

**INTRINSICALLY SAFE
PORTABLE RADIOTELEPHONE
MODEL STORNOPHONE 800
TYPE CQP863U-IS 1W
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 ^o C - +55 ^o C -30 ^o C - +60 ^o 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				
BATTERY	Phase modulation		300-3000	300-2400	300-3000	300-2400	300-3000
	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
INTRINSICALLY SAFE RADIOTELEPHONE
GENERAL DESCRIPTION AND OPERATING INSTRUCTIONS.

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

Radio set for 2-metre band:

CQP813U-IS 1W

CQP814U-IS 1W

Radio set for 4-metre band:

CQP833U-IS 1W

CQP834U-IS 1W

Radio set for 0.7 metre band:

CQP863U-IS 1W

Battery type BU809

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 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.

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

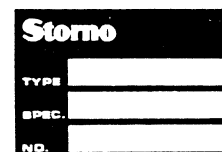
Type specification is as follows:

Specification	code
0. 1-1. 0W 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 1W , 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.



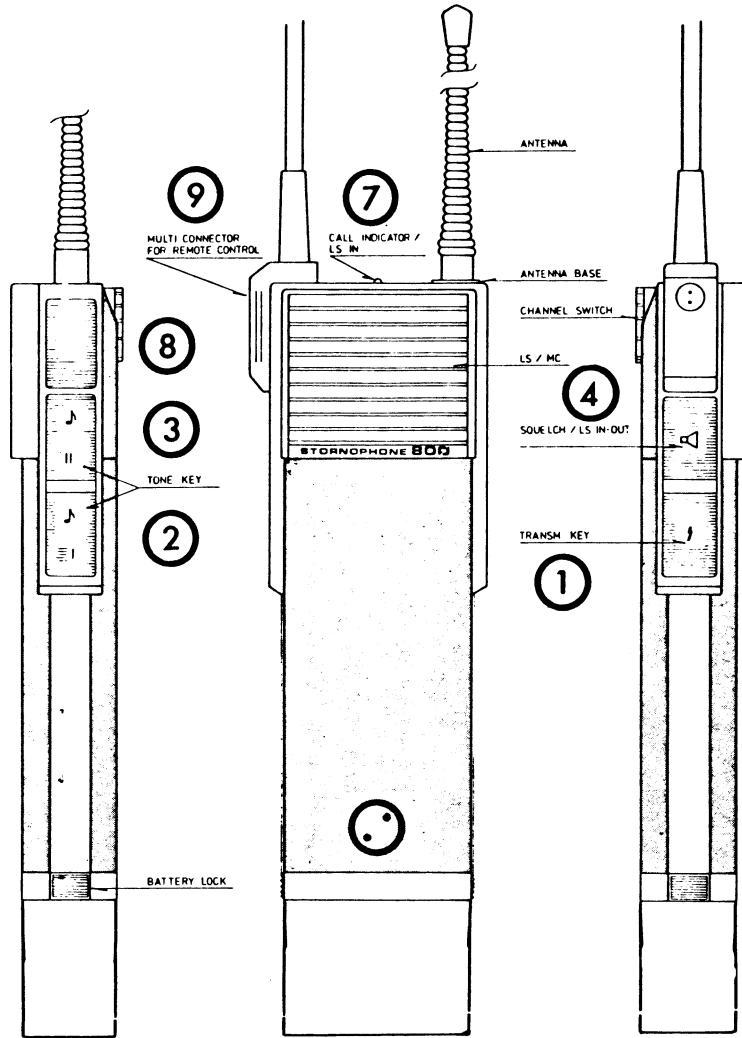
OPERATING INSTRUCTIONS

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:

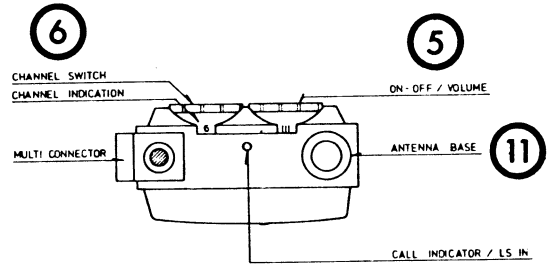
1. push button for keying the transmitter
2. push button for tone keying, tone I
3. push button for tone keying, tone II
4. push button for squelch cancelling-LS in/out.
5. dial-type knob for volume control and on/off switch.
6. 12-position dial-type channel knob
7. call indicator
8. hinged lid for access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

10



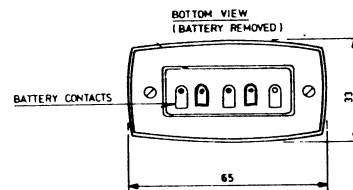
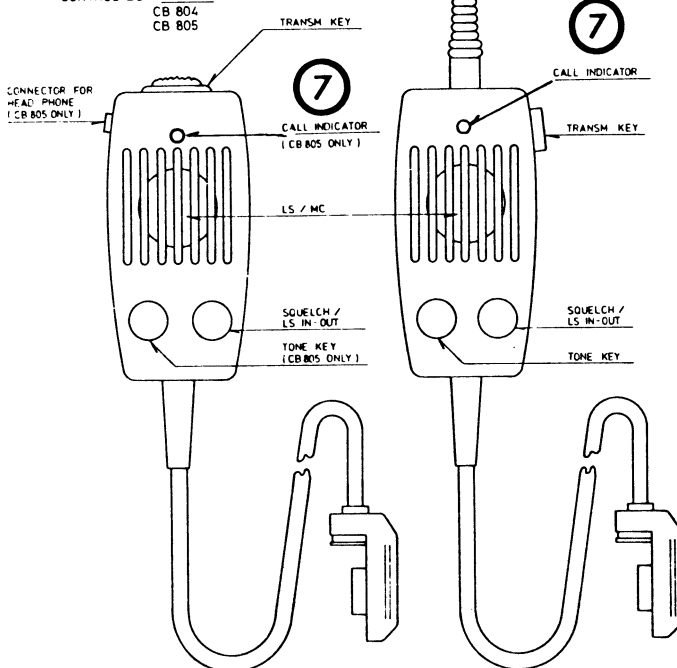
CONTROL BOX WITH ANTENNA

CB 812
CB 831
CB 851
CB 861



CONTROL BOX WITHOUT ANTENNA

CB 804
CB 805



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 tone-key.

ACCESSORIES

Antennas

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
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 the control units type CB812-IS, CB831-IS, or CB861-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 0.2W 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 cylindrical 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 110V or a 220V 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 885Hz to 2800Hz.
- ST802-IS four or five tone sequential tone transmitter, tone frequencies, from 960Hz to 2110Hz.
- SR801-IS four or five tone sequential tone receiver, tone frequencies from 885Hz to 2900Hz.
(can also be coded for use as a double tone receiver).

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

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

STORNOPHONE800U-IS 1W

INTRINSICALLY SAFE RADIOTELEPHONE

MECHANICAL AND CIRCUIT DESCRIPTION

Mechanical Construction.

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 7.5V 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 self-contained 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.

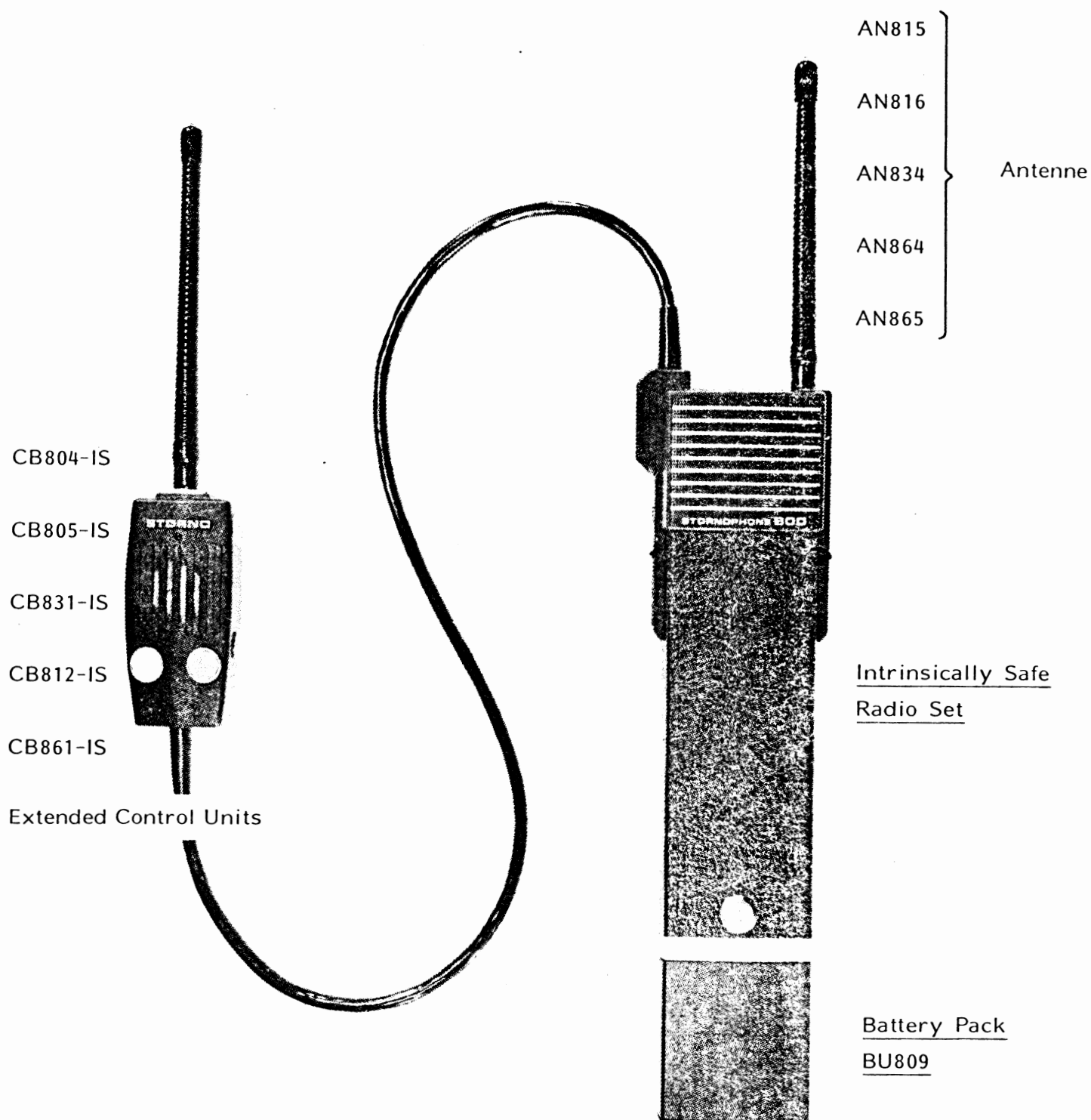
The intrinsically safe battery, type BU809, consists of two sections, a regulator section and a battery cell pack held together by two screws.

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.

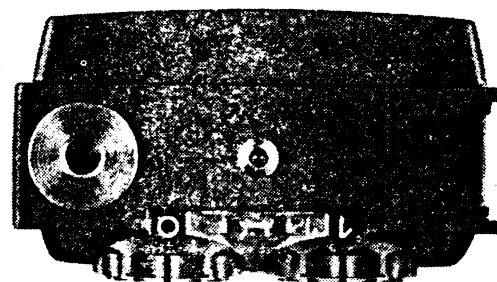
The battery can only be charged in battery charger type CU806.

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



General Assembly View of Intrinsically
Safe 800 Equipment With Extended
Control Units, Antenna and Battery

Antenne Connector
-Silverplated Brass.



Control Head Plus
Operating Buttons
ABS-Plastic

Cabinet CA80x

Control Head

CP808-IS

Tone Equipment
SR801/802-IS
ST801/802-IS

Low Power
-150 mA

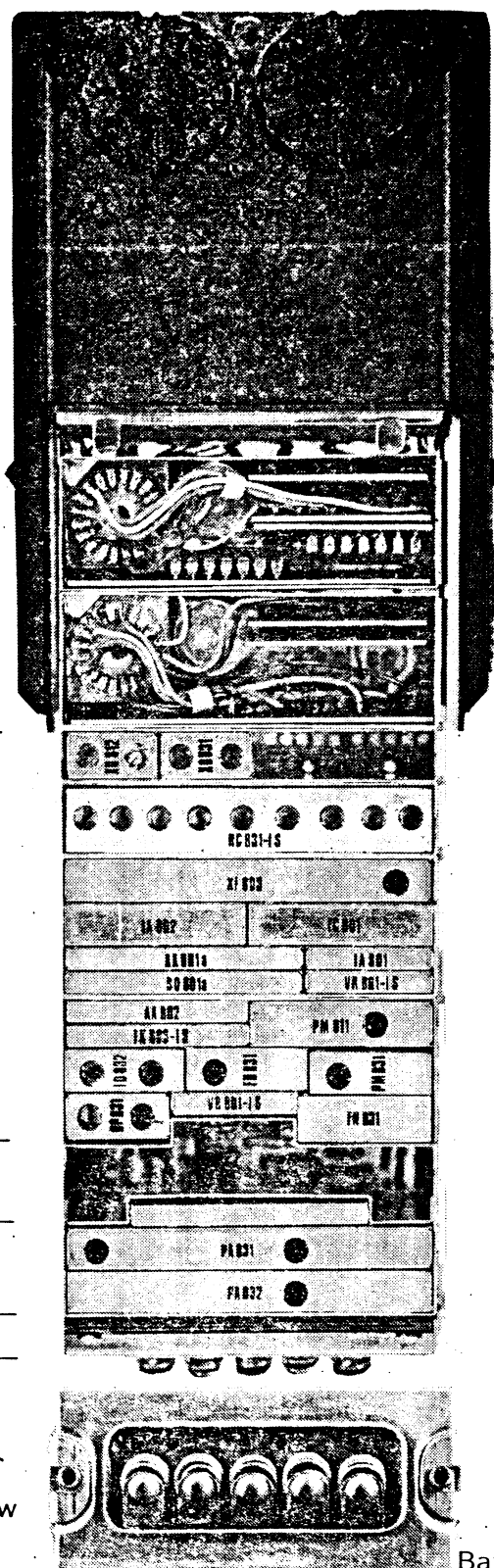
Zone

Barrier Zone

High Power
360 mA Zone

Battery Connector

Battery connector
viewed from below

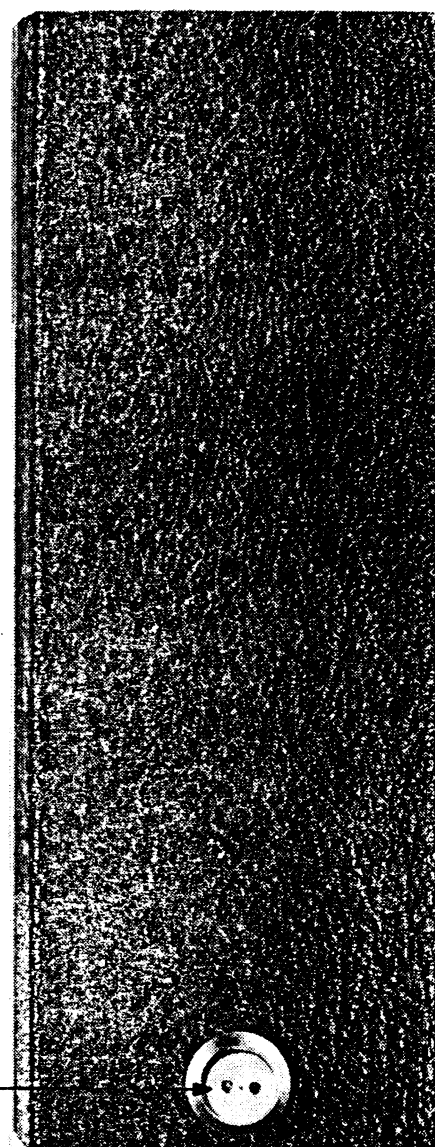


Protective Leather
Covering

External Metal Surfaces
25 μ Hard Anodising Plus
Polyurethan Lacquer.

5 Spring Contacts
Silver Palladium
Plated

Battery Lock
Hard Cromed
Brass



CQP8XX 1 C 8Xxx - IS - Module Side

Doc. No. 60.406-E1

Date of issue 19/2/79

Arrangement of Segregated Areas In IS - 800 Equipment

Storno

Antenne Connector
-Silverplated Brass.

Control Head

Control Head Plus
Operating Buttons
ABS-Plastic

CP808-IS

STORNOPHONE 800

Cabinet CA80x

Tone Equipment
SR801/802-IS
ST801/802-IS

Low Power
-150 mA
Zone

Double Zener

Clamps

Barrier Zone

High Power
360 mA Zone

Battery Connector

Protective Leather
Covering

Conduit

External Metal
Surfaces Anodised
Plus Polyurethan
Lacquer

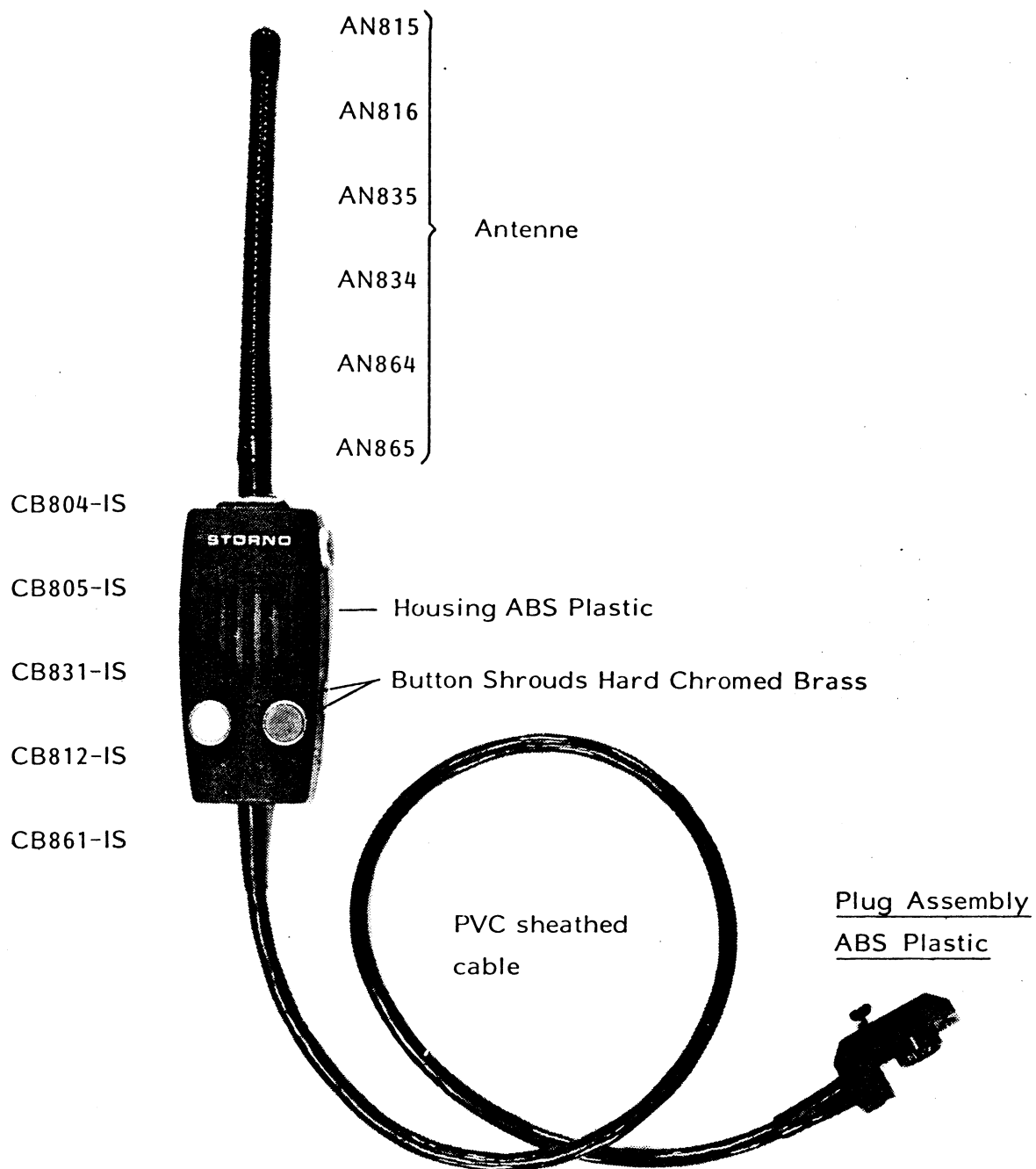
Battery Lock
Hard Chromed
Brass.

Doc. No. 60.407-E1

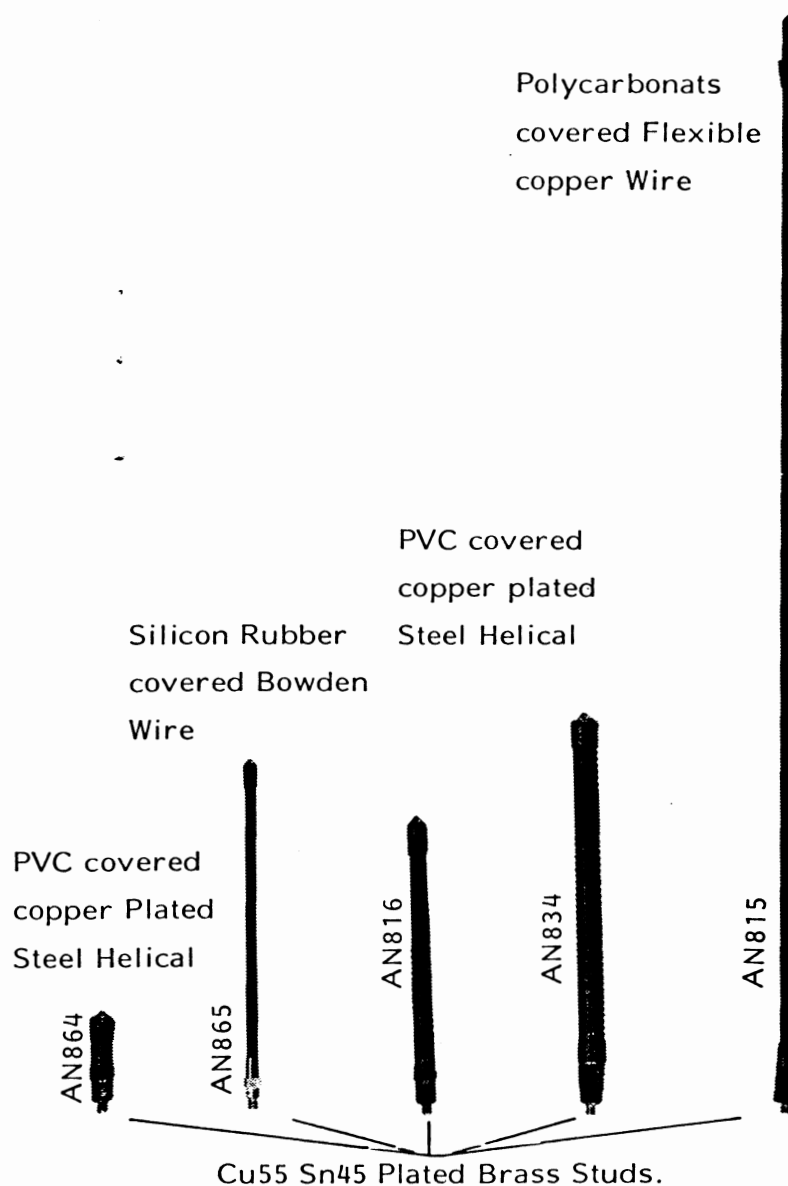
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CQP8XX 1 C 8Xxx - IS - Cableloom Side

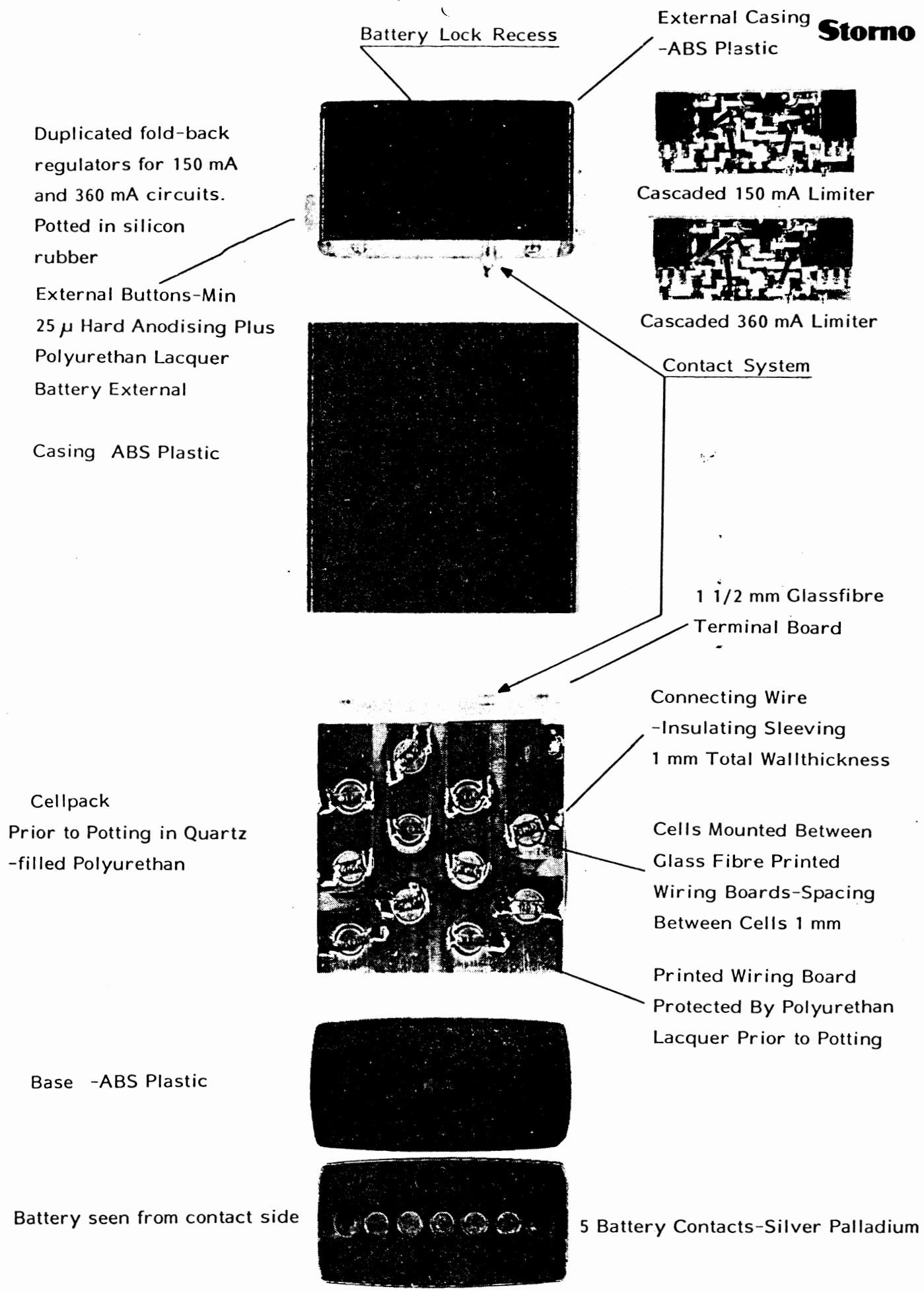
Arrangement of Segregated Areas IN IS - 800 Equipment



General View of Intrinsically Safe
Extended Control Units for use With
Intrinsically Safe CQP800 Equipment.



Antenne Types for use with
Intrinsically Safe CQP800 Equipment



Battery Lock Recess

External Casing

-ABS Plastic

Duplicated fold-back regulators for 150 mA and 360 mA circuits. Potted in silicon rubber



Cascaded 150 mA Limiter



Cascaded 360 mA Limiter

External Buttons-Min 25 μ Hard Anodising Plus Polyurethan Lacquer Battery External

Contact System

Casing ABS Plastic

1 1/2 mm Glassfibre Terminal Board

Cellpack Prior to Potting in Quartz-filled Polyurethan

Connecting Wire -Insulating Sleeving 1 mm Total Wallthickness

Cells Mounted Between Glass Fibre Printed Wiring Boards-Spacing Between Cells 1 mm

Printed Wiring Board Protected By Polyurethan Lacquer Prior to Potting

Base -ABS Plastic

Battery seen from contact side

5 Battery Contacts-Silver Palladium

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)

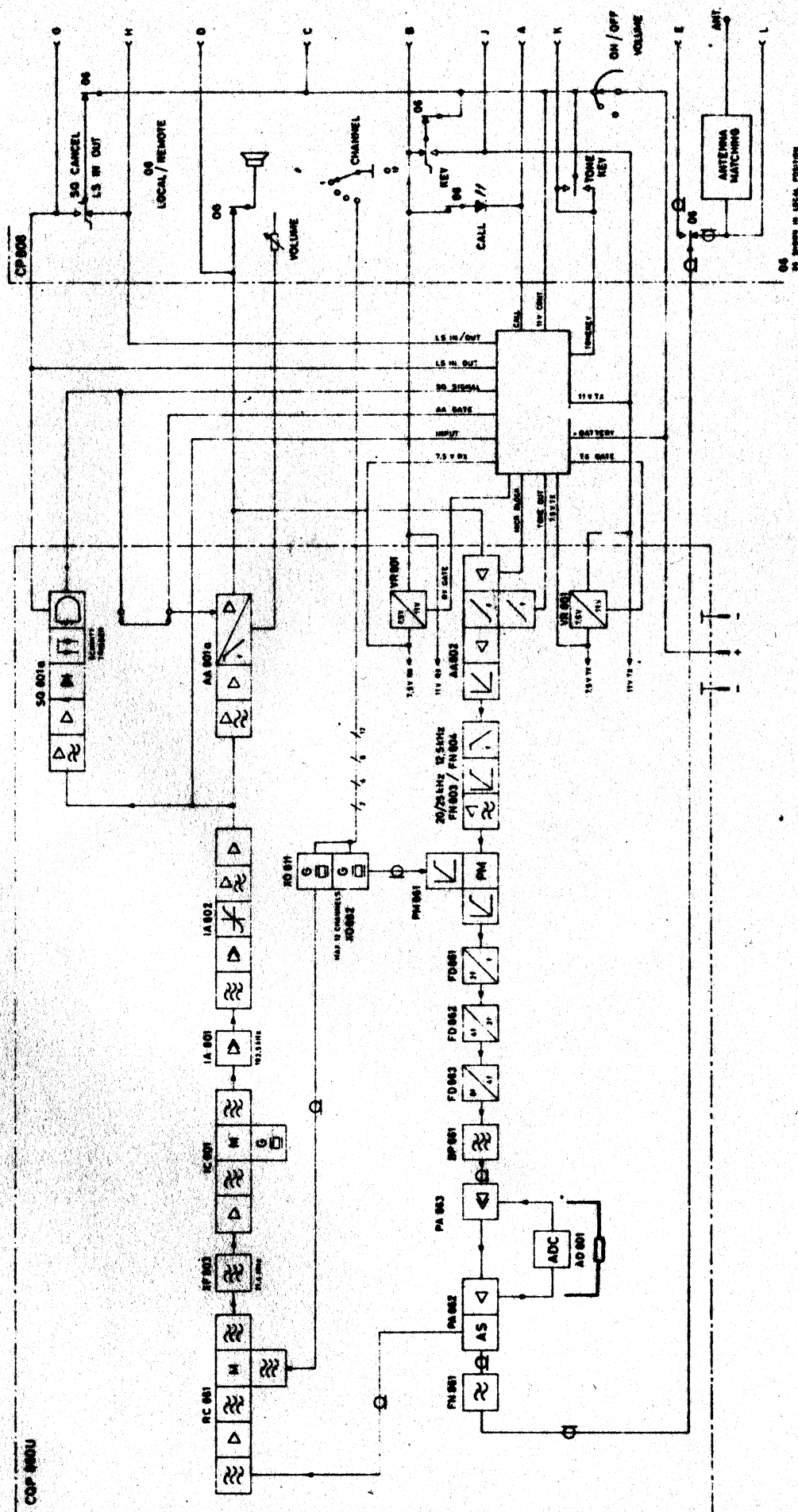
This circuit is omitted in 0.2W transmitters and replaced by two voltage dropping resistors. The transmitter output current is kept very nearly constant by means of the ADC Circuit. The voltage drop across a small resistor in the output transistor's collector return is monitored by the ADC stage, which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

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, polyurethane, 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 polyurethane 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-

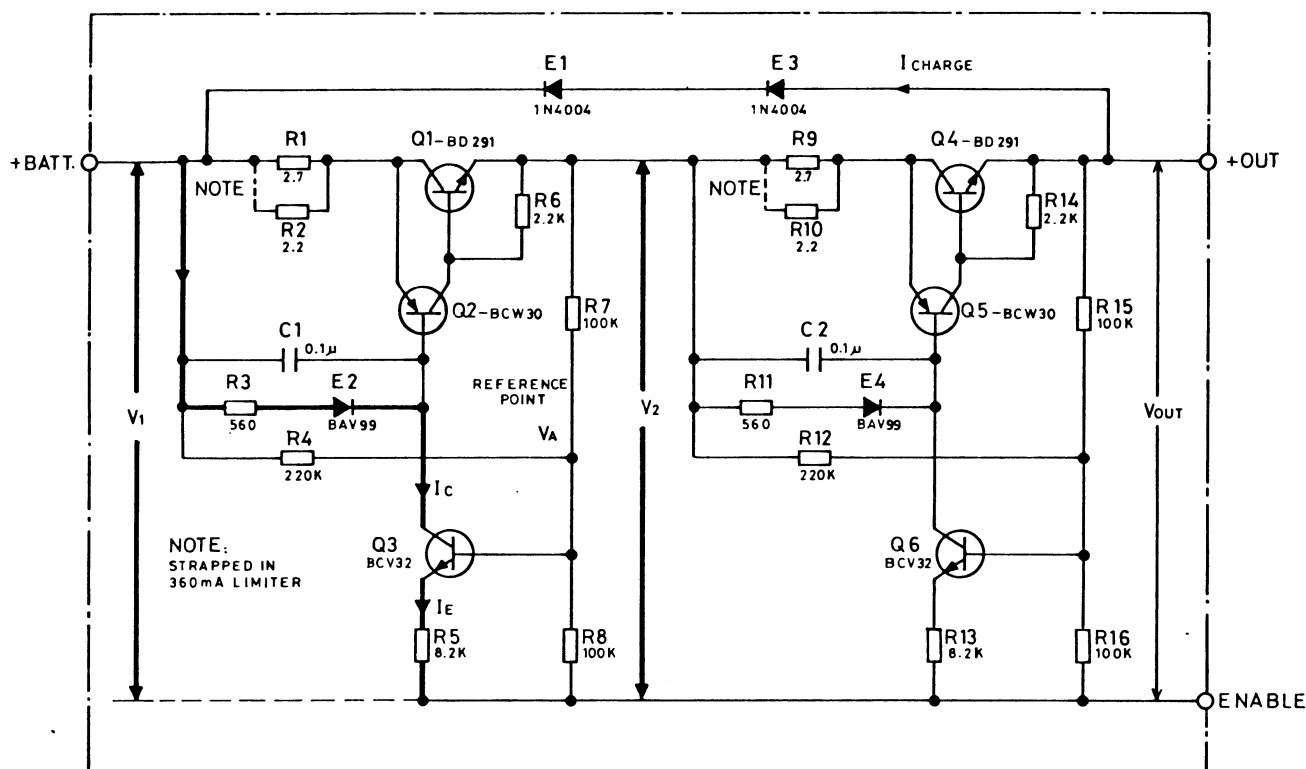


FIG. 1. BU809 CURRENT LIMITER

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.

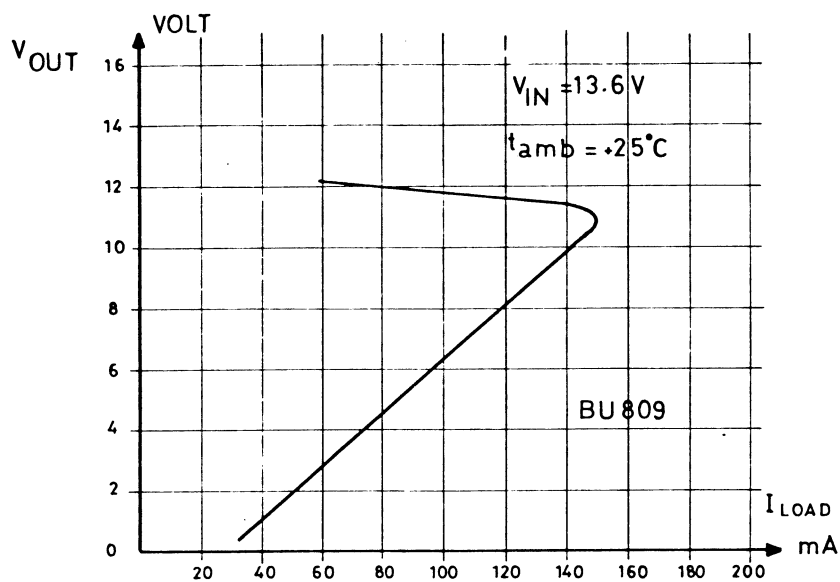


FIG.2. TYPICAL 150mA LIMITER CHARACTERISTIC

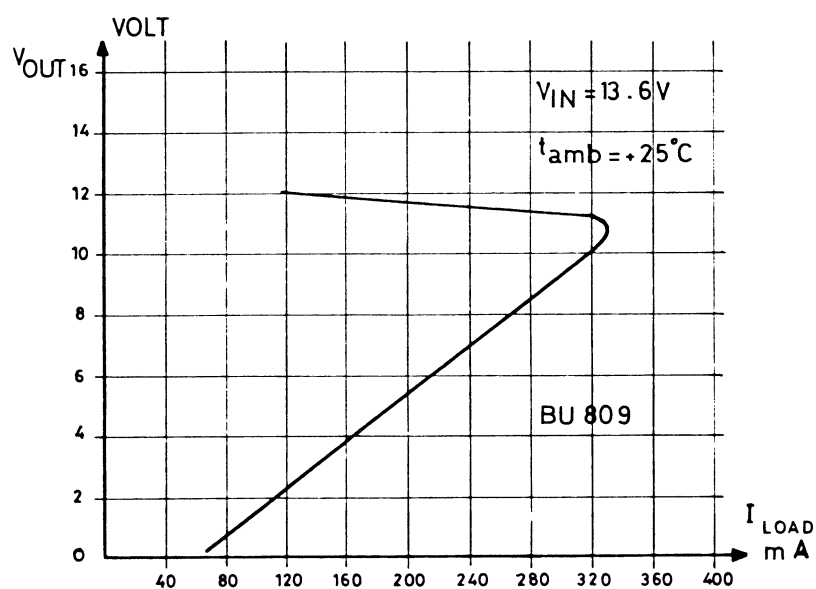


FIG.3. TYPICAL 360mA LIMITER CHARACTERISTIC

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.

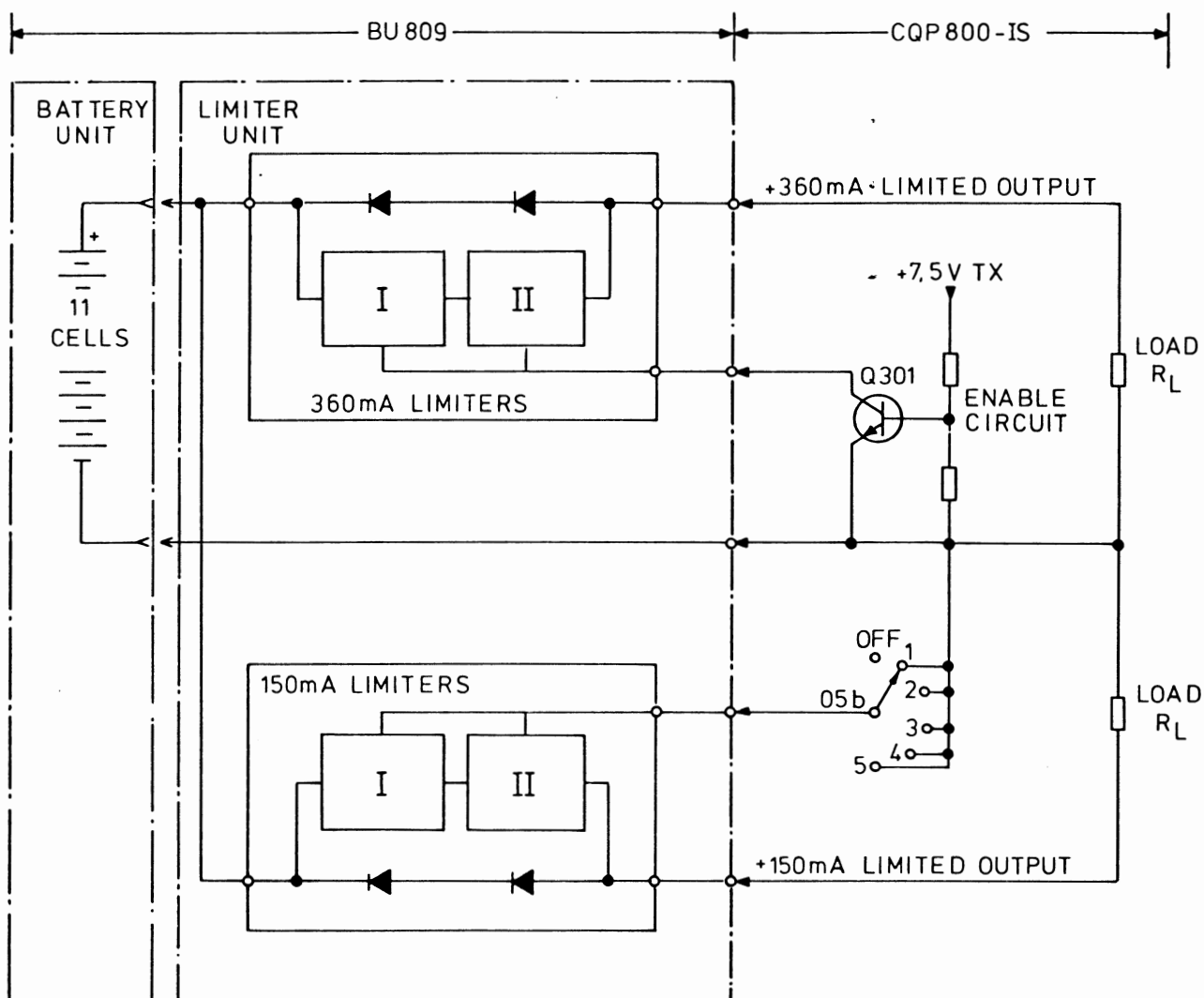


FIG.4. ENABLE FUNCTION

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.

Number of cells

11

Maximum short circuit current

150mA output: Less than 40mA

360mA output: Less than 70mA

TECHNICAL SPECIFICATIONS

Nominal battery voltage

13.6V

Maximum load current

150mA

360mA

Dimensions

94 x 63 x 32

Nominal battery capacity

225mAh

Weight

GRAPHICAL SYMBOLS USED IN STORNO CIRCUIT DIAGRAMS

Resistors (R)

	Resistor
	Resistor with fixed tap
	Variable resistor
	Resistor with movable tap
	Varistor (voltage-dependent resistor)
	Temperature-dependent resistor with negative temperature coefficient
	Light-sensitive resistor (Photosensitive resistor)

Capacitors (C)

	Capacitor
	Variable capacitor
	Trimmer capacitor
	Feedthrough capacitor
	Electrolytic capacitor

Coils (L)

	RF coil, air core
	Coupled RF coils, air core
	RF coil with core
	RF coil with adjustable core
	AF choke

Transformers (T)

	Transformer with adjustable RF cores
	Transformer with iron core
	Transformer with screen connected to chassis

Diodes (E)

	Diode
	Bridge rectifier
	Series-connected stabilizer diodes within one case
	Light-sensitive diode (Photosensitive diode)
	Light-emitting diode
	Zener diode (uni-directional)
	Zener diode (bidirectional)
	Tunnel diode
	Varactor diode (capacitance diode)
	Controlled rectifier, PNP (N-thyristor)
	Controlled rectifier, NPN (P-thyristor)

Transistors (Q)

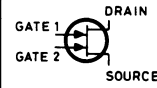
	Transistor, PNP
	Transistor, NPN
	Light-sensitive transistor
	Unipolar transistor with N-type base
	Unipolar transistor with P-type base

Junction Field Effect Transistors (JFET)

	N-channel JFET
	P-channel JFET
	N-channel dual gate JFET



P-channel dual gate JFET

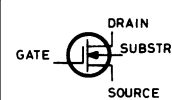


N-channel JFET tetrode



P-channel JFET tetrode

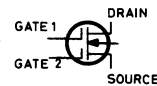
Insulated Gate Field Effect Transistors (IGFET or MOS)



N-channel IGFET (MOS)



P-channel IGFET (MOS)



N-channel dual gate IGFET (MOS)

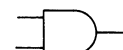


P-channel dual gate IGFET (MOS)

Integrated Circuits (IC)

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

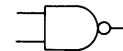
Gates



AND gate



OR gate



NAND gate



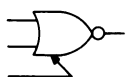
NOR gate

GRAPHICAL SYMBOLS USED IN STORNO CIRCUIT DIAGRAMS

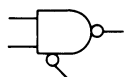
Gates, continued



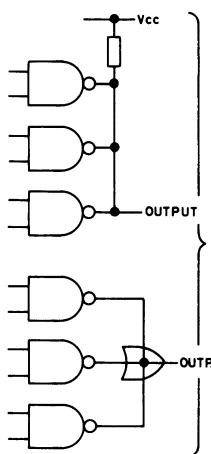
Exclusive OR gate



NOR gate with expander input (high)



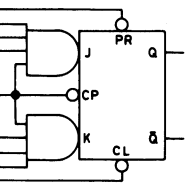
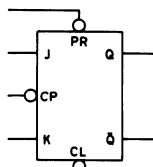
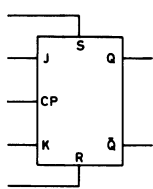
NAND gate with expander input (low)



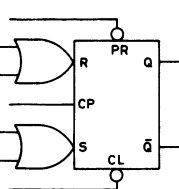
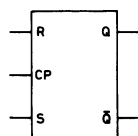
Wired-OR (combined OR outputs) (presentation at top is used in detailed diagrams; presentation below is used in functional diagrams)

Flip-flops

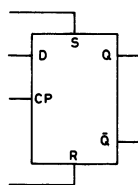
Abbreviations used: S = Set
R = Reset
CP = Clock Pulse
PR = Preset
CL = Clear



J-K Flip-flops

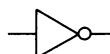


R-S Flip-flops



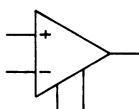
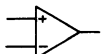
D Flip-flop

Inverters



Inverter

Operational Amplifiers



Operational amplifiers

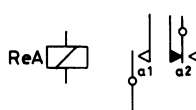
Relays (RE)



Single-coil relay



Dual-coil relay



Relay with make contacts and change-over contacts



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



Polarized relay



Coil for slow-release relay



Coil for slow-acting relay

Contacts

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



Make contacts



Break contacts



Change-over contacts



Change-over contacts, centre off



Make contacts, delayed operation



Make contacts, delayed release



Mechanically coupled make contacts

Switches and Keys (O)



On/off switch



Locking keys or switches; push on, push off



Non-locking self-releasing keys or switches



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





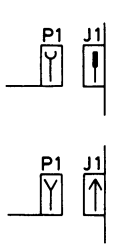
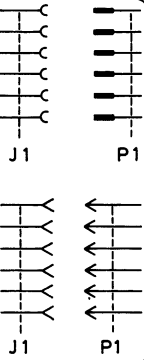








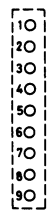

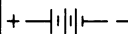











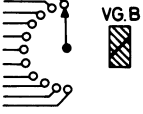
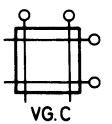


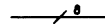
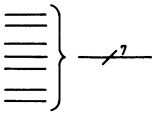









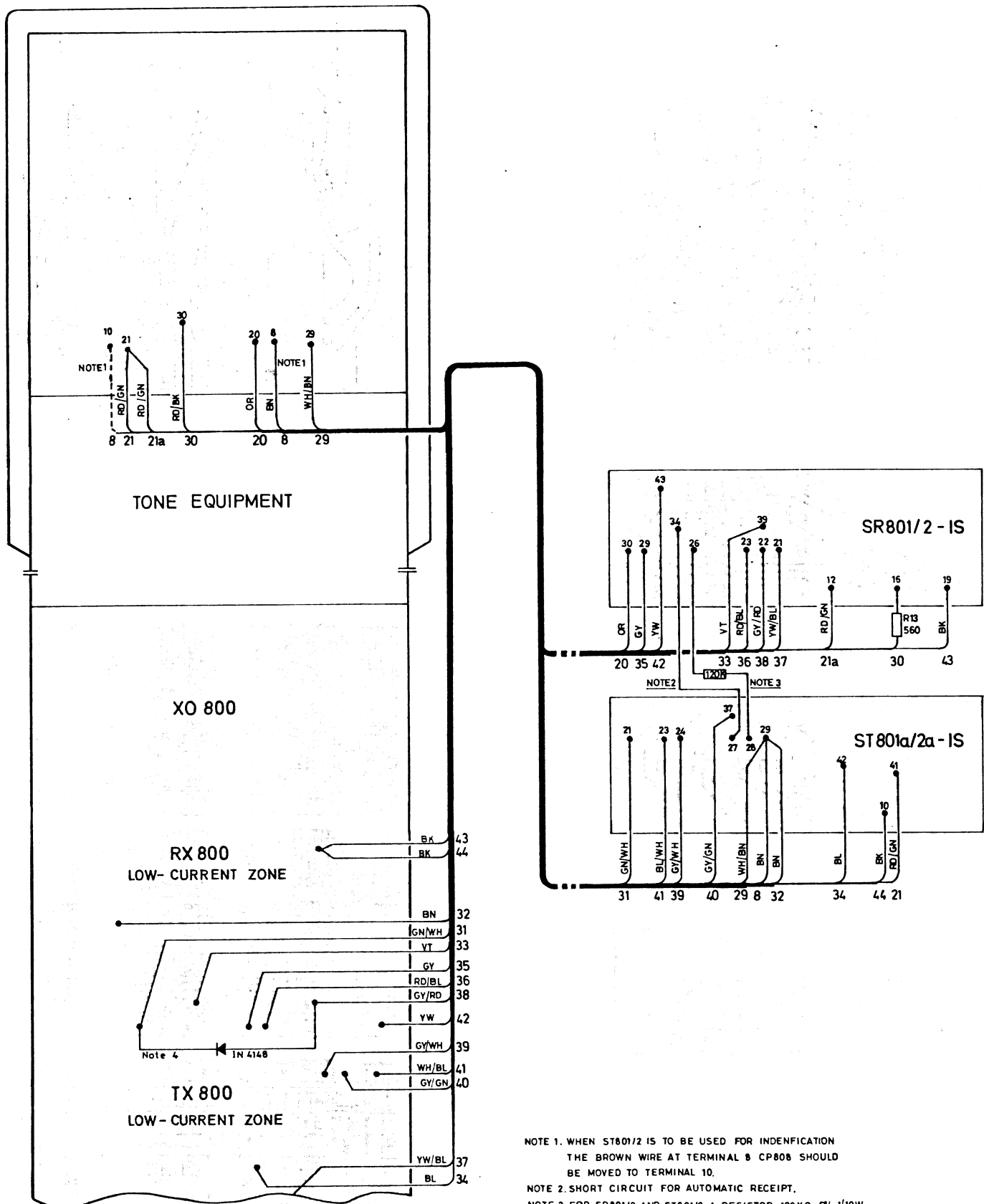
Self-releasing switch (overcurrent switch etc.)



Rotary switch

GRAPHICAL SYMBOLS USED IN STORNO CIRCUIT DIAGRAMS

Lamps (V)  Indicator lamp  Neon lamp	Connectors (J and P)  Female connector (socket). Lower symbol discontinued  Male connector (plug). Lower symbol discontinued  Schematic symbols for multi-wire connectors. (Upper symbol will gradually supersede lower symbol)  Multi-wire connectors are always designated "J" when permanently mounted on a cabinet or unit etc., "P" when fitted to cables  Detail symbols for multi-wire connectors. (Upper symbol will gradually supersede lower symbol)  Where both connectors are fitted to cables, male connector is designated "P" and female connector "J"	Loudspeakers (LS)  Loudspeaker
Fuses and Cut-outs (S)  Fuse  Circuit-breaker		Telephones (TEL)  Telephone  Single headphone (earphone)  Double headphone (headset)
Tag Strips (KL)  Tag strip - dashed frame may be wholly or partly omitted		Microphones (M) 
Batteries (BT)  Battery		Meters etc.  Indicating instrument  Balancing instrument  Inkwriter, recording instrument
Feedthrough Filters (F)  Feedthrough filter		Test Points  DC test point  AC test point
Ferrite Beads (FB)  Ferrite bead		Replaceable Connections  Cross-field connection (jumper)  Strap
Crystals (X)  Crystal		Selectors (VG)  Schematic symbol for rotary selector with designation of number of contact points  Detail symbol for rotary selector  Co-ordinate selector
Cables and Wires (W)  Usual conductor  Three conductors  Eight conductors  Shift from multiple-line to single-line presentation  Screened wire  Coaxial cable	 Coaxial plug  Coaxial socket  Coaxial plug for floating screen  Coaxial socket for floating screen  Coaxial plug with mating socket	



NOTE 1. WHEN ST801/2 IS TO BE USED FOR IDENTIFICATION THE BROWN WIRE AT TERMINAL 8 CP800 SHOULD BE MOVED TO TERMINAL 10.

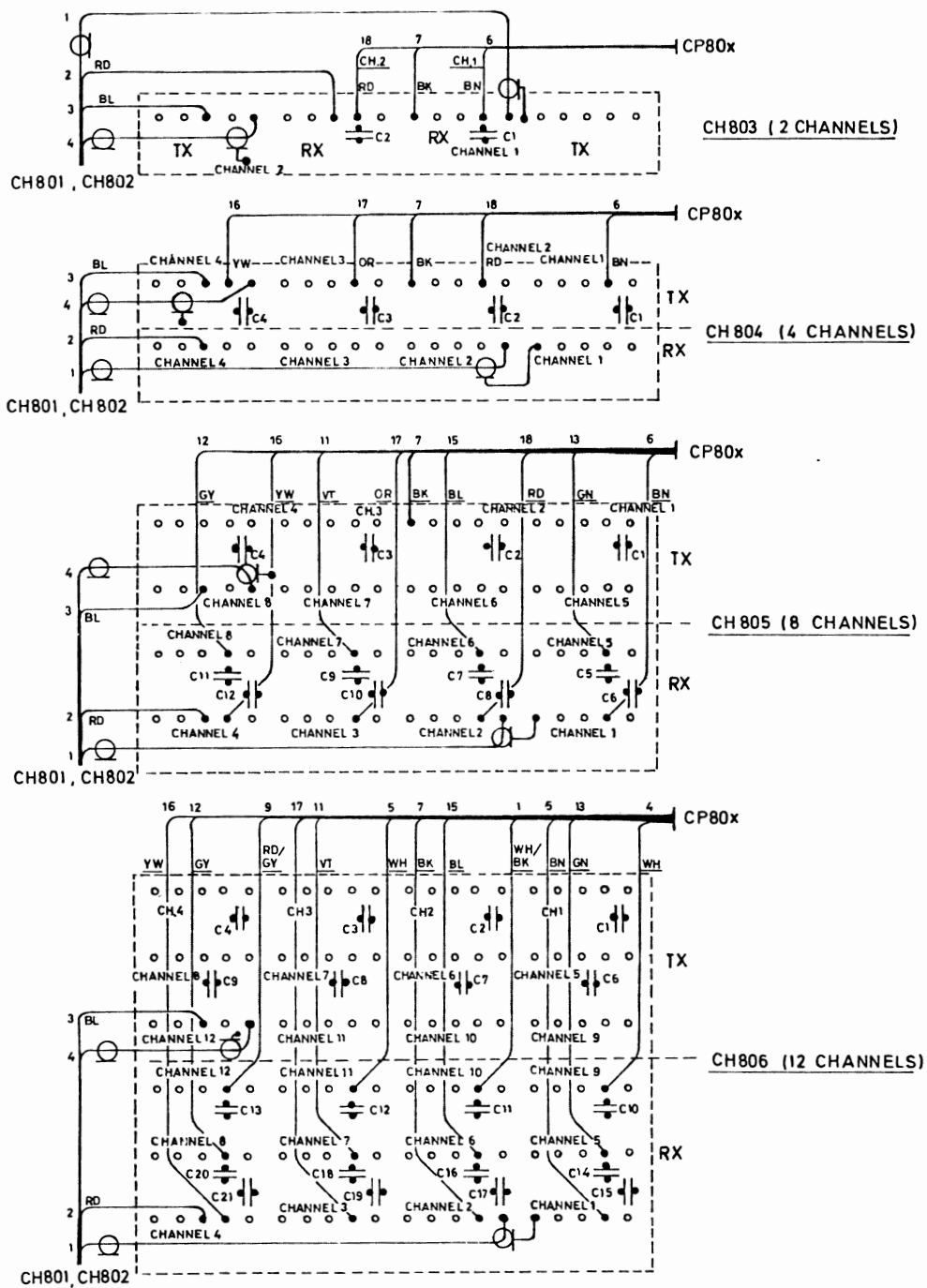
NOTE 2. SHORT CIRCUIT FOR AUTOMATIC RECEIPT.

NOTE 3. FOR SR801/2 AND ST801/2 A RESISTOR, 120KΩ, 5%, 1/10W IS INSTALLED.

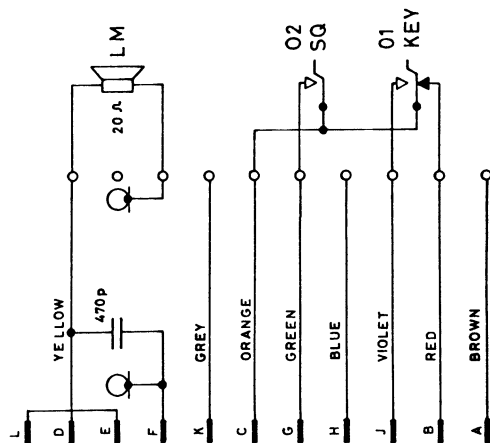
NOTE 4. DIODE ONLY TO BE INSTALLED IN CQP 863U WITH ST801

TONE EQUIPMENT WIRING CQP800U - IS

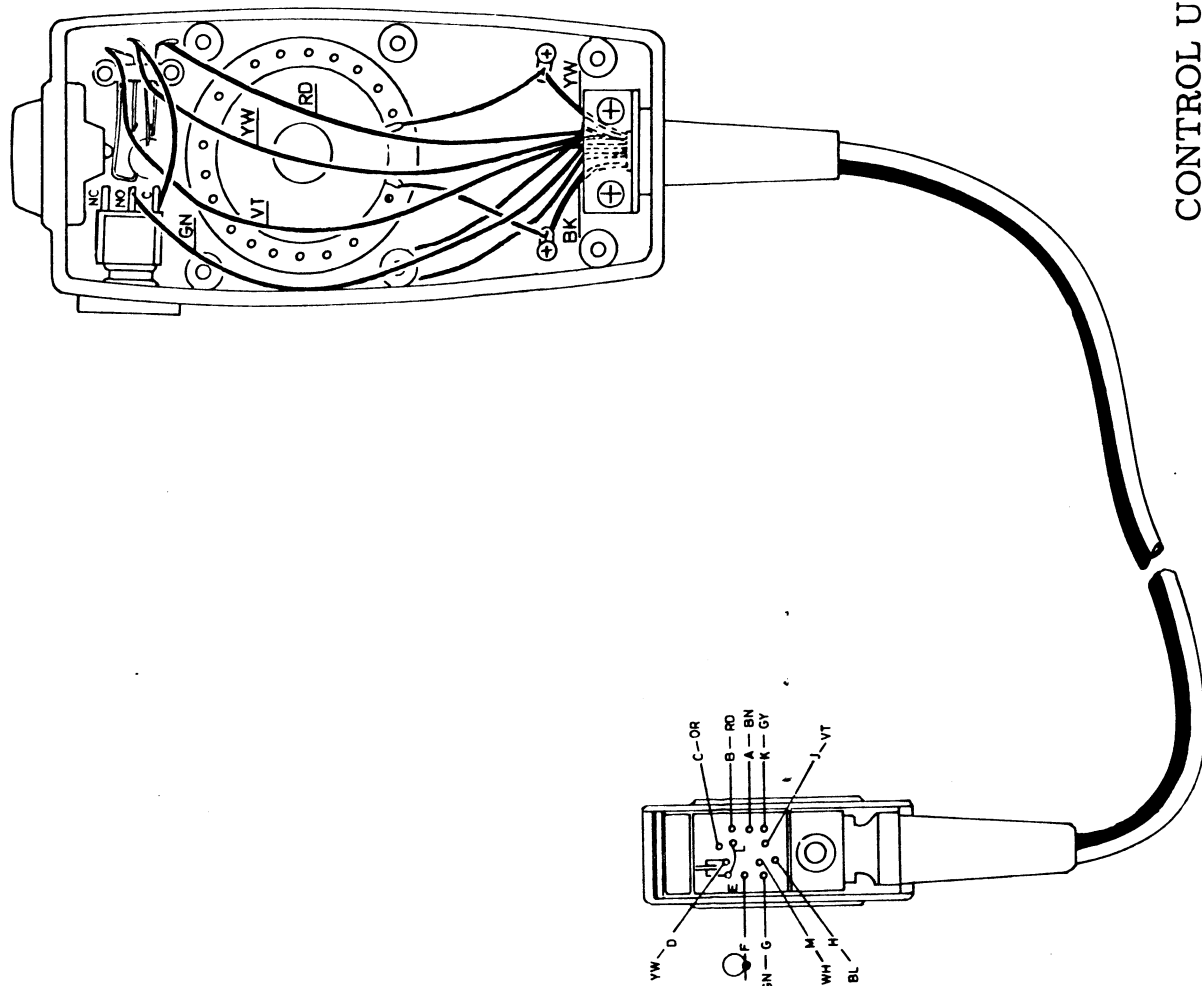
D402.701



WIRING DIAGRAM CH803, CH804, CH805, CH806



CB 804



CONTROL UNIT CB804

Storno

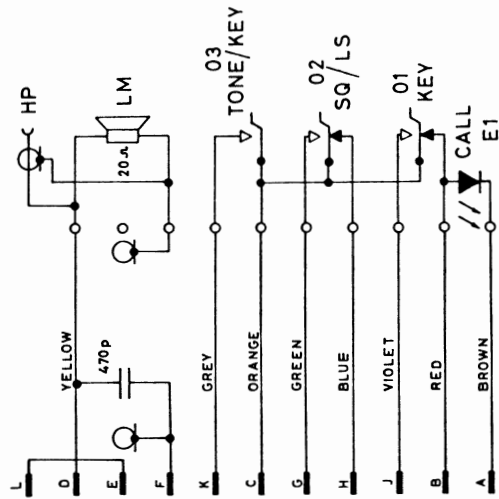
TYPE	Nº	CODE	DATA
CB804	01 02 LM	10. 3602 47.5033 47. 0635 96. 5086	Control Unit Switch, Key Switch, SQ Microphone, dynamic 20 Ohm

Storno

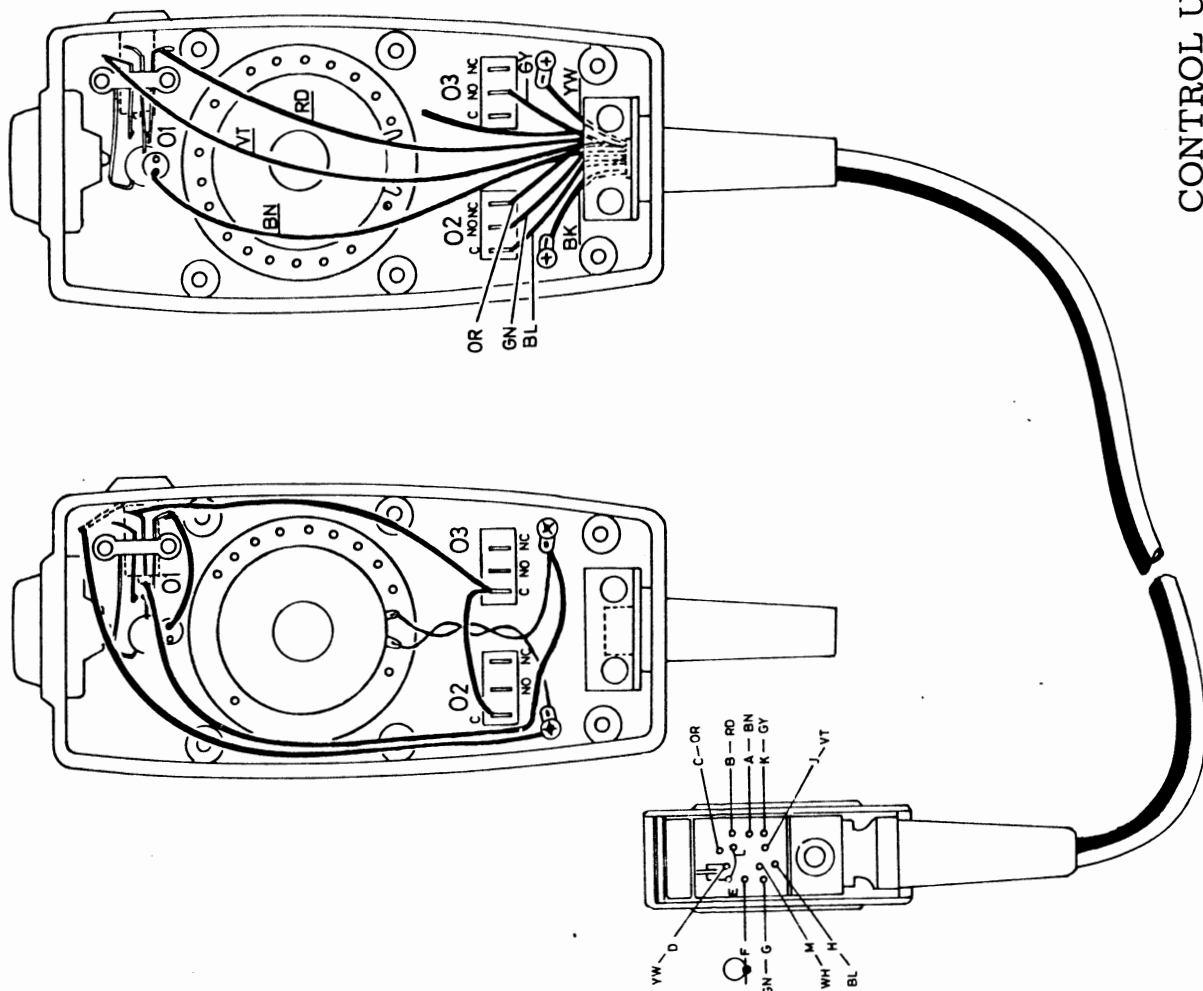
TYPE	Nº	CODE	DATA

CONTROL UNIT CB804

X402.564



CB 805



CONTROL UNIT CB805

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

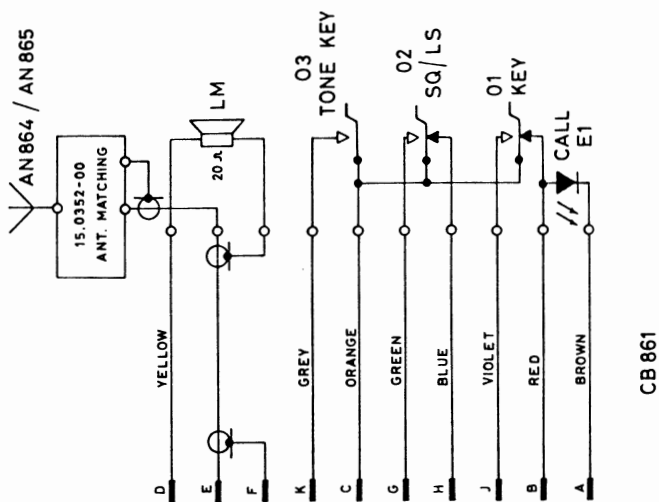
TYPE	Nº	CODE	DATA

CONTROL UNIT CB805

X402. 565

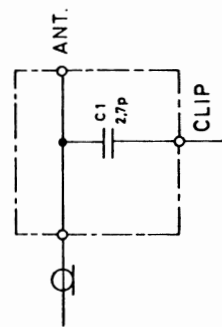
Stomo

Stomo

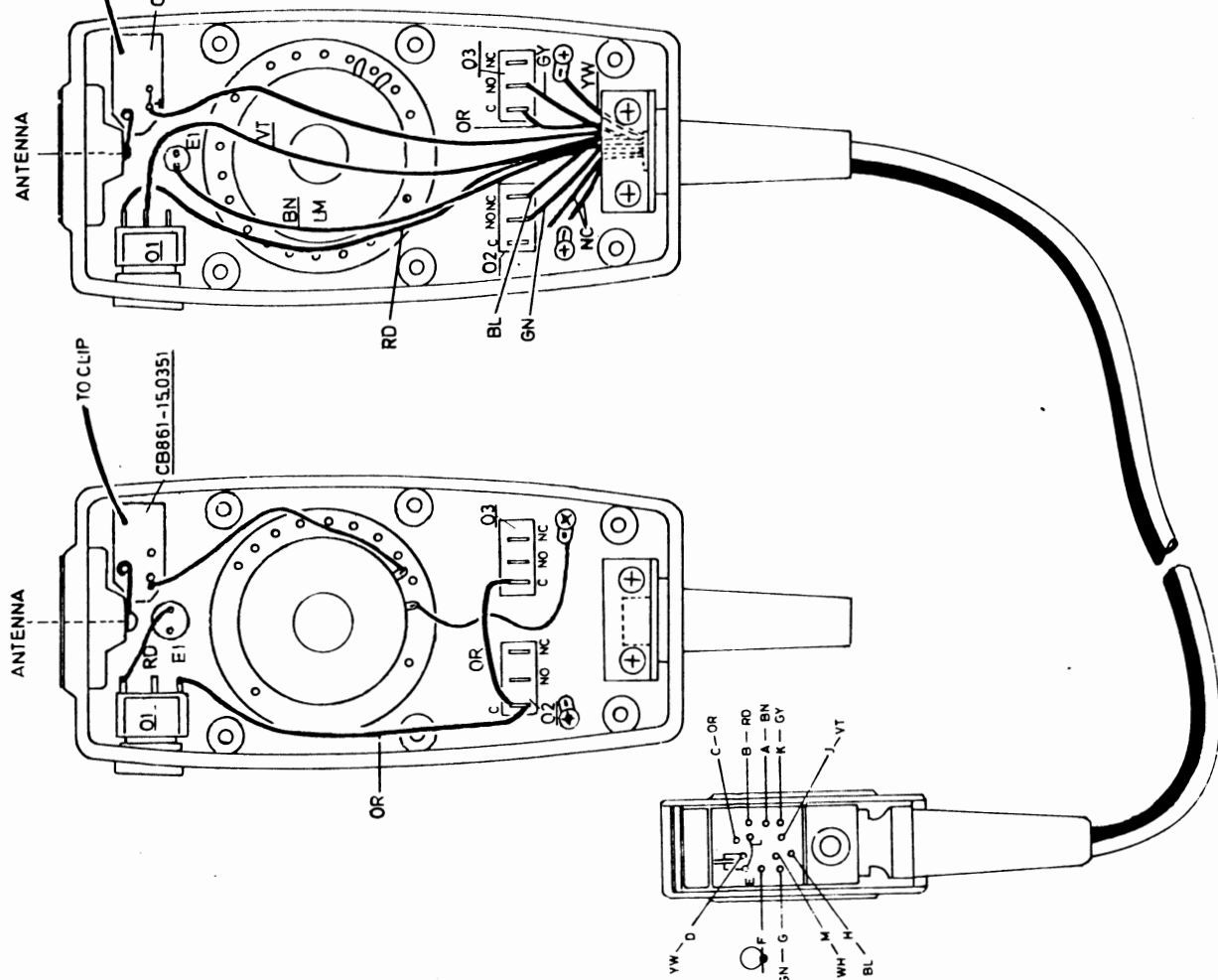
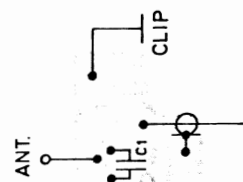


CB 861

CB 861 (420 - 470 MHz)



ANTENNA MATCHING NETWORK



CONTROL UNIT CB861

D 402.530

Storno

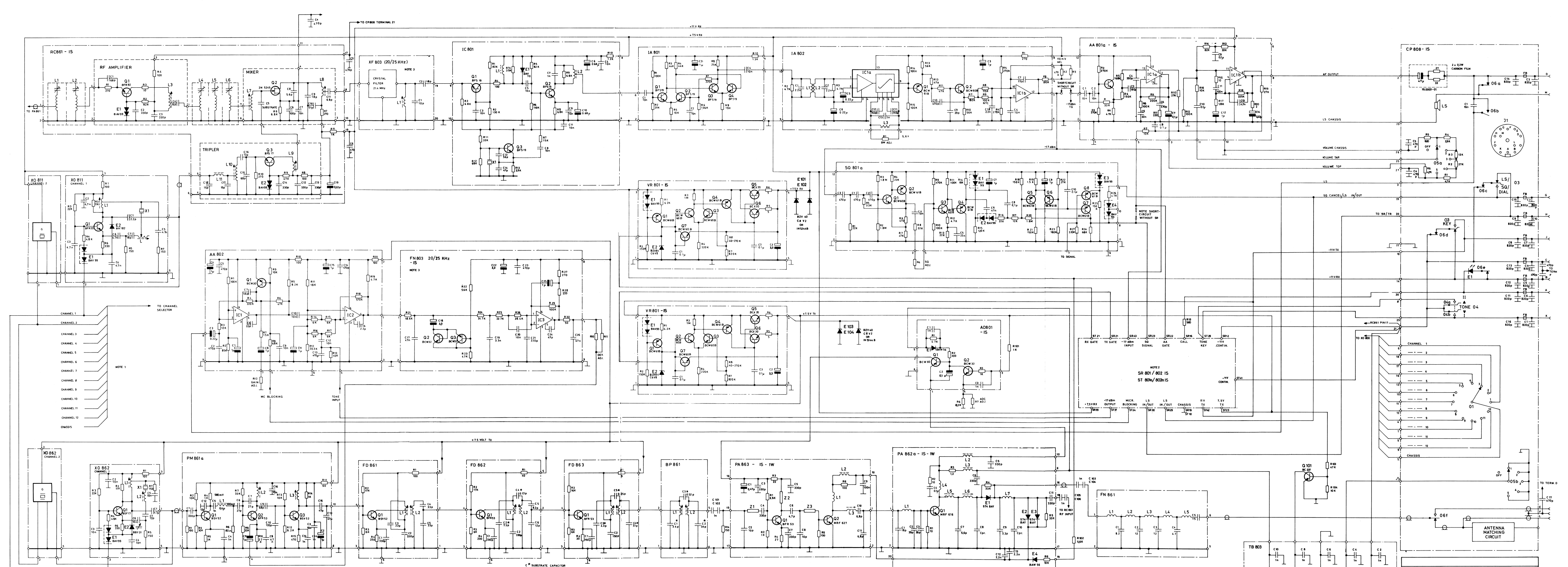
TYPE	Nº	CODE	DATA
CB861		10. 3607	Control Unit (420-470 MHz)
	01	47. 0635	Switch, Key
	02	47. 0635	Switch, LS/SQ
	03	47. 0635	Switch, Tone Key
	E1	99. 5339	Light Emitting Diode
	LM	96. 5086	Microphone, dynamic 20 Ohm
	C1	15. 0352	Antenna Matching Network
		74. 5300	2. 7pF \pm 0. 25pF ceram PL 63V

Storno

TYPE	Nº	CODE	DATA

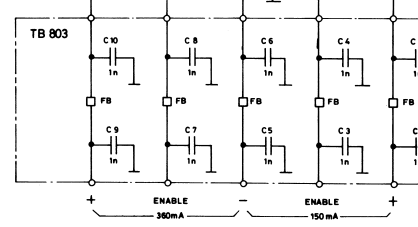
CONTROL UNIT CB861

X402. 568



NOTE 1			NOTE 2			NOTE 3		
No. of channels	No. of XO811	No. of XO862	Tone Equipmt.	Radio Set Type Designation 25KHz Spacing	Radio Set Type Designation 12.5KHz Spacing	No. of channels	No. of XO811	No. of XO862
2	2	2	None	CQP863U Spec. IC8x2-IS	Not Applicable	2	2	2
4	4	4	None	CQP863U Spec. IC8x4-IS	N/A	4	4	4
8	8	8	None	CQP863U Spec. IC8x8-IS	N/A	8	8	8
12	12	12	None	CQP863U Spec. IC8x12-IS	N/A	12	12	12
2	2	2	SR801/802-IS	CQP863U Spec. IC8x2T-IS	N/A	2	2	2
4	4	4	SR801/802-IS	CQP863U Spec. IC8x4T-IS	N/A	4	4	4
8	8	8	SR801/802-IS	CQP863U Spec. IC8x8T-IS	N/A	8	8	8
12	12	12	SR801/802-IS	CQP863U Spec. IC8x12T-IS	N/A	12	12	12

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



UHF PORTABLE RADIOTELEPHONE		CQP 863U
420 - 470 MHz		1W 1S
DATE OF ISSUE		22-3-79
ISSUE NO.		2
DIAGRAM NO.		D402.625/2

Storno