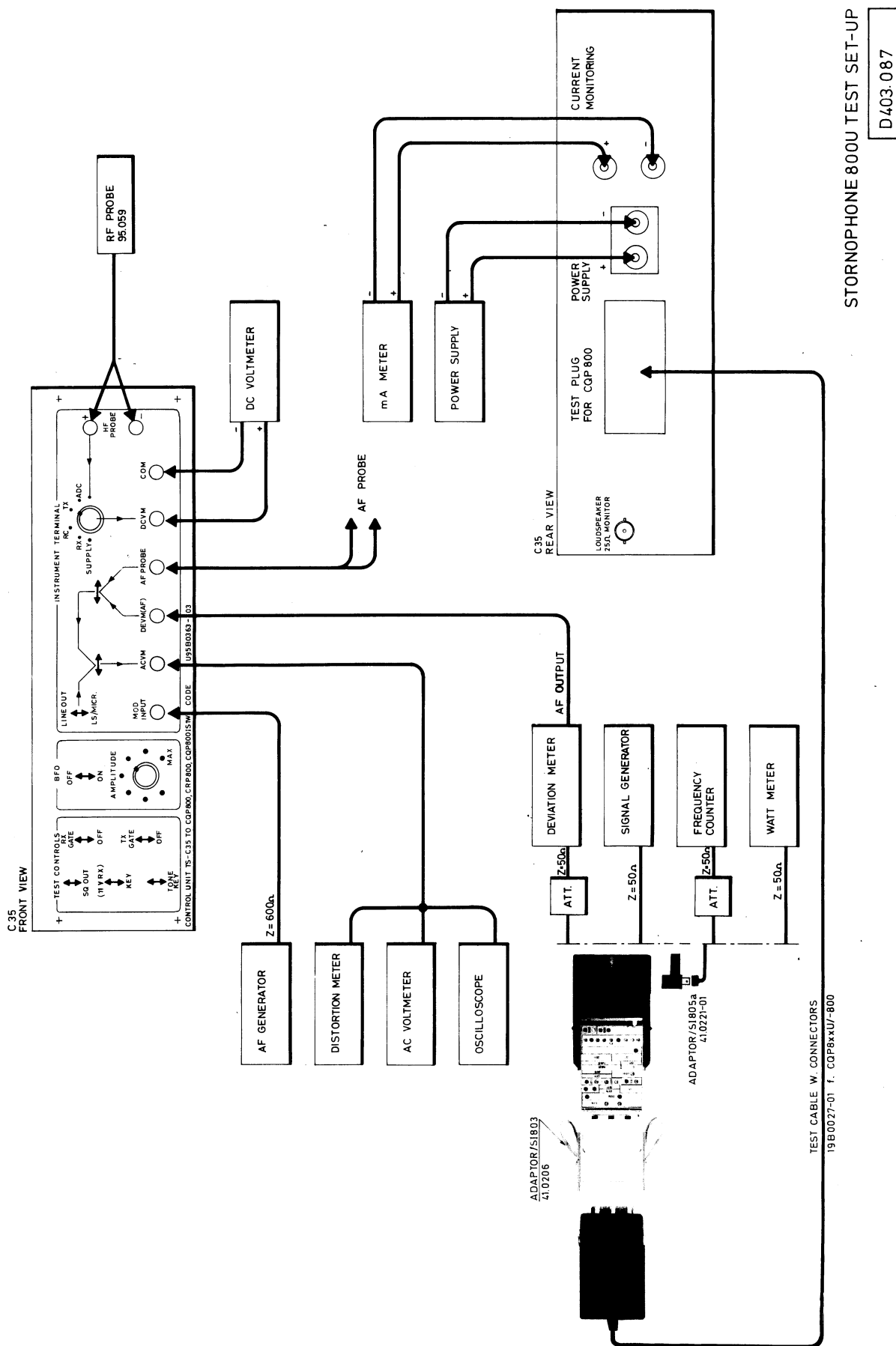


Fig. 2. TEST SET-UP

TEST SET-UP AND LOCATION OF COMPONENTS

The Control Unit C35, the Test Cable SI801, and Adaptor SI803 is connected to the CQP800(U) under test. For CQP800U models is used a BNC adaptor SI805a for connecting various instruments to the multiwire socket. This SI805a adaptor switches the CQP800U to remote mode when plugged into the socket. An external loudspeaker for monitoring the

receiver signal is connected to the AUDIO MONITOR output on the rear. The microswitch on the SI805a is the LS in/out - Sq. cancel button.

For CQP800 models adaptor 41.0201 provides a BNC connection for the measuring instruments.

TRANSMITTER ADJUSTMENTS

For location of components see fig. 3 and fig. 7/8.

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

approx. 6.8 Kohm for 0.1 to 0.5 W output power
approx. 4.7 Kohm for 1 W output power
approx. 2.7 Kohm for 3 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 multiconnector socket via adaptor SI805a.
Adjust the power supply to 11 V.
Set the current limiter to 1 A.
2. KEY the transmitter.
Read the current drain on the mA meter.
Current drain without output: approx. 70 mA.
Current drain with output: <800 mA.

3. Unplug the oscillator and read the current drain.

Requirement: <75 mA.

4. Set the DCVM switch to TX.

Read the TX stabilized voltage.

Requirement: 7.5 V \pm 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 PM861 and hold the probe's metal housing against chassis.

Adjust L1 in XO862 (XO865) for maximum DC voltage, approx. 0.8 V.

Repeat the adjustment on all channels.

ADJUSTMENT OF FREQUENCY MULTIPLIERS AND POWER AMPLIFIERS

Select the channel closest to the center frequency, if more than one.

Set the tuning slugs in PM862, FD861, FD862, FD863, and BP861 to the approximate position:
High frequency (>445 MHz) = outer position
Low frequency (<445 MHz) = inner position
Medium frequency (~445 MHz) = middle position.

KEY the transmitter.

6. Adjust the following coils for maximum current drain as seen on the mA meter.

L1 and L2 in FD861.

L1 and L2 in FD862.

L1 and L2 in FD863.

L1 and L2 in BP861.

L3 in PA863

Adjust L5 and L6 in PA862a/PA864 for maximum power output.

7. Set DCVM switch to ADC.

Adjust L1 and L2 in FD861 for minimum ADC voltage.

Adjust L1 and L2 in FD862 for minimum ADC voltage.

Adjust L1 and L2 in FD863 for minimum ADC voltage.

Adjust L1 and L2 in BP861 for minimum ADC voltage.

Adjust L3 in PA863 for maximum output.

Adjust L5 and L6 in PA862a/PA864 for maximum output.

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

It may be necessary to detune L1 and L2 in FD862 to an ADC voltage of about 10 V while tuning L3 in PM862 and L1 and L2 in FD861, in order to get a clear minimum.

8. The output power level can be adjusted by connecting a resistor, R7, in parallel with R6 (see fig. 7/8.).

The value of R7 is chosen from the standard resistance series (0.1 W) as follows:

Power (nominal)	Select R7 for total current (mA)	Power (W) ± 1 dB
0.5	220 +20/-0	0.5
1.0	380 +40/-0	1.0
3.0	750 +50/-0	3.0

The current adjustment must be made with the power stages fine tuned for maximum output.

Check the output power on all channels.

9. Read the ADC voltage.

Requirement: ≤ 10 V.

Typical ADC voltage at 1 W: 5 V.

APPENDIX FOR CQP864U

PA863 and PA862a/PA864 are principally broad-band tuned power amplifier stages. However, to increase efficiency in certain parts of the frequency band coils L3, L5 and L6 are provided with tuning slugs. These should be adjusted for optimum power output where improvement can be achieved. In many cases the minimum or maximum position will be found to be optimum.

Depending on working frequency, PA863 will be furnished with either a conductive tuning slug (65.0026-00) or a ferrite tuning core (65.0025-00).

TRANSMITTER FREQUENCY ADJUSTMENT

10. Connect a frequency counter through an attenuator to the antenna connector.

Key the transmitter.

Adjust L2 in XO862 (XO865) to the channel frequency.

Repeat the adjustment on all channels.

Requirement at 25°C:

$\pm 0.5 \times 10^{-6}$ (20-25 kHz channels spacing).

$\pm 0.2 \times 10^{-6}$ (12.5 kHz channel spacing).

CHECKING AND ADJUSTMENT OF MODULATOR

11. Connect the deviation meter through an attenuator to the antenna connector.

Set the DEVN (AF) - AF PROBE switch to DEVN (AF).

Set the ACVM switch to DEVM (AF).

Short circuit resistor combination R10/R11

(see fig. 7/8)

KEY the transmitter.

Set the AF generator to 1000 Hz and adjust the output level for approx. ± 3 kHz transmitter frequency deviation.

The output should be below clipping level as seen at the AF output at the deviation meter.

Adjust L2 in PM862 for minimum distortion.

Remove the short circuit across R10/R11.

12. Set the tone generator output to 12 mV (12.5 kHz).

Set the tone generator output to 6 mV (20-25 kHz).

Check that Δf max. is not exceeded at frequencies between 300 Hz and 3000 Hz/2400 Hz (12.5 kHz).

If necessary adjust R11/R10.

Set the tone generator output to $0.7 \times \Delta f$ 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 on the output of the deviation meter.

Requirement: THD <7% (without de-emphasis).

RECEIVER ADJUSTMENT

For location of components see fig. 3 and fig. 7/8.

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.

CQP863-R1= 5.6 Kohm

CQP864-R1= 27 Kohm

Apply 5.0 V to terminal 8 of FC804 (CQP864 only)

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.
 $I_{\text{total}} < 100$ mA
3. Set the DCVM switch to RX.
Read the stabilized RX voltage.
Requirement: 7.5 V \pm 0.15 V.

ADJUSTMENT OF RECEIVER CONVERTER

4. Set the trimming slugs of L1, L2, L3, L4, L5 and L6 in RC861 to the outer position.
Set the slug in L7, L8, L9, and L10 to the middle position.

CRYSTAL OSCILLATOR OUTPUT ADJUSTMENT

Procedure for XO811:

Crystal oscillator XO811 is factory adjusted for maximum output into 50 ohm, and output coil L1 is normally not to be touched.

If the oscillator has been detuned disconnect coaxial cable from XO811 to RC861 at RC861 (terminal 9) and terminate it with a 47 ohm resistor.

Set the DCVM switch to RF PROBE. Tune L1 in XO811 to maximum output as measured with the RF probe connected across the 47 ohm resistor.

Procedure for XO866:

Crystal oscillator XO866 is factory adjusted for maximum output into 50 ohm, and output coil L1 is normally not to be touched.

If the oscillator has been detuned disconnect FC804 (terminal 2) from RC861 (terminal 7) and terminate FC804 with a 47 ohm resistor.

Set the DCVM switch to RF PROBE.

Tune L1 in XO866 to maximum output as measured with the RF probe connected across the 47 ohm resistor.

For both:

Repeat the adjustment on all channels.

Set the DCVM switch to RC.

NOTE: The helix circuits are sensitive to the adjustment tool.

Remove the tool before measuring the result of turning slugs.

Set the channel selector to the channel closest to the center frequency, if more than one.

Adjust L10 in RC861 for maximum DC voltage.

Adjust L9 in RC861 for maximum DC voltage.

Adjust L7 in RC861 for maximum DC voltage.

Set the RX gate switch to OFF to disable the receiver oscillator; the DC voltage should fall at least 0.1 V.

After the check switch the RX gate ON again.

5. Set the signal generator to the receiver frequency.

Modulate the generator with 1 kHz to a frequency deviation of $0.7 \times \Delta f$ 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.

Turn the volume switch to the 2nd position (II) (approx. 0.5 V on the ACVM, no clipping).

Adjust the signal generator output to 12 dB SINAD.

As the receiver sensitivity increases during the adjustment, the signal generator output must be reduced to maintain 12 dB SINAD.

Adjust L8 in RC861 for best signal to noise ratio at approx. 12 dB SINAD.

Adjust L7 in RC861 for best signal to noise ratio at approx. 12 dB SINAD.

Adjust L5 in RC861 for best signal to noise ratio at approx. 12 dB SINAD.

This is the ONLY adjustment of L5.

The following coils are adjusted for best signal to noise ratio in this order:

L6, RC861

L4, RC861

L3, RC861

L1, RC861

L2, RC861

L1, RC861

L3, RC861

L4, RC861

Readjust L7 in RC861 for best signal to noise ratio.

Adjust L6 in RC861 for best signal to noise ratio.

Adjust L9 in RC861 for maximum DC voltage (2-3 V).

6. Set the signal generator output to approx. 100 μ V e.m.f.
Adjust L8 in RC861 and L1 in XF803 (XF804a) for minimum distortion.

MEASURING RECEIVER FREQUENCY

OSCILLATOR FREQUENCY ADJUSTMENT

7. Set the generator to the receiver frequency using the frequency counter.

Remove the signal generator modulation and set the output to 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 XO811 (XO866) 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.

RECEIVER SENSITIVITY MEASUREMENT

EIA (Electronic Industries Association) standard, definition:

The SINAD sensitivity of a receiver is the minimum input signal that will provide at least 50% of the receiver's rated audio output power with 12 dB signal + noise + distortion + 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% being 12 dB below 100, which was our reference condition. ($100 - 6 \text{ dB} = 50$, $50 - 6 \text{ dB} = 25\%$).

In practice our first condition is achieved by feeding a minimum of 1000 μV of RF-signal modulated with 1000 Hz at $0.7 \times \Delta f \text{ max.}$ 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 %. The meter needle immediately 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. 12 dB SINAD sensitivity.

MEASURING RECEIVER SENSITIVITY

8. The sensitivity must be minimum 1.0 μV e.m.f.
Typical value: 0.7 μV e.m.f.
Changing the supply voltage from 9.6 V to 13.5 V should not influence on the sen-

sitivity obtained at 11 V.

If more than one channel is provided, the sensitivity check should be repeated on all channels.

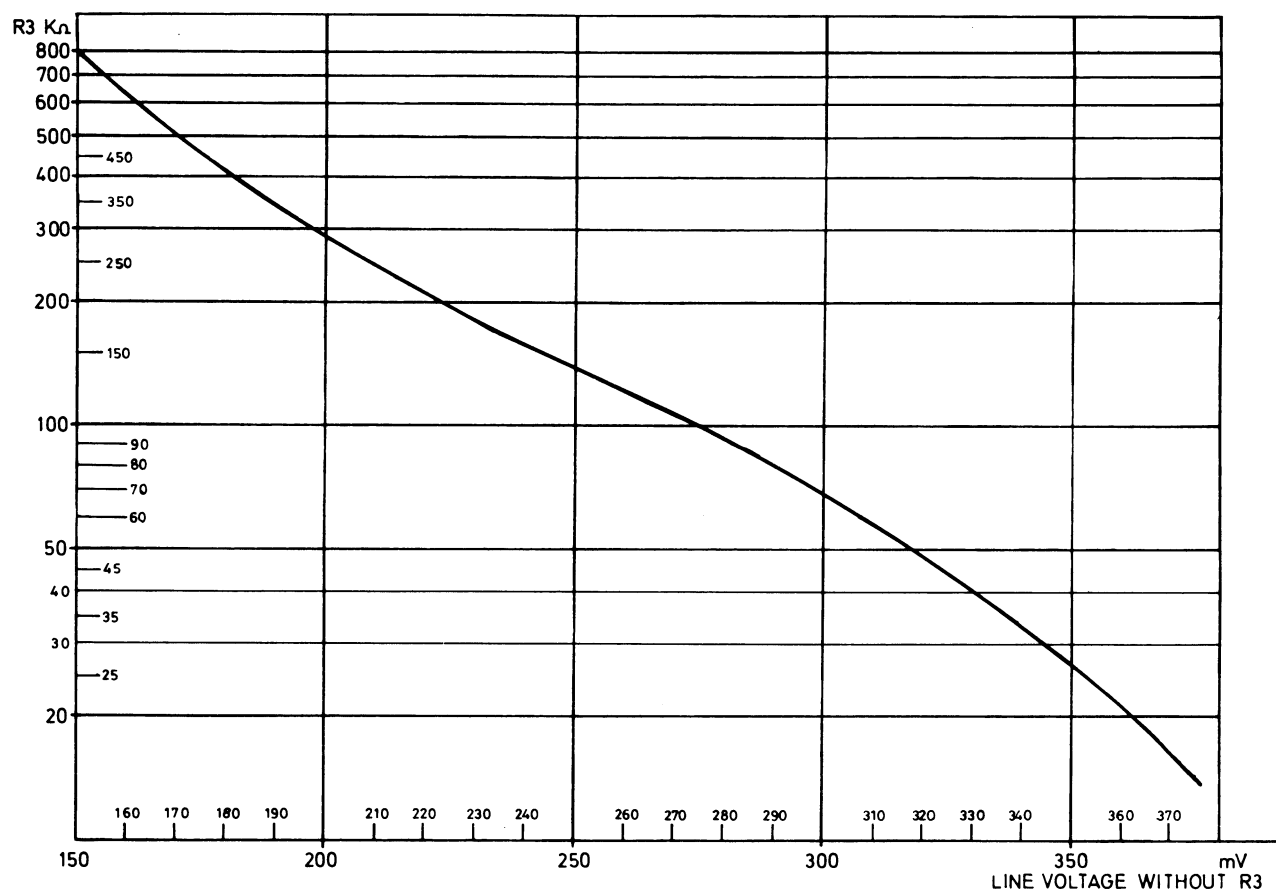


Fig. 4. ADJUSTMENT OF RESISTOR $R3$

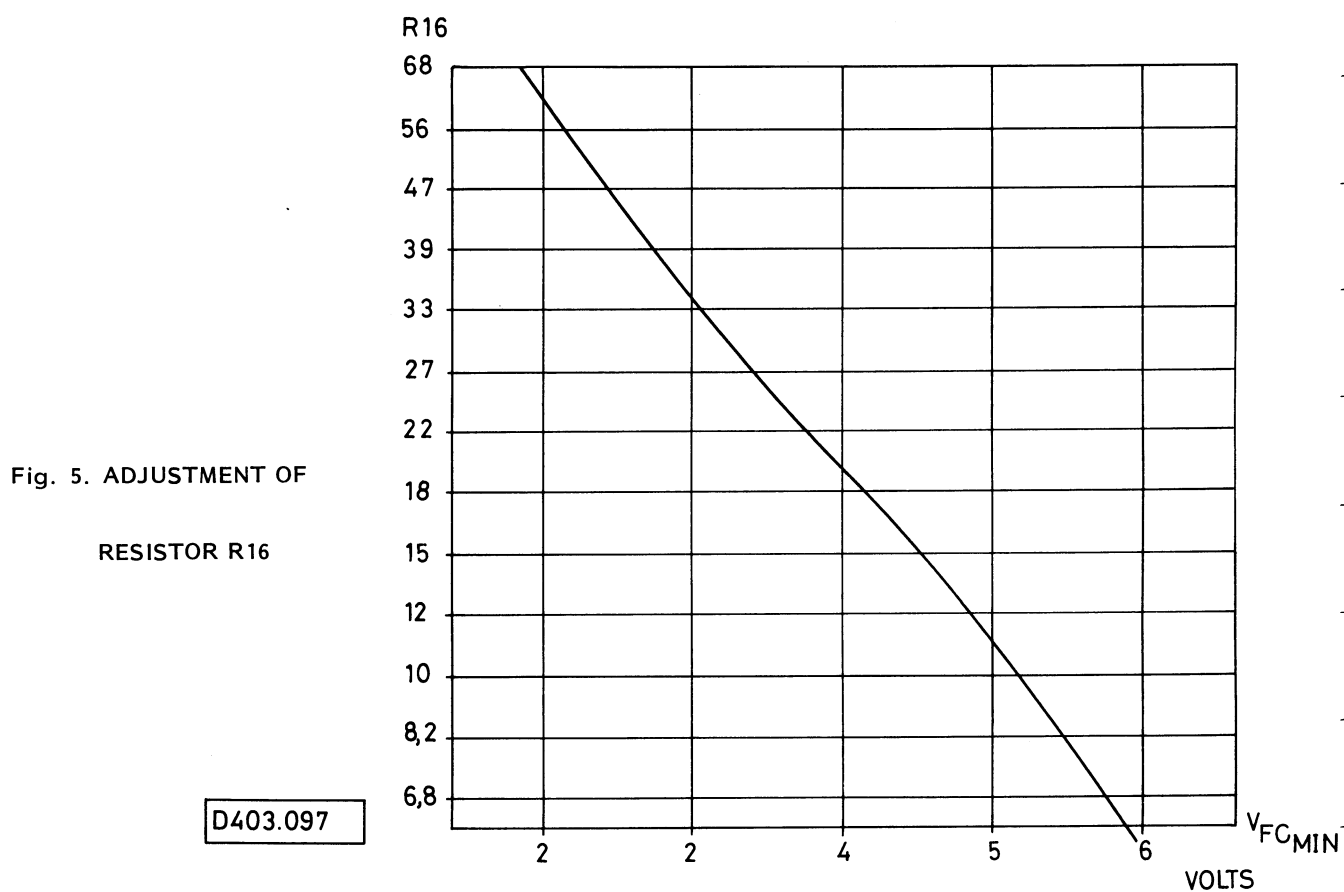


Fig. 5. ADJUSTMENT OF
RESISTOR $R16$

D403.097

MEASURING AND SETTING RECEIVER AUDIO LEVEL

CHECKING RECEIVER AUDIO LINE OUTPUT

9. Modulate the signal generator with 1 kHz and $0.7 \times \Delta f$ 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 the signal generator output to 100 μ V e.m.f.
Switch the ACVM to LINE OUT.
Read the AF Line voltage (-17 dBm).
Requirement: 110 mV $\pm 0/-1$ dB.
If necessary change resistor value (R3) in parallel with R2 (IA802, pin 5 - 6) until 110 mV is obtained.

The graph (fig. 4) indicates the value of the resistor, which should be the closest higher standard value.

CHECKING THE AF FREQUENCY RESPONSE AND DISTORTION

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 3rd position (III).
Read the AF voltage on the ACVM (reference).

Set the modulation frequency to 300 Hz (12.5-20-25 kHz).
AF voltage: +9 dB ± 2 dB rel. to 1000 Hz.
Set the modulation frequency to 3000 Hz (20-25 kHz).
AF voltage: -10 dB ± 2 dB rel. to 1000 Hz.
Set the modulation frequency to 2500 Hz (12.5 kHz).
AF voltage -9 ± 2 dB rel. to 1000 Hz.

11. Turn the volume switch to the 4th position (IIII).
Check the total harmonic distortion (THD) at 1000 Hz.
Requirement: THD = $< 7\%$

ADJUSTMENT AND CHECKING OF THE SQUELCH FUNCTION

12. Set the volume to the 4th position (IIII).
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: < 9.5 mA + current drain of tone equipment (20-25 kHz).
11 mA + current drain of tone equipment (12.5 kHz).
Set the SQ OUT switch down.
Set the volume switch to the 4th position (IIII).

Read the current drain on the mA meter.
Requirement: < 100 mA.

ADJUSTMENT AND CHECKING THE FC804 (only for 12.5 kHz channel spacing)

14. Adjust the receiving frequency +1.2 kHz on one of the channels. (RF level 1 mV e.m.f.)

Apply 7.1 V to terminal 8 of FC804.

Adjust oscillator XO866 to signal generator frequency by means of zero beat with 21.4 MHz.

Then adjust the signal generator frequency to receiving frequency -1.2 kHz.

Lower the voltage at terminal 8 until the oscillator frequency produces zero beat with 21.4 MHz.

This voltage is V_{FC} min.

Resistor R16 can then be determined.

Select the closest standard value and solder it to FC804 between terminal 7 and terminal 8.

Adjust the signal generator frequency to the receiving frequency.

Adjust the voltage V_{FCO} at terminal 8 of FC804 for zero beat with 21.4 MHz.

If it is not possible to select a resistance

value for R14 so that the voltage is $V_{FCO} \pm 0.1$ V, it is necessary to use one more resistor, R15, in parallel with the other.

FINAL ADJUSTMENT OF OSCILLATOR FREQUENCY

15. Connect the power supply (0-10 V) to terminal 8 of FC804 and apply V_{FCO} volts. Then adjust all channels as described in paragraph 8.

NOTE: It is not possible to adjust the receiver oscillators by means of the zero beat method when FC804 is active.

Disconnect the power supply from FC804 and connect a volt-meter instead.

Connect the resistor box (95B0470) to terminal 5 and terminal 6 of FC804.

Select the smallest resistor which causes the voltage to rise above V_{FCO} .

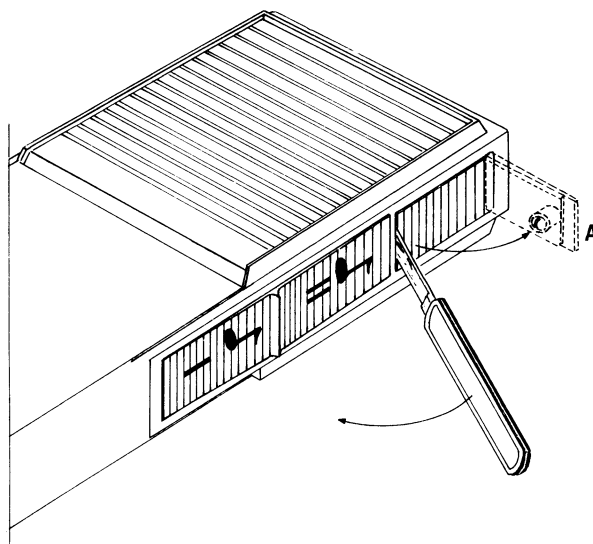
Solder a resistor R13 which is one step higher to FC804 between terminal 5 and 6.

By means of the resistor box select resistor R14 which causes the voltage to be closest to V_{FCO} and solder it to FC804 in parallel with R13.

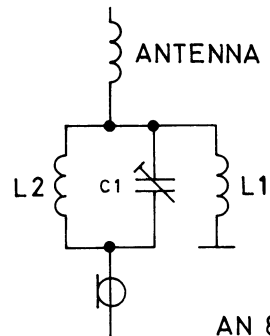
ANTENNA MATCHING ADJUSTMENT

ANTENNA NETWORK ADJUSTMENT IN CP808, LOCAL MODE

1. Assemble the radio set with cabinet sheath and loudspeaker panel in position.
2. Screw antenna AN864 or AN865 in position.
3. Clip antenna alignment unit TS-D37, code 95B0555, in remote control multiplug on CP808.
4. Raise hinged cover "A" on control head CP808 and remove rubber gasket, thus giving access to the matching network's variable components.



5. Power equipment by means of a battery (f. ex. BU807) and hold in normal operating position.
Key transmitter.
6. Adjust C1 for maximum indication on TS-D37.
7. This completes the antenna network adjustment. Replace gasket and snap cover "A" back into position.



AN 864 AND AN 865
MATCHING NETWORK

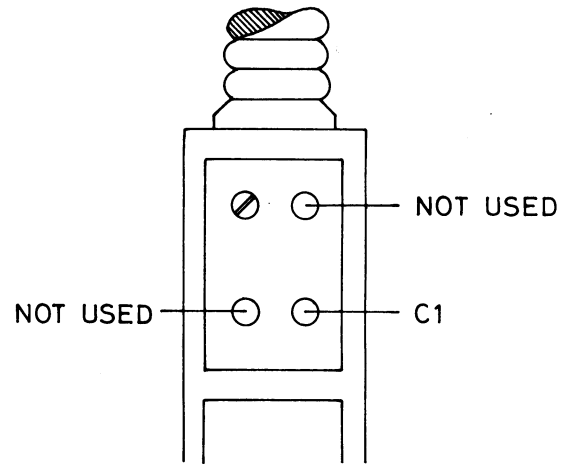


Fig. 6. ANTENNA MATCHING NETWORK IN CP808

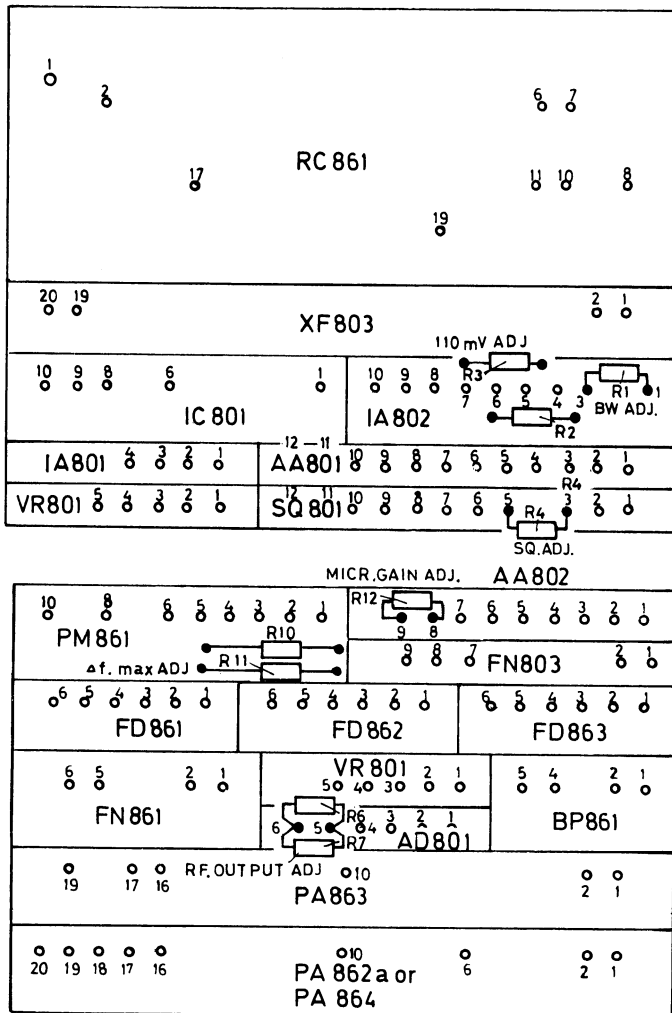


Fig. 7. TERMINAL LAYOUT CQP863U

D403.101

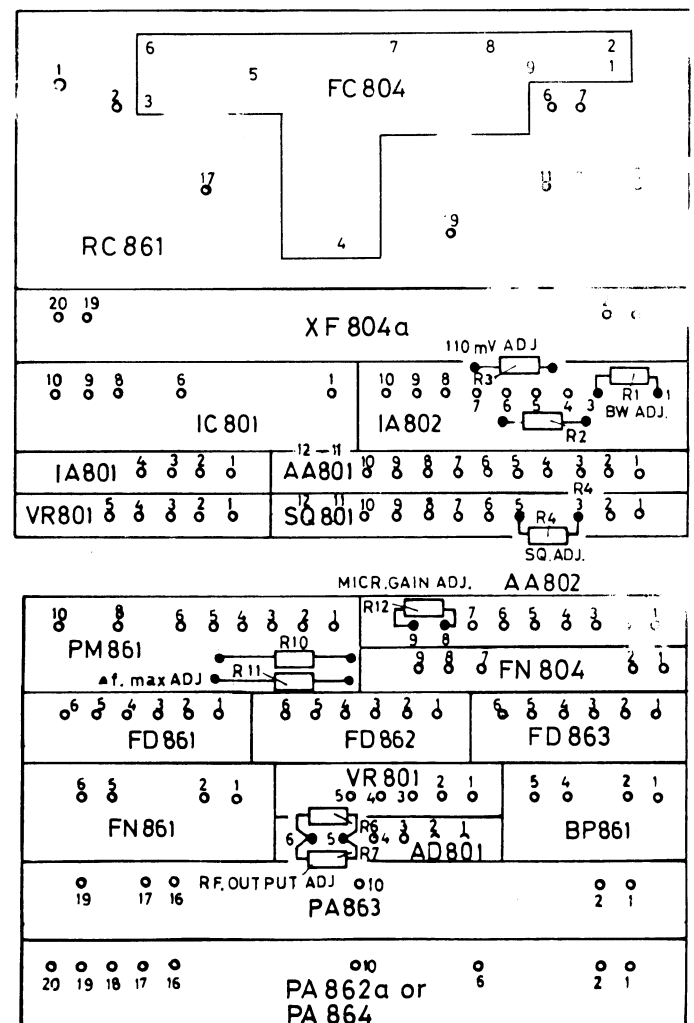


Fig. 8. TERMINAL LAYOUT CQP864U

D403.096

CQP863U/CQP864U

	TEST	ADJUST	INSTRUMENT	READING
1	Supply voltage	Power supply	Voltmeter	11 V
2	Current drain		mA meter	70 - 800 mA
3	Current drain without oscillator		mA meter	<70 mA
4	+7.5 V TX		Voltmeter	+7.5 V $\pm 0.15\%$
5	Oscillator output	XO862 - L1 or XO865 - L1	95.059 + VM	maximum
6	Current drain	FD861 - L1, L2 FD862 - L1, L2 FD863 - L1, L2 BP861 - L1, L2 PA863 - L3	mA meter	maximum
7	Power output ADC voltage	FD861 - L1, L3 FD822 - L1, L2 FD863 - L1, L2 BP861 - L1, L2 PA863 - L3 PA862a - L5, L6 or PA864 - L5, L6	Voltmeter Wattmeter	minimum ADC voltage <10 V 0.1 - 1W } maximum power 1 - 3 W } output
8	Current drain		mA meter	approx. 0.5 W - <240 mA approx. 1 W - <420 mA approx. 3 W - <800 mA
9	Frequency	XO861 - L2 or XO865 - L2	Frequency counter	$f_{ant} \pm 0.5 \times 10^{-6}$ (20 - 25 kHz) $f_{ant} \pm 0.2 \times 10^{-6}$ (12.5 kHz)
10	Modulation	PM861 - L2	AF generator Deviation meter Distortion meter	minimum distortion
11	6 mV AF input Modulation distortion	R11 - R10	AF generator Deviation meter Distortion meter	$0.7 \times \Delta f_{max.}$, $f_{mod} = 1$ kHz THD = <7%
12	Antenna network	C1	TS-D37 code 95B0555	Maximum indication

SUMMARY

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RECEIVER ADJUSTMENT

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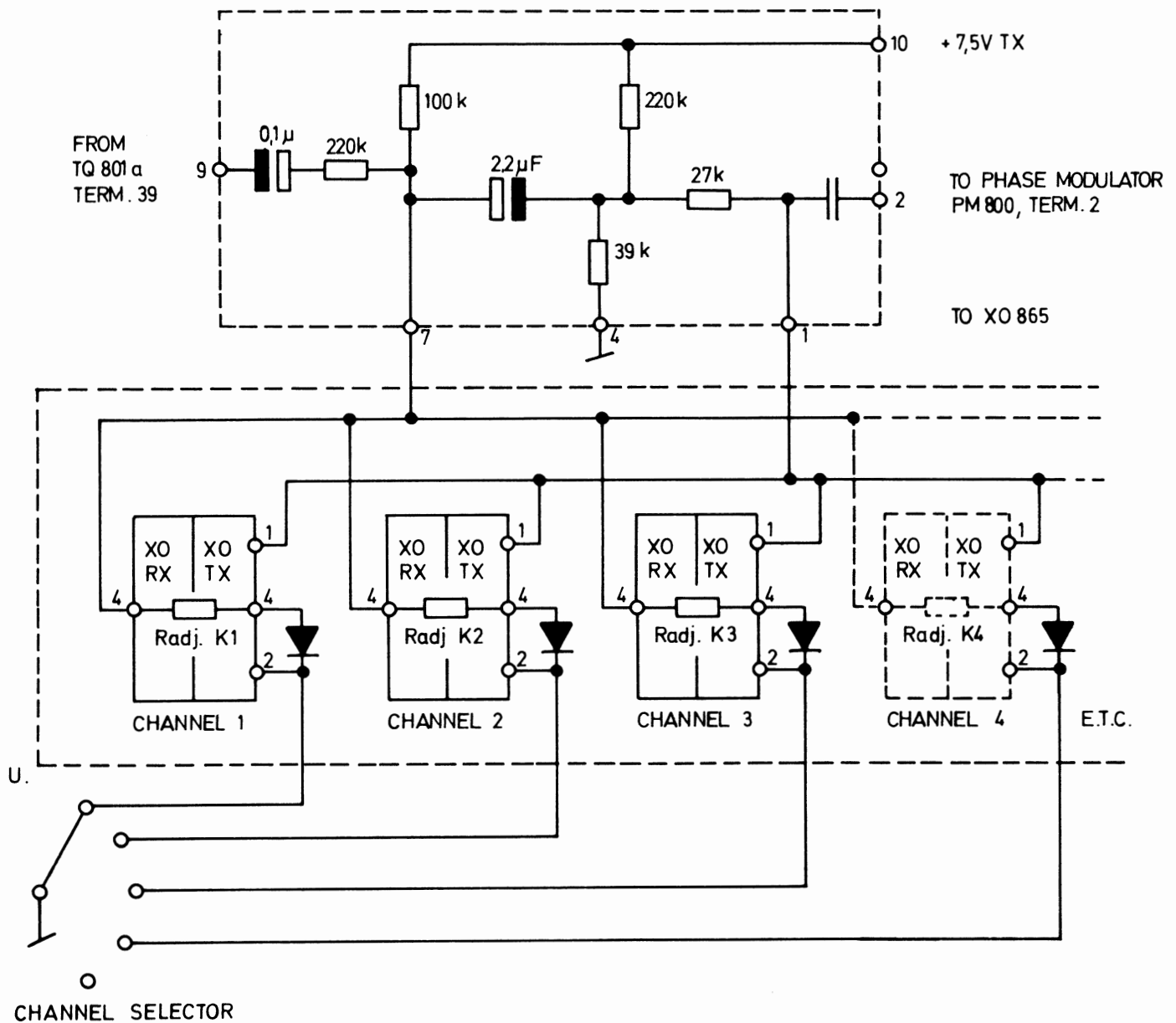
CQP863U/CQP864U

	TEST	ADJUST	INSTRUMENT	READING
1	Supply voltage	Power supply	DC voltmeter	11 V
2	+7.5 V RX	Check	Voltmeter	+7.5 V $\pm 0.15\%$
3	Current drain	Check	mA meter	<100 mA
4	RC test point without oscillator	RC861 - L10, L9, L7	DC voltmeter	maximum (1.7 V) -0.1 V
5	Receiver sensitivity	RC861 - L8, L7 L3, L4	RF generator Distortion meter	minimum distortion
		L6, L9	DC voltmeter Distortion meter	maximum minimum
6		RC861 - L8 XF804a - L1 or XF804a - L1	RF generator high output	minimum distortion
7	Sensitivity	Check		12 dB SINAD <1.0 μ V e. m. f.
8	Frequency	XO811 - L2 or XO866 - L2	RF generator 21.4 MHz BFO oscilloscope	zero beat
9	AF Line output	IA802 (R3)	RF generator (high output) AC voltmeter	110 mV AF
10	AF response	Volume to 3rd position (III)	RF generator (high output) AC voltmeter	300 Hz: +9 ± 2 dB 1000 Hz: 0 dB 3000 Hz: (20-25 kHz) -10 ± 2 dB 2500 Hz (12.5 kHz) -9 ± 2 dB
11	Distortion	Check	Distortion meter	THD= <7%
12	Squelch	R4	RF generator	opens at 10 - 12 dB SINAD
13	Current drain	Volume to pos. 4 (IIII)	mA meter	no signal, Sq. off <9.5 mA (20-25 kHz) <11 mA (12.5 kHz) no signal, SQ. on <100 mA
14	Frequency control	R16 R13, R14, R15	RF Generator Voltmeter Power supply	V _{CF} min V _{FCO} ± 0.1 V ± 1.2 kHz
15	Frequency	XO866	RF generator 21.4 MHz BFO Oscilloscope Power supply	Zero beat

TEST PRESCRIPT SU800-6999/02.

1. Due to different sensitivities for frequency deviation/pilot tone voltage, an individual adjustment must be performed for each channel ($R_{adj.}$ between RX XO term.4 and TX XO term.4)

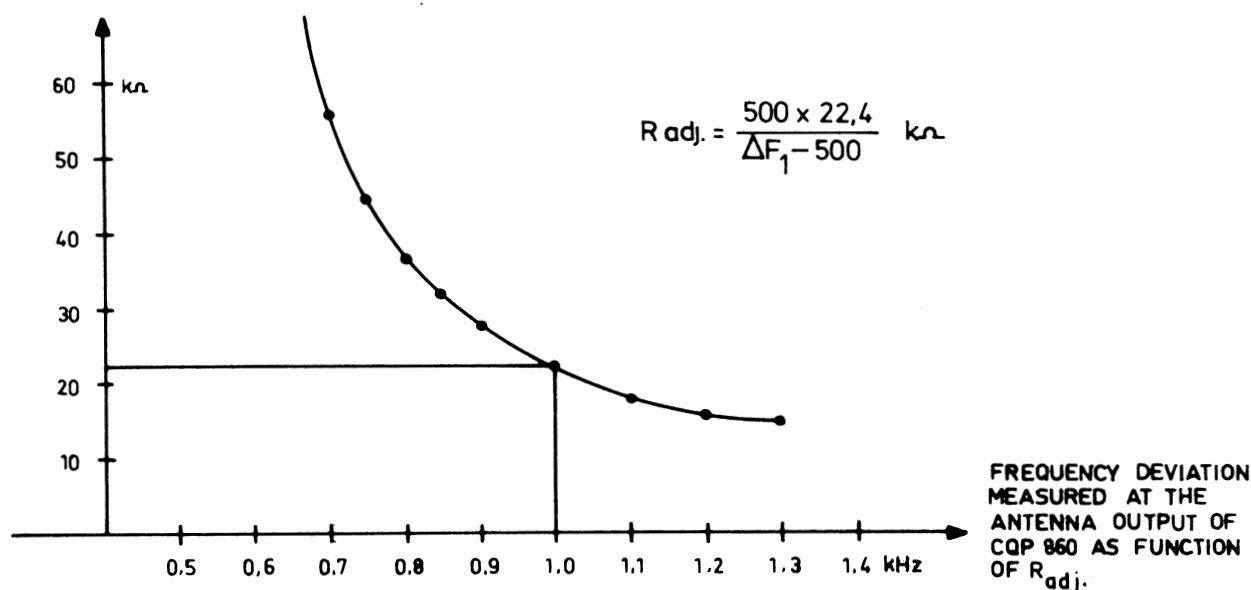
2.



3. The sensitivity is adjusted using $R_{adj.}$, which is placed between RX XO term.4 and TX XO term.4.

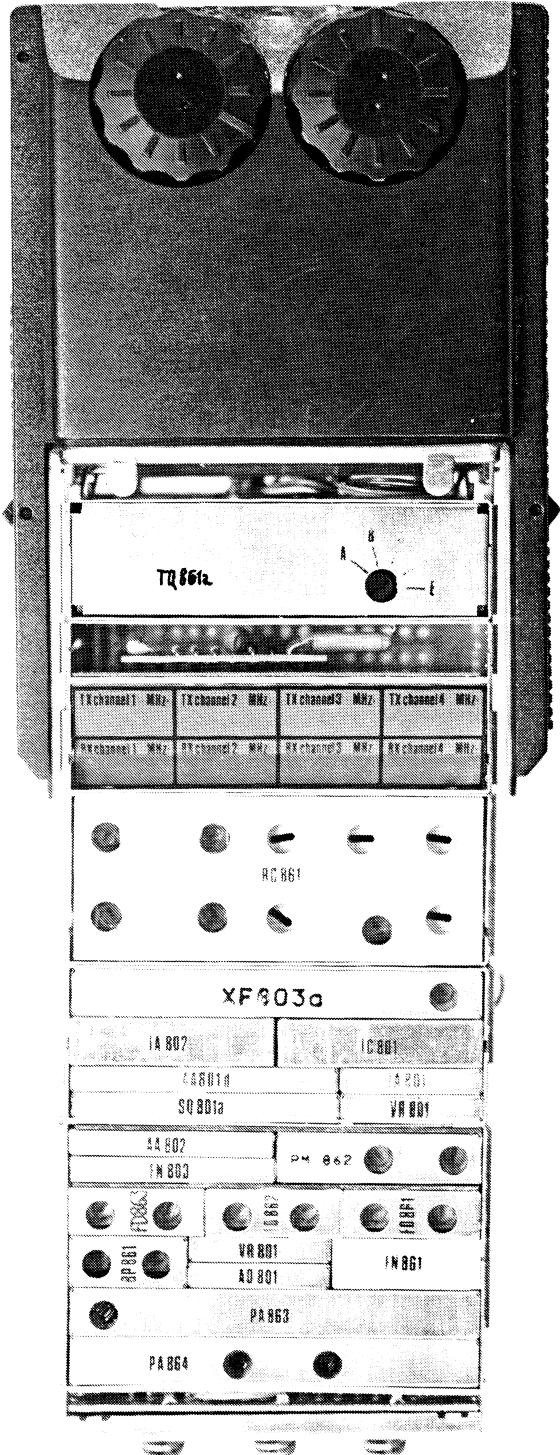
4. TEST PROCEDURE:

- Set the channel selector to the channel in question.
- Set $R_{adj.}$ to ∞ and check the frequency deviation ΔF_1 due to the pilot tone modulation.
- From the curve drawn below $R_{adj.}$ is decided so, that the frequency deviation is limited to $\Delta F \pm 500\text{Hz}$.



5. EXAMPEL.

Set $R_{adj.}$ to ∞ . The frequency deviation shows $\Delta F_1 = 1000\text{Hz}$ which means that ΔF must be reduced to 500Hz using $R_{adj.} = 22\text{k}\Omega$



MODULE LAYOUT FOR
CQP863U 3C8x4TQ

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TYPE	Nº	CODE	DATA
CP808		10.3375-00	CONTROL SECTION Standard control head
CH804 XO811 XO865	1-4 1-4	10.2711-00 10.2708-00 10.3479-00	CRYSTAL OSCILLATOR SECTION Motherboard for 4 RX and 4 TX Oscillator RX-Crystal oscillator, TX-Crystal oscillator, f. Pilot Tone
RX863		10.3436-00	RECEIVER SECTION Complete Receiver Unit
CH8010 AA801d IA801 IA802 IC801 RC861 SQ801a VR801 XF803a		10.3230-00 10.2687-02 10.2685-00 10.2808-00 10.2686-00 10.2699-00 10.2689-01 10.2690-00 10.2692-01	Motherboard f. Receiver Modules AF-Amplifier IF-Amplifier IF-Amplifier/-Discriminator IF-Converter Receiver Converter Squelch Unit Voltage Regulator Crystal-filter Unit
TB802		10.3587-00 15.0327-01 18.0889-00 18.xxxx-	INTERCONNECTING SECTIONS Terminal Board, Bottom section Antenna Matching Network Wiring and RF-cable Spec. TQ801a- to RF-wiring
TX863-3W CH8014 AA802 AD801 BP861 FD861 FD862 FD863 FN803 FN861 PA863 PA864 PM862 VR801		10.3597-00 10.3505-00 10.2688-00 10.2691-00 10.2704-00 10.2701-00 10.2702-00 10.2703-00 10.2694-00 10.2705-00 10.3417-00 10.3418-00 10.4275-00 10.2690-00	TRANSMITTER SECTION Complete 3 W Transmitter Motherboard for transmitter modules Audio Amplifier Automatic Drive Control Baud-Pass Filter Frequency-doubler Frequency-doubler Filter Network Filter Network Power Amplifier, 1. stage Power Amplifier, booster stage Phase Modulator Voltage Regulator
TQ801a		10.2882-01 11.1144-05	TONE EQUIPMENT SECTION Pilot-Tone Unit 20 mm empty-/dummy chassis

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TYPE	Nº	CODE	DATA
CH8013 SU800-6999	02	10.3235-00 10.4073-00	Chassis for Switch Unit Switch Unit
	C- C- C- L1 L2 L3 R1 R2 R6 R12	74.5275-00 74.5275-00 74.5275-00 A700024P6 A700024P6 A700024P6 80.5058-00 80.5081-00 80.5056-00 80.5060-00	ADJUSTMENT COMPONENTS Capacitor, 470 pF, 20%, 2Cl CP Capacitor, 470 pF, 20%, 2Cl CP Capacitor, 470 pF, 20%, 2Cl CP RF-Choke RF-Choke RF-Choke Resistor, 5.6 Kohm, 5%, 0.1 W Resistor, 470 Kohm, 5%, 0.1 W Resistor, 3.9 Kohm, 5%, 0.1 W Resistor, 8.2 Kohm, 5%, 0.1 W
CA802-126		10.3600-27 12.0251-00	CABINET SECTION Cabinet, length 164,25 mm Insulating Set. (cut to length)

MODULE- AND PARTS LIST:
CQP863U-3C8x4T SWISS AIR

X403.495

TYPE	Nº	CODE	DATA
X2-IS		10. 4089	TX863-1W IS Transmitter 1W
X4-IS		10. 3942	RX863-IS Receiver
X8-IS		10. 4084	TB803 Terminal Board
X12-IS		10. 4083	CP808-IS Control Head
X2T-IS		10. 4074-22	CA802-IS-106 Cabinet 2 channels
X4T-IS		10. 4074-25	CA802-IS-114 Cabinet 4 channels
X8T-IS		10. 4074-28	CA802-IS-126 Cabinet 8 channels
X12T-IS		10. 4074-31	CA802-IS-142 Cabinet 12 channels
		10. 4074-32	CA802-IS-146 Cabinet 2 channels +T
		10. 4074-34	CA802-IS-154 Cabinet 4 channels +T
		10. 4074-37	CA802-IS-166 Cabinet 8 channels +T
		10. 4074-41	CA802-IS-182 Cabinet 12 channels
X2(T)		10. 2710	CH803 Oscillator chassis
X4(T)		10. 2711	CH804 Oscillator chassis
X8(T)		10. 2712	CH805 Oscillator chassis
X12(T)		10. 2713	CH806 Oscillator chassis
Transmitter Modules			
		10. 2688	AA802 Modulation Amplifier
		10. 2704	BP861 Bandpass filter
		10. 2701	FD861 Frequency doubler
		10. 2702	FD862 Frequency doubler
		10. 2703	FD863 Frequency doubler
		10. 3352	FN803-IS Filter network
		10. 2705	FN861 Filter network
		10. 4091	PA863-IS Power amplifier
		10. 4090	PA862a-IS Power amplifier
		10. 4076	AD801-IS ADC circuit
		10. 2700-01	PM861a Phase modulator
		10. 3351	VR801-IS Voltage regulator
		10. 2885	XO862 Crystal oscillator
		10. 4087	CH8015 Transmitter chassis
Receiver Modules			
		10. 2687	AA801a-IS Audio amplifier
		10. 2685	IA801 IF amplifier
		10. 2808	IA802 IF amplifier/discriminator
		10. 2686	IC801 IF converter
		10. 3356	RC861-IS Receiver converter
		10. 2689	SQ801a Squelch circuit
		10. 3351	VR801-IS Voltage regulator
		10. 2692	XF803 Crystal filter
		10. 2708	XO811 Crystal oscillator
		10. 3230	CH8010 Receiver chassis

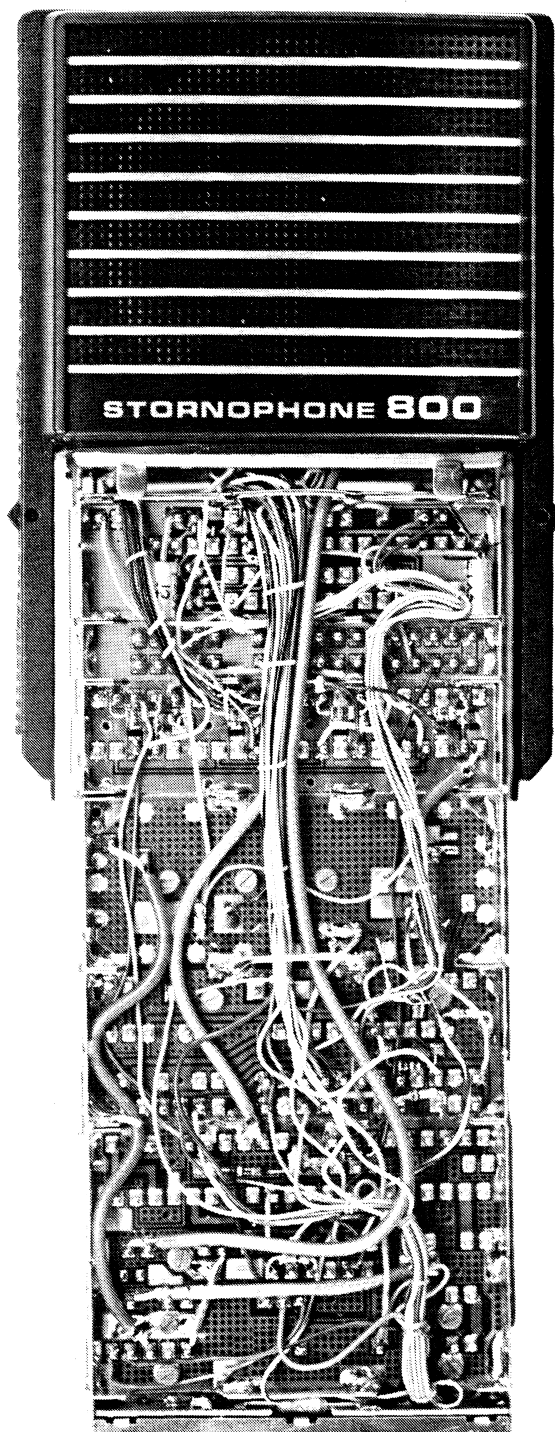
TYPE	Nº	CODE	DATA
	R1	80. 5058	5.6Kohm 5% carbon film
	R2	80. 5081	470Kohm 5% carbon film
	R3	80. 50xx	ADJ (110mV) 5% carbon film
	R4	80. 50xx	ADJ (SQ) 5% carbon film
	R6	80. 5060	8.2Kohm 5% carbon film
	R7	80. 50xx	ADJ (Po) 5% carbon film
	R10	80. 50xx	ADJ (Dev.) 5% carbon film
	R11	80. 50xx	ADJ (Dev.) 5% carbon film
	R12	80. 5060	8.2Kohm 5% carbon film
	R13	80. 5234	560ohm 5% carbon film
	C5	74. 5275	470pF 20% ceram
	C6	74. 5275	470pF 20% ceram
	C7	74. 5275	470pF 20% ceram
	R101	80. 5049	1Kohm 5% carbon film
	R102	80. 5058	5.6Kohm 5% carbon film
	R103	80. 5069	47Kohm 5% carbon film
	R104	80. 5061	10Kohm 5% carbon film
	C101	74. 5155	1nF -20+80% ceramic
	C102	74. 5155	1nF -20+80% ceramic
	C103	74. 5155	1nF -20+80% ceramic
	C104	74. 5155	1nF -20+80% ceramic
	C105	74. 5155	1nF -20+80% ceramic
	C106	74. 5155	1nF -20+80% ceramic
	E101	99. 5366	8.2V Zener diode 5W
	E102	99. 5366	8.2V Zener diode 5W
	E103	99. 5366	8.2V Zener diode 5W
	E104	99. 5366	8.2V Zener diode 5W
	a101	99. 5121	BC237 Transistor

UHF RADIOTELEPHONE

CQP863U-IS 1W

Storno

Storno



WIRING AND CABLE LAYOUT
FOR CQP800U 3C8x4TQ

M405.142

Storno

Storno

TQ801a

CH8013

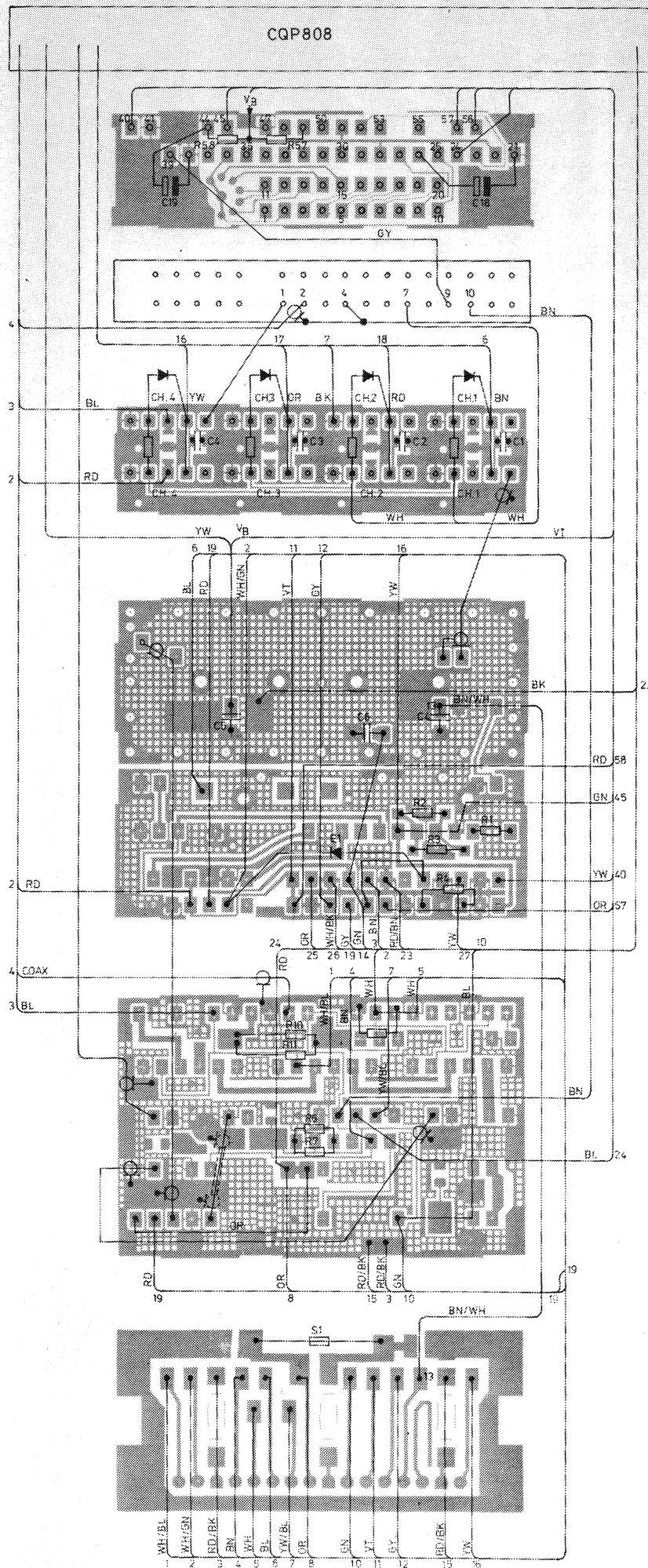
CH804

CH8010

CH8014

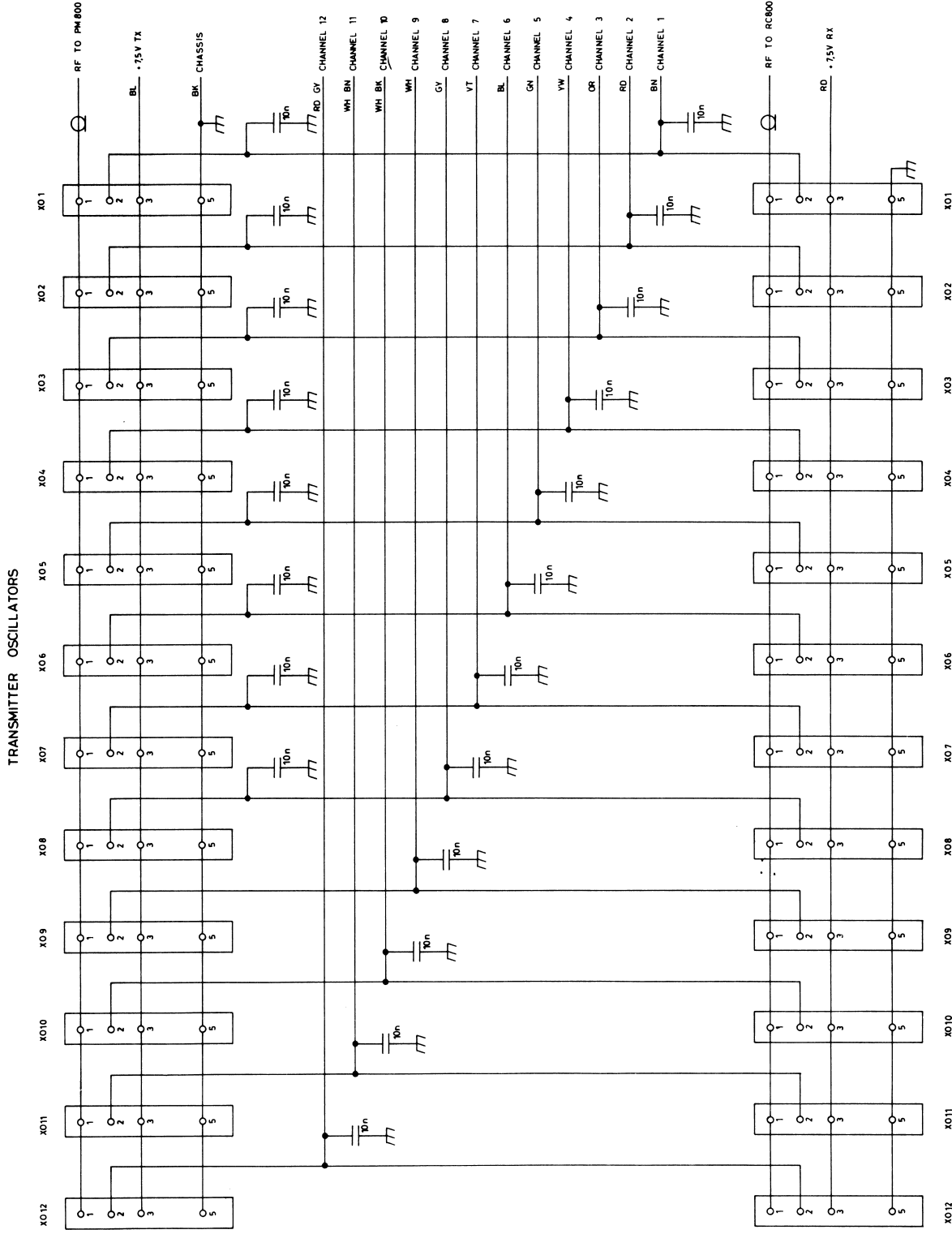
TB802

CQP808



WIRING DIAGRAM
CQP863U 3C8×4TQ

D403.492



RECEIVER OSCILLATORS

C1 - C20 : 74 5280 10nF 50V
CAPACITOR NUMBERS INTENTIONALLY
OMITTED DUE TO DIFFERENT NUMBER
SEQUENCES ON THE UNITS.
REFER TO WIRING DIAGRAM.

CH806

XO1 - XO12

C1 - C20

CH805

XO1 - XO8

C1 - C12

CH804

XO1 - XO4

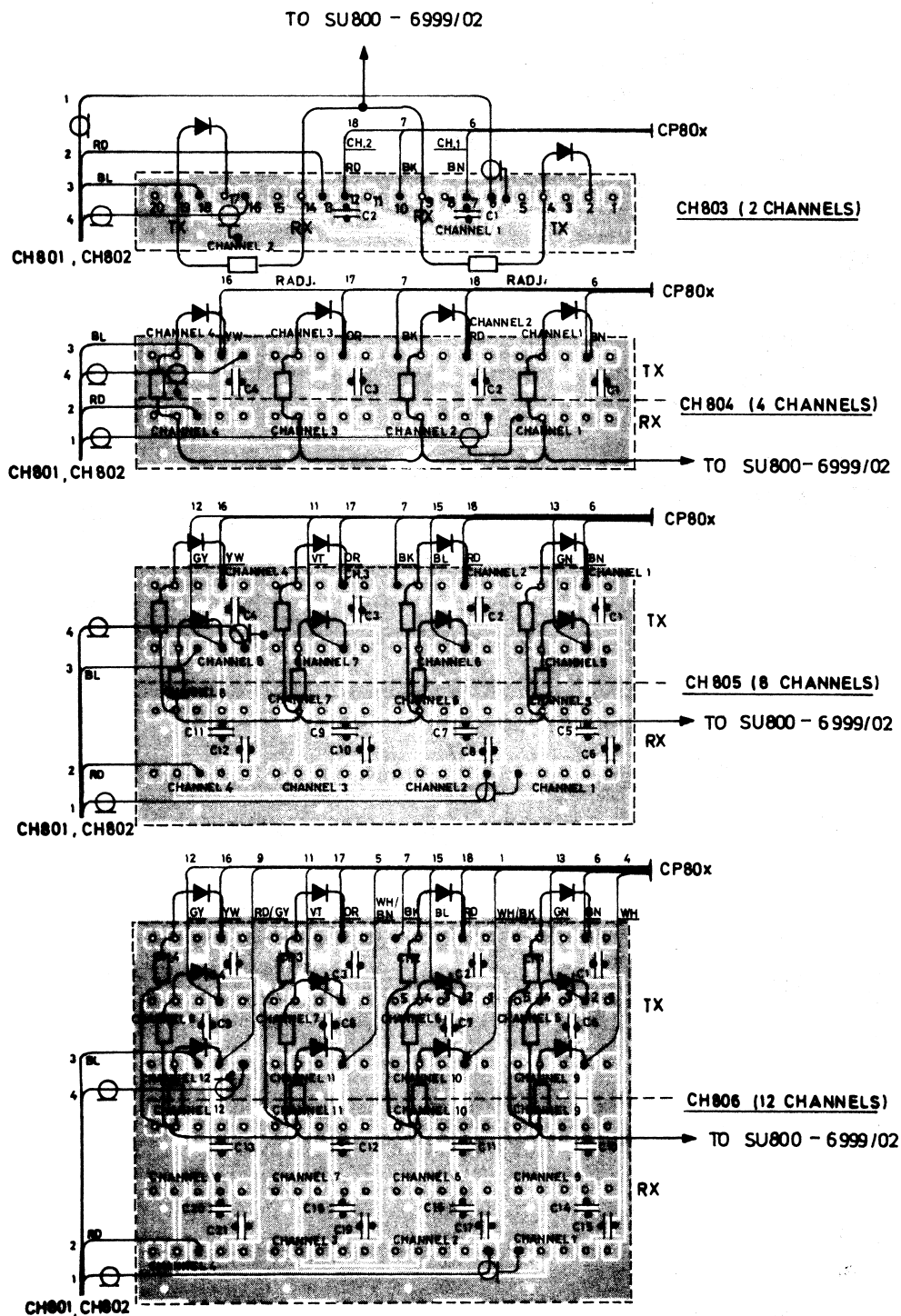
C1 - C4

CH803

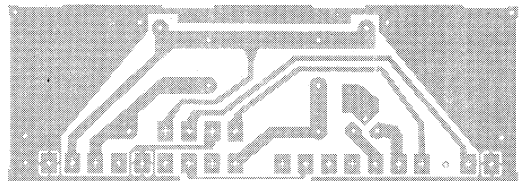
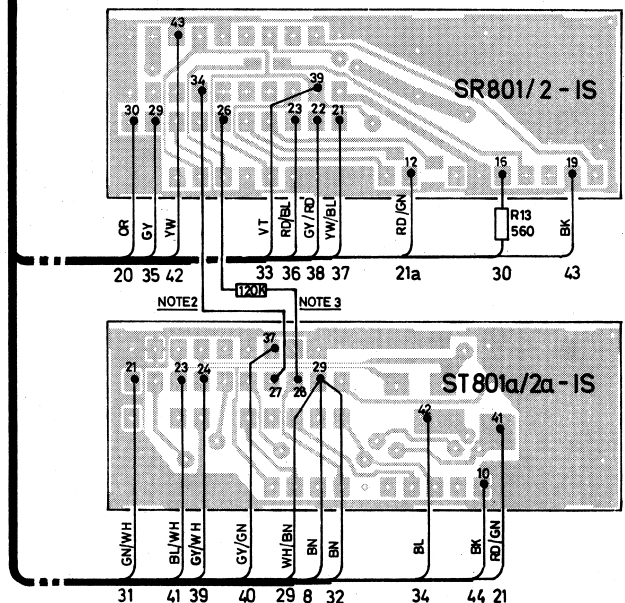
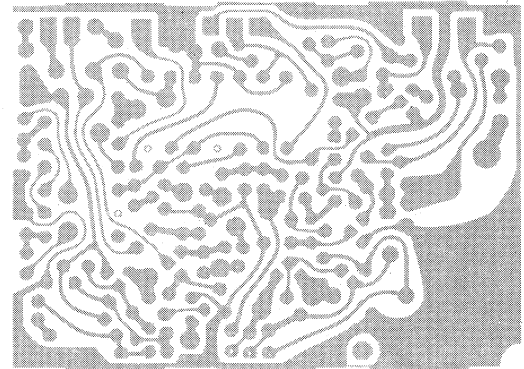
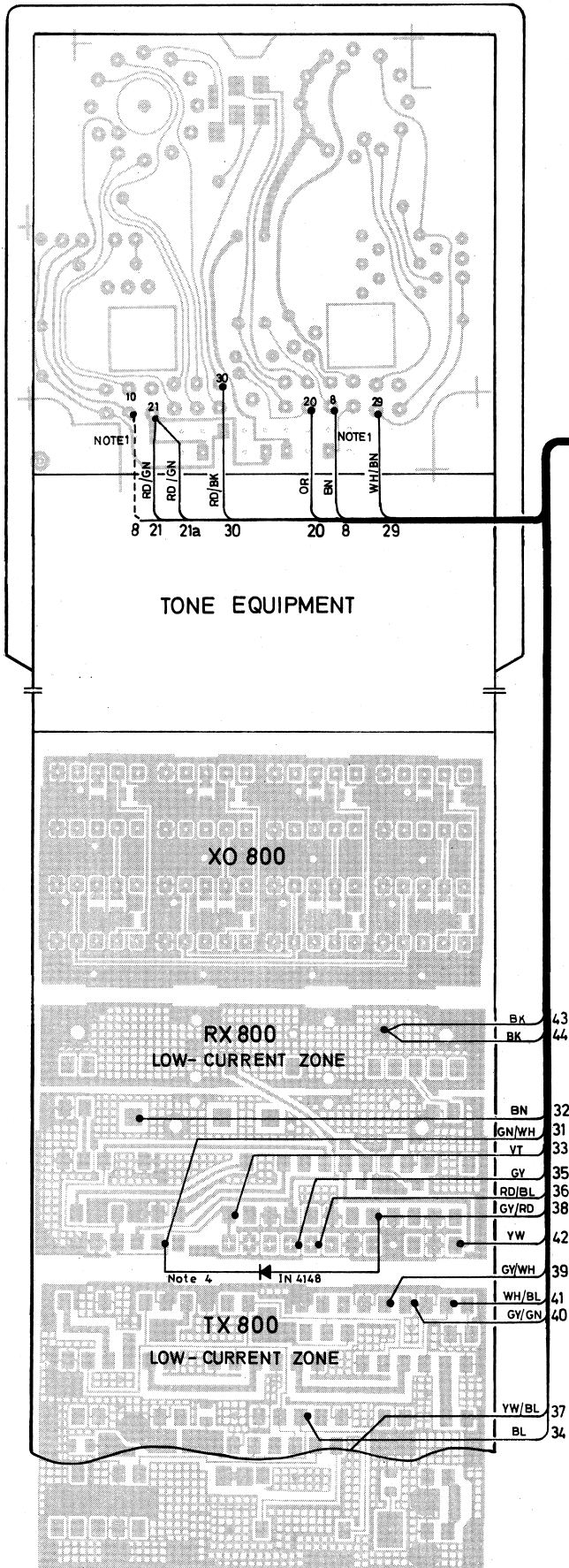
XO1 - XO2

C1 - C2

OSCILLATOR CHASSIS
CH803, CH804, CH805, CH806

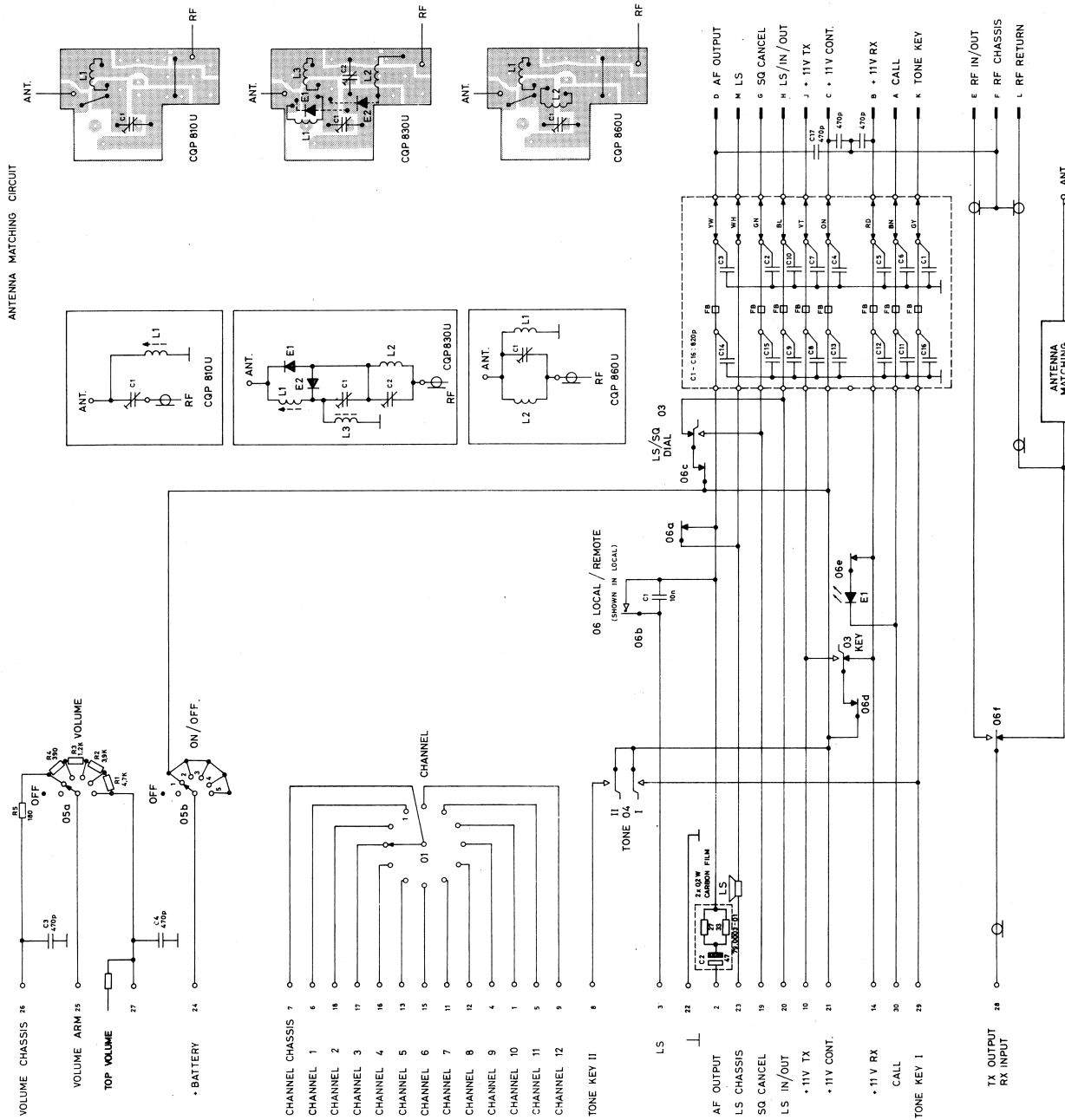


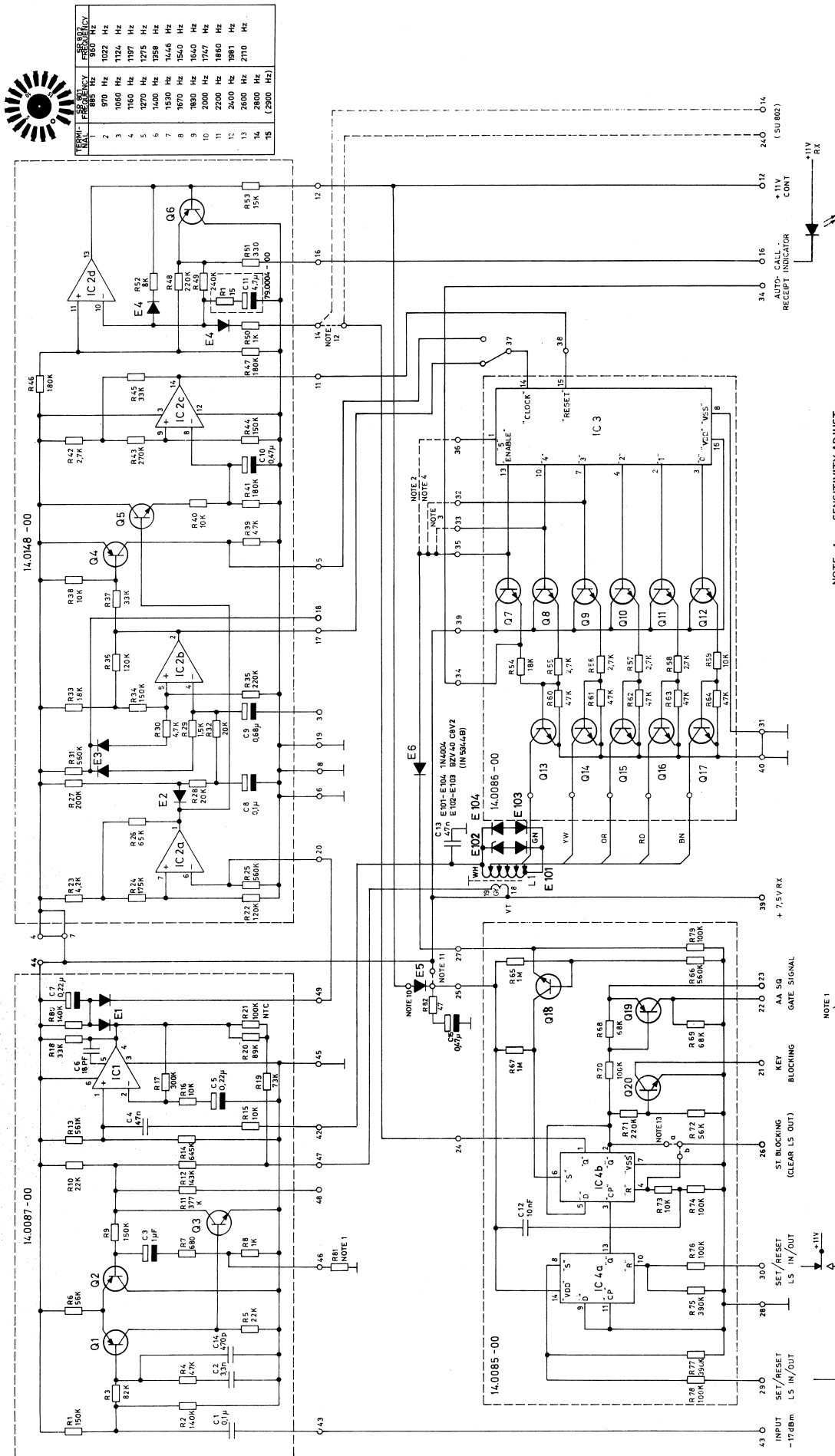
WIRING DIAGRAM CH803, CH804, CH805, CH806 - 6999



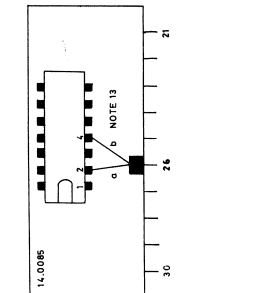
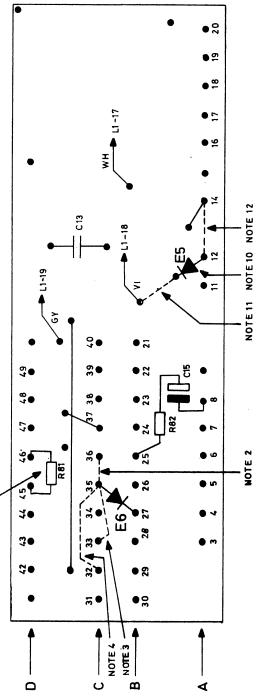
- NOTE 1.** WHEN ST801/2 IS TO BE USED FOR IDENTIFICATION THE BROWN WIRE AT TERMINAL 8 CP808 SHOULD BE MOVED TO TERMINAL 10.
- NOTE 2.** SHORT CIRCUIT FOR AUTOMATIC RECEIPT.
- NOTE 3.** FOR SR801/2 AND ST801/2 A RESISTOR, 120KΩ, 5%, 1/10W IS INSTALLED.
- NOTE 4.** DIODE ONLY TO BE INSTALLED IN CQP 863U WITH ST801

TONE EQUIPMENT WIRING CQP800U - IS

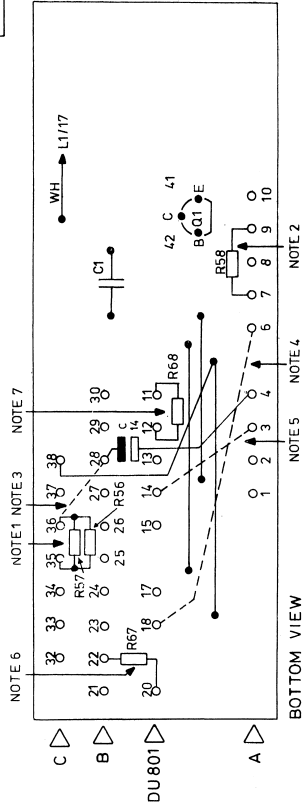
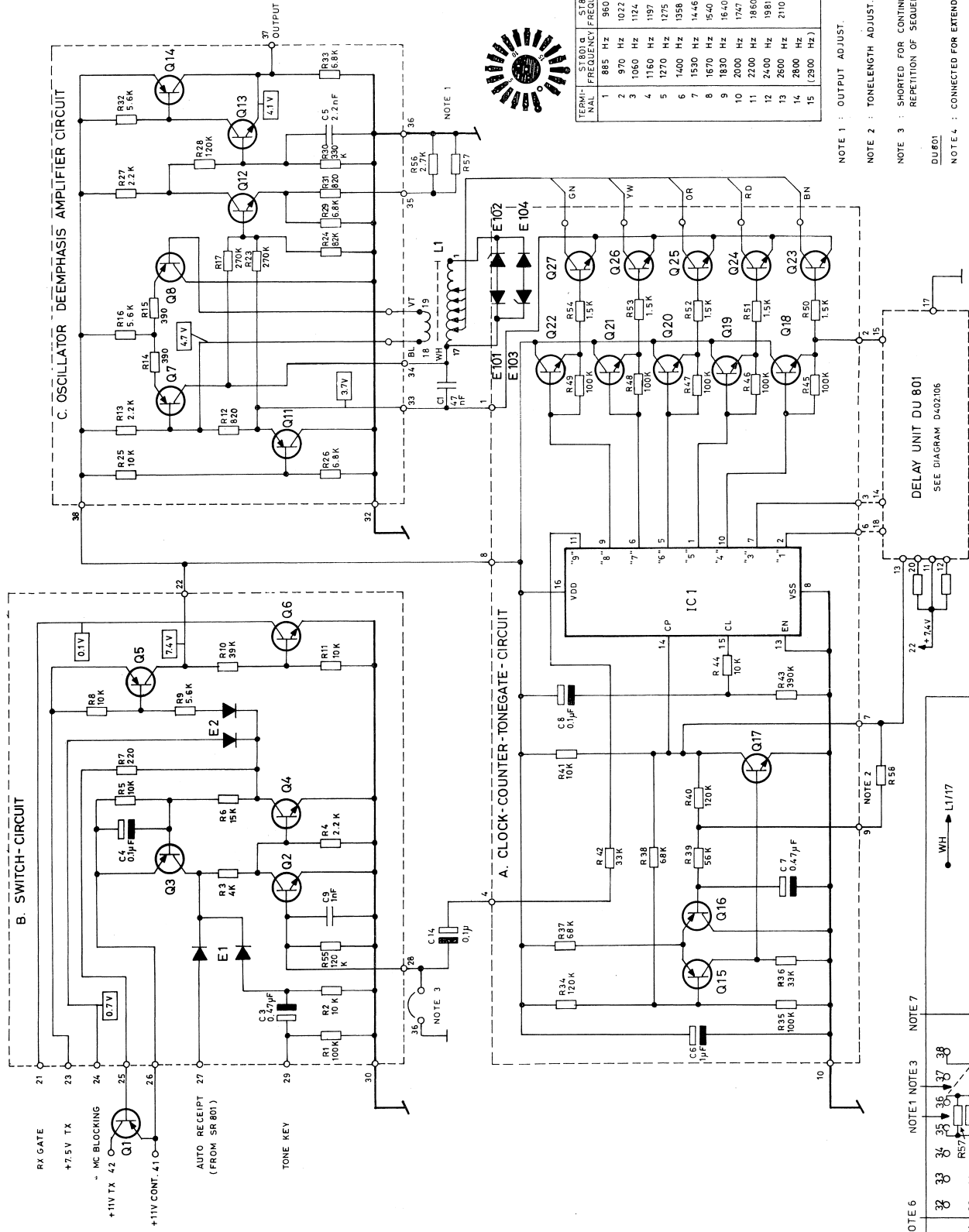




- NOTE 1: SENSITIVITY ADJUST
 NOTE 2: SHORTED FOR 5-TONE SEQUENCE CALL
 NOTE 3: SHORTED FOR 4-TONE SEQUENCE CALL
 NOTE 4: SHORTED FOR 3-TONE SEQUENCE CALL
 NOTE 10: REMOVE IN CRP800
 NOTE 11: SHORTED IN CRP800
 NOTE 12: OPEN IN CRP800 WITH SU802
 NOTE 13: IN CRP800 WITH SU802 THE CONNECTION TO TERMINAL 26 IS MOVED FROM a TO b.

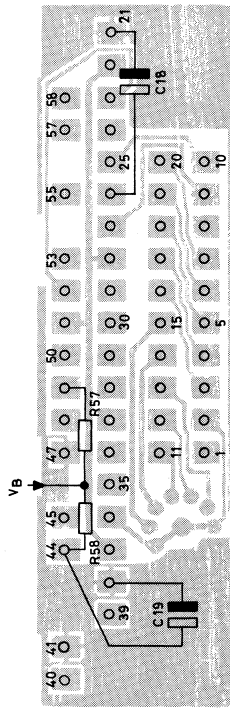
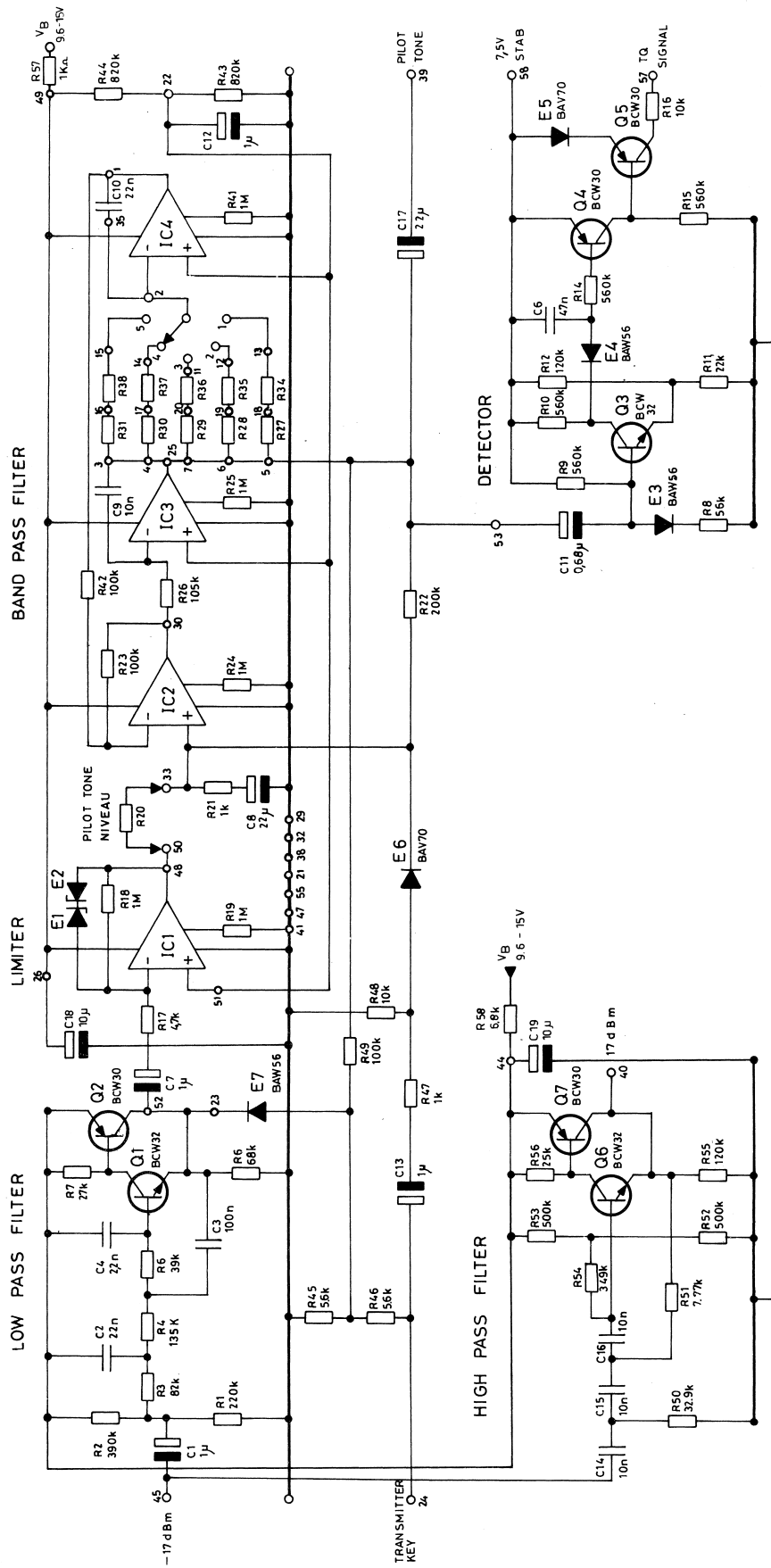


SEQUENTIAL TONE RECEIVER SR801-SR802



SEQUENTIAL TONE TRANSMITTER ST801a-ST802a - IS

D402.629



PILOT TONE UNIT TQ801a

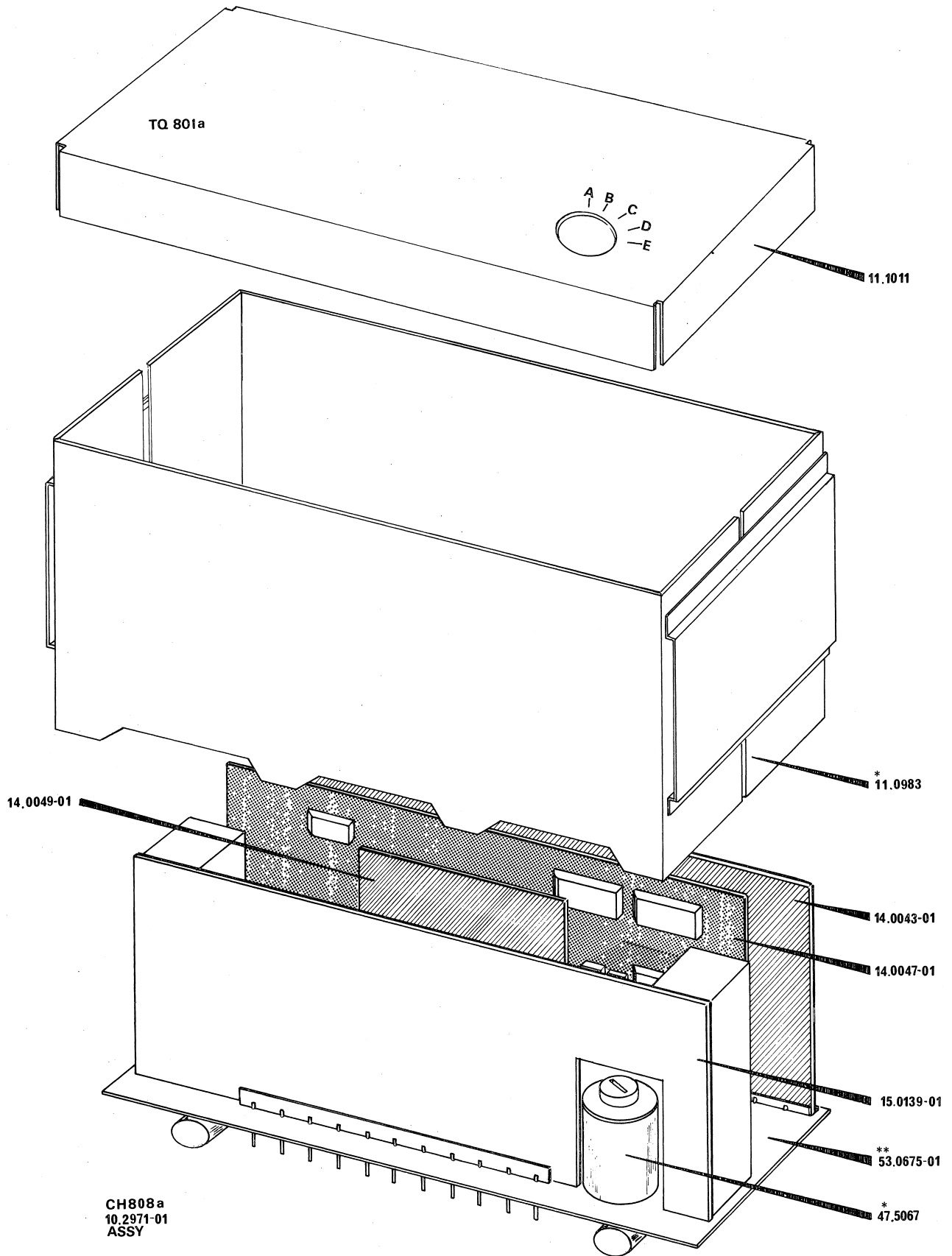
D401.804/2

Storno

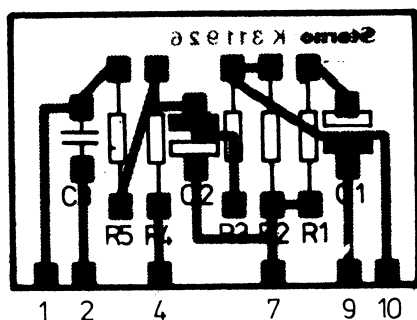
TYPE	Nº	CODE	DATA

PILOT TONE UNIT TQ801

X402. 262



PILOT TONE UNIT TQ801a
Mechanical Lay-out

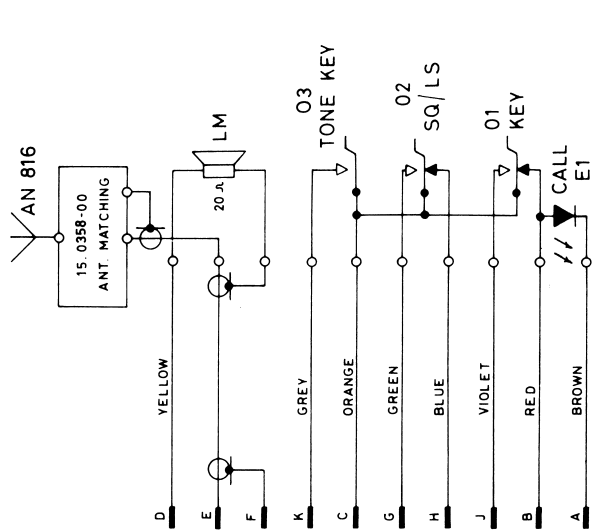


Viewed from component side
Set fra komponentside

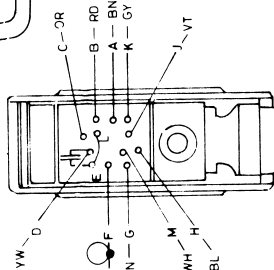
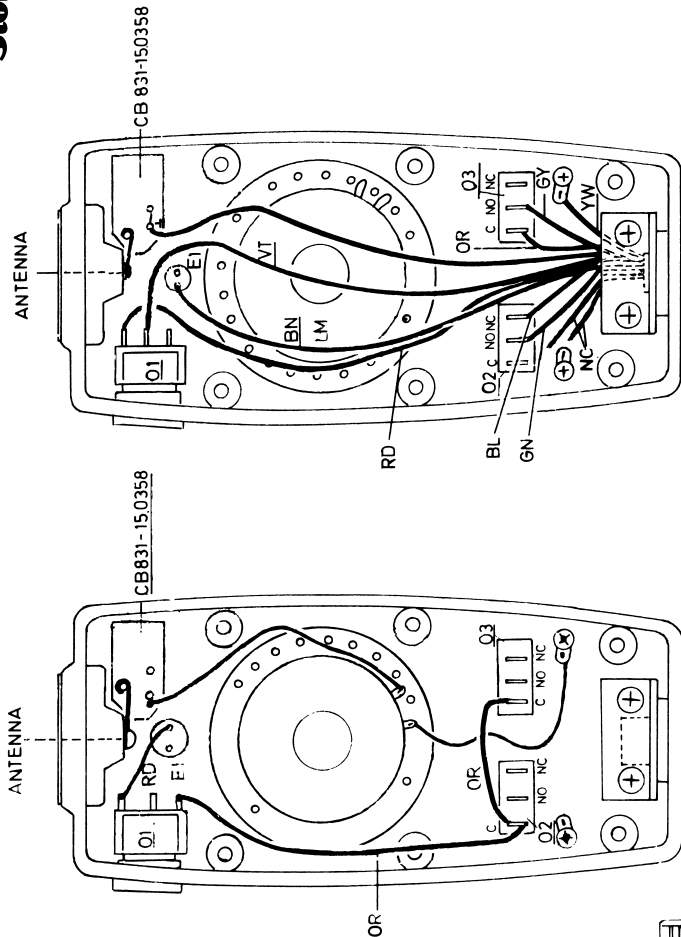
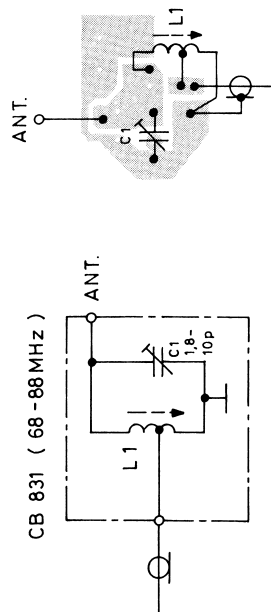
REV.	DESIGN/DRAWN	APPR.	COMP. LIST	LAY - OUT PLACERINGSTEGNING SU800 - 6999/02	DATE
	ESJ / IBa		X 129 877		24. 1. 77
Storno RADIO COMMUNICATION SYSTEMS					A4 DRWG. NO. I 129876

no	code	data	no	code	data
C1	73.5130-00	0,1 μ F tantal			
C2	73.5102-00	2,2 μ F/20V tantal			
C3	76.5072-00	47nF 50V			
R1	80.5077-00	220k Ω carb.film 1/10W			
R2	80.5073-00	100k Ω carb.film 1/10W			
R3	80.5077-00	220k Ω carb.film 1/10W			
R4	80.5068-00	39k Ω carb.film 1/10W			
R5	80.5066-00	27k Ω carb.film 1/10W			

REV.	DESING DRAWN	APPR.	COMP. LIST	Stykliste Parts list SU800-6999/02	DATE 26-1-77
	ESJ/FE				A4 DRWG. NO.
Storno RADIO COMMUNICATION SYSTEMS					X129877



CB 831



CONTROL UNIT CB831

Storno

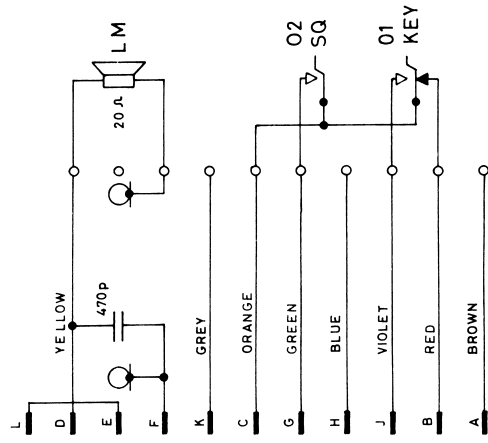
TYPE	N ^o	CODE	DATA
CB831		10. 3606	Control Unit (68-88 MHz)
	01	47. 0635	Switch, Key
	02	47. 0635	Switch. SQ/LS
	03	47. 0635	Switch, Tone Key
	E1	99. 5339	Light Emitting Diode
	LM	96. 5086	Microphone, dynamic 20 Ohm
		15. 0358	Antenna Matching Network
	C1	78. 5048	1. 8-10pF trimmer 300V
	L1	61. 1377	Coil

Storno

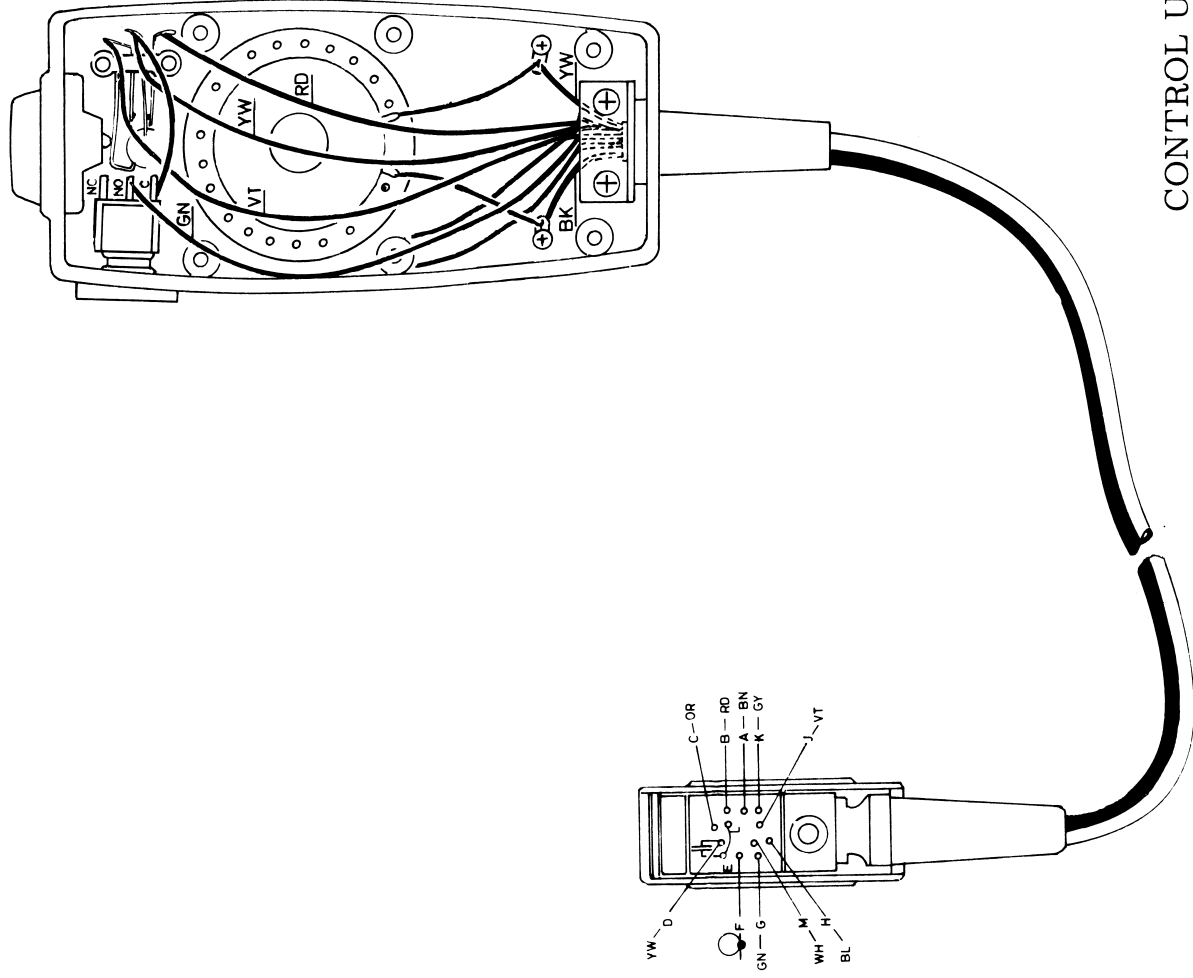
TYPE	N ^o	CODE	DATA

CONTROL UNIT CB831

X402. 567



CB 804



CONTROL UNIT CB804

Storno

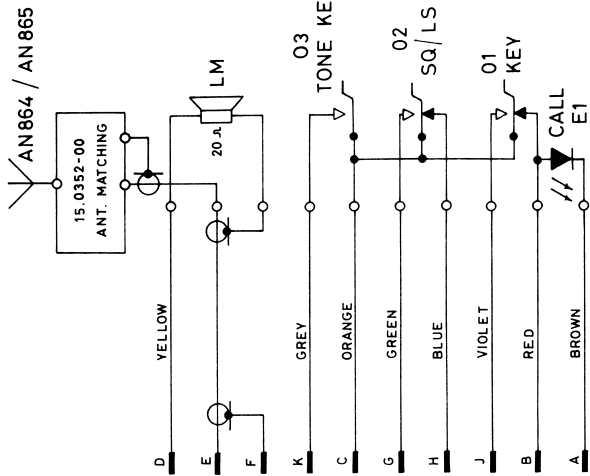
TYPE	Nº	CODE	DATA
CB804		10. 3602	Control Unit
	01	47. 5033	Switch, Key
	02	47. 0635	Switch, SQ
	LM	96. 5086	Microphone, dynamic 20 Ohm

Storno

TYPE	Nº	CODE	DATA

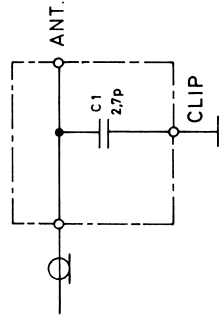
CONTROL UNIT CB804

X402. 564

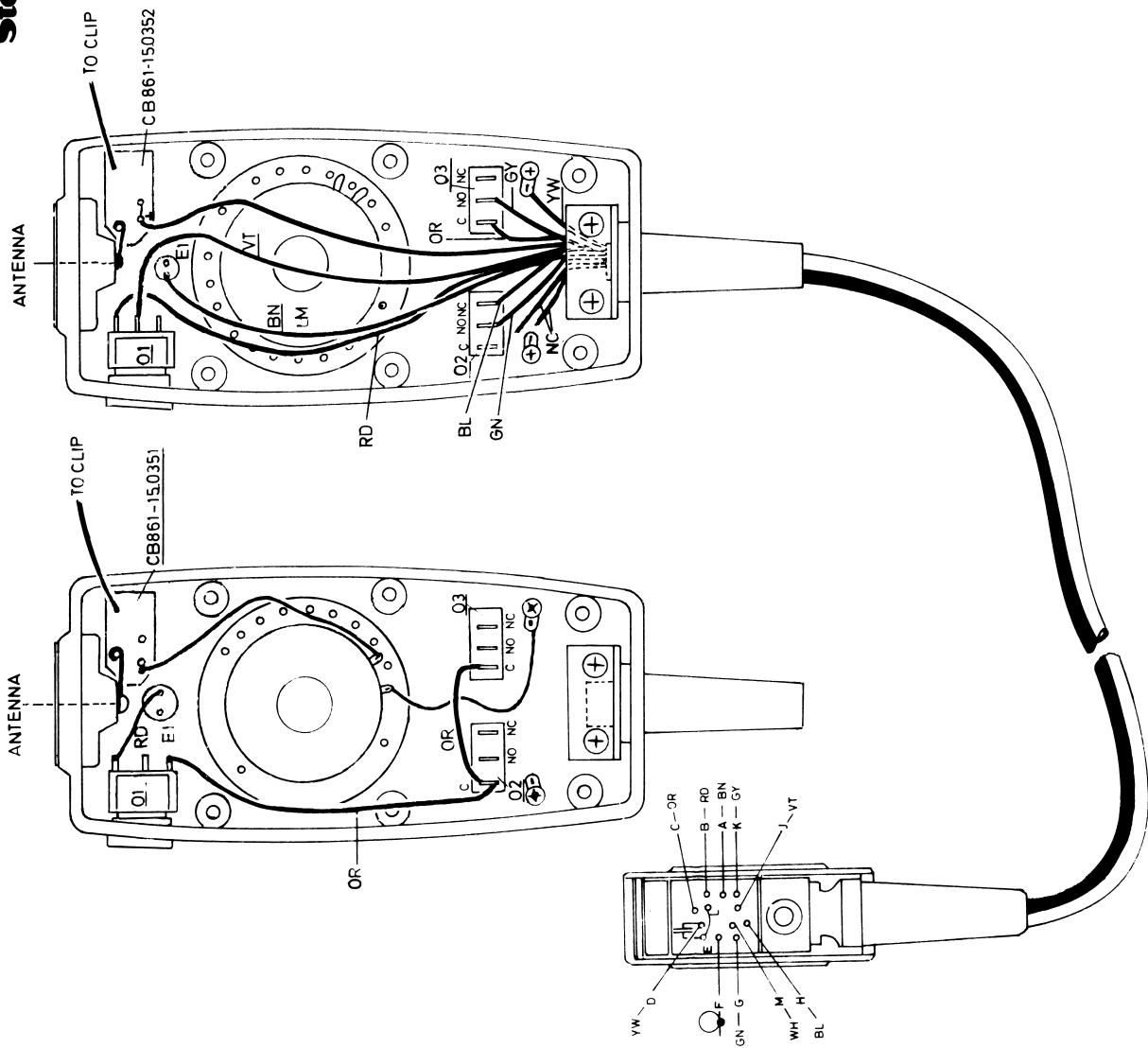
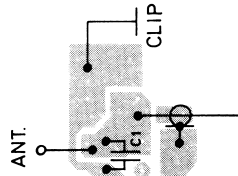


CB 861

CB 861 (420 - 470 MHz)



ANTENNA MATCHING NETWORK



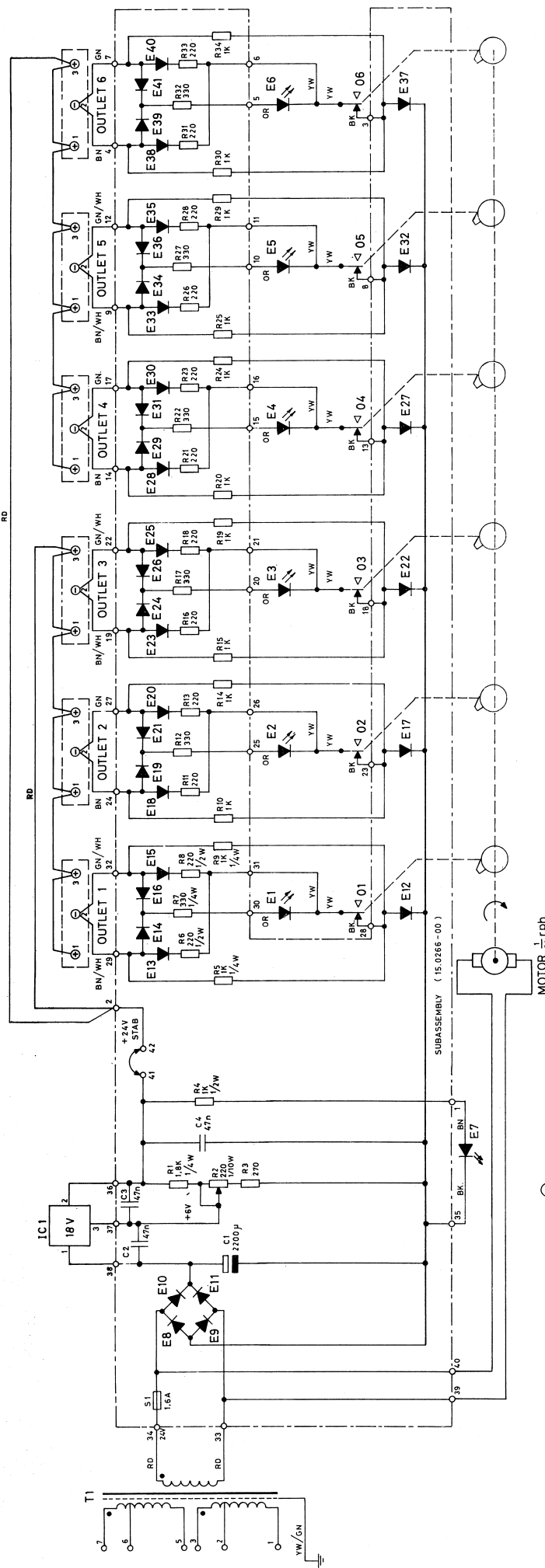
CONTROL UNIT CB861

Storno				Storno	
TYPE	Nº	CODE	DATA		

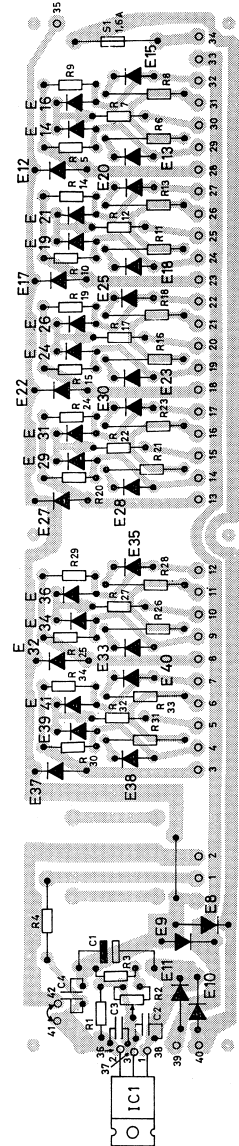
Storno				Storno	
TYPE	Nº	CODE	DATA		
CB861		10. 3607	Control Unit (420-470 MHz)		
	01	47. 0635	Switch, Key		
	02	47. 0635	Switch, LS/SQ		
	03	47. 0635	Switch, Tone Key		
	E1	99. 5339	Light Emitting Diode		
	LM	96. 5086	Microphone, dynamic 20 Ohm		
	C1	15. 0352	Antenna Matching Network		
		74. 5300	2. 7pF + 0. 25pF ceram PL 63V		

CONTROL UNIT CB861

X402.568



MAINS CONNECTIONS: (50 Hz)	0V - 110V - 120V
NETSP. TILSLUTNING:	220V
	240V



BATTERY CHARGING UNIT CU806

(10.4077-00)

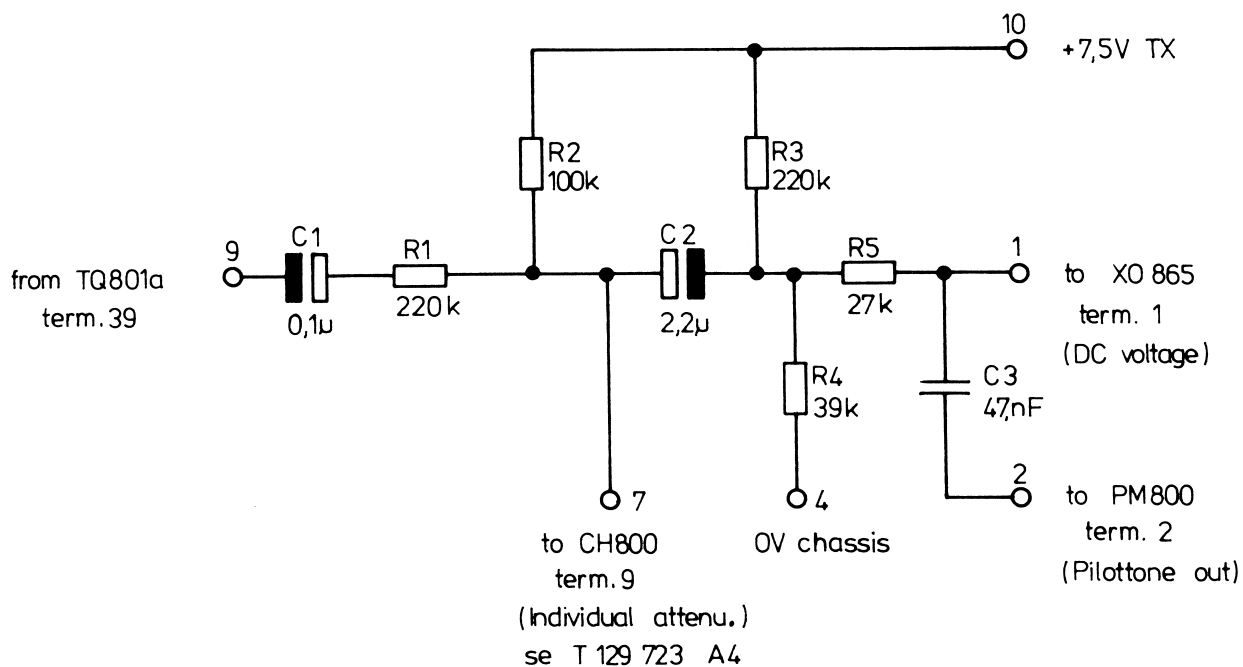
D 402.711

TYPE	Nº	CODE	DATA
CU806	C1	10. 4077-00	Charging Unit, 4 h
	C2	73. 5139	2200uF -10/+50%
	C3	76. 5072	47nF 10%
	C4	76. 5072	47nF 10%
	R1	80. 5452	1. 8Kohm 5%
	R2	86. 5073	220ohm 20% trim.
	R3	80. 5242	270ohm 5%
	R4	81. 5049	1Kohm 5%
	R5	80. 5449	1Kohm 5%
	R6	81. 5041	220ohm 5%
	R7	80. 5443	330ohm 5%
	R8	81. 5041	220ohm 5%
	R9	80. 5449	1Kohm 5%
	R10	80. 5449	1Kohm 5%
	R11	81. 5041	220ohm 5%
	R12	80. 5443	330ohm 5%
	R13	81. 5041	220ohm 5%
	R14	80. 5449	1Kohm 5%
	R15	80. 5449	1Kohm 5%
	R16	81. 5041	220ohm 5%
	R17	80. 5443	330ohm 5%
	R18	81. 5041	220ohm 5%
	R19	80. 5449	1Kohm 5%
	R20	80. 5449	1Kohm 5%
	R21	81. 5041	220ohm 5%
	R22	80. 5443	330ohm 5%
	R23	81. 5041	220ohm 5%
	R24	80. 5449	1Kohm 5%
	R25	80. 5449	1Kohm 5%
	R26	81. 5041	220ohm 5%
	R27	80. 5443	330ohm 5%
	R28	81. 5041	220ohm 5%
	R29	80. 5449	1Kohm 5%
	R30	80. 5449	1Kohm 5%
	R31	81. 5041	220ohm 5%
	R32	80. 5443	330ohm 5%
	R33	81. 5041	220ohm 5%
	R34	80. 5449	1Kohm 5%
	E1-E7	99. 5255	Light emitt. diode 20mA
	E8-E12	99. 5020	1N4004
	E13-E16	99. 5237	1N4148
	E17	99. 5020	1N4004
	E18-E21	99. 5237	1N4148
	E22	99. 5020	1N4004

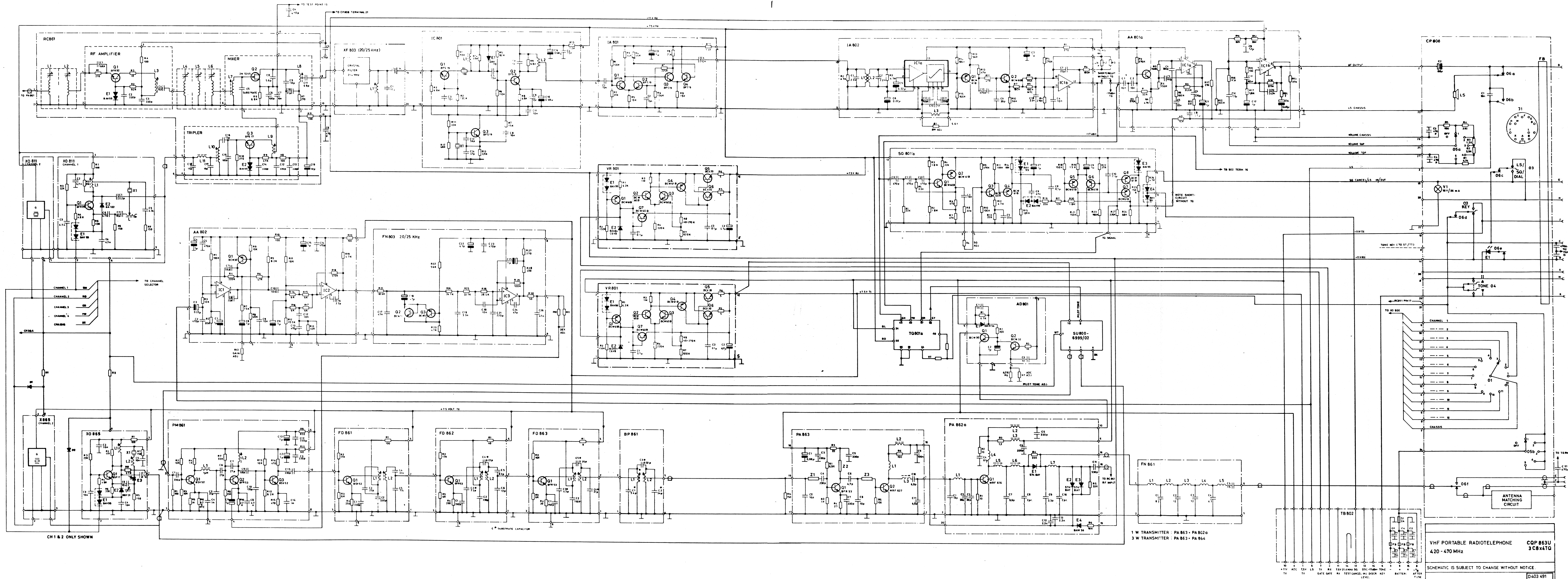
TYPE	Nº	CODE	DATA
	E23-E26	99. 5237	1N4148
	E27	99. 5020	1N4004
	E28-E31	99. 5237	1N4148
	E32	99. 5020	1N4004
	E33-E36	99. 5237	1N4148
	E37	99. 5020	1N4004
	E38-E41	99. 5237	1N4148
	IC1	14. 5106	Pos. Voltage regulator 18V-1A

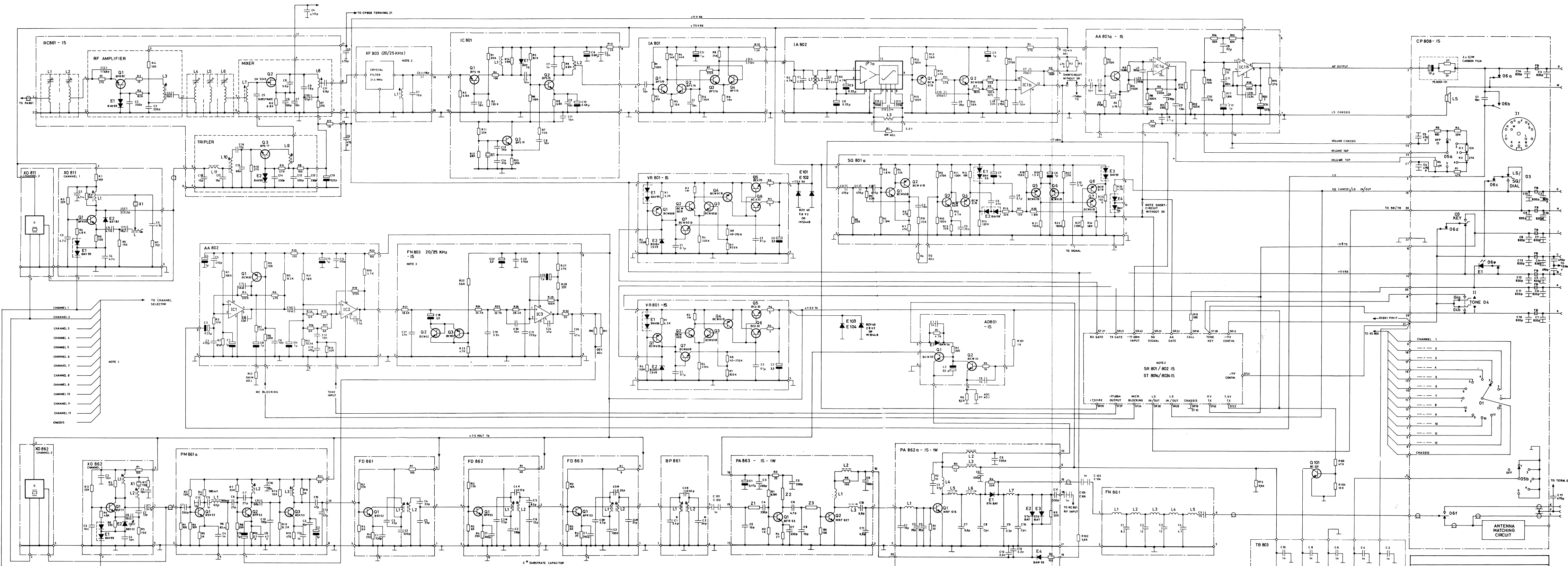
BATTERY CHARGING UNIT CU806

X402. 712



REV.	DESIGN/DRAWN	APPR.	COMP. LIST	CONNECTION UNIT BETWEEN TQ801 AND XO865 SU800 - 6999/02	DATE
	JaH/IBa				25. 1. 77
Storno RADIO COMMUNICATION SYSTEMS					A4 DRWG. NO. D 129 722





COMPONENTS CHARACTERISED BY 3 CIPRE DESIGNATION ARE LOCATED IN "BARRIER ZONE"

NOTE 1			NOTE 2		NOTE 3	
No. of channels	No. of X0811	No. of X0862	Tone Equipt.	Radio Set Type Designation 25KHz Spacing	Radio Set Type Designation 12.5KHz Spacing	
2	2	2	None	CQP863U Spec. IC8x2-IS	Not Applicable	
4	4	4	None	CQP863U Spec. IC8x4-IS	N/A	
8	8	8	None	CQP863U Spec. IC8x8-IS	N/A	
12	12	12	None	CQP863U Spec. IC8x12-IS	N/A	
2	2	2	SR801/802-IS	CQP863U Spec. IC8x2T-IS	N/A	
4	4	4	SR801/802-IS	CQP863U Spec. IC8x4T-IS	N/A	
8	8	8	SR801/802-IS	CQP863U Spec. IC8x8T-IS	N/A	
12	12	12	SR801/802-IS	CQP863U Spec. IC8x12T-IS	N/A	

UHF PORTABLE RADIOTELEPHONE CQP 863U	
420 - 470 MHz 1W IS	
DATE OF ISSUE	19-11-79
ISSUE NO.	
DIAGRAM NO.	D402.825/4

Storno