

RA 3791
RA 3793

RA 3792
RA 3794

DIGITAL HF RECEIVERS



KEY FEATURES

- Frequency Range 10kHz to 30MHz
- High performance RF circuits
- Digital Signal Processing
- User programmable digital IF filters providing up to 100 bandwidths
- Tunable IF notch plus passband tuning
- Simple to operate
- Automatic scanning of channels and frequency
- Remote control
- Controller of slave equipments
- Wide range of options
- Modular construction
- Comprehensive Built In Test Equipment (BITE)

DESCRIPTION

This family of high performance HF receivers covers the frequency range 10kHz to 30MHz with functions such as IF filtering, AGC and demodulation being implemented using digital signal processing techniques. The receivers use a modular design and a number of configurations are available:

RA3791	Single receiver with operator's front panel
RA3792	Dual receiver with operator's front panel
RA3793	Single receiver for remote control
RA3794	Dual receiver for remote control
MA3790	Receiver remote control unit

The receivers provide the high level of RF performance required from a receiver operating in the crowded HF spectrum.

Particular attention has been given to sensitivity, intermodulation, reciprocal mixing and spurious responses. The front panel of the receiver has been designed to provide a comprehensive range of facilities while also being easy to use. Single function push buttons select the most commonly used functions and a menu system is provided to control the receiver's many special features.

The receivers include, as standard, a serial ASCII remote control interface with a built-in multi-addressing capability of up to 100 receivers. Slave receivers may be controlled in a number of ways: by computer; using the MA3790 dedicated receiver control unit which has the same front panel as the RA3791; or by the RA3791 or RA3792 receivers which have built-in controller facilities. All receiver functions may be remotely controlled. The remote control protocol is compatible with that used in the well established RA3701/RA3702 thereby allowing RA3790 and RA3700 Series receivers to be used together in a system.

R A C A L R A D I O

DIGITAL HF RECEIVERS

TECHNICAL SPECIFICATION

Frequency Range

10kHz to 30MHz in 1Hz steps

Tuning

By numeric keypad, single spinwheel tuning knob with selected tune rate

Modes of operation

CW A1A, A1B
 MCW A2A, A2B
 AM A3E
 FM F3E
 FSK F1B
 USB/LSB H2A, H2B, H3E, J2A, J2B, J3E
 R2A, R2B, R3E

Option:

ISB B7B, B8E, B9W

BFO

Tunable ± 8 kHz in 10Hz steps using the main tuning knob or by keypad entry

Channel store

100 frequencies in non-volatile EEPROM memory with associated mode, bandwidth, AGC and BFO settings. Bulk erasure of memory is possible from the front panel or remotely

Scan modes

- Channel scan between designated channels with selected dwell time on each channel (0.1s to 9.99s)
- Frequency sweep over a number of ranges defined by the user. Skip ranges or frequencies may be programmed. Step size 100Hz to 999.9kHz. Sweep rate 10Hz/s to 999.99kHz/s

In either mode scanning may be halted on detection of a signal above a threshold set by the operator

Frequency stability

One of the following optional frequency standards may be fitted:-

- TCXO**
 ± 7 parts in 10^7 over the range -10°C to $+55^\circ\text{C}$
- Ovened oscillator**
 ± 1 part of 10^7 over the range -10°C to $+55^\circ\text{C}$. Ageing ± 2 in 10^6 per day after 30 days continuous operation
- High stability ovened oscillator**
 ± 3 parts in 10^8 over the range -10°C to $+55^\circ\text{C}$. Ageing ± 5 in 10^{10} per day after 30 days continuous operation

Sensitivity

For the frequency range 0.5-30MHz

SSB/CW: A signal of -113dBm ($1\mu\text{V}$ emf) in a 2.7kHz bandwidth gives an S+N/N of: -16dB [19dB], RF amplifier on, 10dB [13dB], RF amplifier off

AM: A signal of -103dBm ($3\mu\text{V}$ emf) 70% modulated at 1kHz, in a 6kHz bandwidth, gives an S+N/N of: -16dB [19dB], RF amplifier on, 10dB [13dB], RF amplifier off

Selectivity

The receiver has digital filters with the following bandwidths:

USB 2.7kHz (300Hz to 3kHz)
 LSB 2.7kHz (300Hz to 3kHz)
 Symmetrical 300Hz, 1kHz, 3kHz, 6kHz, 12kHz

The user may program the receiver from the front panel or via the remote interface to configure additional filters by entering the bandwidths required. Up to 100 different filters may be configured. Once configured, the filters are selected from the front panel or by filter number via the remote interface. All filters have very low ripple and differential group delay and a stopband exceeding 100dB

The software allows the bandwidth and position of a configured filter to be finely adjusted. It also provides a variable width, tunable IF notch filter

Reciprocal mixing

With a wanted signal of -113dBm ($1\mu\text{V}$ emf) in a 2.7kHz bandwidth, an unwanted signal 20kHz removed must be greater than 96dB [102dB] above the wanted signal in order to give a noise level equal to the output produced by the wanted signal. At 80kHz removed the difference in level must be greater than 106dB [115dB]

Out of band intermodulation products

With two -13dBm (100mV emf) signals separated and removed from the wanted signal by 20kHz, the third order intermodulation products, relative to either of the interfering signals, will be not less than: -86dB [90dB], RF amplifier off, 70dB [76dB], RF amplifier on

Third order intercept point is not less than: $+30\text{dBm}$ [$+32\text{dBm}$], RF amplifier off, $+22\text{dBm}$ [$+25\text{dBm}$], RF amplifier on

In band intermodulation products

Two in band signals of -13dBm (100V emf) with 600Hz spacing produce third order intermodulation products not greater than -50dB [-55dB] at the IF and line outputs

Blocking

With a wanted signal of -53dBm (1mV emf), an unwanted signal more than 20kHz removed must be greater than $+7\text{dBm}$ [$+13\text{dBm}$] to reduce the output by 3dB

Cross modulation

With a wanted signal of -53dBm (1mV emf) in a 2.7kHz bandwidth, an unwanted signal 30% modulated, more than 20kHz removed must be greater than $+1\text{dBm}$ [$+7\text{dBm}$] to produce an output 20dB below the output produced by the wanted signal

External spurious responses

Spurious response rejection not less than 80dB [90dB]

Image and IF rejection

Image and IF rejection not less than 90dB [100dB]

Antenna input

- Input impedance 50 ohms nominal
- The receiver will withstand, without damage, input signals of up to 50V emf continuously
- Re-radiation from antenna input:
 0-30MHz: Not greater than -87dBm ($10\mu\text{V}$ pd)
 30-100MHz: Not greater than -67dBm [-87dBm]

AGC

An increase in input of 120dB above -107dBm ($2\mu\text{V}$ emf) produces an output change of less than 2dB

Short, medium and long decay times may be selected from the front panel. When the mode is changed the receiver automatically selects the last time constant used in that mode. Decay time constants are programmable by the user

IF gain control

The IF gain control may be used to set:

- Receiver gain
 - AGC threshold
 - Squelch threshold
- The control range is 120dB

AF outputs

- Internal loudspeaker. Level adjustable using the front panel volume control. May be switched off from the front panel
- Rear panel connection for external loudspeaker. Level adjustable using front panel volume control. Maximum output 1W into 8 ohms or 200mW into 16 ohms
- Front panel headphone output
 Adjustable using front panel volume control. Maximum output, 200mW into 16 ohms or 1mW into 600 ohms. Plugging in headphones disables the internal loudspeaker
- Rear panel line output -20dBm to $+10\text{dBm}$ into 600 ohms balanced. Level adjustable from front panel or via remote control

IF output

Centre frequency may be selected by the user as follows:

- 1.4MHz
- Programmable by the user in the range 10kHz to 455kHz in 5kHz steps

Bandwidth may be selected by the user as follows:

- Narrowband: Bandwidth equal to selected IF bandwidth. Level nominally -7dBm
- Wideband: Bandwidth 12kHz Level nominally 50dB above antenna input or -7dBm , whichever is the smaller

Digital signal output (option)

The serial digital interface can be programmed to provide either:

- Digital IF output: Bandwidth either equal to selected IF bandwidth or fixed at 12kHz
- Digital audio output

Metering

The front panel bar-graph meter may be switched to meter:

- RF signal level
- AF line level
- Tune indication for FSK

Remote control

Serial ASCII complying with CCITT recommendation V10 and EIA standard RS423-A. Compatible with V28/RS232-C. Maximum data rate 9600 baud

Power Supply

100V to 120V and 200V to 240V AC with automatic range selection 47 to 63Hz

Power Consumption

50W (RA3791)

Environmental

Operating temperature -10°C to $+55^\circ\text{C}$
 Storage temperature -40°C to $+70^\circ\text{C}$
 Relative humidity 95% at 40°C

Dimensions

Height 133mm (5.25in)
 Width 483mm (19in)
 Depth 450mm (17.7in) behind the front panel

Note: Figures in [] are typical values

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