DR-2000
DIGITAL RECEIVER

The DR-2000 is a high-performance receiver designed to enable highly sophisticated data and signal processing over a wide frequency spectrum.

L3 Telemetry & RF Products (L3 T&RF) DR-2000 receiving unit incorporates a high-performance telemetry RF section,a DSP-based multimode demodulator with pre-programmed FIR IF and video filters, and an optional tunable bit synchronizer within a single, 5.25-inch rack-mounted chassis.

OPTIONS

- Multi-band tuners
- Single-channel, record-down converter
- Trellis demod for improved signal-to-noise ratio

FEATURES

- Single-channel RF section with multiple, first- and second-IF bandwidths, a wideband DSP-based digital multimode demodulator
- Excellent adjacent channel rejection by using multiple, SAW first IF bandwidth filters, along with highly selectable FIR second IF filters
- Multiple user selected second IF FIR pre-programmed filters. Bandwidths from 50 kHz to 30 MHz are available. The unit comes pre-programmed with all IRIG filters. Other bandwidths can be added.
- Multimode FM, FM Trellis, PM, AM, BPSK, QPSK, OQPSK, FQPSK/SOQPSK demodulator
- Compatible with both conventional auto-tracking antenna systems and linear predictor antenna tracking systems (common in phased-array antennas)
- Small, lightweight and rugged design
- Easy to use operator's front panel and remote control via RS-232, Ethernet and IEEE-488
- Windows® application software which provides remote operation of front panel controls
- Internal, programmable-bit synchro-nizer with data rates from 30 kbps to 20 Mbps, NRZ and bi-phase L, M and S.
- Also includes deinterleaver

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APPLICATIONS

- Data reception
- AM tracking receiver
- Signal analysis
- Satellite TT&C
- Satellite image reception
- Aircraft testing and evaluation
- Video reception from RPV/UAV vehicles
- Expendable launcher data collection
- Unmanned telemetry sites requiring complete computer control
- Low Earth Orbit (LEO) satellite data collection
- Mobile tracking and data systems

L3 T&RF 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 which enable highly sophisticated data and signal processing over a wide frequency spectrum. The DR-2000 exemplifies this leadership with state-of-the-art performance in an easy-to-use form factor.

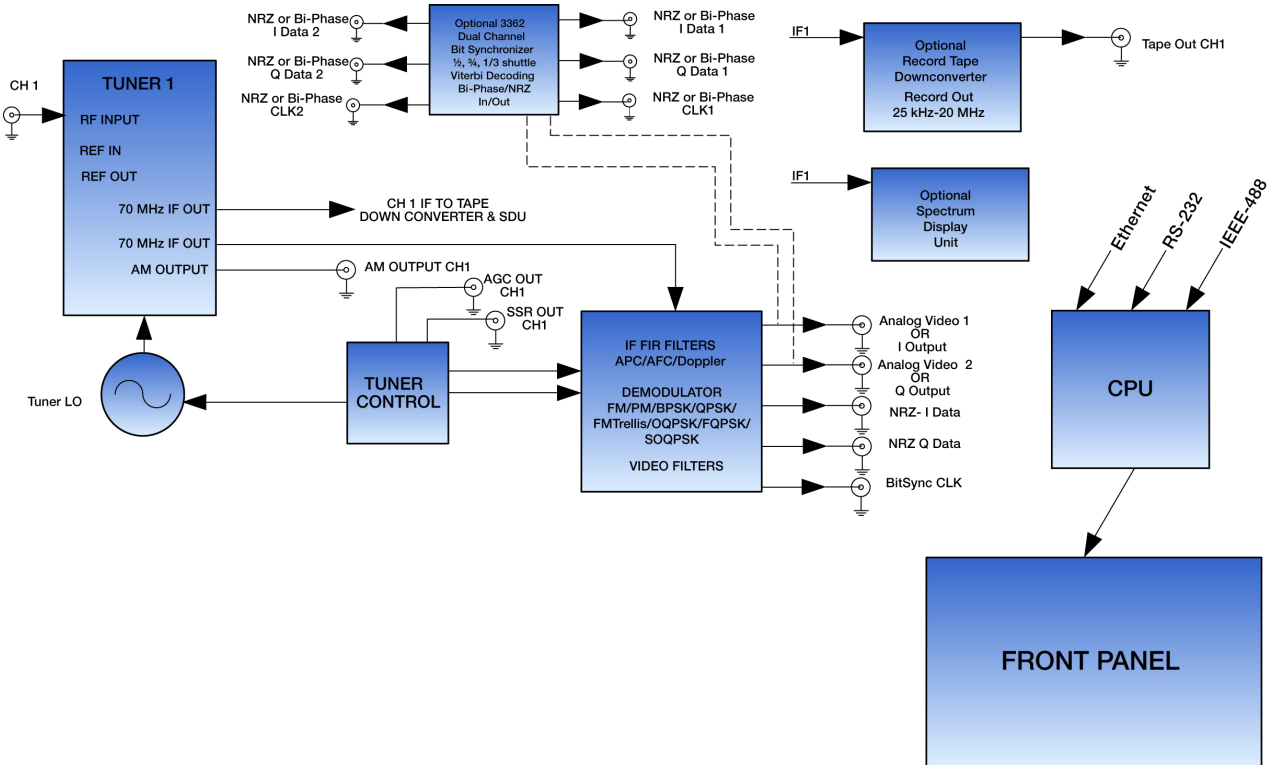
FEATURES

- 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
- Pre-programmed, digital FIR filters eliminate costly IF upgrades

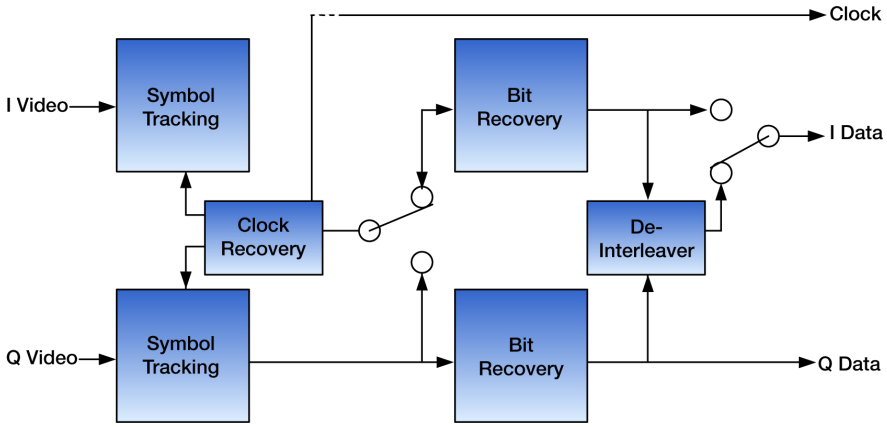
REDUCES

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

BLOCK DIAGRAM



BIT SYNCHRONIZER DIAGRAM



TUNER

The DR-2000 contains a single-channel tuner in the base unit with an option to add up to two additional tuner bands. The tuning is controlled by an LO phase locked to an internal or external reference.

Available frequency ranges include P, UL, LL, S/E, C-IF and C-RF bands. The tuner's center frequency can be selected with a resolution of 100 kHz either from the front panel or by remote control. For other frequency ranges, contact factory.

The DR-2000 Series has both an internal 10 MHz reference oscillator and the ability to use an external 10 MHz or 5 MHz reference.

The tuner contains a peak AM detector to provide AM demodulation. Maximum AM frequency response is 50 kHz with the low end determined by the AGC time constant.

A programmable manual gain control is provided for the receiver, which is controlled through the remote digital interface or by the front panel.

The DR-2000 provides the capability to hold (or freeze) the gain of the receiver with the remote digital interface, or by the front panel. Receiver gain is held to the value at the time the hold command is detected.

AGC monitor outputs are provided for the RF section with a range of 0 to a maximum of –5 volts. An AGC zero capability is provided to optimize the performance of the pre-detection combiner. Adjustment of this offset does not affect AGC slope. Auto zero capability is programmable through the remote digital interface or through the front panel. A single control zeros the AGC monitor outputs.

An additional signal strength record output is available with switchable output polarity.

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TUNER SPECIFICATIONS

RF Tuner Type	Dual conversion, Superheterodyne
Frequency Ranges Available	5090 to 5150 MHz (C Upper Band) 4400 to 4940 MHz (C Lower Band) 2185 to 2485 MHz (S/E Band) 1429 to 1545 MHz (Lower L-Band) 1750 to 1850 MHz (Upper L-Band) 610 to 1150 MHz (C-IF Upper Band) 400 to 460 MHz (C-IF Lower Band) 215 to 320 MHz (P-Band) (others available)
VSWR	1.5:1 typical, 2.0:1 max
Second IF Center Frequency	70 MHz
AM OUTPUT Level	2 VP-P into 75 Ω for 50% modulation
Envelope AM Frequency Response	High-end response 50 kHz Low-end response determined by AGC TC
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 by digital control
Noise Figure	8 dB maximum
Image Rejection	60 dB
Input Impedance	50 Ω (unbalanced)
Operating Dynamic Range	Threshold –10 dBm
Maximum Input Level	+10 dBm
IF Rejection	70 dB, 80 dB typical
Spurious Rejection	60 dB
First LO Type	Synthesized

DIGITAL FIR FILTERS

The internal, pre-programmed FIR Second-IF filters provide bandwidths form 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 filters are included. Contact L3 T&RF factory for additional filter requirements.

The standard FIR filters offered are as follows: 50 kHz, 100 kHz, 150 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, and 30 MHz.

DIGITAL MULTI-MODE DEMODULATOR

The multimode demodulator employs the latest application specific technology in processing the 70 MHz IF signal. The demodulator provides FM, PM, BPSK, QPSK, and 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 re-configured as applications change.

Two analog video outputs are provided for monitoring both I & Q channel video signals in QPSK/FQPSK operation. Pre-programmed FIR video filters provide maximally flat group delay filters with bandwidths compatible with receiver IF filter bandwidths. 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, 357 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 and widths can be implemented by changing the receiver firmware (contact factory for more information). The DR-2000 provides user controllable video output levels with a 63 dB range in 1 dB steps.

The user can also control the video coupling (AC/DC).

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DEMODULATOR SPECIFICATIONS

Demodulation Modes	FM, PM, AM, BPSK, QPSK, OQPSK, *FQPSK (option)
Maximum Data Rates	(PCM/NRZ-L) 20 Mbps FM 20 Mbps PM 20 Mbps BPSK 20 Mbps/QPSK/OQPSK 20 MBps/*FQPSK
Acquisition and Tracking	± 250 kHz
Doppler Tracking/ Center Frequency	2.8125 MHz nominal
Reference Stability	± 1.5 ppm
Video Output Level (adjustable)	4 Vp-p nominal, 8 Vp-p maximum
Video Bandwidths	Digital FIR
Video Output Impedance	75 ohms unbalanced
Reference Oscillator	10 MHz internal, 5 or 10 MHz external

DR-2000 DISPLAY ENVIRONMENT

DISPLAY	
Graphics Display Type	LCD
Graphics Display Size	3.6 in. x 6 in.
Graphics Display Color	White on black
Data Entry	16-button keypad
Stored Setups	Stores up to 27 setups in non-volatile memory
Interface Baud Rate	Up to 115.2 Kbps
Remote Control Interface Formats	Ethernet, RS232, IEEE-488-2
AGC Modes	Automatic (AGC), Manual, Freeze
ENVIRONMENT	
Operating Altitude	N/A
Storage Altitude	15,000 ft.
Operating Temperature Range	0 °C to 50 °C
Non-Operating Temperature Range	-55 °C to +65 °C
Humidity	Up to 95% non-condensing
EMI/RFI	Designed to meet or exceed MIL-STD-461-D

RECORD TAPE CARRIER (OPTIONAL)

A record carrier output is available as an option for the receiver. Record carrier frequencies, selectable through the remote digital interface or through the front panel, are in 25 kHz steps from 25 kHz to 20 MHz. The record carrier output level is 1 VRMS. The output impedance is 75 ohms.

PROGRAMMABLE SINGLE CHANNEL BIT SYNCHRONIZER

A single-channel bit synchronizer is now a standard feature in the DR-2000. The bit synchronizer is tunable to 20 Mbps, with NRZ-L and clock outputs. The user can select the following:

- Input Code – NRZ-L/M/S, Biphase-L/M/S
- Bit Rate – 30 kbps to 20 Mbps
- De-Interleaver – In or Out
- Clock and data polarity
- IRIG de-randomizer
- 15 Bit de-randomizer – In or Out

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

Custom video filter and widths can be implemented by changing the receiver firmware (contact factory for more information). The DR-2000 provides user controllable video output levels with a 63 dB range in 1 dB steps. The user can also control the video coupling (AC/DC).

SPECIFICATIONS

Dimensions	5.25 in. H x 19 in. W x 22 in. D
Weight	Approx. 30 lbs.
Power Requirements	115 to 230 VAC, 50 to 400 Hz Autosensing 150 W typical

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DR-2000 REAR PANEL CONNECTORS

J1	AC Power Input	IEC-320 Appliance AC connector with strain relief
J2	CH1 RF Input	115/230 VAC, 50 to 400 Hz
J3	Not Used	50 ΩType N, -10 dBm to threshold
J4	CH1 Video1	75 Ω BNC, 4 V P-P nominal
J5	Not Used	
J7	Reference Output (10 MHz)	50 Ω BNC, 0 dBm ±3 dB
J8	CH1 NRZ I	75 Ω BNC, 0 to 5 V nominal
J9	CH1 NRZQ	75 Ω BNC, 0 to 5 V nominal
J10	CH1 Bit Sync Clock	0 Ω BNC, -10 dBm 70 MHz
J11	CH1 IF OUT	50 Ω BNC, -11 dBm nominal
J13	Not Used	
J14	Not Used	
J15	Not Used	
J16	Not Used	
J17	Not Used	
J18	Not Used	
J19	Not Used	
J20	Not Used	
J21	Not Used	
J24	ACC (Accessories)	Type “D” 9-pin female
J24-1		Ground
J24-2		
J24-3		TTL, COR CH1
J24-4		
J24-6		Ground

J25	RS-232	Type “D” 9-pin female
J25-2		TX-Data
J25-3		RX-Data
J25-5		Ground
J26	REF IN	50 Ω BNC, 0 dBm ± 2 dB
J27	Ethernet	
J28	IEEE-488	
J29	CH1 Video 2	75 Ω BNC, 0 to 4 V p-p
J30	Not Used	
J31	Not Used	
J32-A1	CH1 AM	75 Ω BNC, 2 Vp-p nominal
J32-A4	CH1 GC	BNC, -6 V to +6 V
J33-A1	CH1 Doppler	BNC, -15 dBm nominal
J33-A4	CH1 Record	75 Ω BNC, 1 V p-p nominal
J34-A1	CH1 Signal STR Record	BNC, -6 V to +6 V
J34-A3	CH1 Signal Quality (Option)	BNC, RS-423

BRML659 Rev A