

# FREQUENCY CONVERTER



## HIGH-PERFORMANCE OUTDOOR BLOCK UP AND DOWNCONVERTERS



### FEATURES

- Antenna mount, weatherproof to IP-65
- Automatic 5/10 MHz internal/external reference selection
- RS-485/RS-422 and 10/100 Base-T Ethernet remote control
- Superior phase noise below IESS-308/IESS-309 and MIL-STD-188-164B specification
- 30 dB gain control
- 32 memory locations
- High frequency stability
- Summary alarm
- AC power supply (CE mark)

### OPTIONS

- Custom and multi-band models
- Higher frequency stability
- Lower phase noise
- Fiber-optic L-Band interface
- Fiber-optic RF-Band interface
- LO level monitor
- Lower gain
- DC power
- Eternal reference on IF connector
- Amplitude slope control

This series of outdoor block upconverters and downconverters is designed for antenna mounting.

A strong set of monitor and control functions support powerful remote control. A contact closure summary alarm is provided for fault monitoring. A continuously updated log of time-stamped records of activity is also provided.



# FREQUENCY CONVERTER

## BLOCK UP CONVERTERS

RF FREQUENCY (GHz)	IF FREQUENCY (MHz)	LO FREQUENCY (GHz)	MODEL NUMBER
5.85 to 6.425	950 to 1525	7.375	UPB-WS-6.1-IN*
5.85 to 6.65	950 to 1750	4.9	UPB-WS-6.25
6.7 to 7.1	950 to 1350	5.75	UPB-WS-6.9
7.9 to 8.4	950 to 1450	6.95	UPB-WS-8.15
11.7 to 12.75	950 to 2000	10.75	UPB-WS-12.225**
12.75 to 13.25	950 to 1450	11.8	UPB-WS-13
13.75 to 14.5	950 to 1700	12.8	UPB-WS-14.125
14 to 14.5	950 to 1450	13.05	UPB-WS-14.25
17.3 to 18.4	950 to 2050	16.35	UPB-WS-17.85**
18.1 to 18.4	950 to 1250	17.15	UPB-WS-18.25

\* Model includes frequency inversion.

\*\* Wide IF: 1 to 1.5 GHz IF bandwidths.

## Ka-BAND

RF FREQUENCY (GHz)	IF FREQUENCY (MHz)	LO FREQUENCY (GHz)	MODEL NUMBER
19.2 to 20.2	950 to 1950	18.25	UPB-WS-19.7**
20.2 to 21.2	1000 to 2000	19.2	UPB-WS-20.7-1**
25.5 to 27.0	950 to 2450	24.55	UPB-WS-26.25-1.5**
27.5 to 28.0	950 to 1450	26.55	UPB-WS-27.75
27 to 27.55	950 to 1500	26.05	UPB-WS-29.275
28.0 to 28.5	950 to 1450	27.05	UPB-WS-28.25
28.1 to 28.6	950 to 1450	27.15	UPB-WS-28.35
28.35 to 28.6	950 to 1200	27.4	UPB-WS-28.475
28.5 to 29.0	950 to 450	27.55	UPB-WS-28.75
28.6 to 29.1	950 to 1450	27.65	UPB-WS-28.85
28.75 to 29.35	950 to 1550	27.8	UPB-WS-29.05
28.8 to 30.0	950 to 2150	27.85	UPB-WS-29.4**
29.0 to 29.5	950 to 1450	28.05	UPB-WS-29.25
29 to 30	1000 to 2000	28	UPB-WS-29.5-1**
29.5 to 30.0	950 to 1450	28	UPB-WS-29.75
30 to 31	950 to 1950	29.05	UPB-WS-30.5**
30 to 31	1000 to 2000	29	UPB-WS-30.5-1**

\*\* Wide IF: 1 to 1.5 GHz IF bandwidths.



## BLOCK DOWNCONVERTERS

RF FREQUENCY (GHz)	IF FREQUENCY (MHz)	LO FREQUENCY (GHz)	MODEL NUMBER
3.4 to 4.2	950 to 1750	5.15	DNB-WS-3.8-IN*
3.4 to 4.2	950 to 1750	8.85/11.3	DNB-WS-3.8B
3.7 to 4.2	950 to 1450	8.55/11.3	DNB-WS-3.95D
7.25 to 7.75	950 to 1450	6.3	DNB-WS-7.5
10.7 to 11.7	950 to 1950	9.75	DNB-WS-11.2**
10.95 to 11.7	950 to 1700	10	DNB-WS-11.325
11.2 to 12	950 to 1750	10.25	DNB-WS-11.6
11.45 to 12.25	950 to 1750	10.5	DNB-WS-11.85
11.7 to 12.5	950 to 1750	10.75	DNB-WS-12.1
11.7 to 12.75	950 to 2000	10.75	DNB-WS-12.225**
12.2 to 12.75	950 to 1500	11.25	DNB-WS-12.475
12.25 to 12.75	950 to 1450	11.3	DNB-WS-12.5
17.3 to 18.4	950 to 2050	16.35	DNB-WS-17.85

\* Model includes frequency inversion.

\*\* Wide IF: 1 to 1.5 GHz IF bandwidths.

## Ka-BAND

RF FREQUENCY (GHz)	IF FREQUENCY (MHz)	LO FREQUENCY (GHz)	MODEL NUMBER
17.7 to 18.2	950 to 1450	16.75	DNB-WS-17.95
18.3 to 18.8	950 to 1450	17.35	DNB-WS-18.55
18.8 to 19.3	950 to 1450	17.85	DNB-WS-19.05
19.7 to 20.2	950 to 1450	18.75	DNB-WS-19.95
20.2 to 21.2	950 to 1950	19.25	DNB-WS-20.7**
20.2 to 21.2	1000 to 2000	19.2	DNB-WS-20.7-1**
25.5 to 27.0	950 to 2450	24.55	DNB-WS-26.25-1.5**
27.5 to 28.0	950 to 1450	26.55	DNB-WS-27.75
27.6 to 29.1	950 to 2450	26.65	DNB-WS-28.35-1.5**
28.0 to 28.5	950 to 1450	27.05	DNB-WS-28.25
28.1 to 28.6	950 to 1450	27.15	DNB-WS-28.35
28.35 to 28.6	950 to 1200	27.4	DNB-WS-28.475
28.5 to 29.0	950 to 1450	27.55	DNB-WS-28.75
28.6 to 29.1	950 to 1450	27.65	DNB-WS-28.85
28.8 to 30.0	950 to 2150	27.85	DNB-WS-29.4**
29.0 to 29.5	950 to 1450	28.05	DNB-WS-29.25
29 to 30	1000 to 2000	28	DNB-WS-29.5-1**
29.5 to 30.0	950 to 1450	28.55	DNB-WS-29.75
30 to 31	950 to 1950	29.05	DNB-WS-30.5**
30 to 31	1000 to 2000	29	DNB-WS-30.5-1**

\*\* Wide IF: 1 to 1.5 GHz IF bandwidths.

# FREQUENCY CONVERTER

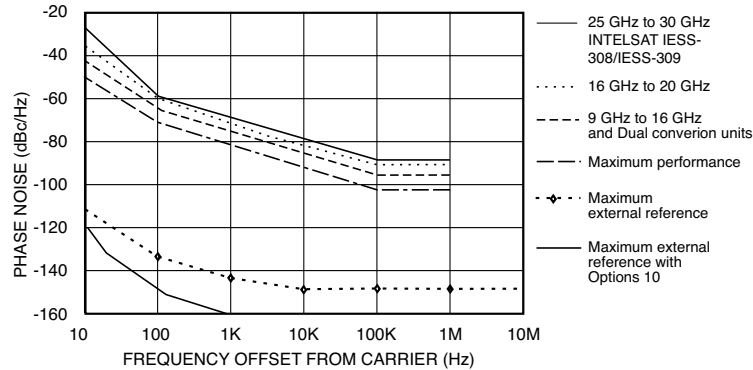
SPECIFICATIONS	UPCONVERTERS	DOWNCONVERTERS
Input characteristics		
Return loss (50 ohms)	18 dB minimum	18 dB minimum
LO leakage	N/A	-80 dBm maximum
Signal monitor	-20 dBc nominal	-20 dBc nominal
Output characteristics		
Return loss	18 dB minimum	18 dB minimum
Signal monitor	-20 dBc nominal (optional above 18 GHz)	-20 dBc nominal
Power output (P1 dB)	+13 dB minimum	+18 dB minimum
Transfer characteristics		
Gain	33 dB, $\pm 3$ dB at 23 °C	38 dB, $\pm 3$ dB at 23 °C
Gain adjustment	30 dB in 0.2 dB steps	30 dB in 0.2 dB steps
Gain stability	$\pm 0.25$ dB/day maximum at constant temperature, $\pm 2$ dB -40 °C to +60 °C	
Amplitude response	$\pm 0.25$ dB/40 MHz maximum, $\pm 1$ dB over RF frequency band	
Image rejection	80 dB minimum	80 dB minimum
Noise figure at minimum attenuation	15 dB maximum, 18 dB with 1 GHz IF bandwidth	15 dB maximum
Intermodulation distortion (third order)	With two inband signals at 0 dBm output, third-order intermodulation products are less than:	
	50 dBc minimum	60 dBc minimum
Spurious outputs (inband)	65 dBc minimum up to 0 dBm output	
Signal-related	(65 dBc minimum up to -10 dBm output including 2x1 spurious on 1 GHz to 1.5 GHz IF bandwidth upconverters)	65 dBc minimum up to 0 dBm output -60 dBm 2nd harmonic up to 0 dBm output
Signal-independent	-75 dBm maximum	-75 dBm maximum
Phase noise	See graph on next page	See graph on next page
Frequency stability	$\pm 5 \times 10^{-8}$ , -40 °C to +60 °C (higher stability options available), $5 \times 10^{-9}$ /day typical (fixed temperature after 24 hour on time)	
Automatic reference configuration	5 MHz or 10 MHz at +4 $\pm 3$ dBm on J4 (0 $\pm 5$ dBm on L-Band connector, available as option). If external reference is above +1 dBm, the internal reference oscillator will lock to the external reference input. Reference oscillator acts as an analog phase lock with a 0.1 Hz nominal loop bandwidth. Typical loop suppression of the external reference is as follows: 28 dB at 1 Hz offset, 65 dB at 10 Hz offset, and 100 dB at 100 Hz offset (improved external reference tracking and no reference suppression with Option 10F)	
Upconverter mute	60 dB minimum on summary alarm or mute command (100 ms maximum)	
Remote interface	10/100 Base-T Ethernet interface providing web-browser based configuration, SNMP 1.0 configuration, alarm reporting via SNMP trap, telnet access, password protection and selectable RS-485/RS-422. Refer to L3 Narda-MITEQ Technical Note 25T060 for details.	
Indicator and summary alarms (front panel)	Red LED (for active alarm), Amber LED (for logged alarms), Summary alarm indicates: LO out-of-lock or DC voltage alarm or LNA current on block downconverters	
Power ON indicator	Green LED (front panel)	
Summary alarm	Contact closure status for DC voltage and local oscillator, external mute input on J3 connector (programmable LNA current alarm for downconverters +12 VDC up to 500 mA maximum)	

Note: All specifications at maximum gain unless otherwise noted.



# PHASE NOISE SPECIFICATIONS

## PHASE NOISE CHARACTERISTICS (1.0 Hz BANDWIDTH)



## GENERAL SPECIFICATIONS

### PRIMARY POWER REQUIREMENTS

- Voltage ..... 100 VAC to 240 VAC (-10%, +6%)
- Frequency ..... 47 Hz to 63 Hz
- Consumption ..... 30 W typical, 38 W maximum at turn on

### PHYSICAL

Weight ..... 15 lb. [6.8 kg] nominal

### Connectors

#### Front panel connectors

#### RF band\*\*

- Below 22 GHz ..... SMA female compatible
- 25 GHz to 27 GHz ..... WR-34 grooved, 2 psi 10 cm<sup>3</sup>/min leakage rate (see Options 25, 27 for alternatives)
- Above 27 GHz ..... WR-28 grooved, 2 psi 10 cm<sup>3</sup>/min leakage rate (see Options 25, 27 for alternatives)

L-Band ..... N female

RF band monitor ..... SMA female compatible (available as option for Ka-Band Up and Down)

L-Band monitor ..... SMA female with termination

External reference input ..... SMA female with termination

Status/control interface\* ..... MS3116F14-18S for summary alarm, RS-422/RS-485, and LNA power

Remote interface\* ..... RJ-45 female for Ethernet, RS-422/RS-485 available on status connector

Primary power input\* ..... FCI clipper series CL1M1102

Notes: \* Unit supplied with mating connector.

\*\* Option 14 RF input on rear (see outline drawing on page ten).

# FREQUENCY CONVERTER

## GENERAL SPECIFICATIONS (CONTINUED)

### ENVIRONMENTAL

Enclosure rating ..... IP-65

#### Operating

Ambient temperature ..... -40 °C to +60 °C

Atmospheric pressure..... Up to 10,000 feet

Humidity..... Up to 100% condensing

#### Nonoperating

Ambient temperature ..... -50 °C to +70 °C

Atmospheric pressure..... Up to 40,000 feet

Shock and vibration ..... Normal handling by commercial carriers

## OPTIONS

Missing option numbers are not applicable for this product.

### 1. High-performance package

Power output (1 dB compression) ..... 20 dBm minimum (15 dBm minimum, Ka-Band upconverters)

Gain slope ..... 0.03 dB/MHz maximum

Gain stability ..... ±0.25 dB/day maximum at constant temperature,  
±1 dB peak-to-peak maximum/-40 °C to +60 °C

Group delay..... 1 ns peak-to-peak maximum

#### Spurious outputs (inband)

Signal-independent..... -80 dBm maximum

LO leakage ..... -70 dBm maximum (upconverters only)

Intermodulation distortion (third order) ... With two inband signals at 0 dBm output, third-order intermodulation products are less than 60 dBc minimum and 50 dBc minimum (Ka-Band upconverters)

#### High-performance phase noise (dBc/Hz) (maximum)

LO FREQUENCY	OFFSET (Hz)					
	10	100	1K	10K	100K/300K	1M
Up to 6.7 GHz	-54	-78	-108	-116	-119	-136
6.7 LO < 8 GHz	-53	-76	-107	-114	-117	-134
8 LO < 12 GHz	-48	-73	-103	-112	-115	-132
12 LO < 13.4 GHz	-48	-72	-102	-110	-113	-130
13.4 LO < 16 GHz	-47	-70	-100	-108	-111	-128
16 LO < 24 GHz	-42	-67	-98	-106	-109	-126
24 LO < 29.5 GHz	-41	-64	-94	-102	-107	-124

Noise spectral density ..... 87 dBm/4 kHz maximum (upconverters below 1 GHz IF bandwidth), -84 dB/4 kHz maximum (upconverters above 1 GHz IF bandwidth)



## OPTIONS (CONTINUED)

Missing option numbers are not applicable for this product.

- AM/PM conversion (at 0 dBm output).....0.1 %/dB maximum
- Upconverter mute.....80 dB minimum on summary alarm, external mute, input command or remote control
- 2. Lower gain.....20 ±3 dB at 23 °C, 18 dB NF (20 dB for upconverters with 1 GHz bandwidth and downconverters above 22 GHz), (Wide IF: 1 GHz to 1.5 GHz 2 x 1 signal related, 65 dBc at -10 dBm output) at maximum gain
- 3. Lower gain.....10 ±3 dB at 23 °C, 20 dB NF (22 dB for upconverters with 1 GHz bandwidth and downconverters above 22 GHz), (Wide IF: 1 GHz to 1.5 GHz 2 x 1 signal related, 65 dBc at -20 dBm output) at maximum gain
- 6. RF monitor above 18 GHz .....20 dBc nominal from RF signal
- 8. LO level alarm  
Summary alarm is generated for loss of power in any of the required local oscillators
- 10. High-frequency stability reference  
±5 x 10<sup>-9</sup>, -40 °C to +60 °C,  
1 x 10<sup>-9</sup>/day typical (fixed temperature after 24 hours on time)
- 10F. ±5 x 10<sup>-9</sup>, -40 °C to +60 °C,  
1 x 10<sup>-9</sup>/day typical (fixed temperature after 24 hours on time)  
High-frequency stability reference with direct phase lock to external reference input. No phase noise suppression on external reference input inside 100 kHz (inside 100 Hz with Option 1).  
Note: Converter may require 7-10 days to reach stability after long storage periods.
- 10G. Self-calibrating tracking reference with controlled slew rate. Internal reference tracks external reference and uses external reference to correct for aging of the internal reference. The internal reference changes frequency at a maximum rate of 0.06 ppm/second. Frequency stability on internal reference: ±5 x 10<sup>-9</sup>, -40 °C to +60 °C, 1 x 10<sup>-9</sup>/day typical (fixed temperature after 72 hours on time), 5 x 10<sup>-8</sup>/year typical
- 14. Low noise option (downconverters only). See outline drawing on page ten.

FREQUENCY (GHz)	AVAILABLE NOISE TEMPERATURE	INTERFACE INPUT
	At +25 °C (MAXIMUM)	(LOCATED ON REAR PANEL)
3.40 to 4.20	35	CPR-229GN
3.70 to 4.20	35	CPR-229GN
7.25 to 7.75	50	CPR-112G
10.70 to 11.70	80	WR-75 Grooved Flange
10.95 to 11.70	70	WR-75 Grooved Flange
11.45 to 12.25	70	WR-75 Grooved Flange
11.70 to 12.50	70	WR-75 Grooved Flange
12.20 to 12.75	70	WR-75 Grooved Flange
18.30 to 18.80	120	WR-42 Grooved Flange
19.70 to 20.20	120	WR-42 Grooved Flange
20.20 to 21.20	120	WR-42 Grooved Flange

Note: Gain increase of 25 dB to system gain. This option is not available with Options 2 and 3.

# FREQUENCY CONVERTER

## OPTIONS (CONTINUED)

Missing option numbers are not applicable for this product.

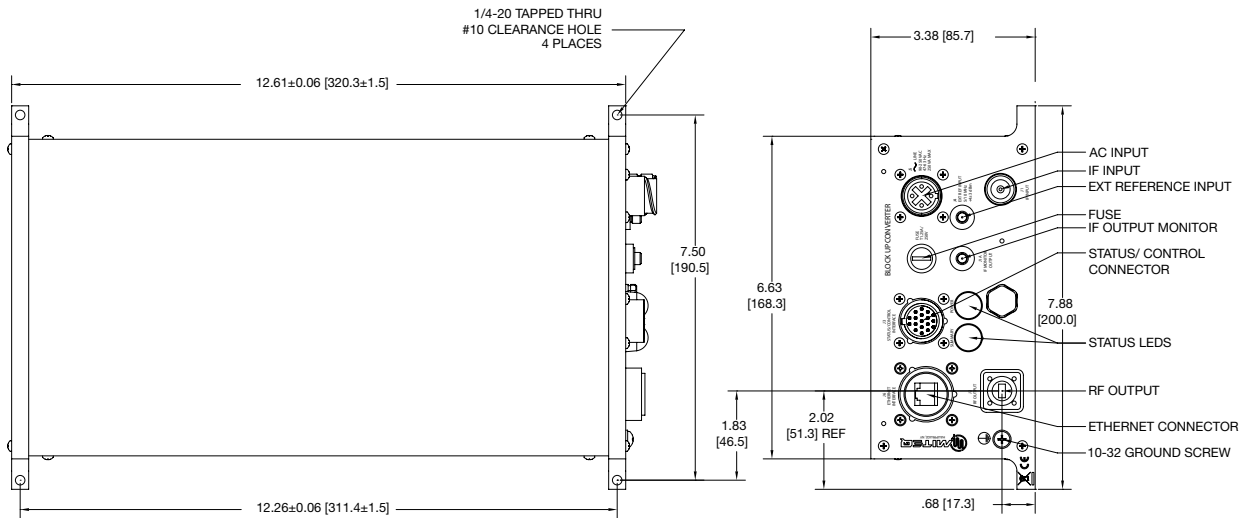
- 19. DC power input
    - A. +24 to +32 VDC input
  - \*21-1. Amplitude slope control ..... Remote control of amplitude slope. Control range: 0 dB to 1 dB minimum 500 MHz IF BW, 0 dB to 1.5 dB minimum 800 MHz IF BW, 0 dB to 2 dB minimum 1000 MHz IF BW, 0 dB to 3 dB minimum 1500 MHz IF BW. Control step size: 0.2 dB
  - \*21-2. Amplitude slope control ..... Remote control of amplitude slope. Control range: 0 dB to 2 dB minimum 500 MHz IF BW, 0 dB to 3 dB minimum 800 MHz IF BW, 0 dB to 4 dB minimum 1000 MHz IF BW, 0 dB to 6 dB minimum 1500 MHz IF BW. Control step size: 0.2 dB
- Notes: Amplitude response specifications are measure with linear components of slope equalization removed. Units are calibrated outside minimum range, however, minimum slope range provided as listed above. For Option 21-1 and 21-2, amplitude slope may be flat for 0 dB slope value.
- \* Available with Option 17 only.
- 25. Front panel connector option
    - 1. WR-42 per low noise Ka-Band outline
    - 2. WR-34 input per Ka-Band up outline
    - 3. 2.92 mm female per standard outline
    - 4. 3.5 mm female per standard outline
  - 27. Rear panel RF waveguide connector option. RF output on rear panel as per outlines on pages nine and ten
    - 1. WR-34 input per low noise outline
    - 2. WR-42 input per Ka-Band up outline
    - 3. 2.92 mm female per standard outline
    - 4. 3.5 mm female per standard outline
  - 28. L-Band fiber-optic interface (available 0.95 GHz to 2.15 GHz)
    - A. Downconverter output transmitter
      - Fiber: 9/125 (single-mode fiber), Wavelength: 1540 nm to 1560 nm, Optical power in fiber: 4 mW typical, Connector: FC/APC
    - B. Upconverter input receiver
      - Fiber: 9/125 (single-mode fiber), Wavelength: 1300 nm to 1560 nm, Connector: FC/APC
  - 29. RF-Band fiber-optic interface (available 0.95 GHz to 18 GHz)
    - A. Upconverter output transmitter
      - Fiber: 9/125 (single-mode fiber), Wavelength: 1540 nm to 1560 nm, Optical power in fiber: 4 mW typical, Connector: FC/APC
    - B. Downconverter input receiver
      - Fiber: 9/125 (single-mode fiber), Wavelength: 1300 nm to 1560 nm, Connector: FC/APC
  - 34. External reference input on IF connector
  - VM. Vertical Mount (see outline on page ten)



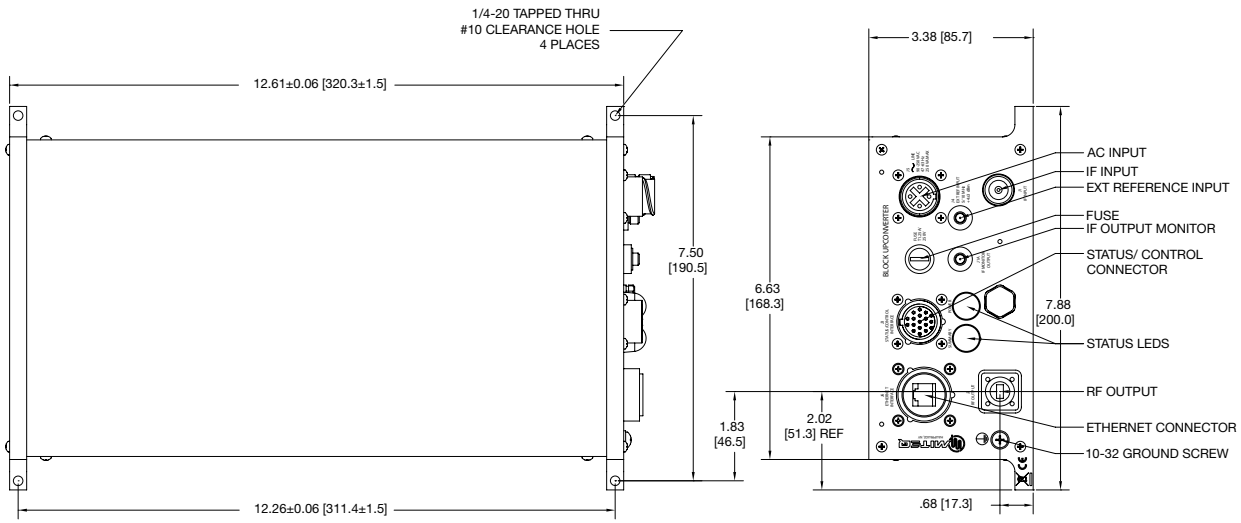


# OUTLINE DRAWINGS

## Ka-BAND UPCONVERTER PACKAGE



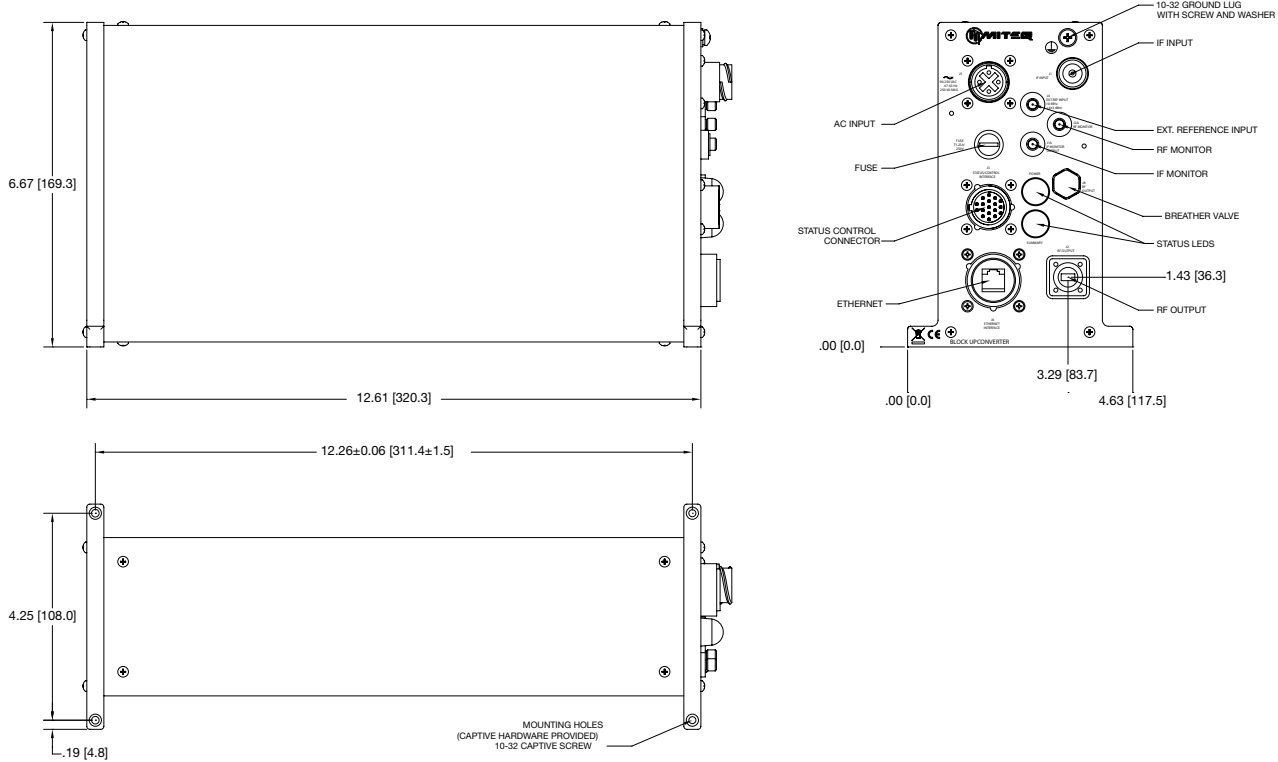
## STANDARD PACKAGE FOR ALL BANDS EXCEPT Ka-BAND UPCONVERTER



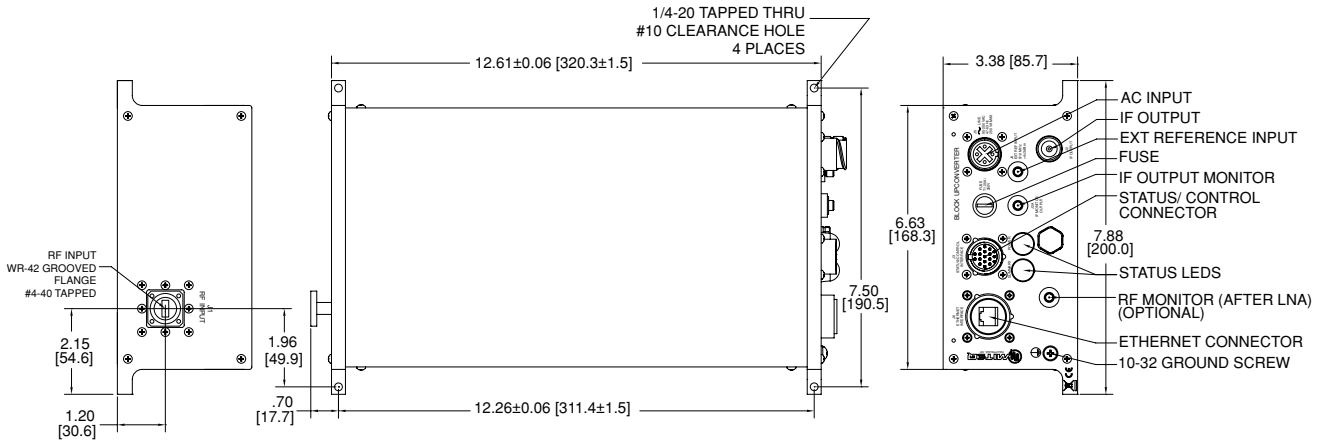
Note: Dimensions shown are in inches and those shown in brackets [ ] are in millimeters.

# FREQUENCY CONVERTER

## OUTLINE DRAWINGS (CONTINUED) VERTICAL MOUNT Ka-BAND



## LOW NOISE OPTION 14 (DOWNCONVERTER PACKAGE)



Note: Dimensions shown are in inches and those shown in brackets [ ] are in millimeters.



435 Moreland Road  
Hauppauge, NY 11788

Tel: 631-231-1700

Fax: 631-231-1711

Email: [satcomsalesnm@L3T.com](mailto:satcomsalesnm@L3T.com)

[www.nardamiteq.com](http://www.nardamiteq.com)

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D-327J/01.30.18