MODEL DVM-100

DIGITAL VIDEO MODULATOR



Model DVM-100 is a high performance variable rate digital video broadcast modulator. The base unit supports QPSK, 8PSK or 16QAM modulation formats with up to 30 Mbps in 1 bps steps. The system's options can be tailored to support all modulation formats, up to 108.5 Mbps, 140/950–1750 MHz outputs, redundant ASI coaxial, SPI, ASI optical data interfaces and internet programming. All operating parameters are programmable from the front panel or remotely via RS485/RS422/RS232. Full keypad entry with user-friendly menu simplifies the programming, alarm status/usable rate/packet buffer monitoring and switchover/supervisory contact closures setup process.

FEATURES

- EN 300 421/EN 301 210 DVB compliant
  - Outer coding, Reed Solomon
  - Inner coding, Viterbi/trellis
  - Baseband filtering with programmable roll-off factor (IF spectrum shaping)
  - Randomization for energy dispersal
- Data rates up to 30 Mbps
- One data interface of customer choice
- One modulation of customer choice; QPSK, 8PSK or 16QAM
- Selectable normal or inverted spectrum
- Rate adaptive or data source locked mode
- 4000 packet buffer
- Programmable IF frequency and level
- PCR time-stamped updating
- Front panel monitoring of ASI coaxial input and carrier spectrum

OPTIONS

- Choice of data input interfaces
- Choice of modulation formats
- Higher data rates up to 108.5 Mbps
- 1:1 IF redundancy
- Additional adaptively equalized/re-timed coaxial ASI input with manual/auto switching and user defined fallback time
- Re-timed adaptively equalized coaxial ASI output
- Re-timed ASI optical output
- Ethernet remote programming

MODEL DVM-100 DIGITAL VIDEO MODULATOR FEATURES

The standard system is equipped with one data interface (adaptively equalized/re-timed ASI coaxial, ASI optical, SPI or RS422), and one modulation format (QPSK, 8PSK or 16QAM) supporting data rates up to 30 Mbps in 1 bps steps as standard features. Most of the features below are included in the standard unit. The system is easily upgradable for all the available options.

FEATURES

- DVB compliant to EN 300 421 and EN 301 210 standards
- Choice of QPSK, 8PSK and 16QAM modulation formats
- Programmable symbol rate in 1 Baud steps
- Programmable interface data rates in 1 bps steps
- Programmable roll off factor from 0.15 to 0.35 in 0.05 steps
- Programmable CW IF center frequency from 52 to 88 MHz in 31.25 kHz steps
- Programmable modulated IF center frequency in 2.5 kHz steps
- Selectable normal and inverted spectrum
- Selectable modulated or CW IF carrier
- IF mute
- 10 MHz external reference input/output
- Selectable internal or external 10 MHz reference
- Local and remote programming of all parameters
- Front panel and remote monitoring of all fault alarms
- Programmable switchover and supervisory summary alarm contact closures
- Choice of data interfaces (see Options):
  Additional adaptively equalized ASI input
  ASI optical input
  SPI input
  RS422 input
- Coaxial ASI redundancy with manual/auto switching and user defined fall back time (option)
- Fail-safe switching of either ASI coaxial input to the ASI output (option)
- Adaptive cable equalizer for ASI coaxial data interfaces
- Raw or adaptively equalized and re-timed ASI coaxial input signal to the ASI coaxial output (option)
- Re-timed ASI optical outputs (option)
- Rate adapter with 4000 packets buffer
- PCR time-stamped updating
- RS485/RS422/RS232 remote programming (front panel selectable)
- Ethernet programming (option)
- Low profile, 1RU (height: 1.75 inches)
- Front panel on-line monitoring of IF output and ASI inputs
- Low power consumption (< 30 watts)
- High reliability at low cost

PROGRAMMABLE PARAMETERS

- IF center frequency
- IF output level

PROGRAMMABLE PARAMETERS (CONT.)

- Modulated or CW IF carrier
- IF mute
- Spectrum normal/inverted
- Modulation type
- ASI coaxial data interface input selection (option)
- ASI coaxial data interface output selection (option)
- Code rate
- Symbol rate
- Data rate
- Roll-off alpha factor
- Data input format (187, 188, or 204 byte mode)
- Sync byte value
- 1:1 redundancy operation (option)

FRONT PANEL CONTROLS

- Power ON/OFF switch
- Keypad entry

FRONT PANEL INDICATORS

- Data inactivity
  ASI carrier detect
  ASI optical power loss
  ASI receive violation symbols
  Interface clock alarm (for SPI or RS422, option)
- FIFO over/underflow
- Loss of sync
- IF level alarm
- IF lock alarm
- Communication error
- Built-in test
- Local operation
- Remote operation

FRONT PANEL MONITOR

- See physical

REAR PANEL I/O

- See physical

MODEL DVM-100 DIGITAL VIDEO MODULATOR SPECIFICATIONS

INPUT

SPI, ASI coaxial and optical data interfaces
Data Rate:
- For DVB 188 byte format ..... 0.92 to 99.99 Mbps
- (for other input formats refer to equation)

RS422 data interface ..... 0.92 to 18 Mbps
Data frame structure
- 187 byte mode ..... 187 data bytes
- DVB 188 byte mode ..... 1 sync byte, 187 data bytes
- DVB 204 byte mode ..... 1 sync byte, 187 data bytes, 16 parity bytes

IF OUTPUT

Center frequency ..... 52 to 88 MHz
Programming resolution
- CW IF ..... 31.25 kHz
- Modulated IF center frequency ..... 2.5 kHz
- Frequency accuracy ..... ±2.5 kHz
- Frequency stability ..... ±1 ppm

Phase noise .....

Offset from carrier	dBc/Hz (typ.)
100 Hz	-70 dBc
1 kHz	-75 dBc
10 kHz	-90 dBc
100 kHz	-110 dBc
1000 kHz	-115 dBc

Output level ..... -20 to 0 dBm (-10 to +10 dBm, option)
Programming resolution ..... 0.1 dB
- Accuracy ..... ±0.5 dB
- Stability from 0 to 50 degrees ..... ±1 dB

Output spurious ..... -60 dBc/4 kHz
(referenced to -10 dBm unmodulated carrier)
Output impedance ..... 75 ohms
- Return loss ..... > 15 dB

MODULATION AND TRANSFER FUNCTION

Inner FEC code rates
- QPSK 1/2, 2/3, 3/4, 5/6, 7/8,
  (Viterbi, K = 7, G_1 = 171 oct, G_2 = 133 oct)
- 8PSK ..... 2/3, 5/6, 8/9 (PTCM)
- 16QPSK ..... 3/4, 7/8 (PTCM)

Outer code ..... (204, 188) Reed Solomon,
Per EN 300 421 / EN 301 210
Spectral mask ..... Per EN 300 421 / EN 301 210
Inband ripple ..... Per EN 300 421 / EN 301 210
Inband group delay ..... Per EN 300 421 / EN 301 210
Interleaver ..... Convolutional, depth 12
Data scrambling ..... Per EN 300 421
Frame synchronization ..... 1 sync byte in a group of 8 packets is
inverted from 47 Hex to B8 Hex

OUTPUT TRANSPORT RATE

SPI, ASI coaxial and optical, RS422 (rate adapter ON)
- Symbol rate ..... 1 to 31 Mbaud
- RS422 rate adapter OFF (188 byte format) .... 1 to 19.53 Mbaud
- (for other input formats, refer to equation)
- Programming resolution ..... 1 Baud

MODEL DVM-100 DIGITAL VIDEO MODULATOR SPECIFICATIONS (CONT.)

REFERENCE

External reference input ..... 10 MHz
  Level ..... 0 ±2 dBm
  Input impedance ..... 50 ohms
10 MHz external reference output
  Level ..... External reference level -1 dB maximum
  Output impedance ..... 50 ohms
Internal reference ..... 10 MHz
Frequency stability ..... ±1 ppm

OUTPUT IF OCCUPIED BANDWIDTH

INTERFACE BIT RATE - EXTERNAL 188 BYTE FRAMES

MODULATION / CODE RATE	SYMBOL RATE 1 MBAUD (Mbps, Min.)	SYMBOL RATE 31 MBAUD (Mbps, Max.)	(BW/RU) -3 dB BW	(BW/RU) x (1 + α) -26 dB BW (α = 0.35**)
QPSK FEC R1/2	0.921569	28.568627	1.085	1.465
QPSK FEC R2/3	1.228758	38.091503	0.814	1.099
QPSK FEC R3/4	1.382353	42.852941	0.723	0.977
QPSK FEC R5/6	1.535948	47.614379	0.651	0.879
QPSK FEC R7/8	1.612745	49.995098	0.620	0.837
8PSK FEC R2/3	1.843137	57.137255	0.543	0.732
8PSK FEC R5/6	2.303922	71.421569	0.434	0.586
8PSK FEC R8/9	2.457516	76.183007	0.407	0.549
16QAM FEC 3/4	2.764706	85.705882	0.362	0.488
16QAM FEC 7/8	3.22549	99.990196	0.310	0.419

**To obtain -26 dB bandwidth (BW) for roll-off factors (α) other than 0.35, multiply (BW/RU) by ($1+\alpha_{programmed}$). It is recommended that α of 0.25 be used for 8PSK and 16QAM modulation formats.

PULSE SHAPING

Roll-off factor (α) range ..... 0.15 to 0.35
Programming resolution 0.05

INTERFACE BIT RATE CALCULATION

Interface bit rate for 187 and 204 input byte format frames can be calculated by the following equation:
  *Interface bit rate = (symbol rate) x (inner FEC code rate) x (outer RS code rate) x (modulation order)
  (96.25 Mbps maximum for 187 byte format; 105.00 Mbps maximum for 204 byte format)
Where:
Symbol rate ..... 1 Mbaud minimum, 30 Mbaud maximum
Inner FEC code rates
  QPSK 1/2, 2/3, 3/4, 5/6, 7/8
  8PSK 2/3, 5/6, 8/9
  16QAM 3/4, 7/8
Outer RS code rate ..... 187/204 for 187 byte frame, 188/204 for 188 byte frame or 1 for 204 byte frame
Modulation order ..... 2 for QPSK, 3 for 8PSK or 4 for 16QAM

MODEL DVM-100 DIGITAL VIDEO MODULATOR OPTIONS

DATA INTERFACE

DVM-1 Additional adaptively equalized/re-timed ASI input with redundancy capability. In auto mode, non-faulty ASI coaxial port is selected when a fault occurs in the programmed port. After a switchover occurs, fallback mode (programmed by user) specifies whether or not the system should automatically switch back to the programmed port when fault goes away. In manual mode automatic switchover is inhibited and the ASI ports are left as programmed.

DVM-2 Programmable ASI switched output in addition to Option DVM-1. The ASI coaxial inputs can be switched out at this port equalized/re-timed or raw for monitoring or transmitting (connecting to another modulator) without disturbing the operation. Only raw ASI coaxial is allowed to be switched to the output port for the ASI coaxial input which is being modulated.

DVM-3 ASI optical input port.

DVM-4 Re-timed ASI optical output port for monitoring or transmission (connecting to another modulator). This option requires Option DVM-3.

DVM-5 SPI (Synchronous Parallel Interface) transport stream input port.

DVM-6 RS422 transport stream input port.

MODULATION FORMAT

DVM-7 QPSK
DVM-8 8PSK
DVM-9 16QAM

70, 140 OR 950–1750 MHz REDUNDANCY

DVM-10 70 MHz
DVM-11 140 MHz
DVM-12 L-band

REMOTE PROGRAMMING

DVM-13 Ethernet programming

IF/RF HIGHER POWER OUTPUT PROGRAMMING

DVM-14 -10 to +10 dBm

HIGHER DATA RATES

DVM-15 52 Mbps
DVM-16 72 Mbps
DVM-17 108.5 Mbps

MODULATOR DATA INTERFACE SPECIFICATIONS

INTERFACE

- Two selectable ASI coaxial inputs, and one each of ASI optical, SPI and RS422 data inputs
- Adaptive cable equalizer for ASI coaxial data interface
- Selectable re-timed ASI coaxial data interface output
- Re-timed ASI optical data interface output
- Rate adapter with packet buffer
- PCR time-stamped updating
- Operating distance:
  ASI coaxial ..... > 150 meters
  ASI optical ..... 1500 meters
  SPI/RS422 ..... Rack environment

ELECTRICAL PERFORMANCE

ASI ELECTRICAL OUTPUT

Voltage ..... 800 mV ±10%
Rise/fall time (20% to 80%) .. < 1.2 ns
Impedance ..... 75 ohms
Return loss ..... 17 dB
Coupling ..... Transformer
Connector ..... BNC female

INPUT

Maximum voltage ..... 880 mV
Minimum sensitivity ..... 200 mV
Input impedance ..... 75 ohms
Return loss ..... 17 dB
Coupling ..... Transformer
Connector ..... BNC female

ASI OPTICAL OUTPUT

Fiber ..... 1300 nm, multimode 62.5/125 um
Transmit power ..... -14 to -19 dBm
Wavelength ..... 1280 nm (min.), 1380 nm (max.)
Connector ..... ST

INPUT

Fiber ..... 1300 nm, multimode 62.5/125 um
Receive power ..... -26 to -14 dBm
Wavelength ..... 1280 nm (min.), 1380 nm (max.)
Connector ..... ST

TRANSFER CHARACTERISTICS

ASI BAUD rate in ..... 270 Mbaud ±100 ppm

ASI / SPI transport rate in
188 byte format ..... 0.92 to 96.765 Mbps
(for other input formats refer to equation)
Upper limit
(rate adapter ON) ..... Output rate: -100 ppm
Tolerance
(rate adapter OFF) ..... < ±80 ppm

ASI BAUD rate out ..... 270 Mbaud ±100 ppm
Transfer packet ..... DVB 188 or 204 bytes or 187 bytes mode
RS422 transport rate in ..... 0.92 to 18 Mbit/s
Input packet data
timing variation ..... Bursty or linearly distributed
Packet buffer
Rate adapter OFF ..... 4 packets
Rate adapter ON ..... 4000 packets
PCR update accuracy
SPI and RS422 ..... < TD + PKDLY x (10 MHz reference) + input PCR jitter
ASI coaxial or optical ..... < TD + ASI clock jitter + input PCR jitter

GENERAL SPECIFICATIONS

PRIMARY POWER REQUIREMENTS

Voltage	95–250 VAC
Frequency	47–63 Hz
Power consumption	30 W maximum

PHYSICAL

Weight	20 pounds nominal
Overall dimensions	19" x 1.75" x 20" nominal
Rear panel connectors	
AC input receptacle	Standard AC connector
Summary contact closure	9 pin SUB-D, female
Remote control input	9 pin SUB-D, female
Ethernet remote programming	RJ45 (option)
IF output	BNC female
10 MHz external reference input/output	BNC female
Transport stream data interface	See standard features and options
ASI coaxial data input	BNC female
ASI coaxial data output	BNC female
SPI/RS422 data interface	25 pin SUB-D, female
ASI optical input/output data connectors	ST
Front panel connector	
IF monitor	BNC female
Raw ASI coaxial data inputs	BNC female

ENVIRONMENTAL

Operating	
Ambient temperature	0 to 50°C
Relative humidity	Up to 95% at 30°C, noncondensing
Atmospheric pressure	Up to 10,000 feet
Nonoperating	
Ambient temperature	-50 to +70°C
Relative humidity	Up to 95% at 40°C, noncondensing
Atmospheric pressure	Up to 40,000 feet
Shock and vibration	Normal handling by commercial carriers

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