TRA. 921 SYNCAL
Synthesizer Controlled H.F., S.S.B. Manpack

- 2 to 8 MHz synthesizer control
- 6000 Channels at 1 kHz separation
- Solid state—20 watts p.e.p.
- Single control antenna tuning
- S.S.B./Keyed tone (U.S.B. or L.S.B.)/A.M.
- Simple operation and maintenance
- Lightweight—waterproof—robust—reliable
- Wide range of accessories for fixed or vehicle stations

The Racal TRA.921 "Syncal" Manpack is designed for high performance, low cost, military or civil communication requirements. Providing h.f. transmission and reception in the 2 to 8 MHz frequency range, the synthesizer controlled TRA.921 is particularly suited for the manpack role, but may be used as a fixed or vehicle station by using selected ancillary items.

6000 synthesizer controlled channels, with 1 KHz spacing, may be selected within the frequency range. Designed primarily for s.s.b. operation with upper or lower sideband selectable by the operator, the TRA.921 also has facilities for a.m. and c.w. operation. C.W. operation by keyed tone is available in either sideband. Transmitter power output is 20 watts p.e.p. but this may be reduced by approximately 6 dB by means of a front panel switch.

Completely sealed the TRA.921 is dustproof and waterproof. The conservatively-rated components ensure extremely reliable performance under the most severe environmental and operational conditions.

SYNCAL 'L' NEW 'SYNCAL' FOR LOW TEMPERATURE OPERATION

A version of 'Syncal' suitable for operation in the −40°C to +55°C temperature range is now available.

Designated 'Syncal L' (TRA, 921L) this version utilises components specially selected for their reliable performance over the extended temperature range whilst retaining all facilities available in the standard version.

TRA. 921 SYNCAL

Synthesizer Controlled H.F., S.S.B. Manpack

TECHNICAL DESCRIPTION

The "SYNCAL" Manpack Type TRA.921 consists of two main units in addition to the battery. These units are the Transceiver Unit Type MA.924 (also used in the TRA.922) and the Synthesizer Type MA.920.

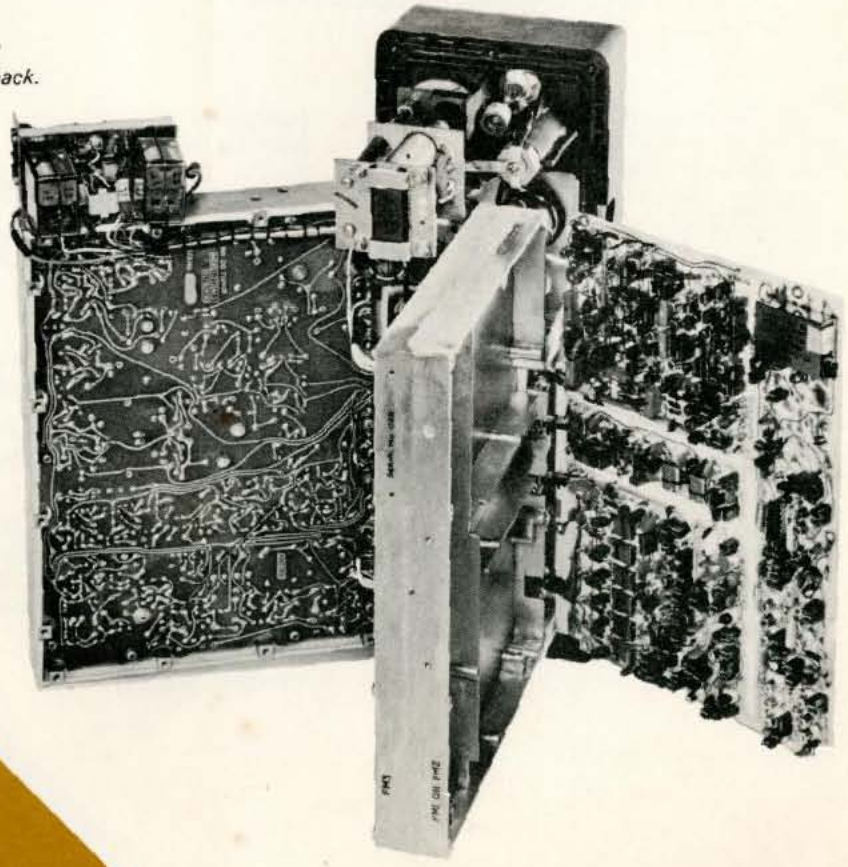
In the transceiver unit, speech input from the microphone is fed, via an amplifier and clipper circuit, to the modulator; alternatively, a keyed tone of approximately 1 kHz for c.w. operation is injected into the modulator. Either of these inputs modulate the 10·7 MHz signal from the crystal oscillator, resulting in a double sideband output with the carrier suppressed for s.s.b. operation. For A.M. or TUNE, the modulator is unbalanced to provide the necessary carrier level. The signal is amplified and passed via diode switches to the upper or lower sideband filter and then to the A.M. filter—for A.M. operation the signal is fed direct to the A.M. filter. The filtered output is then mixed with the selected synthesizer channel output to provide a modulated signal at the radiated frequency. The driver and final amplifier are operated at high efficiency and matched, via the Send/Receive relay, to the 50 ohm or whip socket by a single control A.T.U. To ensure maximum efficiency when low power operation is selected, levels in the i.f. amplifier, the driver and P.A. loading are changed for this operating condition. Tuning is carried out by using a low level carrier which ensures minimum battery drain together with small radiated signals for security and non-interference reasons.

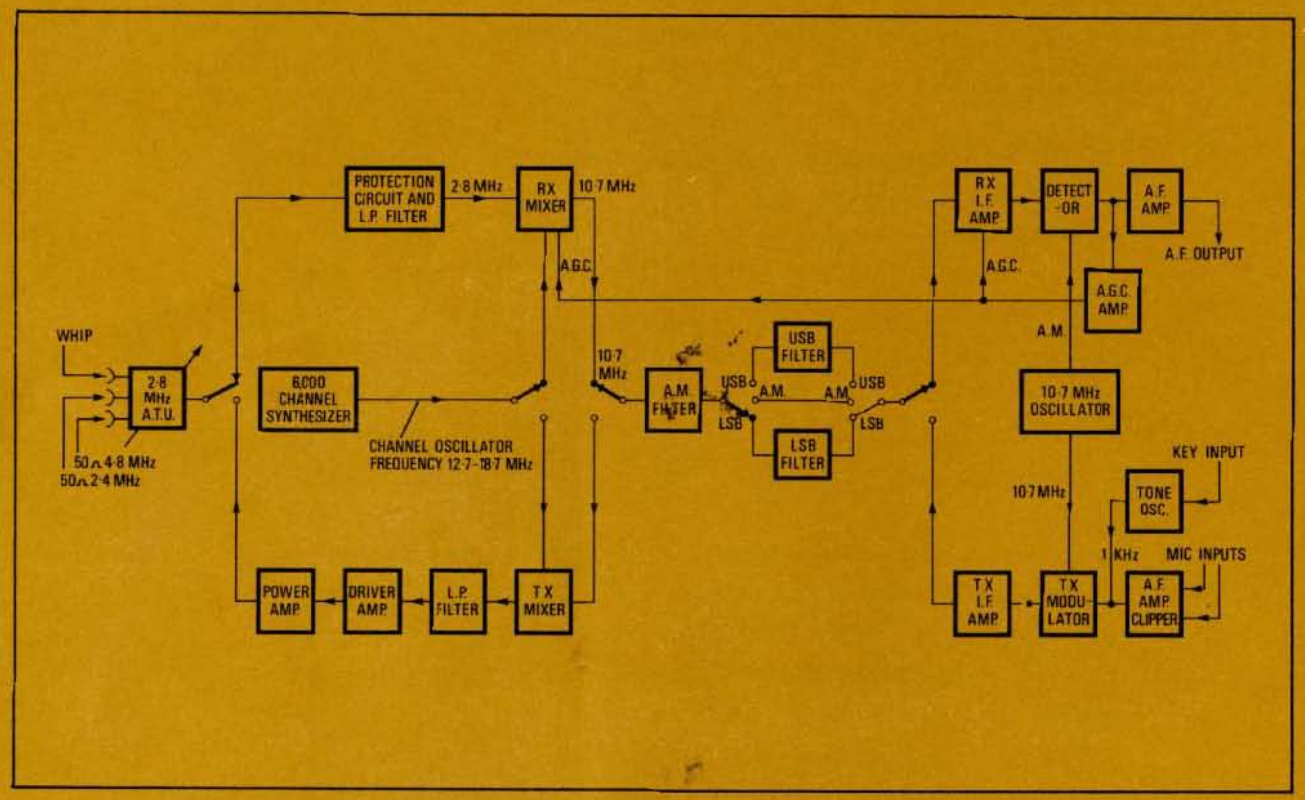
Received signals at the antenna are fed, via the a.t.u., to a receiver protection circuit and low-pass filter. The filtered received signal is then fed to the mixer circuit, which also has the selected synthesizer channel frequency fed to it during reception, and the resultant difference signal provides a 10·7 MHz i.f. signal output. Sideband or a.m. filtering is then followed by a.g.c.—controlled i.f. amplification. The a.f. intelligence is then detected and amplified to the required output level.

The 6,000 Channel Synthesizer Type MA.920 has a main oscillator which covers the frequency range 12·7 to 18·7 MHz. The front-panel megahertz control selects one of six locked oscillators, which, together with a frequency determined by a programmed divider set by the kilohertz control, phase-locks the main oscillator to the appropriate frequency. All the signals are locked to a precision crystal oscillator frequency standard within the synthesizer.

An 18V, 3·5 Ah sealed nickel-cadmium battery provides the power supply. The battery may be recharged in situ via front panel socket, or may be unmoved without disturbing the waterproof sealing of the main equipment. Alternative power units, with inbuilt audio amplifier units and special mounting trays are available for operation from 12/24 V d.c. or 100/250 V a.c. supplies.

Interior view of "Syncal" showing part of the Synthesizer circuit opened for accessibility and indicating the simple construction of the Manpack.





TECHNICAL SPECIFICATION

GENERAL

Frequency range 2 to 8 MHz.

Channels 6000 Channels in 1 kHz steps derived from a single High Stability crystal, selected by 4 in-line switches. Maximum synthesizer locking time, less than 1 sec.

Operating modes
U.S.B.
L.S.B.
A.M. (A3).
C.W. (U.S.B. keyed tone) } Approx. 1000 Hz
C.W. (L.S.B. keyed tone) }

Frequency stability Over the temperature range 0°C to +40°C the frequency change will be less than 30 Hz relative to the frequency at 25°C.

Temperature range Operating —10°C to +55°C. Storage —40°C to +70°C.

Power supply
INTERNAL BATTERY
18 volt 3·5 Ah nickel-cadmium rechargeable battery type MA.928 or MA.948.
VEHICLE OPERATION
12/24 volt D.C. Power Unit type MA.926.
STATIC OPERATION
100-125/200-250 volt 45 to 60 Hz Power Unit Type MA.927.

Antennas 8 ft. (2·4 m) Whip. Long Wire or Dipole.

Antenna tuning Single-control tuning. Inbuilt A.T.U. tunes above antennas for both transmit and receive.

Sealing Transmitter-Receiver case sealed and fitted with desiccator. Battery container may be removed without breaking main seal.

Weight Basic TRA.921 unit only 4·5 kg (10 lb.). Operational manpack with handset, whip antenna, nickel-cadmium batteries and haversack 10 kg 22¼ lb) approx.

Dimensions (Basic Set)
Width: 310 mm (12$\frac{5}{16}$ in.)
Height: 110 mm (4$\frac{3}{8}$ in.)
Depth: 390 mm (15$\frac{1}{2}$ in.)

Technical Specification (cont'd)

TRANSMITTER

Power output
HIGH
S.S.B. 20 watts p.e.p.
C.W. 15 watts
A.M. 5 watts carrier
LOW
Power output reduced by approx. 6 dB.

Harmonic emissions No harmonic will exceed —40dB relative to p.e.p. in 50 ohms load.

Spurious emissions Typically better than —40dB relative to p.e.p. in 50 ohms load.

Carrier suppression 40dB relative to p.e.p. output.

Unwanted sideband suppression 40 dB relative to p.e.p. ouput at 1 kHz.

Intermodulation distortion —25 dB relative to p.e.p. output.

Power consumption 1·5 A for s.s.b. average speech.

RECEIVER

Sensitivity 1 microvolt (p.d.) r.f. input will give 2 mW a.f. output with a signal to noise ratio of not less than 15 dB.

Selectivity
S.S.B. 6 dB bandwidth
2·2 kHz typical
40 dB bandwidth
5·0 kHz typical
A.M. 6 dB bandwidth
7·0 kHz typical
55 dB bandwidth
25 kHz typical

Image rejection Better than 60 dB.

Spurious responses All spurious responses attentuated by at least 40 dB.

A.F. power output 4 mW nominal.

Distortion 5% maximum at 2mW.

A.G.C. The a.f. output will change less than 6 dB for an r.f. signal input variation of 80 dB above 2 microvolts p.d.

Power consumption Approximately 170 mA.

Technical Specification (cont'd)

Front panel, controls and facilities

(a) Four frequency Selection Switches.

(b) Function Switch selecting:
OFF.
VOICE (A.M.).
KEY L.S.B.
VOICE L.S.B.
VOICE U.S.B.
KEY U.S.B.
TUNE.

(c) Antenna Tuning Control.

(d) Gain Control.

(e) High Power/Low Power Switch.

(f) Meter monitoring battery voltage (on a.m. c.w., and s.s.b. modes) and antenna current (on Tune).

(g) Whip Antenna Socket.

(h) Two 50 ohm sockets for dipole antenna (1) 2-4 MHz. (2) 4-8 MHz.

(j) Ground terminal.

(k) Two accessory sockets for handset, headset or morse key or loud-speaker amplifier/P.S.U. or battery charging unit.

ABRIDGED LIST OF EQUIPMENT AND ACCESSORIES

Description	Ref. No.	Weight Kg.	lbs.	oz.
Type TRA. 921 Transmitter/Receiver and battery container	ST700386	4·52	10	0
2·4 m (8 ft.) sectional whip antenna	ST711017	·28		10
Flexible plug-in antenna mount	ST711018	·2		7
Telephone handset	ST711013	·39		14
Headset—single earpiece	ST711015/A	·14		5
Headset—noise excluding	ST711014/A	·34		12
Headset and boom microphone	ST711024	·62	1	6
Morse key with knee strap	ST700059/A	·21		7·5
Ground spike and lead	ST700067	·17		6
Tool kit	ST700397	·04		1·5
Loudspeaker/amplifier unit Type MA. 909	ST700110	·66	1	7
Nickel cadmium rechargeable battery pack (3·5 ah Type MA. 928)	ST700117	2·6	5	12
Nickel cadmium rechargeable battery pack (3·5 ah Type MA. 948)	ST700515	3·37	7	7
Universal battery charger Type MA. 945 for nickel cadmium cells	ST700103	2·72	6	0
Carrying harness and frame for TRA. 921	ST700049	1·9	4	4
Vehicle mounting tray Type MA. 912A for TRA. 921	—	·96	2	2
Static mounting assembly	ST700288	0·34		12
Vehicle mounting Tray Type MA. 912B for MA. 926/MA. 927	ST700075	·79	1	12
Lightweight dipole antenna complete with feeder, support lines, throwing weights and spools	ST711025	1·76	3	14
End fed antenna	ST711026	·34		12
Terminal adapter (Whip/Terminal) for separate whip/end fed antenna	ST700118	·06		2
Terminal adapter (BNC/Terminal)	ST700074	·06		2
Shock absorbing antenna mount	ST700072	·39		14
Test set Type CA. 470B	ST700119	3·4	7	8
12V/24V DC Power Unit/Loudspeaker amplifier for vehicle operation Type MA. 926	ST700140	3·46	7	10
100-125V/200-250V, 45-60 Hz AC Power Unit/Loudspeaker amplifier for static operation Type MA. 927	ST700158	3·62	8	0
Hand operated battery charger (18V) Type MA. 913A	ST700212	3·62	8	0
Tree clamp for hand generator MA. 913A	ST700217	·74	1	10
Unipod stand for hand generator MA. 913A	ST700482	1·24	2	12

RACAL

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The RACAL policy is one of continuous improvement, and consequently the equipment may vary in detail from the description and specification in this publication.

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