

Ground Systems

FEATURES

L-3 Microdyne's Model RCB-2000(A) compact receiving system is configured with two high performance telemetry receivers and a post-detection diversity combiner. The receivers utilize preprogrammed FIR IF and Video Filters, DSP-based Multimode Demodulators, and an optional programmable Bit Synchronizer, all within a single 5.25-inch rack-mountable chassis. The unit may be utilized as two independent receivers within a single chassis, or in conjunction with the internal post-detection combiner for use with frequency diverse RF telemetry systems. The receiving system offers the following features and performance characteristics:

- Independently tunable receivers with multiple first and second IF bandwidths, wideband DSP-based Digital Multimode Demodulator, and optional, fully programmable Bit Synchronizer.
- Excellent Adjacent Channel Rejection by using multiple SAW First IF bandwidth filters along with highly selectable FIR second IF filters.
- Superior handling of Fast/Deep fades (50 kHz Combiner Break Frequency).
- Each receiver is equipped with multiple, user-selectable second IF Finite Impulse Response (FIR) preprogrammed filters with bandwidths from 50 kHz to 30 MHz.



communications
Telemetry & RF Products

Excellence You Can Measure

RCB-2000(A) Dual Digital Receiver/Post-Detection Combiner System Telemetry Products



FEATURES (continued)

- Digital Multimode Demodulator (FM, PM, BPSK, QPSK, and OQPSK).
- Compatible with conventional Auto-Tracking Antenna Systems.
- Small, lightweight, & rugged design
- User friendly Front Panel operation; and remotely controllable via RS-232, Ethernet and IEEE-488.
- Windows Application Software supplied at no cost for remote operation via Ethernet interface.

OPTIONS

- Fully programmable Bit Synchronizer providing data and clock outputs.
- Multi-Band Tuners (P, L, UL, E-bands).
- Trellis FM Demodulator for improved signal-to-noise ratio performance.

RCB-2000(A) APPLICATIONS

L-3 Telemetry East/Microdyne has been manufacturing general and special purpose receivers and combiners for over 30 years and continues to be the undisputed leader in telemetry receiving products that allow telemetry reception over a wide frequency spectrum. The RCB-2000(A) exemplifies this leadership with state-of-the-art performance in a compact, easy-to-use form factor.

Applications Include

- Frequency Diverse RF Systems such as common in helicopter and test track telemetry
- Data Reception from aircraft, missiles, munitions
- AM Tracking Receiver
- Signal Analysis
- Satellite TT&C
- Satellite image reception
- Aircraft pre-flight testing
- High Resolution video/TV reception from RPV/UAV vehicles and camera-equipped missiles
- Expendable launcher telemetry data collection
- Unmanned telemetry sites requiring complete computer control
- Low Earth Orbit (LEO) satellite data collection
- Mobile tracking and data systems

RCB-2000(A) BENEFITS

Dual Digital Receiver/Post-Detection Combiner System - *leading edge technology and performance*

This advanced technology with digital flexibility will provide customers with viable technology as requirements develop for years to come. This phenomenal design has resulted in a broad array of benefits.

Benefits

- Optional internal bit synchronizer eliminates need for external components
- Easy-to-use front panel controls all operations resulting in saving setup time, eliminating errors, and resolving status issues
- Multiple pre-programmed digital FIR filters eliminate costly IF upgrades
- Two independent RF Receivers and one Post-Detection Combiner in a single package
- Configured with up to 3 RF Tuning Bands

Reduces

- Rack Space
- Power consumption
- Rack wiring problems
- Cost
- Weight
- Remote control complexities
- Spares
- Maintenance issues

TUNER SPECIFICATIONS

RF

Dual Conversion Superheterodyne

Frequency Ranges Available

2185-2485 MHz,
1429-1545 MHz,
1700-1850 MHz
215-320 MHz
830-1130 MHz
130-180 MHz
400-500 MHz
900-950 MHz
(others available, consult factory)

Second IF Center Frequency

70 MHz

AM Output Level

2 volts peak-to-peak into 75 ohm for 50% modulation

Envelope AM Frequency Response

High end response 50 kHz, Low end response determined by AGC Time Constant

Receiver LO Stability

±1.5 ppm

AGC Type

Envelope

AGC Time Constants

0.1, 1, 10, 100, 1000 mS

Receiver Tuning Resolution

100 kHz

Manual Gain/AGC Freeze

Variable/Selectable by digital control

Noise Figure

8 dB maximum (6 dB typical)

Image Rejection

60 dB

Input Impedance

50 ohms (unbalanced)

VSWR

1.5:1 Typical, 2.0:1 max

Operating Dynamic Range

Threshold to -10 dBm

Maximum Input

+10 dBm

IF Rejection

70 dB min., 80 dB typical

Spurious Rejection

60 dB

First LO Type

Synthesized

POST-DETECTION DIVERSITY COMBINER

The RCB-2000 provides circuitry for diversity post-detection combining of the incoming signals. The combining takes place utilizing the video outputs of the two receivers.

When operating under normal conditions, the AGC levels from the tuners are a true measure of the quality of the received data, and combiner weighting is a direct function of these levels. Certain applications, (high multipath environments, for example), may require that the combiner weighting include the addition of an AM component. This is handled in the combiner where the AM component is summed with the AGC levels to provide optimal combining under high fade rate conditions.

The Post-Detection Combiner provides 2.5 dB signal-to-noise improvement with equal S/N ratio inputs. (With unequal inputs S/N ratio) S/N combiner = $10 \log (pr1 + pr2) - .5$ dB. Where $Pr1 = C/N$ power ratio CH1 and $Pr2 = C/N$ power ratio of CH2.

DIGITAL FIR IF FILTERS

Each receiver is equipped with internal, pre-programmed FIR Second IF filters which provide bandwidths from 50 kHz to 30 MHz without the need for module replacement.

Bandwidth selection is made through the remote interfaces or by the front panel. All standard IRIG filter bandwidths are included plus several additional non-IRIG bandwidths. Additional IF filters are easily added via software. Contact factory for additional filter requirements.

The standard delivered FIR filters offered include: 50 kHz, 100 kHz, 150 kHz, 250 kHz, 300 kHz, 375 kHz, 500 kHz, 750 kHz, 1 MHz, 1.3 MHz, 1.5 MHz, 2 MHz, 2.4 MHz, 3 MHz, 3.3 MHz, 4 MHz, 5 MHz, 6 MHz, 7.5 MHz, 10 MHz, 12 MHz, 15 MHz, 20 MHz, 22 MHz, 25 MHz, 30 MHz.

DIGITAL MULTI-MODE DEMODULATOR

Each receiver is equipped with a Multi-Mode Demodulator employs the latest application specific technology in processing the 70 MHz IF signal. The demodulator provides FM, PM, BPSK, QPSK,

OQPSK., and **optional *FQPSK** operation. Data rates of up to 20 Mbps can be supported. The flexible nature of the demodulator and its associated IF and video filtering allows it to be used for a wide range of applications and it can easily be reconfigured as applications change. An optional Trellis FM Demodulator is available for signal-to-noise improvement.

Two analog video outputs are provided for monitoring both I & Q channel video signals when operating in the QPSK and OQPSK modes. Programmed FIR video filters provide maximally flat group delay filters. Video filters are provided with the -3 dB bandwidths from 150 kHz to 15 MHz.

Video filter values are as follows: 150 kHz, 187.5 kHz, 250 kHz, 375 kHz, 500 kHz, 750 kHz, 1 MHz, 1.2 MHz, 1.5 MHz, 1.65 MHz, 2 MHz, 2.4 MHz, 2.5 MHz, 3 MHz, 3.3 MHz, 3.75 MHz, 4

MHz, 5 MHz, 6 MHz, 7 MHz, 7.5 MHz, 10 MHz and 15 MHz.

Custom video filter bandwidths can be implemented by changing the receiver firmware (contact factory).

The RCB-2000(A) provides user-controllable video output levels with a 63 dB range of adjustment in 1 dB steps. The user can also control the video coupling (AC/DC) and video polarity through the front panel and via remote control.

DEMODULATOR SPECIFICATIONS

Each receiver is equipped with a DSP-based multimode demodulator, and meets the following demodulator specifications:

Demodulation Modes

FM, PM, AM, BPSK,
QPSK/OQPSK
*FQPSK (Option)
Trellis FM (Option)

Acquisition and Tracking

±250 kHz

Doppler Tracking Center Frequency

2.8125 MHz nominal

Reference Stability

±1.5 ppm

Video Output Level (Adjustable)

4 V_{p-p} nominal, 8 V_{pp} max

Video Bandwidths

Digital FIR

Video Output Impedance

75 ohms unbalanced

Reference Oscillator

10 MHz Internal, 5 or 10 MHz External

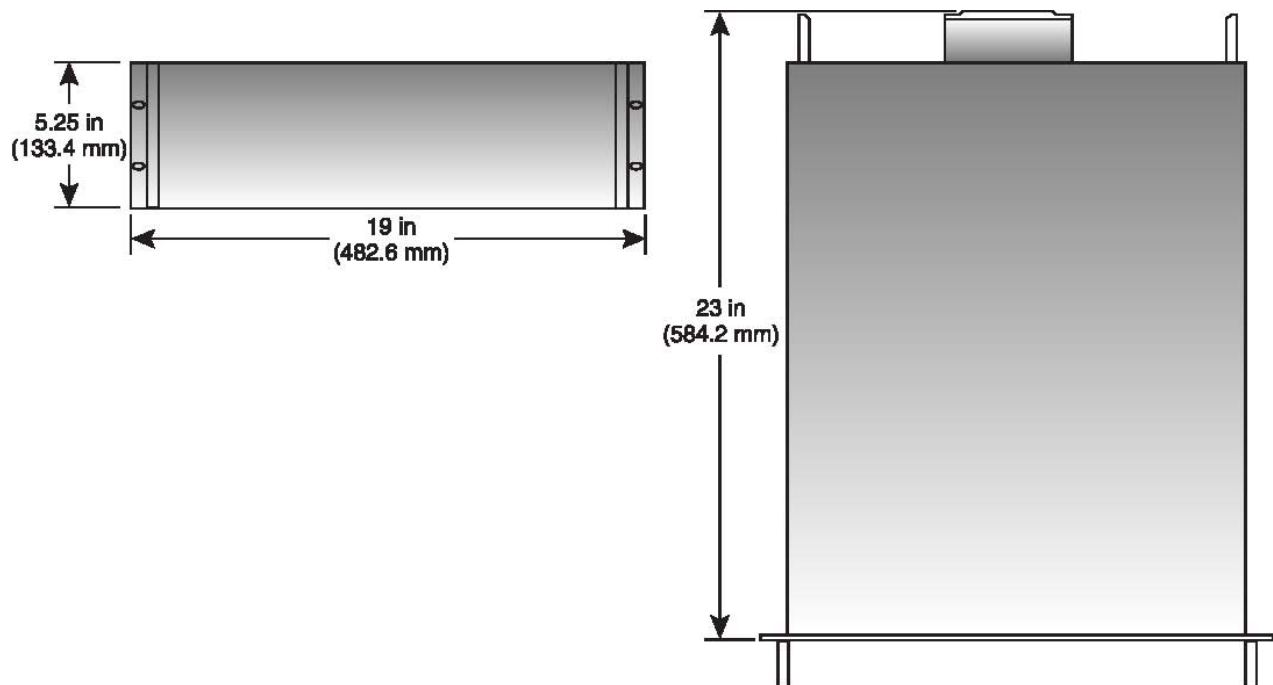
PROGRAMMABLE BIT SYNCHRONIZER (OPTIONAL)

An **optional programmable Bit Synchronizer** is available as an integral part of the RCB-2000(A) supporting data rates up to 20 Mbps per channel. The output of the bit sync is NRZ-L data with clock along with three soft decision bits for I & Q channels. The user can select the following:

- Input code - NRZ-L/M/S, Bi-Phase-L/M/S
- Bit Rate - 30 kbps to 20 Mbps (NRZ-L) per channel
- De-interleaver - in or out (10 Mbps maximum)
- Clock and data polarity per channel maximum control
- 15 bit Derandomizer On or Off

Settings can be changed via the front panel or through the remote digital interface.

OUTLINE DRAWING



General Specifications

Graphics Display Type	Electroluminescent
Graphics Display Size	3" x 8.25"
Graphics Display Color	Amber on Black
Data Entry	16 Button Keypad
Stored Setups	Stores up to 9 setups in non-volatile memory
AGC Modes	AGC, Manual Gain, AGC Freeze
Interface Baud Rate	Up to 19.2 Kbps
Remote Interface Formats	Ethernet, IEEE-488.1, RS-232

Operating Temperature Range	0 to 50 degrees C
Non-Operating Temperature Range	-55 to +65 degrees C
Humidity	Up to 90% non-condensing
EMI/RFI	Designed to meet 89/336/EEC
Dimensions	5.25" H x 19" W x 22" D
Weight	Less than 40 lbs.
Power Requirements	115/230 VAC (auto select) 50 - 400 Hz 200 watts maximum

Connector	Function	Connector Type
J1	115/230 VAC, 50-400 Hz auto select	IEC-320 Appliance AC connector with strain relief
J2	RF Channel 1 Input, 50 ohm unbalanced	N
J3	RF Channel 2 Input, 50 ohm unbalanced	N
J4	Video Out 1, nominal 4 Vp-p, 75 ohms	BNC
J5	Video Out 2, nominal 4 Vp-p, 75 ohms	BNC
J6	Signal Strength Record Channel 1, 0 to +5 V or -5 V into a 1K load	BNC
J7	10 MHz Reference Out, 50 ohms	BNC
J8	AM Channel 1 Output, 2 Vp-p for 50% AM, 75 ohms	BNC
J9	AGC Channel 1, 0 to -5 V into a 1K load	BNC
J10	IF Channel 1 Out, 70 MHz, -10 dBm, 50 ohms	BNC
J11	Record Out CH. 1 (option), 75 ohms	BNC
J12	Signal Strength Record Channel 2, 0 to +5 V or -5 V into a 1K load	BNC
J13	10/5 MHz Reference In, 50 ohms	BNC
J14	AM Channel 2 Output, 2 Vp-p for 50% AM, 75 ohms	BNC

Connector	Function	Connector Type
J15	AGC Channel 2, 0 to -5 V into a 1K load	BNC
J16	IF Channel 2 Out, 70 MHz, -10 dBm, 50 ohms	BNC
J17	Record Out CH. 2 (option), 75 ohms	BNC
J18	OR'D AM 2Vp-p for 50% AM, 75 ohms	BNC
J19	OR'D AGC , 0 to -5 V into a 1K load	BNC
J20	IF Combined Out, 70 MHz, -10 dBm, 50 ohms	BNC
J21	Record Out Combined (option), 75 ohms	BNC
J22	Doppler, 2.8125 MHz	BNC
J23	Bit Sync Outputs - Soft decision, Clock and Data, (TTL levels)	Type "D", 15 pin female
J24	Accessory	Type "D", 25 pin female
J25	RS-232C Interface	RS-232C Standard 9 pin, Type "D" female
J27	Ethernet, 100Base-TX	RJ-45 Socket
J28	IEEE-488.1 Interface	IEEE-488.1 Standard
J29	CLK	BNC
J30	NRZ I	BNC
J31	NRZ Q	BNC

Note: Rear panel configuration may vary depending on the options chosen.



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