MODEMS, RECEIVERS AND RF/IF/BASEBAND PROCESSING SYSTEMS AND COMPONENTS

• Modems
• Switching Systems
• Receivers
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The ASM-100 expansion audio subcarrier modulator system is a one-rack unit, capable of supporting up to two remote-programmable audio subcarrier modulators. This expands the total number of subcarriers supported by the VM-100R video modulator system to six. Expansion subcarrier modulators are locally and remotely programmable (see Option MRVA for VM-100R) via the VM-100R front panel and remote port, respectively. A special port is provided on both the VM-100R and the subcarrier modulator expansion systems for intra-system local communication.

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Number of subcarrier channels/systems</th>
<th>Up to two</th>
</tr>
</thead>
</table>

#### AUDIO
- **Input level**: +18 dBm maximum
- **Input impedance**: 600 ohms balanced (others available)
- **Input return loss**: 30 dB minimum
- **Frequency response**: 100 Hz to 12 kHz, 0.6 dB p-p, 40 Hz to 15 kHz, < 1 dB p-p
- **Harmonic distortion**: < 0.5%, 150 kHz p-p deviation, < 1%, 840 kHz p-p deviation
- **Pre-emphasis**: 50/75 µs, J17 and flat response switchable
- **Signal/noise (weighted)**: > 62 dB, 300 kHz p-p deviation

#### SUBCARRIER MODULATOR
- **Subcarrier deviation by audio**: Programmable from 25 to 420 kHz peak (1 kHz programming resolution)
- **Subcarrier IF level**: Programmable below the main IF carrier level from -35 to -13 dBc (corresponding to < 2% to > 20% of IF deviation by video) (0.1 dBc programming resolution)
- **Subcarrier pre-emphasis**: 50/75 µs, J17 pre-emphasis or flat response selection
- **Subcarrier IF frequency**: Programmable from 5 to 8.2 MHz (10 kHz programming resolution)
- **Subcarrier limit level**: Programmable from 12 to 20 dBm (0.5 dBm programming resolution)

#### PRIMARY POWER REQUIREMENTS
- **Voltage**: 100/120/220/240 VAC, ±10%, rear panel selectable
- **Frequency**: 47 to 63 Hz
- **Power consumption**: 20 W

#### PHYSICAL
- **Dimensions**: 19” x 24” x 1.75”
- **Weight**: 11 pounds

#### CONNECTORS
- **Audio input**: 8-pin DIN
- **Subcarrier output**: BNC
- **Remote and local programming**: 9-pin male, D type (to VM-100R modulator)
- **Contact closure**: 9-pin male, D type
- **Chassis ground**: 10-32 stud
The VM-2000ADEQ video modulator is designed for applications that require high signal-to-noise ratios and minimum distortions of the transmitted information, for both video and audio signals. The applications include multiloop terrestrial and satellite links where cumulative distortions render conventional modulator performance unacceptable. These modulators are designed to meet or exceed RS-250C short-haul and IESS-306 standards and are compatible with NTSC, PAL and SECAM video formats. A wide selection of optional features make the modulators compatible with B-MAC, D2-MAC, SIS, IRDETO and encrypted NTSC, PAL/SECAM video formats.

**FEATURES**
- Adaptable to a wide variety of video formats
- Satellite and system amplitude/group delay equalization
- Four stages of linear/parabolic group delay equalization, IF amplitude slope equalization
- DC-coupled circuitry
- Synthesized front panel, thumbwheel programmable audio subcarrier modulators
- Multiple pre-emphasis selection for video and audio
- Averaging AFC with enable/disable select
- Baseband, IF and subcarrier monitor ports
- Video present, dispersal failure, IF and subcarriers out-of-lock condition indicators
- Summary alarm
- One IF filter and one video filter of customer’s choice
- Up to two audio subcarrier modulators programmable from 5 to 8.2 MHz in 10 kHz steps, supporting 50/75 µs and J17 audio pre-emphasis
- Up to two switchable IF filters
- Up to two switchable video filters

**OPTIONS**
- Wide selection of IF and video filter bandwidths
- Switchable video filters
- Switchable IF filters
- Half/full transponder operation
- Gated/averaging AFC for NTSC, PAL/SECAM and B-MAC/D2-MAC video formats
- ED synchronization for encrypted video format
- External subcarrier port
- ATIS (Automatic Transmitter Identification System)
**IF OUTPUT**
Center frequency .............................................. 70 MHz
Peak deviation by video ..................................... 5 to 18 MHz, adjustable
Impedance ........................................................... 75 ohms
Level .................................................................... 25 to +2 dBm adjustable (higher output levels optional)
Linearity ............................................................... < ±1.5%, ±18 MHz, (< ±1% optional)
Group delay (±18 MHz)
  Linear .............................................................. 0.05 ns/MHz maximum
  Parabolic .......................................................... 0.0025 ns/MHz^2 maximum

**AMPLITUDE/GROUP DELAY**
Group delay adjustment range ............................ 70 ±18 MHz
  Linear .............................................................. 0 to ±1.5 ns/MHz/section
  Parabolic .......................................................... 0.04 to 0.15 ns/MHz^2/section
Amplitude slope adjustment range ...................... ±3 dB

**AFC SYNTHESIZED REFERENCE SOURCE (APPLIES TO GATED AFC OPTION)**
Frequency range.................................................. 55 to 85 MHz
Step size.............................................................. 10 kHz

**VIDEO INPUT**
Level .................................................................... 1 V p-p
Impedance ........................................................... 75 ohms
Return loss........................................................... 30 dB minimum

**VIDEO CHARACTERISTICS (BACK-TO-BACK WITH WIDEBAND REFERENCE DEMODULATOR, HIGH C/ N)**
Frequency response ............................................ 10 Hz to 6 MHz, ±0.3 dB maximum,
  10 Hz to 10 MHz, ±0.35 dB maximum (video filter out)
Short-time distortion............................................ < ±1%
Chrominance/luminance gain error ..................... < ±1.5 IRE
Chrominance/luminance delay error..................... < ±4.5 ns nominal without video filter,
  < ±20 ns with optional video filter
Differential gain.................................................... < ±1%
Differential phase.................................................. < ±0.5°
S/N luminance (weighted) .................................... 70 dB minimum (half transponder)

**ENERGY DISPERSAL WAVEFORM**
Frequency ............................................................ 25/30 Hz, phase locked to video frame rate
Stability .............................................................. ±1 Hz
Deviation (factory preset) ..................................... 1 MHz p-p with video,
  2 MHz p-p without video (can be set for other customer satellite requirements)
Variable mode...................................................... Adjustable from 1 to 8 MHz p-p minimum (the deviation is halved automatically with presence of video)

**AUDIO**
Input level ............................................................ +18 dBm maximum
Input impedance .................................................. 600 ohms balanced (others available)
Frequency response ............................................ 100 Hz to 12 kHz, 0.6 dB p-p,
  40 Hz to 15 kHz, < 1 dB p-p
Harmonic distortion ............................................ < 0.5%, 150 kHz p-p deviation,
  < 1%, 840 kHz p-p deviation
Pre-emphasis ....................................................... 50/75 µs and J17 response, switchable
Signal/noise ....................................................... > 62 dB, 300 kHz p-p deviation

**SUBCARRIER MODULATOR**
Subcarrier deviation ............................................ Adjustable 25 to 420 kHz peak
70 MHz IF carrier deviation by subcarrier ............ Adjustable from 5% to 20% of deviation by video
Subcarrier IF frequency ......................................... Adjustable from 5 to 8.2 MHz in 10 kHz step size
PRIMARy POWER REQUIREMENTS
Voltage................................................................. 100/120/220/240 VAC, ±10%, rear panel selectable
Frequency............................................................ 47 to 63 Hz
Power consumption............................................. 80 W typical, can vary with number of subcarriers and options

PHYSICAL
Dimensions.................................................................. 19“ x 22” x 3.5”
Weight.................................................................. 27 pounds

CONNECTORS
Video input........................................................... BNC female
Audio input........................................................... Three-terminal block
B-MAC sync input ................................................ BNC female (optional)
ED sync input ...................................................... BNC female (optional)
External subcarrier input...................................... BNC female (optional)
Contact closure output......................................... 25-pin male, D type
Chassis ground.................................................... 10-32 stud

ELECTRICAL SPECIFICATIONS (CONT.)

M1 525 NTSC video filter (4.2 MHz flat, 4.5 MHz -3 dB) (included in NTSC systems).
M2* 625 B-PAL video filter (5.1 MHz flat, 5.5 MHz -40 dB).
M3* 625 D-PAL video filter (6 MHz flat, 6.5 MHz -40 dB).
M4* 625 I-PAL or wideband B-PAL video filter (5.5 MHz flat, 6 MHz -40 dB).
M5 Video filter switching between any two combinations of Options M1, M2, M3 or M4.
M6 Additional switchable IF filter.
M6A2 Automatic selection of up to four preset deviation settings for two IF filters for half/full transponder operations for NTSC and PAL/SECAM video formats.
M8 Switchable gated/averaging AFC with front panel LED indicator of the synthesizer lock status of the IF spectrum shift.
M9 Switchable gated, either B-MAC or D2-MAC and averaging AFC.
A. External AFC synchronization for B-MAC.
B. External AFC synchronization for D2-MAC.
M10 Automatic external ED synchronization for:
A. Encrypted PAL/SECAM, NTSC video formats (rear panel composite video sync or normal video input).
B. IRDETO video format (rear panel composite video sync input only).
C. M10A and M10B combined (rear panel composite video sync input only).
M12 SIS (Sound in Sync) operation.
M13 ATIS (Automatic Transmitter Identification System).
M14 External wideband subcarrier input (rear panel BNC).
M15 Baseband mute.
M16 70 MHz auxillary output (rear panel BNC).
M18 IF loop interface.
M19 Video polarity select.
M21 High level IF output power (+10 dBm).
* Either M2, M3 or M4 included in PAL/SECAM systems.
These demodulators are designed for applications that require high signal-to-noise ratios and minimum distortion of the transmitted information, for both video and audio signals. The applications include half/full transponder multiloop terrestrial and satellite links where cumulative distortions render conventional demodulator performance unacceptable. These demodulators are designed to meet or exceed RS-250C short-haul and IESS-306 standards, and are compatible with NTSC, PAL/SECAM, B-MAC, D2-MAC, SIS, IRDETO and encrypted PAL/SECAM and NTSC video formats, with selection of appropriate options.

FEATURES
- Adaptable to a wide variety of video formats
- Satellite and system amplitude/group delay equalization (VDMD-2000ADEQ only)
- IF amplitude slope equalization (VDMD-2000AEDQ only)
- High-performance video clamp
- Synthesized front panel, thumbwheel programmable audio subcarrier demodulators
- Multiple de-emphasis selection for video and audio
- Switchable audio subcarrier receiver bandwidths
- Front panel IF spectrum monitor
- Video present status indicator
- Contact closure and summary alarm
- Auto/manual AGC mode
- One IF filter and one video filter of customer’s choice.
IF INPUT
Center frequency ................................................. 70 MHz
Peak deviation ..................................................... 18 MHz
Level ............................................................... -40 to 0 dBm
Linearity ............................................................ < ±1.5%, ±18 MHz,
                                                  < ±0.75%, ±18 MHz (optional)

VIDEO OUTPUT
Level ............................................................... 1 V p-p, ±3 dB continuous adjust
Impedance ........................................................... 75 ohms

CLAMP
Dispersal clamping .............................................. 40 dB nominal

VIDEO AND AUDIO CHARACTERISTICS (BACK-TO-BACK REFERENCE MODULATOR, HIGH C/ N)

VIDEO
Frequency response ............................................ 10 Hz to 6 MHz ±0.3 dB maximum,
                                                  10 Hz to 10 MHz < ±0.35 dB
Short-time distortion ........................................... ±1% maximum
Chrominance/luminance delay error ....................... ±20 ns maximum (with video filter)
Differential gain ................................................... ±1% maximum
Differential phase .................................................. ±0.8° maximum
S/N luminance (weighted) ..................................... 68 dB minimum (half transponder)

AUDIO
Output level .......................................................... +8 dBm maximum
Frequency response ............................................ 100 Hz to 12 kHz, ±0.3 dB
Amplitude response ............................................. 40 Hz to 15 kHz, < ±1 dB
Harmonic distortion ............................................. < 0.5%, 150 kHz p-p deviation,
                                                  < 1%, 450 kHz p-p deviation
Signal/noise (weighted) ........................................... > 62 dB, 300 kHz p-p deviation

SUBCARRIER DEMODULATOR
Subcarrier IF level .............................................. Front panel programmable 5 to 8.2 MHz in 10 kHz step size

PRIMARY POWER REQUIREMENTS
Voltage ................................................................. 100/120/220/240 VAC, ±10%, rear panel selectable
Frequency ........................................................... 47 to 63 Hz
Power consumption ............................................. 80 W typical, can vary with number of subcarriers and options

PHYSICAL
Dimensions
VDMD-2000 .................................................... 19” x 20” x 3.5”
VDMD-2004 .................................................... 19” x 20” x 5.25”
VDMD-2000ADEQ .......................................... 19” x 22” x 3.5”
VDMD-2140 .................................................... 19” x 22” x 3.5”

Weight
VDMD-2000 .................................................... 27 pounds
VDMD-2004 .................................................... 31 pounds
VDMD-2000ADEQ .......................................... 27 pounds
VDMD-2140 .................................................... 27 pounds
CONNECTORS (FOR ALL VIDEO DEMODULATOR MODELS)
IF input................................................................. BNC female
Video output......................................................... BNC female
Composite output................................................. BNC female
Audio output......................................................... Three-terminal block
Contact closure.................................................... 25-pin male, D type
Remote interface ................................................. (Not available with VDMD-2000ADEQ)
RS232 ............................................................. 25-pin male, D type (optional)
RS422/485 ...................................................... 9-pin male, D type (optional)
Chassis ground.................................................... 10-32 stud

D1 525 NTSC video filter (4.2 MHz flat, $f_3$ dB 4.5 MHz) (included in NTSC systems).
D2* 625 B-PAL video filter (5.1 MHz flat, $f_{40}$ dB 5.5 MHz).
D3* 625 D-PAL video filter (6 MHz flat, $f_{40}$ dB 6.5 MHz).
D4* 625 I-PAL video filter (5.5 MHz flat, $f_{40}$ dB 6 MHz).
D5 Video filter switching of any two options of D1, D2, D3 or D4.
D6 Additional switchable IF filter.
D6A2 Automatic selection of four preset deviation settings for two IF filters for half/full transponder operation for up to two video formats.
D7 Additional equalized IF filter (VDMD-2004 series).
D7A Automatic selection of eight preset deviation settings for up to four IF filters for half/full transponder operation for up to two video formats (VDMD-2004 series).
D8 SIS (Sound in Sync) operation.
D9 Video polarity selection.
D10 IF loop interface.
D11 De-emphasized gain equalized composite output.
D12 Programming interface for audio expansion subsystem.
D13 Linearity $\leq \pm0.75\%$, $\pm18$ MHz.

REMOTE OPTION PACKAGES (EXCLUDING VDMD-2000ADEQ SERIES)
(Option R11 must be ordered for this package)
DPR3 Includes R1, R2A3, R4, R5.
DPR4 Includes R1, R3, R4, R5 (VDMD-2004 only).
ADRP Subcarrier demodulator, Options R6, R7, R9.

REMOTE OPTION EXPLANATIONS
R1 NTSC/PAL/SECAM de-emphasis or flat response select.
R2A3 Full/half transponder operation for up to two video formats and two IF filters.
R3 Full/half transponder operation for up to two video formats and four IF filters.
R4 Video filter switching of any two combinations of Options D1, D2, D3 or D4.
R5 Video clamp in/out.
R6 Audio 50/75 µs, J17 de-emphasis response select.
R7 Programming of any subcarrier frequencies from 5 to 8.2 MHz in 10 kHz steps.
R8 Video polarity select.
R9 Subcarrier IF bandwidth select.
R11 Remote interface bus programming through RS232, RS485 or RS422. Customer must specify bus operation on order).
* Either D2, D3 or D4 included in PAL/SECAM systems.
The ASDM-100 expansion system is a one-rack unit capable of supporting up to two local or remote programmable audio subcarrier demodulators. This extends the total number of subcarriers supported by the VDMD-2004 video demodulator system to six. Local operation of the expansion subcarrier demodulator is at the front panel of the system. Remote programming of the subcarrier demodulators is accomplished via the VDMD-2004 remote port. A special remote port is provided on both the VDMD-2004 and the subcarrier demodulator expansion system for intra-system local communication.

**SPECIFICATIONS**

Number of subcarrier channels/systems .......... Up to two

**PROGRAMMABLE SUBCARRIER DEMODULATOR**

Subcarrier ...................................................... Synthesized from 5 to 8.5 MHz, IF frequency in 10 kHz step size

**AUDIO**

Output level .................................................... -35 to +10 dBm
Output impedance .......................................... 600 ohms balanced (others available)
Return loss .................................................... 30 dB minimum
Switchable audio subcarrier receiver
  bandwidths ................................................. 180/280/600 kHz switchable
  Frequency response .................................... 100 Hz to 12 kHz, 0.6 dB p-p,
                                                         40 Hz to 15 kHz, < 1 dB p-p
  Harmonic distortion ................................... < 0.5%, 150 kHz p-p deviation,
                                                         < 1%, 450 kHz p-p deviation
  De-emphasis ............................................ 50/75 µs, J17 switchable
  Signal/noise (weighted) ............................ > 62 dB, 300 kHz p-p deviation

**PRIMARY POWER REQUIREMENTS**

Voltage ........................................................ 100/120/220/240 VAC, +10%, rear panel selectable
Frequency .................................................... 47 to 63 Hz
Power consumption ...................................... 20 W typical

**PHYSICAL**

Dimensions .................................................. 19” x 24” x 1.75”
Weight .......................................................... 14 pounds

**CONNECTORS**

Subcarrier IF input ........................................ BNC
Audio output ................................................. Three-terminal block
Remote programming ..................................... 9-pin male, D type (to VMDM-2004 video demodulator)
Contact closure ............................................ 9-pin male, D type
Ground ......................................................... 10-32 stud
These high-quality narrow-band modulators and demodulators are designed to generate a highly stable low-phase noise 70 MHz carrier, phase locked to an internal reference crystal oscillator. The main carrier deviation accuracy is less than 0.45 dB p-p while maintaining excellent linearity across the entire baseband frequency range. Applications include telemetry systems and ranging equipment.

**FEATURES**
- 5 to 30 kHz baseband information bandwidth
- Excellent baseband frequency response
- Ultra low phase noise

**MODULATORS**
- FMODE-70 70 MHz IF, FM modulator
- PMODE-70 70 MHz IF, PM modulator

**DEMODULATORS**
- FDMODE-70 70 MHz IF, FM demodulator
- PDMODE-70 70 MHz IF, PM demodulator

**IF OUTPUT**
- Center frequency: 70 MHz
- Stability: ±2 kHz
- Level: 0 dBm nominal
- Linearity: ±1% ±400 kHz for FM modulator, ±1° for PM modulator

**FM CHARACTERISTICS**
- Peak-to-peak frequency deviation: ±400 kHz (see Options)
- Frequency response: 5 to 30 kHz, ±0.3 dB (wider frequency response available)
- Input level: 2.8 V p-p with ±3 dB continuous adjust

**PM CHARACTERISTICS**
- Phase deviation: ±1 radian (wider available)
- Frequency response: 5 to 30 kHz, ±0.3 dB
- Input level: 2.8 V p-p with ±3 dB continuous adjust

**TYPICAL PHASE NOISE**
- Offset from carrier
  - 100 Hz: 68 dBc/Hz
  - 1 kHz: 67 dBc/Hz
  - 10 kHz: 78 dBc/Hz
  - 100 kHz: 129 dBc/Hz
  - 1 MHz: 133 dBc/Hz
  - 10 MHz: 140 dBc/Hz
PRIMARY POWER REQUIREMENTS
Voltage................................................................. 100/120/220/240 VAC, ±10%, rear panel selectable
Frequency............................................................ 47 to 63 Hz
Power consumption............................................. 20 W typical, can vary with options

PHYSICAL
Dimensions.......................................................... 19” x 20” x 3.5”
Weight.................................................................. 16 pounds

CONNECTORS
FMOD-70 AND PMOD-70
IF output............................................................... BNC female
Baseband input.................................................... BNC female
Contact closure output......................................... 9-pin male, D type
Chassis ground.................................................... 10-32 stud

PDMOD-70 AND PDMOD-70
IF input................................................................. BNC female
Baseband output.................................................. BNC female
Contact closure output......................................... 9-pin male, D type
Chassis ground.................................................... 10-32 stud

OPTIONS
FMOD-70 AND PMOD-70
PF1 < ±500 Hz carrier stability.
PF2 -10 to +10 dBm continious IF level adjust.
PF3 -20 to 0 dBm continious IF level adjust.
PF4 Fixed +10 dBm IF output.
PF5 Customer-defined baseband frequency response.
PF6 Complete redundant system in the same chassis.
PF7 55 to 85 MHz in 100 kHz step front panel programmable IF frequency (wide IF bandwidth).
PF8 Customer-defined phase deviation.
PF9 Customer-defined FM deviation.

FDMOD-70 AND PDMOD-70
PFD1 -60 to 0 dBm IF level input range.
PFD2 Customized receive IF bandwidth.
PFD3 Customer-defined baseband frequency response.
PFD4 Complete redundant receive chain in the same chassis.
PFD5 55 to 85 MHz in 100 kHz step front panel programmable receive chain (wide IF bandwidth).
The MFUM-70 is a high-quality front panel and remote programmable multiframe uplink modulator with external and internal frequency pulse modulation. Features include framing pulse fall/rise time programmability, internal pulse width and PRF programmability, agile IF frequency and signal detection/alarm status. The MFUM-70 is used in a TDMA system by converting the referenced traffic multiframe pulse from a network synchronization system to a modulated IF carrier which is subsequently transmitted to the satellite. The satellite TDMA processor processes this signal to maintain synchronization with the communication’s network timing and manage mobile-to-mobile cellular call traffic through the satellite.

FEATURES
- Programmable IF frequency from 50 to 90 MHz in 100 kHz step
- External/internal modulation select
- Framing pulse/rise time programmability
- Internal pulse width/PRF programmability

ELECTRICAL SPECIFICATIONS

**IF OUTPUT**
Frequency range.................................................. 50 to 90 MHz (100 kHz programming resolution)
IF output level ...................................................... -30 to -10 dBm (0.5 dB programming resolution)
Inband gain flatness ............................................ < ±0.4 dB
Input/output impedance ....................................... 75 ohms
IF isolation ........................................................... > 60 dB
Harmonics............................................................ 50 dBC minimum
Phase noise
  Offset from carrier
  100 Hz..................................................................... -60 dBC/Hz
  1 kHz................................................................. -75 dBC/Hz
  10 kHz............................................................... -100 dBC/Hz
  100 kHz............................................................. -110 dBC/Hz
  1 MHz ............................................................ -125 dBC/Hz

**IF MODULATION INPUT**
External gate input............................................... Differential of single-ended TTL
Input rise/fall time ................................................ < 5 µs
Input pulse width.................................................. > Programmed (rise time + fall time) x 0.625
Output rise/fall time.............................................. Programmable, 5 to 50 µs (0.1 µs programming resolution)

**INTERNAL MODULATOR GATE**
PRF................................................................. 2 Hz to 20 Hz (0.0001 Hz frequency resolution)
Pulse width .................................................. 20 to 400 µs (0.1 µs programming resolution)
Rise-time programming ....................................... 5 to 50 µs (0.1 µs programming resolution)
Fall-time programming ....................................... 5 to 50 µs (0.1 µs programming resolution)
**M O D E S O F O P E R A T I O N**
- External modulation gate, sync and trigger
- Internal modulation gate
- Continuous IF output, no modulation
- IF mute

**A L A R M O U T P U T S**
- Gate input detect
- Pulsed IF output detect
- Power supply failure detect

**R E M O T E P R O G R A M M I N G**
Remote interface bus programming through RS422/485 or RS232

**P R I M A R Y P O W E R R E Q U I R E M E N T S**
- Voltage: 100/120/220/240 VAC, ±10%, rear panel selectable
- Frequency: 47 to 63 Hz
- Power consumption: 25 W typical

**P H Y S I C A L**
- Dimensions: 19" x 22" x 1.75"
- Weight: 14 pounds

**C O N N E C T O R S**
- IF output: BNC female
- IF monitor: BNC female
- Gate sync input: 9-pin male, D type
- Gate sync monitor: BNC female
- Contact closure output: 9-pin male, D type
- Remote interface:
  - RS232: 25-pin male, D type
  - RS422/485: 9-pin male, D type
- Chassis ground: 10-32 stud

**O P T I O N S**
- **MU1** IF output level programming (customer to specify the range).
- **MU2** Selection of equalized IF filters from 17.5, 18, 20, 22, 24, 25, 26, 27, 30, 33, 36 and 40 MHz.
MITEQ’s WFMD-70 demodulator is designed to receive a 70 MHz FM modulated carrier in the range of -60 to 0 dBm and recover the baseband signal with high fidelity. These demodulators are equipped with five front panel selectable baseband filters and equalized IF filters, optionally expandable to seven. The system is provided with a very high-performance wideband video amplifier, with adjustable gain up to 50 dB (40 dB in 10 dB steps and 10 dB continuous adjust).

**FEATURES**
- Selectable baseband and equalized IF filters
- ±1% demodulator linearity
- Baseband amplitude ripple of ±0.25 dB
- -60 to 0 dBm IF input range

**ELECTRICAL SPECIFICATIONS**

**IF INPUT**
- Center frequency ................................................. 70 MHz
- Noise figure ....................................................... 20 dB maximum
- Input level range ................................................... -60 to 0 dBm
- IF gain control ...................................................... 60 dB AGC and MGC
- Input impedance .................................................. 75 ohms
- Input return loss ................................................... 18 dB minimum
- Number of IF filters ........................... 5 bands with the following specifications (see Options)

<table>
<thead>
<tr>
<th>IF FILTER BANDWIDTH</th>
<th>GROUP DELAY (G/3 BAND)</th>
<th>AMPLITUDE RIPPLE (A BAND)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 MHz</td>
<td>3 ns maximum</td>
<td>±0.30 dB</td>
</tr>
<tr>
<td>24 MHz</td>
<td>4 ns maximum</td>
<td>±0.25 dB</td>
</tr>
<tr>
<td>16 MHz</td>
<td>6 ns maximum</td>
<td>±0.20 dB</td>
</tr>
<tr>
<td>12 MHz</td>
<td>8 ns maximum</td>
<td>±0.25 dB</td>
</tr>
<tr>
<td>8 MHz</td>
<td>12 ns maximum</td>
<td>±0.35 dB</td>
</tr>
</tbody>
</table>

Note: For group delay and amplitude ripple characteristics of the table above, refer to FEQ-70-xx series, group delay equalized IF filters. (See catalog C-33, page 24).

IF filter shape factor (3/60 dB) .................. 3:1
Number of video filters .......................... 5 bands
Video bandwidth ....................................... 4, 6, 8, 12 and 15 MHz
Video filter characteristics ...................... 5-pole Bessel ±0.25 dB (see Options)
**OUTPUT**
Level ................................................................. 2 volts p-p into 75 ohms
Impedance .......................................................... 75 ohms
Amplitude ripple ............................................... ±0.25 dB
Video response (1 dB) ......................................... 20 Hz to selected video bandwidth
Gain control range ............................................ 0 to 50 dB minimum, 40 dB in 10 dB steps and 10 dB continuous adjust

**TRANSFER CHARACTERISTICS**
Receiver FM linearity ........................................... ±1% maximum

**PRIMARY POWER REQUIREMENTS**
Voltage ......................................................... 100/120/220/240 VAC, ±10%, rear panel selectable
Frequency ....................................................... 47 to 63 Hz
Power consumption ......................................... 75 W typical

**MECHANICAL SPECIFICATIONS**

**PHYSICAL**
Dimensions ...................................................... 19” x 20” x 5.25”
Weight ............................................................. 26 pounds

**CONNECTORS**
IF input ........................................................... BNC female
Baseband output ............................................... BNC female
IF monitor ......................................................... SMA female
Contact closure output ...................................... 9-pin male, D type
Chassis ground .................................................. 10-32 stud

**OPTIONS**

**MBD-1xx**  Additional equalized IF filter bandwidths from 1.25, 2.5, 5, 7.5, 8, 10, 12, 15, 17.5, 18, 20, 22, 24, 25, 26, 27, 33, 34, 36 and 40 MHz.

**MBD-2**  Chebychev characteristic baseband filters (customer to specify).

**MBD-3**  Butterworth characteristic baseband filters (customer to specify).

**MBD-4**  7 dB IF chain noise figure.
The MRSS-70VAESI Video, Audio, IF, External Subcarrier and Sync 1:1 Redundant Switchover System is used with one online video modulator and one standby modulator. It automatically switches over to the standby video modulator when a fault is detected within the online system. Switching may also be controlled manually, either through the front panel keypad or via remote command. The standby modulator can carry traffic while there is no fault with the online modulator.

FEATURES
• All switching is provided via latching type relays
• Shield planes for IF, video, external subcarrier and sync are fully independent and isolated from system chassis
• Extremely low-noise operation and high performance
• Completely floating audio inputs and outputs
• Fully automatic or manual control
• Programmable fault masks permit fault alarms to be individually enabled or disabled
• Automatically programs the standby modulator to match the operating parameters of the modulator that has been taken offline (when used with MITEQ modulators)
• Remote/local control permits control of the switchover system over a remote interface bus (RS485, RS422, RS232) or via a front panel keypad and LCD display
• Both modulators can be programmed from the front panel of the switchover system, or through the remote interface bus (when used with MITEQ modulators)
• Provides fault status of the modulators and switchover system and online/offline/not-connected status for each modulator
• Redundant power supply

ELECTRICAL SPECIFICATIONS

VIDEO SWITCHING
Frequency ............................................................ DC to 10 MHz
Amplitude flatness ............................................... < 0.1 dB p-p
Impedance ........................................................... 75 ohms
Return loss........................................................... > 26 dB
System-to-system isolation.............................. > 80 dB
Insertion loss (in to out)................................. < 0.05 dB
Insertion loss (in to redundant out).............. < 0.1 dB
Number of baseband inputs ......................... 2
Number of baseband outputs ....................... 2
**AUDIO SWITCHING**
Frequency ............................................................ DC to 50 kHz
Amplitude flatness ............................................... < 0.1 dB p-p
Impedance ........................................................... 600 ohms balanced
Return loss........................................................... > 30 dB
Channel-to-channel isolation .................................. > 80 dB
System-to-system isolation .................................... > 85 dB
Insertion loss (in to out) ........................................ < 0.05 dB
Insertion loss (in to redundant out) ....................... < 0.05 dB
Number of audio inputs ....................................... 2 ports with 4 channels per port
Number of audio outputs ..................................... 2 ports with 4 channels per port

**IF SWITCHING**
Frequency ........................................................... 50 to 90 MHz
Amplitude flatness ............................................... < 0.1 dB p-p
Impedance ........................................................... 75 ohms
Return loss........................................................... > 26 dB
Isolation ............................................................... > 80 dB
Number of IF inputs ............................................. 2
Number of IF outputs........................................... 2 (1 system output and 1 monitor port)

**EXTERNAL SYNC SWITCHING**
Frequency ............................................................ DC to 10 MHz
Amplitude flatness ............................................... < 0.1 dB p-p
Impedance ........................................................... 75 ohms
Return loss........................................................... > 20 dB
System-to-system isolation .................................... > 75 dB
Insertion loss (in to out) ........................................ < 0.15 dB
Insertion loss (in to redundant out) ....................... < 0.2 dB
Number of sync inputs ........................................ 2
Number of sync outputs....................................... 2

**EXTERNAL SUBCARRIER SWITCHING**
Frequency ............................................................ DC to 10 MHz
Amplitude flatness ............................................... < 0.1 dB p-p
Impedance ........................................................... 75 ohms
Return loss........................................................... > 26 dB
System-to-system isolation .................................... > 75 dB
Insertion loss (in to out) ........................................ < 0.15 dB
Insertion loss (in to redundant out) ....................... < 0.2 dB
Number of subcarrier inputs ................................ 2
Number of subcarrier outputs .............................. 2

**SWITCH TIMING**
Switching speed...................................................... < 100 ms from fault detection to switchover

**PRIMARY POWER REQUIREMENTS**
Voltage ................................................................. 100/120/220/240 VAC, +10%, rear panel selectable
Frequency ............................................................. 47 to 63 Hz
Power consumption .............................................. 20 W steady state, 35 W during switchover
PHYSICAL
Dimensions .......................................................... 19" x 22" x 1.75"
Weight ................................................................. 18 pounds

CONNECTORS
Online System
Audio input/output ................................................ 8-pin DIN
Video input/output ................................................ BNC female
External subcarrier input/output ......................... BNC female
IF input/output .................................................... BNC female
Contact closure input ........................................... 25-pin male, D type
Remote interface RS422/485 .............................. 9-pin male, D type

Redundant System
Audio output ......................................................... 8-pin DIN
Video output ........................................................ BNC female
External subcarrier output ................................. BNC female
External sync output ........................................... BNC female
IF input ............................................................... BNC female
Contact closure input ........................................... 25-pin male, D type
Remote interface RS422/485 .............................. 9-pin male, D type

Switchover System
Host interface RS422/485 ................................. 9-pin male, D type
Contact closure output ........................................ 25-pin male, D type
Chassis ground .................................................... 10-32 stud

CONFIGURATIONS
IFI-1 IF switching.
VAI1-1 Video, audio and IF switching.
VA1-1 Video and audio switching.

OPTIONS
ESC1 External subcarrier.
ESYC1 External synchronization.
The MRSS-704VAESI Video, Audio, IF, External Subcarrier and Sync 1:4 Redundant Switchover System is used with up to four online video modulators and one standby modulator. It automatically switches over to the standby video modulator when a fault is detected within the online systems. Switching may also be controlled manually, either through the front panel keypad or via remote command.

FEATURES

• All switching is provided via latching type relays
• Shield planes for IF, video, external subcarrier and sync are fully independent and isolated from system chassis
• Extremely low-noise operation and high performance
• Completely floating audio inputs and outputs
• Fully automatic or manual control can be individually selected for each modulator
• Programmable fault masks permit fault alarms to be individually enabled or disabled
• Automatically programs the standby modulator to match the operating parameters of the modulator that has been taken offline (when used with MITEQ modulators)
• Remote/local control permits control of the switchover system over a remote interface bus (RS485, RS422, RS232) or via a front panel keypad and LCD display
• All connected modulators can be programmed from the front panel of the switchover system, or through the remote interface bus (when used with MITEQ modulators)
• Provides status indicators for:
  - Fault status of the modulators and switchover system
  - Online/offline/not connected status for each modulator
  - Auto/manual mode indication for each online modulator
• Redundant power supply

ELECTRICAL SPECIFICATIONS

VIDEO SWITCHING

Frequency ............................................................ DC to 10 MHz
Amplitude flatness ............................................... < 0.1 dB p-p
Impedance ........................................................... 75 ohms
Return loss ........................................................... > 26 dB
System-to-system isolation .................. > 80 dB
Insertion loss (in to out) .................. < 0.05 dB
Insertion loss (in to redundant out) ..........< 0.1 dB
Number of baseband inputs ................. 4
Number of baseband outputs .............. 5
**AUDIO SWITCHING**
Frequency ............................................................ DC to 50 kHz
Amplitude flatness ............................................... < 0.1 dB p-p
Impedance ........................................................... 600 ohms balanced
Return loss........................................................... > 30 dB
Channel-to-channel isolation ................. > 80 dB
System-to-system isolation ..................... > 85 dB
Insertion loss (in to out) ..................... < 0.05 dB
Insertion loss (in to redundant out) ........ < 0.1 dB
Number of audio inputs ...................... 4 ports with 4 channels per port
Number of audio outputs .................... 5 ports with 4 channels per port

**IF SWITCHING**
Frequency ............................................................ 50 to 90 MHz
Amplitude flatness ............................................... < 0.1 dB p-p
Impedance .......................................................... 75 ohms
Return loss........................................................... > 20 dB
System-to-system isolation ..................... > 65 dB
Redundant-to-system isolation ................. > 63 dB
Insertion loss (in to out) ..................... < 0.15 dB
Insertion loss (redundant in to out) ........ < 0.25 dB
Insertion loss (in to monitor out) .......... < 0.25 dB
Number of IF inputs .......................... 5
Number of IF outputs .......................... 5 (4 system outputs and 1 monitor port)

**EXTERNAL SYNC SWITCHING**
Frequency ............................................................ DC to 10 MHz
Amplitude flatness ............................................... < 0.1 dB p-p
Impedance ........................................................... 75 ohms
Return loss........................................................... > 26 dB
System-to-system isolation ..................... > 75 dB
Insertion loss (in to out) ..................... < 0.15 dB
Insertion loss (in to redundant out) ........ < 0.2 dB
Insertion loss (in to monitor out) .......... < 0.25 dB
Number of sync inputs ......................... 4
Number of sync outputs ....................... 5

**EXTERNAL SUBCARRIER SWITCHING**
Frequency ............................................................ DC to 10 MHz
Amplitude flatness ............................................... < 0.1 dB p-p
Impedance ........................................................... 75 ohms
Return loss........................................................... > 26 dB
System-to-system isolation ..................... > 75 dB
Insertion loss (in to out) ..................... < 0.15 dB
Insertion loss (in to redundant out) ........ < 0.2 dB
Number of subcarrier inputs ................... 4
Number of subcarrier outputs ............... 5

**SWITCH TIMING**
Switching speed...................................................... < 100 ms from fault detection to switchover

**PRIMARY POWER REQUIREMENTS**
Voltage ................................................................. 100/120/220/240 VAC, +10%, rear panel selectable
Frequency ........................................................... 47 to 63 Hz
Power consumption ............................. 25 W steady state, 40 W during switchover
PHYSICAL
Dimensions.......................................................... 19" x 22" x 5.25"
Weight................................................................. 22 pounds

CONNECTORS
Online Systems
Audio input/output................................................ 8-pin DIN
Video input/output................................................ BNC female
External subcarrier input/output......................... BNC female
External sync input/output ................................ BNC female
IF input/output.................................................... BNC female
Contact closure input........................................ 25-pin male, D type
Remote interface
   RS232 ............................................................. 25-pin male, D type
   RS422/485 ........................................................ 9-pin male, D type
Redundant System
Audio output......................................................... 8-pin DIN
Video output......................................................... BNC female
External subcarrier output .............................. BNC female
External sync output ..................................... BNC female
IF input................................................................. BNC female
Contact closure input........................................ 25-pin male, D type
Remote interface
   RS232 ............................................................. 25-pin male, D type
   RS422/485 ........................................................ 9-pin male, D type
Switchover System
Host interface
   RS232 ............................................................. 25-pin male, D type
   RS422/485 ........................................................ 9-pin male, D type
Contact closure output.................................... 25-pin male, D type
Discrete input......................................................... 25-pin male, D type
Discrete output......................................................... 25-pin male, D type
Chassis ground.................................................... 10-32 stud

CONFIGURATIONS

1:2
   IF4-2 ............................................................. IF switching.
   VAI4-2 .......................................................... Video, audio and IF switching.
   VA4-2 ............................................................ Video and audio switching.

1:4
   IF4-4 ............................................................. IF switching.
   VAI4-4 .......................................................... Video, audio and IF switching.
   VA4-4 ............................................................ Video and audio switching.

OPTIONS

ESC4-2 or 4 ......................................................... External subcarrier.
ESYC4-2 or 4 ....................................................... External synchronization.
DSCO ................................................................. Discrete TTL-level outputs for controlling additional switching equipment.
UALM .............................................................. Discrete inputs for user-defined fault alarms.
The MRSS-708VAESI Video, Audio, IF, External Subcarrier and Sync 1:N Redundant Switchover System is used with up to eight online video modulators and one standby modulator. It automatically switches over to the standby video modulator when a fault is detected within the online systems. Switching may also be controlled manually, either through the front panel keypad or via remote command. The standby modulator can carry traffic while there is no fault with the online modulators.

**FEATURES**

- All switching is provided via latching type relays
- Shield planes for IF, video, external subcarrier and sync are fully independent and isolated from system chassis
- Extremely low-noise operation and high performance
- Completely floating audio inputs and outputs
- Fully automatic or manual control can be individually selected for each modulator
- Programmable fault masks permit fault alarms to be individually enabled or disabled
- Automatically programs the standby modulator to match the operating parameters of the modulator that has been taken offline (when used with MITEQ modulators)
- Remote/local control permits control of the switchover system over a remote interface bus (RS485, RS422, RS232) or via a front panel keypad and LCD display
- All connected modulators can be programmed from the front panel of the switchover system, or through the remote interface bus (when used with MITEQ modulators)
- Provides status indicators for:
  - Fault status of the modulators and switchover system
  - Online/offline/not connected status for each modulator
  - Auto/manual mode indication for each online modulator
- Redundant power supply

**ELECTRICAL SPECIFICATIONS**

**VIDEO SWITCHING**

- Frequency: DC to 10 MHz
- Amplitude flatness: < 0.1 dB p-p
- Impedance: 75 ohms
- Return loss: > 26 dB
- System-to-system isolation: > 80 dB
- Insertion loss (in to out): < 0.05 dB
- Insertion loss (redundant in to out): < 0.1 dB
- Insertion loss (in to switched out): < 0.1 dB
- Number of baseband inputs: 9
- Number of baseband outputs: 9
**AUDIO SWITCHING**

- **Frequency**: DC to 50 kHz
- **Amplitude flatness**: < 0.1 dB p-p
- **Impedance**: 600 ohms balanced
- **Return loss**: > 30 dB
- **Channel-to-channel isolation**: > 80 dB
- **System-to-system isolation**: > 80 dB
- **Insertion loss (in to out)**: < 0.05 dB
- **Insertion loss (redundant in to out)**: < 0.1 dB
- **Insertion loss (in to switched out)**: < 0.1 dB
- **Number of audio inputs**: 9 ports with 4 channels per port
- **Number of audio outputs**: 9 ports with 4 channels per port

**IF SWITCHING**

- **Frequency**: 50 to 90 MHz
- **Amplitude flatness**: < 0.15 dB p-p
- **Impedance**: 75 ohms
- **Return loss**: > 20 dB
- **System-to-system isolation**: > 60 dB
- **Redundant-to-system isolation**: > 55 dB
- **Insertion loss (in to out)**: < 0.15 dB
- **Insertion loss (redundant in to out)**: < 0.3 dB
- **Insertion loss (online in to offline out)**: < 0.3 dB
- **Number of IF inputs**: 9
- **Number of IF outputs**: 9 (8 system outputs and 1 monitor port)

**EXTERNAL SYNC SWITCHING**

- **Frequency**: DC to 10 MHz
- **Amplitude flatness**: < 0.1 dB p-p
- **Impedance**: 75 ohms
- **Return loss**: > 26 dB
- **System-to-system isolation**: > 75 dB
- **Insertion loss (in to out)**: < 0.05 dB
- **Insertion loss (in to redundant out)**: < 0.1 dB
- **Insertion loss (in to switched out)**: < 0.1 dB
- **Number of sync inputs**: 9
- **Number of sync outputs**: 9

**EXTERNAL SUBCARRIER SWITCHING**

- **Frequency**: DC to 10 MHz
- **Amplitude flatness**: < 0.1 dB p-p
- **Impedance**: 75 ohms
- **Return loss**: > 26 dB
- **System-to-system isolation**: > 75 dB
- **Insertion loss (in to out)**: < 0.05 dB
- **Insertion loss (redundant in to out)**: < 0.1 dB
- **Insertion loss (in to switched out)**: < 0.1 dB
- **Number of subcarrier inputs**: 9
- **Number of subcarrier outputs**: 9

**SWITCH TIMING**

- **Switching speed**: < 150 ms from fault detection to switchover

**PRIMARY POWER REQUIREMENTS**

- **Voltage**: 100/120/220/240 VAC, +10%, rear panel selectable
- **Frequency**: 47 to 63 Hz
- **Power consumption**: 30 W steady state, 60 W during switchover
### PHYSICAL
- Dimensions: 9" x 22" x 8.75"
- Weight: 28 pounds

### CONNECTORS
#### Online Systems
- Audio input/output: 8-pin DIN
- Video input/output: BNC female
- External subcarrier input/output: BNC female
- External sync input/output: BNC female
- IF input/output: BNC female
- Contact closure input: 25-pin male, D type
- Remote interface:
  - RS232: 25-pin male, D type
  - RS422/485: 9-pin male, D type

#### Redundant System
- Audio output: 8-pin DIN
- Video output: BNC female
- External subcarrier output: BNC female
- External sync output: BNC female
- IF input: BNC female
- Contact closure input: 25-pin male, D type
- Remote interface:
  - RS232: 25-pin male, D type
  - RS422/485: 9-pin male, D type

#### Switchover System
- Host interface:
  - RS232: 25-pin male, D type
  - RS422/485: 9-pin male, D type
- Contact closure output: 25-pin male, D type
- Discrete input: 25-pin male, D type
- Discrete output: 25-pin male, D type
- Chassis ground: 10-32 stud

### CONFIGURATIONS

<table>
<thead>
<tr>
<th>1:6</th>
<th>1:8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IF8-6</strong></td>
<td><strong>IF8-8</strong></td>
</tr>
<tr>
<td><strong>VAI6</strong></td>
<td><strong>VAI8-8</strong></td>
</tr>
<tr>
<td><strong>VA8-6</strong></td>
<td><strong>VA8-8</strong></td>
</tr>
</tbody>
</table>

### OPTIONS
- **ESC8-6 or 8**: External subcarrier.
- **ESYC8-6 or 8**: External synchronization.
- **DSCO**: Discrete TTL-level outputs for controlling additional switching equipment.
- **UALM**: Discrete inputs for user-defined fault alarms.
The pulsed radar tracking receiver consists of an RF front end and a tracking LO subsystem. The inputs to the system are coupled signals from the transmitter (Magnetron) and the received RF signal return from the target. The RF transmitter signal can be any frequency between 2.8 to 3.2 GHz. The coupled signal from the transmitter is detected and fed to an AFC processor. The AFC processor sweeps a local oscillator, mixes the output with the coupled RF signal and disables the sweep when the local LO subsystem is approximately 35 MHz above the RF signal. After the initial lock is obtained, a digital AFC tracking system is activated which fine tunes the local oscillator to precisely 35 MHz above the coupled RF signal. The digital AFC then continuously tracks the RF coupled signal. The digital AFC processor keeps the system in-lock even in the absence of a large number of RF pulses (AFC dead-time ride through). The LO output signal is mixed in the RF front-end mixer to generate a system IF output at 35 MHz. The doppler shift is detected as an offset from the 35 MHz IF output. These pulsed radar tracking receivers are primarily used in moving target indicator (MTI) systems.

FEATURES
• Real-time software and hardware, digital AFC processing
• Programmable frequency accuracy control and update rate optimization
• Accurate frequency control in the absence of RF pulses (dead time)
• Interface and control flexibility

PRTR-44 ADVANTAGES COMPARED TO EXISTING SYSTEMS
• Digital tracking eliminates the instabilities present in conventional AFC processors (temperature variation, offsets, etc.)
• Digital processing algorithms are used to achieve a more accurate lock than conventional AFC processors
• Digital processing enables better control and provides more flexibility
### ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Input frequency</td>
<td>3 GHz ±200 MHz (see Options). Available frequency bands from 1 to 35 GHz</td>
</tr>
<tr>
<td>Input bandpass filter</td>
<td>40 MHz bandwidth. Tunable from 2.8 to 3.2 GHz. Other bandwidths available across the input frequency band</td>
</tr>
<tr>
<td>Tracking range</td>
<td>±200 MHz, wider bands available</td>
</tr>
<tr>
<td>Pulse width</td>
<td>0.4 µs @ 2500 PRF, 0.8 µs @ 1250 PRF. Other pulse widths and PRFs available</td>
</tr>
<tr>
<td>Dynamic range</td>
<td>80 dB</td>
</tr>
<tr>
<td>RF-to-IF gain</td>
<td>75 dB</td>
</tr>
<tr>
<td>IF center frequency</td>
<td>See options</td>
</tr>
<tr>
<td>IF gain adjust</td>
<td>45 dB, wider gain adjust range available</td>
</tr>
<tr>
<td>IF bandwidth</td>
<td>6 MHz (see Options)</td>
</tr>
<tr>
<td>AFC tracking accuracy</td>
<td>±0.1 MHz</td>
</tr>
<tr>
<td>AFC dead-time ride through</td>
<td>30 ms (see Options)</td>
</tr>
<tr>
<td>IF output power</td>
<td>+12 dBm minimum</td>
</tr>
<tr>
<td>Noise figure</td>
<td>&lt; 5 dB includes loss from input bandpass filter</td>
</tr>
</tbody>
</table>

### PRIMARY POWER REQUIREMENTS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
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<tbody>
<tr>
<td>Voltage</td>
<td>100/120/220/240 VAC, ±10%, rear panel selectable</td>
</tr>
<tr>
<td>Frequency</td>
<td>47 to 63 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>85 W typical</td>
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</table>

### PHYSICAL

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>21” x 9.75” x 6”</td>
</tr>
<tr>
<td>Weight</td>
<td>27 pounds</td>
</tr>
</tbody>
</table>

### CONNECTORS

<table>
<thead>
<tr>
<th>Connector</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF input/output</td>
<td>SMA female</td>
</tr>
<tr>
<td>IF output</td>
<td>SMA female</td>
</tr>
<tr>
<td>IF monitor</td>
<td>SMA female</td>
</tr>
<tr>
<td>AC power</td>
<td>MS3102A18-22P</td>
</tr>
<tr>
<td>Remote/control/status</td>
<td>MS3102A22-27P</td>
</tr>
<tr>
<td>DC power monitor</td>
<td>Test point jack</td>
</tr>
</tbody>
</table>

### OPTIONS

- **P1** RF input frequency range (customer to specify).
- **P2** RF input bandpass filter (customer to specify).
- **P3** Auto sweep bandwidth at RF, available bandwidths are ±200, ±400 and ±800 MHz.
- **P4** IF center frequency selection, 21.4, 30, 35, 60 and 160 MHz (customer to specify).
- **P5** IF bandwidth (customer to specify).
- **P6** PRF range (customer to specify).
- **P7** Pulse width range (customer to specify).
The MMR-1-18-160 series microwave receiver inputs an FM modulated signal in the frequency range of 1 to 18 GHz and a local oscillator in the range of 1 to 18 GHz, producing a high-performance demodulated wideband baseband signal. The receiver is integrated with additional features to provide flexible configurations via U-links. An IF loop is provided for IF signal test and integration of an external group-delay equalized IF filter, if required.

**FEATURES**
- Low-noise front end
- IF filter
- Remote/local and automatic/manual IF gain control
- IF signal monitoring
- Limiter/discriminator
- Baseband variable gain amplifier
- Input signal status monitor

**ELECTRICAL SPECIFICATIONS**

- **Center frequency**: 1 to 18 GHz (see Options)
- **Input signal**: -70 to -30 dBm (see Options)
- **Input impedance**: 50 ohms
- **Input VSWR**: 3.5:1 at band edges, 2.5:1 over most of the band
- **Input IP3**: -5 dBm
- **Input IP2**: 0 dBm
- **LO-to-RF isolation**: 12 dB minimum
- **LO power**: +7 to +10 dBm
- **Noise figure**: 12 dB maximum
- **IF frequency**: 160 MHz (see Options)
- **IF rejection**: 20 dB minimum
- **IF gain control AGC or MGC at input**: 40 dB, from -70 to -30 dBm (see Options)
- **AGC/MGC selection method**: TTL logic
- **IF bandwidth**: 10 MHz (see Options)
- **Filter bandwidth shape factor (3/45 dB)**: < 5:1
- **Bandwidth ripple**: ±0.5 dB maximum
- **Group delay variation for 10 MHz**: 22 ns
- **IF bandpass filter**:
  - ±3 MHz: 22 ns
  - ±3.5 MHz: 44 ns
  - ±4 MHz: 66 ns
- **Demodulation sensitivity**: 0.05 to 1 V/MHz
- **Video bandwidth**: DC to 15 MHz (see Options)
- **Video gain control**: Manual
Discriminator linearity
- IF ±10 MHz: < ±1% for a 70 MHz IF
- IF ±35 MHz: < ±3% for a 160 MHz IF

Output impedance: 75 ohms (50 ohms available)

Gain control voltage vs. gain: 0 volts maximum gain, -5 volts minimum gain
Input signal status monitor: 0 volts no signal, -2 volts -30 dBm

**PRIMARY POWER REQUIREMENTS**
Current/voltage:
- 280 mA @ +15 volts
- 30 mA @ -15 volts

**PHYSICAL**
Dimensions: 6" x 7" x 3"

**CONNECTORS**
- RF input: SMA female
- LO input: SMA female
- IF loop output: SMA female
- IF loop input: SMA female
- IF monitor output: SMA female
- Baseband output: SMA female
- AGC mode select control: Feedthru terminal
- DC power: Feedthru terminal
- Housing ground: 2-56 terminal

**OPTIONS**

**MR1** Input frequency (customer to specify).
**MR2** Higher input level up to 0 dBm.
**MR3** Lower noise figure (customer to specify).
**MR4** 60 dB range IF gain.
**MR5** IF frequency selection: 21.4, 30, 35, 60 and 160 MHz.
**MR6** IF filter selection (customer to specify).
**MR7** I/Q processing, bandwidth DC to 30 MHz.
**MR8** Linearity < ±2%, ±35 MHz for 160 MHz IF.
These receivers have been designed to accept FM modulated carriers centered from 360 MHz to 18 GHz (see Options) in the range of -70 to -35 dBm and recover the baseband with a high signal-to-noise ratio at low C/N. Each receiver channel is equipped with its own independent power supply. Applications include voice communications (50 Hz to 15 kHz), telemetry systems and ranging equipment.

**FEATURES**

- Excellent IF-to-baseband characteristics
- Customer-defined IF pre-detection bandwidth and modulation frequency
- Customer-defined input IF frequency
- Redundant system

<table>
<thead>
<tr>
<th>ELECTRICAL SPECIFICATIONS</th>
<th>FMDR-360</th>
<th>FMDR-360R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center frequency</td>
<td>360 MHz (see Options)</td>
<td>360 MHz (see Options)</td>
</tr>
<tr>
<td>Level</td>
<td>-70 to -35 dBm (see Options)</td>
<td>-70 to -35 dBm (see Options)</td>
</tr>
<tr>
<td>Automatic gain control (AGC)</td>
<td>&gt; 40 dB</td>
<td>&gt; 40 dB</td>
</tr>
<tr>
<td>Manual gain control (MGC)</td>
<td>&gt; 40 dB</td>
<td>&gt; 40 dB</td>
</tr>
<tr>
<td>Impedance</td>
<td>50/75 ohms available</td>
<td>50/75 ohms available</td>
</tr>
<tr>
<td>Input VSWR</td>
<td>1.25:1</td>
<td>1.25:1</td>
</tr>
<tr>
<td>IF pre-detection bandwidth</td>
<td>±300 kHz</td>
<td>±500 kHz (see Options)</td>
</tr>
<tr>
<td>Gain flatness</td>
<td>±0.5 dB over ±100 kHz</td>
<td>±0.5 dB over ±400 kHz</td>
</tr>
<tr>
<td></td>
<td>-3 dB @ ±300 kHz</td>
<td>-3 dB @ ±1 MHz</td>
</tr>
<tr>
<td>Group delay over IF frequency response</td>
<td>&lt; 25 ns over the central ±100 kHz bandwidth</td>
<td>&lt; 15 ns over the central ±400 kHz bandwidth</td>
</tr>
<tr>
<td>Group-delay ripple response</td>
<td>&lt; ±5 ns over the central ±100 kHz bandwidth</td>
<td>&lt; ±3 ns over the central ±350 kHz bandwidth</td>
</tr>
<tr>
<td>Modulation frequency</td>
<td>100 to 150 kHz (see Options)</td>
<td>300 to 350 kHz (see Options)</td>
</tr>
<tr>
<td>Modulation index</td>
<td>0.7 to 2</td>
<td>0.7 to 2</td>
</tr>
<tr>
<td>Demodulator threshold (C/N)</td>
<td>9 dB maximum</td>
<td>9 dB maximum</td>
</tr>
<tr>
<td>Demodulator linearity</td>
<td>4% over ±125 kHz (see Options)</td>
<td>5% over ±350 kHz (see Options)</td>
</tr>
<tr>
<td>Output level</td>
<td>-10 dBm ±5 dB with deviation of 125 kHz peak (front panel pot adjust)</td>
<td>-10 dBm ±5 dB with deviation of 350 kHz peak (front panel pot adjust)</td>
</tr>
<tr>
<td>Output impedance</td>
<td>50/75 ohms available</td>
<td>50/75 ohms available</td>
</tr>
<tr>
<td>Voltage</td>
<td>100/120/220/240 VAC, ±10%</td>
<td>100/120/220/240 VAC, ±10%</td>
</tr>
<tr>
<td>Frequency</td>
<td>47 to 63 Hz</td>
<td>47 to 63 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>55 W</td>
<td>55 W</td>
</tr>
</tbody>
</table>
PHYSICAL
Dimensions .......................................................... 19” x 22” x 3.5”
Weight ................................................................. 28 pounds

CONNECTORS
IF input ................................................................. BNC female
IF loop ................................................................. BNC female
Baseband output .................................................. BNC female
Monitor output ...................................................... BNC female
Contact closure output ......................................... CH1/CH2 9-pin male, D type
Chassis ground ..................................................... 10-32 stud

DR1 Input frequency select 360 MHz to 18 GHz (customer to specify).
DR2 -70 to -10 dBm input range.
DR3 IF pre-detection bandwidth (customer to specify).
DR4 Modulation frequency range (customer to specify).
DR5 Improved linearity (customer to specify).
DR6 C/N < 9 dB.
DR7 C/N < 5 dB.
The DLMRS-70-40K FSK synthesized receiver is designed to receive custom-defined IF carriers in the band 300 MHz to 1.2 GHz and recover the baseband information with high fidelity. The receiver is a dual-conversion type and contains the following features:

- RF preselector filter and RF front end
- Wide dynamic range AGC
- Wide dynamic range limiter
- Intermediate crystal and ceramic filtering
- Fast-programmable synthesizer in 100 kHz steps
- Demodulation and output level signal conditioning

The DLMRS-70-40K synthesized receiver is used in voice communications and telemetry applications.

**FEATURES**

- Wide dynamic range (110 dB)
- Dual-conversion IF processing
- Fast programmable synthesizer (< 1 ms lock time)
- Built-in test
- Compact size 1.1" x 2.7" x 10"
### ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input frequency</td>
<td>300 to 324.9 MHz (see Options)</td>
</tr>
<tr>
<td>Preselect input filter bandwidth</td>
<td>3 dB, ±12.5 MHz, 60 dB, ±87.5 MHz</td>
</tr>
<tr>
<td>Channel programming</td>
<td>100 kHz steps</td>
</tr>
<tr>
<td>Channel selection time</td>
<td>&lt; 2 ms</td>
</tr>
<tr>
<td>Receiver frequency stability</td>
<td>±1 kHz</td>
</tr>
<tr>
<td>Input dynamic range</td>
<td>-100 to +10 dBm minimum</td>
</tr>
<tr>
<td>Input impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Return loss</td>
<td>15 dB</td>
</tr>
<tr>
<td>Channel rejection</td>
<td>&gt; 50 dB</td>
</tr>
<tr>
<td>FSK data rate</td>
<td>30 Hz to 10 kHz (see Options)</td>
</tr>
<tr>
<td>Deviation</td>
<td>±20 kHz, +20 kHz for logic &quot;1&quot;, -20 kHz for logic &quot;0&quot;</td>
</tr>
<tr>
<td>IF filter bandwidth</td>
<td>3 dB, ±35 kHz, 60 dB, ±70 kHz</td>
</tr>
<tr>
<td>Image rejection</td>
<td>&gt; 50 dB</td>
</tr>
<tr>
<td>Automatic gain control</td>
<td>55 dB</td>
</tr>
<tr>
<td>Limiting range</td>
<td>55 dB (see Options)</td>
</tr>
<tr>
<td>Data bandwidth</td>
<td>30 Hz to 10 kHz (see Options)</td>
</tr>
<tr>
<td>IF bandwidth</td>
<td>&gt; 20 kHz</td>
</tr>
<tr>
<td>Video output level</td>
<td>Logic &quot;1&quot;: 250 mV, ±50 mV, others available (see Options)</td>
</tr>
<tr>
<td>Power supply rejection ratio</td>
<td>&gt; 40 dB</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-62 to +70°C</td>
</tr>
</tbody>
</table>

#### PRIMARY POWER REQUIREMENTS

- **Current/voltage:**
  - 500 mA @ +15 volts
  - 50 mA @ -15 volts

### MECHANICAL SPECIFICATIONS

#### PHYSICAL

- **Dimensions:** 2.65" x 10" x 1.1

#### CONNECTORS

- **Baseband output/control DC power input/ground:** 25-pin male, D type
- **IF input:** F type (others available)

### OPTIONS

- **K1** Input frequency select 300 MHz to 1.2 GHz (customer to specify).
- **K2** Video output level (customer to specify).
- **K3** Output impedance (customer to specify).
- **K4** Higher FSK data rate (customer to specify).
- **K5** 110 dB limiting range only (no AGC).
<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
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</thead>
<tbody>
<tr>
<td>ASDM-100</td>
<td>13</td>
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<tr>
<td>ASM-100</td>
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</tr>
<tr>
<td>DLMRS-70-40K</td>
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<tr>
<td>FDMOD-70</td>
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<tr>
<td>FMDR-360</td>
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<tr>
<td>FMOD-70</td>
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<tr>
<td>MFUM-70</td>
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<td>MMR-1-18-160</td>
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<tr>
<td>MRSS-704VAESI</td>
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<tr>
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<td>PMOD-70</td>
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<tr>
<td>PRTR-44</td>
<td>29</td>
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<tr>
<td>VDMD-2000</td>
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<td>VDMD-2000ADEQ</td>
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<td>VDMD-2004</td>
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<td>VDMD-2140</td>
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<tr>
<td>VM-100R</td>
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<tr>
<td>VM-2000ADEQ</td>
<td>7</td>
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<tr>
<td>WFMD-70</td>
<td>18</td>
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</table>
For additional technical, price and delivery information, please mail or fax this form to (516) 436-9219, or call Jack Hakoupian at (516) 439-9130 or Vartan Hakoupian at (516) 439-9311.

### STANDARD PRODUCTS

(Please specify values where “customer to specify” is noted on options)

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<thead>
<tr>
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### CUSTOM REQUIREMENTS

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**PLEASE SEND ADDITIONAL INFORMATION ON THE FOLLOWING PRODUCTS:**

- [ ] Mixers
- [ ] Switches
- [ ] Amplifiers
- [ ] IF Signal Processing Components
- [ ] Integrated Assemblies
- [ ] SATCOM Products
**ELECTRICAL SPECIFICATIONS**

Input frequency .................................................... 300 to 324.9 MHz (see Options)
Preselect input filter bandwidth .......................... 3 dB, ±12.5 MHz, 60 dB, ±87.5 MHz
Channel programming ........................................ 100 kHz steps
Channel selection time ........................................ < 2 ms
Receiver frequency stability ................................ ±1 kHz
Input dynamic range ......................................... -100 to +10 dBm minimum
Input impedance .................................................. 50 ohms
Return loss........................................................... 15 dB
Channel rejection................................................. > 50 dB
FSK data rate ...................................................... 30 Hz to 10 kHz (see Options)
Deviation .............................................................. ±20 kHz,
+20 kHz for logic "1",
-20 kHz for logic "0"
IF filter bandwidth ................................................ 3 dB, ±35 kHz,
60 dB, ±70 kHz
Image rejection ..................................................... > 50 dB
Automatic gain control ........................................ 55 dB
Limiting range ...................................................... 55 dB (see Options)
Data bandwidth .................................................... 30 Hz to 10 kHz (see Options)
IF bandwidth ........................................................ > 20 kHz
Video output level
  Logic "1".......................................................... 250 mV, ±50 mV, others available (see Options)
  Logic "0".......................................................... -250 mV, ±50 mV, others available (see Options)
Output impedance ................................................. 1000 ohms, others available (see Options)
Power supply rejection ratio ............................... > 40 dB
Operating temperature ........................................ -62 to +70˚C

**PRIMARY POWER REQUIREMENTS**

Current/voltage .................................................... 500 mA @ +15 volts
50 mA @ -15 volts

**MECHANICAL SPECIFICATIONS**

**PHYSICAL**

Dimensions .......................................................... 2.65" x 10" x 1.1

**CONNECTORS**

Baseband output/control DC power
    input/ground ................................................ 25-pin male, D type
    IF input ....................................................... F type (others available)

**OPTIONS**

K1  Input frequency select 300 MHz to 1.2 GHz (customer to specify).
K2  Video output level (customer to specify).
K3  Output impedance (customer to specify).
K4  Higher FSK data rate (customer to specify).
K5  110 dB limiting range only (no AGC).
## PRODUCT INDEX

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<tr>
<td>CONTACT</td>
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<td>TEL.</td>
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<td>FAX</td>
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