

Technical Bulletin

DR-2000 Digital Receiver Ground Products/Microdyne



FEATURES

Microdyne's Model 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. The receiver offers the following features and performance characteristics:

- Single Channel RF section with multiple first and second IF bandwidths, a Wideband DSP-based Digital Multimode Demodulator, and optional Bit Sync.
- 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 (consult factory).
- Multimode FM, PM, AM, BPSK, QPSK/OQPSK Demodulator.

- Compatible with both conventional Auto-Tracking Antenna Systems and Linear Predictor Antenna Tracking Systems (common in Phased Array Antennas).
- Small, lightweight & 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.

OPTIONS:

- Internal programmable Bit Synchronizer with data rates from 30 kbps to 20 Mbps, NRZ and Biphase -L, M & S. Also includes de-interleaver and 3 bit soft decision per I and Q outputs.
- Multi-Band Tuners
- Single Channel Record Down Converter
- Feher Patented *FQPSK Demodulation



communications

**Feher Patented FQPSK Technologies*

DR-2000 APPLICATIONS

Applications include:

- 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

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 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.

DR-2000 BENEFITS

DR-2000 Compact Digital Receiver System — *leading edge technology and performance*

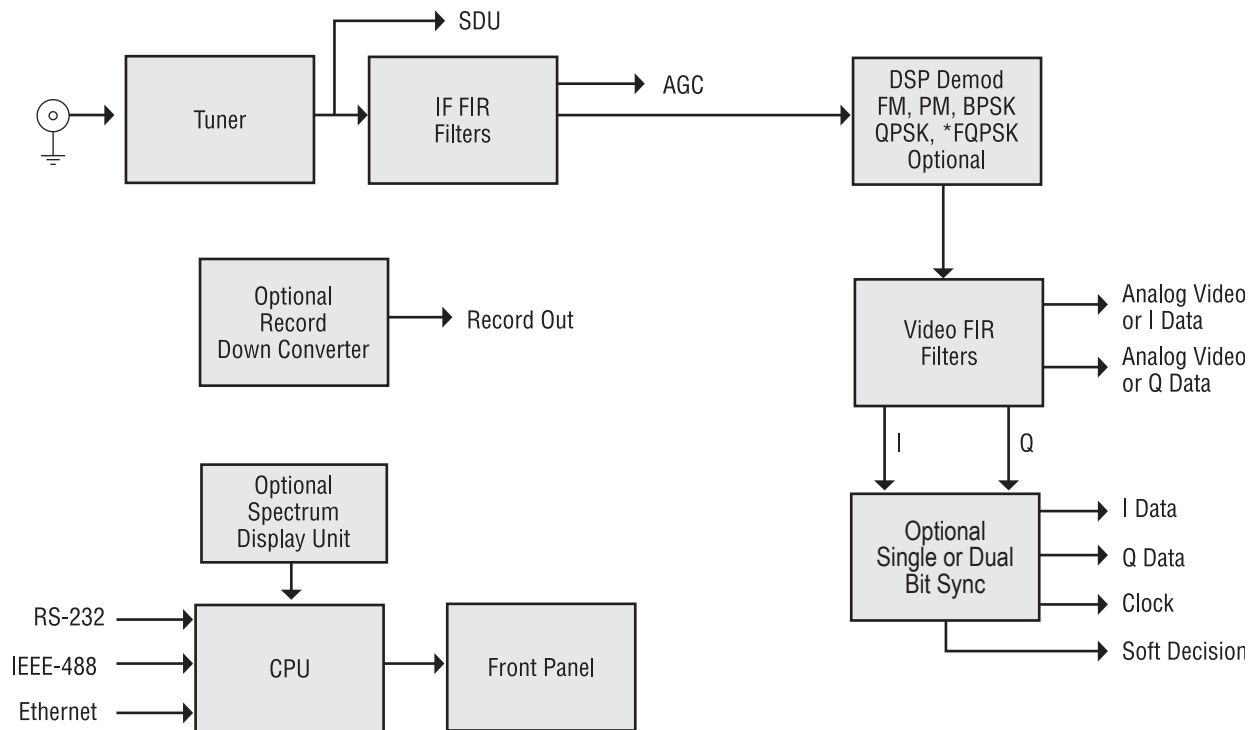
BENEFITS:

- 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

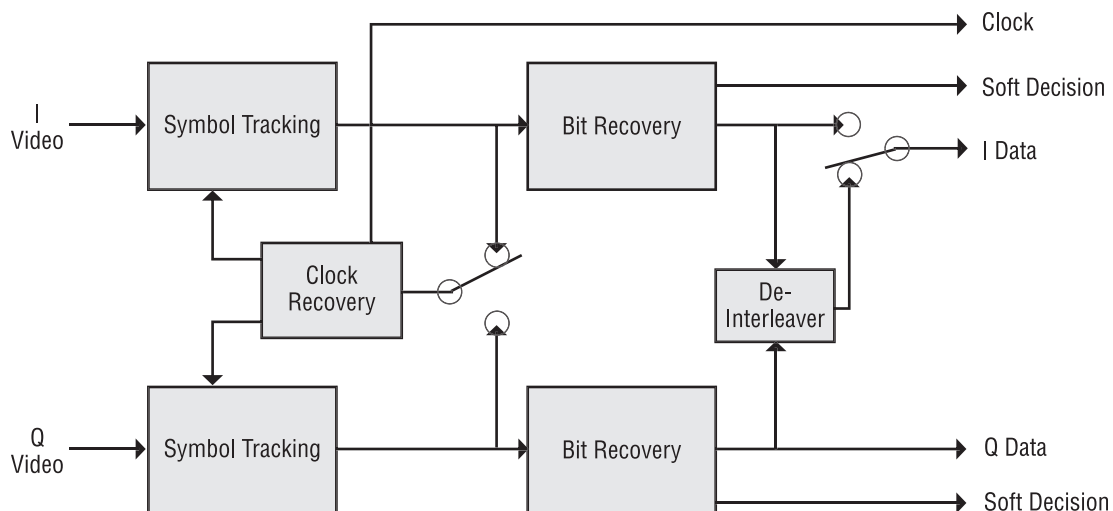
REDUCES:

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

Simplified 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 2185 MHz to 2485 MHz, 1429 MHz to 1545 MHz, 1700 MHz to 1850 MHz and 215 MHz to 320 MHz. 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 consult the 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 low end determined by AGC time constant.

Envelope AGC is derived from a peak AM detector with five selectable time constant settings.

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.

TUNER SPECIFICATIONS

RF Tuner Type

Dual Conversion, Superheterodyne

Frequency Ranges Available

2185-2485 MHz,
1429-1545 MHz,
1700-1850 MHz,
215-320 MHz
(others available)

VSWR

1.5:1 Typical, 2.0:1 max

Second IF Center Frequency

70 MHz

AM OUTPUT Level

2 V pp into 75 ohms 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 max.

Image Rejection

60 dB

Input Impedance

50 ohms (unbalanced)

Operating Dynamic Range

Threshold to -10 dBm

Maximum Input Level

+10 dBm

IF Rejection

70 dB, 80 dB Typical

Spurious Rejection

60 dB

First LO Type

Synthesized

DIGITAL FIR IF FILTERS

The internal pre-programmed FIR Second IF filters 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 filters are included. Contact 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 MULTIMODE 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 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 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, 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 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).

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 V pp 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

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 7.500 MHz. The record carrier output level is 1 V RMS. The output impedance is 75 ohms.

PROGRAMMABLE SINGLE CHANNEL BIT SYNCHRONIZER (OPTIONAL)

An optional pre-programmable Bit Synchronizer is available for the DR-2000 supporting data rates up to 20 Mbps. The outputs of the bit sync are NRZ-L data with clock along with three soft decision bits for I and 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
- 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.

PROGRAMMABLE DUAL BIT SYNCHRONIZER (OPTIONAL)

See separate data sheet for the 3362 Bit Sync.

DR-2000 Display/Environment

Display

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 10 setups in non-volatile memory
Interface Baud Rate	Up to 19.2 Kbps
Remote Control Interface Formats	Ethernet, IEEE-488-1, RS-232
AGC Modes	Automatic (AGC) Manual, Freeze

Environment

Operating Altitude	15,000 feet
Storage Altitude	30,000 feet
Operating Temperature Range	0 to 50 degrees C
Non-Operating Temperature Range	-55 to +65 degrees C
Humidity	Up to 95% non-condensing
EMI/RFI	Designed to meet or exceed MIL-STD-461-D

Specifications

Dimensions	5.25" H x 19" W x 22" D
Weight	Approximately 30 pounds
Power Requirements	115 - 230 VAC, 50-400 Hz autosensing 150 watts typical

DR-2000 Rear Panel Connectors

Connector	Function	Connector Type
J1	115/230 VAC, 50-400 Hz Auto sensing	IEC-320 Appliance AC connector with strain relief
J2	RF Input, 50 ohm unbalanced	N
J4	Video 1, nominal 4Vp-p, 75 ohms	BNC
J5	Video 2, nominal 4Vp-p, 75 ohms	BNC
J6	Signal Strength Record, 0 to +5 V or -5 V into a 1K load	BNC
J7	10 MHz Reference Out, 50 ohms	BNC Level
J8	AM Output, 2 Vp-p for 50% AM, 75 ohms	BNC
J9	AGC, 0 to -5 V into a 1K load	BNC
J10	IF Out, 70 MHz, -10 dBm, 50 ohms	BNC
J11	Record Out, 75 ohms to 1.0 VRMS, nominal	BNC

Connector	Function	Connector Type
J13	5/10 MHz Reference In, 50 ohms	BNC
J14	Clock Out TTL	BNC
J15	I data Out TTL	BNC
J16	Q data Out TTL	BNC
J22	Doppler, 2.8125 MHz nominal, 50 ohms	BNC 2VPP
J23	Bit Sync Outputs, Soft decision, Clock and Data, RS-422 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, 100 Base-TX	RJ-45 Socket
J28	IEEE-488 Interface	IEEE-488 Standard





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