

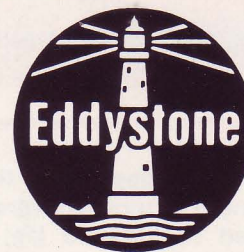
## Eddystone Radio Limited

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# High-Stability ISB Communication Receiver

## Model EC958/12

### GENERAL DESCRIPTION

The Eddystone EC958/12 is an advanced solid-state receiver developed from the well-established EC958/7 High-Stability Receiver which is currently in wide use throughout the world. The new design retains all the standard features of the EC958/7 including the versatile tuning system which allows complete frequency setting with a maximum of two adjustments. Model 958/12 High Stability Receiver provides for ISB reception in a single receiver unit incorporating separate Upper and Lower sideband and carrier channels. The carrier channel provides a comprehensive AFC and AGC generating network. The Upper and Lower sideband channels have facilities for independent  $600\Omega$  line outputs which can be continuously monitored by means of front panel meters, the meters being switchable to indicate AGC levels on all three channels. A separate meter displays the whole AFC range and an LED indicates optimum AFC operation. The very high stability and accurate readout of the 958/7 is fully retained on the 958/12. Utilisation of many standard EC958/7 modules and sub-units in the EC958/12 simplifies spares holding for establishments using a number of receivers of each type. A feature of the receiver is that it maintains tuned frequency during supply interruptions.

The EC958/12 covers the frequency band 10kHz to 30MHz with reception facilities for all normal signal modes including FSK. Self-contained circuitry permits high-stability working at all frequencies above 1.6MHz. The receiver can be powered from any 40-60Hz AC supply and is available in basic form for rack-mounting, or complete with cabinet to suit bench installations.

### FEATURES

**10kHz - 30MHz coverage.**

**Readout to 1Hz with accuracy of 4Hz.**

**Maximum of two frequency adjustments.**

**Provision for all standard signal modes AM/CW SSB ISB FSK.**

**Low reciprocal mixing.**

**RF preselection provides high standard of performance under multi-signal conditions.**

**High-Performance AFC.**

The circuit configuration for frequencies below 1.6MHz employs either single-conversion with an IF of 100kHz, or double-conversion using an additional IF of 250kHz. An oven-controlled crystal oscillator provides 350kHz injection for the second conversion stage on those ranges where double-conversion is used.

The 1st Oscillator is continuously tunable for all frequencies from 10kHz to 1.6MHz and provides adequate stability for the types of signal normally encountered in this part of the spectrum. For more stringent requirements at low frequencies, provision is made for connection of an external synthesiser. Frequency read-out is by means of a high-resolution optical projection system providing optimum readability in conditions of high ambient lighting. The scale markings are free from parallax and frequencies can be read to 1kHz.

Front view of EC958/12 in cabinet



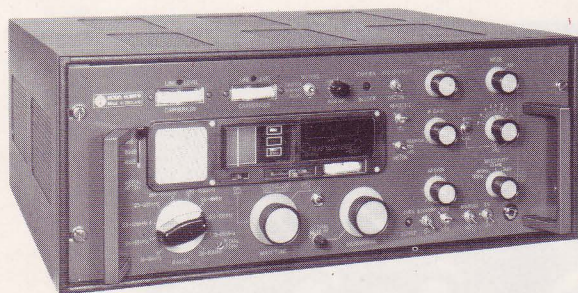
At frequencies higher than 1.6MHz, the circuit changes to triple-conversion with a tunable 1st IF ahead of the two IFs used on the double-conversion ranges. The 1st Oscillator becomes part of a narrowband drift-cancelling loop which can be locked at intervals of 100kHz by reference to an oven-controlled Master Oscillator to give an effective 1st Oscillator stability of  $\pm 0.5$  parts in  $10^7$ . Adjustment of the 1st Oscillator to the appropriate 100kHz point is by use of the Main Tuning Control with frequency read-out provided by the optical projection system in the same manner as on the lower frequency ranges.

Interpolation between adjacent 100kHz points on the main scale is achieved by use of the tunable IF facility which is set by means of the Incremental Tuning Control. Calibration read-out is by a 5-character digital display which can be read to the nearest Hertz of the tune frequency; overall accuracy is within 4Hz under all conditions of operation.

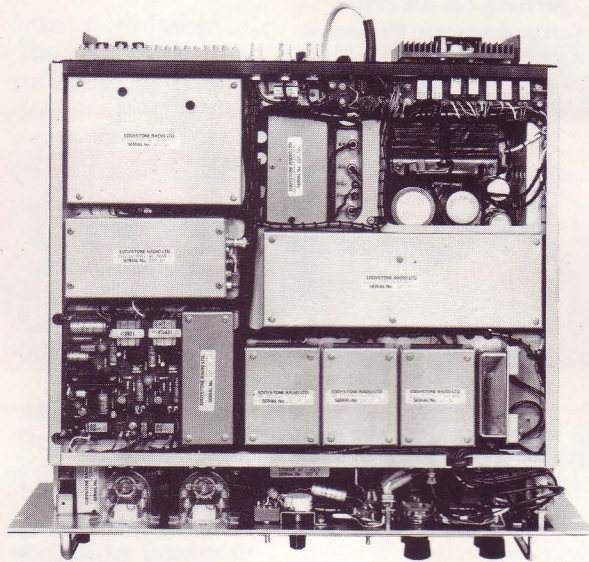
Provision is made for disabling the drift-cancelling loop to permit continuous search tuning over any selected HF range with the incremental facility still available for use as a fine frequency control.

The AFC system is such as to assure that a resolved transmission has a zero frequency error and that the frequency readout (within accuracy of receiver standards) indicates the transmitter radiated carrier frequency. The AFC system consists of two loops, the first loop operating on the interpolating oscillator over the frequency range  $\pm 500$ Hz, this loop being low gain resulting in a frequency control of  $\pm 15$ Hz. A second AFC circuit using phase lock techniques operating on the demodulating oscillator ensures frequency coincidence of this oscillator with the final carrier frequency. A unit is provided summing all the variable oscillators to ensure that the frequency read-out accurately displays the received frequency.

The system permits not only conventional reception of ISB but because of its zero frequency error is ideal for reception of DSB/AM signals and rapid frequency measurement and monitoring. Simple single trimmer adjustment is all that is necessary to standardise receiver against a standard transmission.



Three-quarter view of EC958/12



Plan view of EC958/12 showing modular construction

#### Brief Circuit Details

The receiver employs FETs and MOSFETs in almost all the front-end and IF stages, and utilises single, double or triple-conversion according to the frequency range in use. Input protection is included as a standard feature and desensitizing is provided by an internal relay which interrupts the aerial feeder and grounds the input to the RF Stage during periods of transmission. Three signal frequency circuits are used before the 1st Signal-Mixer on all except the two lowest ranges where adequate selectivity is provided by two circuits.

The Master Oscillator, Incremental Oscillator and the 350kHz crystal in the final conversion stage are all oven controlled; provision is made for standardising the Master against an external frequency standard.

Bandwidth in the 1st and 2nd IF is limited to a maximum of the order 15kHz and selectivity is adjustable at the final IF where a 5-section L/C filter can be switched to provide bandwidths of 400Hz, 1.3kHz, 3kHz and 8kHz. Separate upper and lower sideband filters are introduced for SSB/ISB reception with characteristics in accordance with CEPT Specifications. A crystal filter of 150Hz bandwidth is provided for CW reception. Four IF outputs are available at 100kHz, 1 for conventional AM/CW, 3 for ISB/SSB operation (1 USB, 1 LSB and at carrier frequency).

The ISB/SSB Detectors are driven from the phase lock loop circuitry when AFC is operating and from the master oscillator when AFC is off, CW detectors are driven from a variable BFO. A conventional AM detector is also provided. FSK is by means of optional FSK Module Type LP 3058. Provision is made for dual diversity working.

Audio outputs are provided for external loudspeaker, telephones and lines, the line outputs being fed from totally independent amplifiers with separate level controls. A miniature monitor speaker fed from the main channel is fitted behind the front panel.

### Construction

Mechanical and electrical design of the EC958/12 have been closely integrated and the receiver can be subjected to extremes of environmental conditions with only minor degradation in performance.

All front-end circuitry is built into a diecast aluminium-alloy frame to ensure optimum screening and maximum rigidity.

The basic chassis is of steel cadmium plated and passivated which provides a strong rigid assembly. Most circuitry, apart from the power supply is housed in detachable modules or units to facilitate servicing and inspection.

## GENERAL SPECIFICATION

### Application

High grade professional-class receiver suitable for fixed, mobile or maritime use where wide frequency coverage and high-stability are of paramount importance.

### Reception Modes

A1, A2B and A2H telegraphy (and FI telegraphy when optional FSK Module Type LP 3058 is fitted).

A3, A3A, A3H, A3B and A3J telephony with separate filters for upper, lower and double side-band working.

### Frequency Coverage

Continuously tunable 10kHz to 30MHz in ten ranges.

Ranges 1-4: 1.6-30MHz with internal facilities for high stability working and digital frequency read-out to 1Hz.

Ranges 5-10: 10kHz-1650kHz with provision for use with external synthesizer.

### Circuit Configuration

Ranges 1-4: Triple-conversion with tunable 1st IF and drift cancelling loop.

Ranges 5-10: Single conversion, or double-conversion with oven-controlled crystal in second conversion stage.

### Intermediate Frequencies

IF1: 1235-1335kHz (incremental tuning)

IF2: 250kHz (high-grade ceramic filter)

IF3: 100kHz (L/C and crystal filters)

### Aerial Input

75 $\Omega$  unbalanced (also 600 $\Omega$  on Ranges 5-10).

### Output Facilities

- 1 100kHz IF Output (low-Z)
- 2 External Loudspeaker (3 $\Omega$ ).
- 3 Lines (600 $\Omega$ , bal. or unbal.).
- 4 Headset (low/medium-Z).
- 5 FSK Relay (h/s mercury reed).
- 6 Diversity AGC
- 7 Incremental Oscillator (550-650kHz) for common oscillator working.
- 8 BFO: 100kHz  $\pm$  8kHz with calibrated scale and standardisation facility at 100kHz, a BFO low impedance output at rear panel is provided.

### Muting

Internal high-speed reed relay controlled from associated transmitter interrupts aerial feeder and grounds input circuit during transmission.

### Environmental

The receiver conforms generally to the climatic and shock/vibration requirements of DEF-133.

### Operational Temperature Rating

-15°C to +55°C (+40°C, 95% relative humidity).

### Power Supply

100/130V or 200/260V (40-60Hz) single-phase AC.

Consumption 90VA approx.

DC/AC Converter can be supplied to special order to permit operation from 12V or 24V supply.

### Mounting Styles

Standard version is in rack-mounting form to suit 483mm (19in) racking. Also available with cabinet (and shock mounts) for bench mounting.

### Dimensions and Weights

Rack-mounting (with dust covers)

Width: 483mm (19in)

Height: 177mm (7in)

Intrusion into rack: 411mm (16.2in)

Weight (approx.): 27.2kg. (60 lbs)

Bench-mounting (with cabinet)

Width: 502mm (19.75in)

Height (with feet): 203mm (8in)

Depth (overall): 457mm (18in)

Weight (approx.): 32.65kg. (72 lbs)

### Accessories

FSK Module Cat. No. LP3058

Plinth Loudspeaker Unit Cat. No. 989

Cabinet Loudspeaker

Unit Cat. No. 935

**TYPICAL PERFORMANCE SPECIFICATION****Sensitivity**

AM	3 $\mu$ V for 10dB S+N/N ratio (3kHz B/W)
CW/SSB/ISB	1 $\mu$ V for 10dB S+N/N ratio (3kHz B/W)
CW (10-100kHz)	1 $\mu$ V for 20dB SINAD (1.3kHz B/W)

**IF Selectivity**

Four selectable bandwidths using switched L/C filter plus separate multi-pole crystal filters for upper and lower sideband and CW.

L/C Filter (6dB/60dB): Posn. (1) 400Hz/2.4Hz  
(2) 1.3kHz/4.5kHz (3) 3kHz/12kHz (4)  
8kHz/18kHz.

SSB/ISB Filters: 2.4kHz B/W at -3dB, 3.9kHz at -60dB asymmetrical, meeting CEPT Specification. (Special filters against enquiry). CW Filter 150Hz-6dB 1kHz-60dB.

**Image Rejection**

10kHz-18MHz greater than 75dB  
18MHz-30MHz greater than 60dB

**IF Rejection**

53kHz-126kHz greater than 85dB  
280kHz-3MHz greater than 90dB  
3MHz-30MHz greater than 100dB  
Other freqs. greater than 60dB

**Frequency Stability**

1.6MHz-30MHz: Tune frequency will remain within 4Hz of Master Osc. stability\* for any 20°C change in the range 0°C to 60°C.  
160kHz-1.6MHz: Better than 1 part in 10<sup>4</sup> in any 5 min. period with constant ambient.  
10kHz-160kHz: Better than 50Hz in any 5 min. period with constant ambient.

\* $\pm 0.5$  parts in 10<sup>7</sup> over the range 0 to +60°C.

Calibration facilities provided every 10kHz below 1.6MHz and every 1MHz above 1.6MHz.

**Cross Modulation**

With a wanted signal 60dB $\mu$ V producing standard output, unwanted output will be at least 30dB below this level with an interfering signal 20kHz off-tune and of level 95dB $\mu$ V (or 5% off-tune of level 110dB $\mu$ V in the range of 1.6-30MHz).

**Blocking**

With a wanted signal 60dB $\mu$ V, output will be affected by less than 3dB with an interfering carrier 20kHz off-tune of level 100dB $\mu$ V (or 3% off-tune of level 120dB $\mu$ V in the range 1.6-30MHz).

**Intermodulation**

The level of third-order intermodulation products produced by two signals of equal strength lying carrier +1kHz and +1.6kHz will be at least 30dB below the level of either signal.

With a wanted signal 30dB $\mu$ V producing standard output, two unwanted signals adjusted to produce a third-order intermodulation product at the wanted frequency, must each be of a level greater than 90dB $\mu$ V to produce standard output (neither signal closer than 20kHz to the wanted frequency, or within 3% in the range 1.6-30MHz).

**AGC Characteristic**

Output is maintained within 6dB for a change in input of 90dB from 3 $\mu$ V reference level.

**AGC Time Constant**

Governed by Mode Switch. Of the order 40ms attack and 1 sec. decay at 'AM' and 'CW/SSB': increased to 200ms and 10 secs. when switched to 'SSB/ISB/HIGH-STAB'.

**Audio Output**

Ext. Loudspeaker (3 $\Omega$ ): 0.5W at 5% distortion  
Lines (600 $\Omega$ ): 10mW max.

**Audio Response**

Level within 3dB over the range 300Hz to 4kHz. The overall response is dependent on the IF selectivity.

**IF Outputs**

20mV into 75 $\Omega$  for 3 $\mu$ V at aerial input.

**Radiation**

Less than 400pW (Typically 20pW).

**Scale Resolution**

10kHz-1650kHz: Readable to 1kHz  
1.6MHz-30MHz: Readable to 1Hz

**FSK Performance**

Keying speeds up to 200 bauds with shifts of 85-850Hz can be accommodated when FSK Module Type LP 3058 is fitted.

Not to be interpreted as a test specification.