

Satellite Up- and Downconverter

Single / Dual / Triple Band

Single / Dual Channel

S-, C-, X-, Ku-, K(DBS)-, Ka-Band



The satellite up- and downconverters which are developed and manufactured by WORK Microwave, are designed to satisfy the high requirements of modern satellite transmission, such as TV uplinks and high speed data networks. Analogue transmission formats are supported as well as digital transmission formats. For many years, these devices have been used worldwide for fixed satellite earth stations, satellite news gathering (SNG) vehicles, Fly-Aways and other mobile or portable applications (Special housing for compact mobile application is offered.). The up-and down-converters have been produced for more than 1200 times so far and customers worldwide appreciate their reliability and high level of quality.

4th Generation – still better

The 4th generation, based on our experience and skill, is still better. The synthesizer and oscillator portion in every satellite converter is the most important component because it decides the converter's reliability. For many years WORK Microwave has been developing and manufacturing high sophisticated microwave oscillators and synthesizers, which are used in our converter series as well. The new design allows us to reduce the number of components by more than 30%. In addition, significant improvements have been made on circuit design.

This design results in an AC power consumption of typically 35 VA / 27 W. This leads to an even higher reliability and longer life time.

S-, C-, X-, Ku- and K-Band coverage

The satellite converter series cover the satellite frequency bands S-, C-, X-, Ku-, K-Band and Ka-Band. The converters support the standard IF-frequency bands 70 ± 20 MHz and/or 140 ± 40 MHz. The conversion is performed without spectral inversion. The upconverters offer an increased power output ($P_{1dB} \geq +10$ dBm) in all versions. The units are available as single band or as triple band converters (see also next page under "Specials and OEM products").

High signal integrity

The extreme low phase noise of the oscillators guarantees an excellent signal quality. Low spurious emissions allow our customers to use the converters also in the environments with demanding requirements, such as high power video uplinks. Sophisticated temperature compensation guarantees the stability over a very wide temperature range.

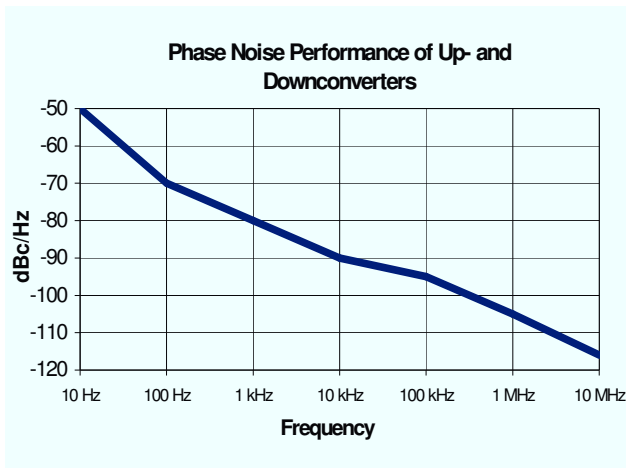
Housing options

The converters normally are delivered without fans and can be operated in environments, where at minimum 1 RU space for natural ventilation is available above each unit. This eliminates the fan as potential point of failure. For rack installations without any space in between the units a fan within the converter unit is recommended, which forces an airflow from the right side to left side of the units.

Operating and control – easy integration into your system

The converters can be operated via the push buttons on the front panel using self-explanatory display menus or via remote control (RS232, RS422/485, TCP/IP over Ethernet). Detailed monitoring of the system status and a summary alarm output (dual change over switch contacts) are provided. For the remote control either ASCII string based commands as well as addressable, packet based commands are provided.

Remote monitoring and control through SNMP and a Web browser interface is now also available.



Specials and OEM products

WORK Microwave is specialized to offer custom tailored products. Converters are sold also as OEM products with our customer's brand name and logo on it.

We offer specials as follows:

- Modified or smaller housings to fit into your existing design for mobile and portable applications.
- Extended storage or operating temperature range.
- Military versions for hostile environment (shock, vibration, humidity).
- For downconverters: Application specific output filtering and automatic level control. The output level is kept constant independent of the strength of the input signal with adjustable control.
- Additional PLO output.

Key features

- 70 MHz or 140 MHz IF bands available
- Optional switchable IF 70 and 140 MHz (IF 70/140)

- Extreme low power consumption maximum 35 VA / 27 W (single band unit) 37 VA / 29 W (triple band units)
- Extreme low phase noise (< -50 dBc/Hz @ 10 Hz)
- Long- term stability 10^{-7} / year
- Output power +10 dBm (1dB compression point)
- Low spurious emissions < - 80 dBm at full gain (high performance series)
- Automatic reference recognition (5 and 10 MHz)
- Adjustable gain equalizer ± 2.5 dB / 40 MHz
- Digital gain compensation
- Operating temperature range either -30°C to 60°C (-22°F to 140°F) or 0°C to 50°C (32°F to 122°F)
- Remote control through RS232, RS422/485 (2-wire or 4-wire) interfaces, TCP/IP over Ethernet, Web browser interface, SNMP (MIBs are provided).
- Packet command syntax supports RS485 bus systems and allows addressed operation.
- Test output on the front panel: RF-Test at upconverter, IF-Test at downconverter.
- Optional IF-Test output for upconverters on rear panel (Option: IFT)
- AC power switch on the front panel
- Summary alarm output (dual change over switch contacts)
- Transmit mute input
- Optional internal Fan (Option: FAN)
- CE compliant
- **3 years warranty**

Order information

WORK Microwave offers two series of 19" rack mount satellite converters, Standard and High Performance. The specifications are the same for both types except the operating temperature range. The High Performance type operates between -30°C to 60°C (-22°F to 140°F) and the standard type between 0°C to 50°C (32°F to 122°F). So if you only need units for inside use, the standard unit is perfectly suited for this application and it is significant cheaper.

Open questions, demo units

If you need more information about WORK Microwave's 4th satellite converter generation or if you would like to have demo unit, please contact us via e-mail: sales@work-microwave.de or call us. We are glad to assist you.

Satellite Upconverter

Indoor Version

Single / Dual / Triple Band Upconverter or Dual Channel Upconverter S-Type (standard version), H-Type (extended temperature range)

Upconverter Type:	HCU-S / SCU-S	HCU-S4 / SCU-S4	HCU-C / SCU-C	HCU-C1 / SCU-C1
RF-Output Frequency:	S-Band 2.025...2.290 GHz	S-Band 2.0...2.6 GHz	C-Band 5.85...6.65 GHz	C-Band 5.85...7.025 GHz
Intermediate Frequency:	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	3050 MHz for 70 MHz IF Input 3040 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2610 MHz for 70 MHz IF Input 2600 MHz for 140 MHz IF Input
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 60 - 80 - 90 - 98 - 103 ¹⁾ - 112 ¹⁾	- 60 - 80 - 90 - 98 - 103 ¹⁾ - 112 ¹⁾	- 55 - 75 - 85 - 95 - 100 ¹⁾ - 110 ¹⁾
max. values in dBc/ Hz ¹⁾ 0°C to 50°C, outside this temperature range degraded by max 5 dB.				
Test Output: (Fixed Oscillator)	2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ± 3 dBm SMA female	3120 MHz (70 MHz IF) 3160 MHz (140 MHz IF) -6 ± 3 dBm SMA female	2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ± 3 dBm SMA female	2680 MHz (70 MHz IF) 2740 MHz (140 MHz IF) -6 ± 3 dBm SMA female
Test Output: (Microwave Oscillator)	4.475...4.740 GHz (70 MHz IF) 4.465...4.730 GHz (140 MHz IF) - 7 ± 3 dBm SMA female	5.05...5.65 GHz (70 MHz IF) 5.04...5.64 GHz (140 MHz IF) - 7 ± 3 dBm SMA female	8.30...9.10 GHz (70 MHz IF) 8.29...9.09 GHz (140 MHz IF) - 7 ± 3 dBm SMA female	8.46...9.635 GHz (70 MHz IF) 8.45...9.625 GHz (140 MHz IF) - 7 ± 3 dBm SMA female

Upconverter Type:	HCU-X	HCU-Ku / SCU-Ku	HCU-Ku2 / SCU-Ku2	HCU-K / SCU-K
RF-Output Frequency:	X-Band 7.90...8.40 GHz	Ku-Band 12.75...14.50 GHz	Ku-Band 11.80...13.40 GHz	K-Band 17.3...18.4 GHz
Intermediate Frequency:	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2300 MHz for 70 MHz IF Input 2270 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 53 - 73 - 83 - 93 - 98 ¹⁾ - 108 ¹⁾	- 50 - 70 - 80 - 90 - 95 ¹⁾ - 105 ¹⁾	- 50 - 70 - 80 - 90 - 95 ¹⁾ - 105 ¹⁾
max. values in dBc/ Hz ¹⁾ 0°C to 50°C, outside this temperature range degraded by max 5 dB.				
Test Output: (Fixed Oscillator)	2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ± 3 dBm SMA female	2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ± 3 dBm SMA female	2370 MHz (70 MHz IF) 2410 MHz (140 MHz IF) -6 ± 3 dBm SMA female	2380 MHz (70 MHz IF) 2300 MHz (140MHzIF) -6 ± 3 dBm SMA female
Test Output: (Microwave Oscillator)	10.35...10.85 GHz (70 MHz IF) 10.34...10.84 GHz (140 MHz IF) - 7 ± 3 dBm SMA female	15.20...16.95 GHz (70 MHz IF) 15.19...16.94 GHz (140 MHz IF) - 7 ± 3 dBm SMA female	14.1...15.7 GHz (70 MHz IF) 14.07...15.67 GHz (140 MHz IF) - 7 ± 3 dBm SMA female	14.85...15.95 GHz (70 MHz IF) 15.86...15.96 GHz (140 MHz IF) - 7 ± 3 dBm SMA female

Specifications continued next page

Satellite Upconverter

Indoor Version

Single / Dual / Triple Band Upconverter or Dual Channel Upconverter S-Type (standard version), H-Type (extended temperature range)

Specifications continued:

Upconverter Type:	HCU-Ka / SCU-Ka	HCU-Ka1 / SCU-Ka1	HCU-Ka3-2 / SCU-Ka3-2	HCU-Ka4 / SCU-Ka4
RF-Output Frequency:	Ka-Band 29.7...31.5 GHz	Ka-Band 19.2...20.2 GHz	Ka-Band 17.7...19.5 GHz 19.4...21.2 GHz (automatically switched)	Ka-Band 27.5... 31 GHz
Intermediate Frequency:	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	5170 MHz for 70 MHz IF Input 5100 MHz for 140 MHz IF Input
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 46 - 66 - 76 - 86 - 88 ¹⁾ - 101 ¹⁾	- 50 - 70 - 80 - 90 ¹⁾ - 95 ¹⁾ - 105 ¹⁾	- 50 - 70 - 80 - 90 - 95 ¹⁾ - 105 ¹⁾
max. values in dBc/ Hz ¹⁾ 0°C to 50°C, outside this temperature range degraded by max 5 dB.				
Test Output: (Fixed Oscillator)	2380 MHz (70 MHz IF) 2300 MHz (140MHzIF) -6 ± 3 dBm SMA female	2380 MHz (70 MHz IF) 2300 MHz (140MHzIF) -6 ± 3 dBm SMA female	2380 MHz (70 MHz IF) 2300 MHz (140MHzIF) -6 ± 3 dBm SMA female	5240 MHz (70 MHz IF) 5240 MHz (140MHzIF) -6 ± 3 dBm SMA female
Test Output: (Microwave Oscillator)	27.25...29.05 GHz (70 MHz IF) 27.26...29.06 GHz (140 MHz IF) - 10 ± 3 dBm SMA female	16.75... 17.75 GHz (70 MHz IF) 16.76... 17.76 GHz (140 MHz IF) - 7 ± 3 dBm SMA female	15.25... 18.75 GHz (70 MHz IF) 15.26... 18.76 GHz (140 MHz IF) - 7 ± 3 dBm SMA female	16.335... 18.085 GHz (70 MHz IF) 16.335... 18.085 GHz (140 MHz IF) - 7 ± 3 dBm SMA female

Upconverter Type:	HCU-Ka8 / SCU-Ka8			
RF-Output Frequency:	Ka-Band 22.55... 23.15 GHz			
Intermediate Frequency:	2150 MHz for 70 MHz IF Input 2140 MHz for 140 MHz IF Input t			
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 56 - 66 - 76 - 86 - 88 ¹⁾ - 101 ¹⁾		
max. values in dBc/ Hz ¹⁾ 0°C to 50°C, outside this temperature range degraded by max 5 dB.				
Test Output: (Fixed Oscillator)	2080 MHz (70 MHz IF) 2000 MHz (140MHzIF) -6 ± 3 dBm SMA female			
Test Output: (Microwave Oscillator)	10.2...10.5 GHz (70 MHz IF) 10.205...10.505 GHz (140 MHz IF) - 7 ± 3 dBm SMA female			

Specifications continued next page

Satellite Upconverter

Indoor Version

Single / Dual / Triple Band Upconverter or Dual Channel Upconverter S-Type (standard version), H-Type (extended temperature range)

Specifications continued:

Conversion Scheme:	Dual up-conversion, no frequency inversion
Frequency Resolution:	10 Hz
IF-Input Characteristics:	Frequency: 70 ± 20 MHz or 140 ± 40 MHz (optional: both → [IF-Band] = 70/140) Impedance: 50 or 75 Ω Return Loss: 26 dB min IF-Connectors: BNC female
RF-Output Characteristics:	Impedance: 50 Ω Return Loss: >20 dB (>17 dB HCU3-CKuK) 1 dB Compression Point: >10 dBm Output Muting: >60 dB (by command or sense input or by alarm condition) RF-Signal Monitor: -20 dB of RF-output RF-Connectors: SMA female (Standard) K female (RF output > 22 GHz)
Transfer Characteristics:	Max. Conversion Gain: 40 dB Attenuation Range: 0...30 dB, Step 0.1 dB (Conversion Gain 40...10 dB) Gain Accuracy: ± 1 dB Level Stability: ± 0.25 dB/day (constant temperature) Amplitude Response: ± 0.2 dB / ± 18 MHz, ± 0.25 dB / ± 20 MHz, ± 0.4 dB / ± 40 MHz Image Rejection: >80 dB Noise Figure: <25 dB, 20 dB typical
Equalizer (Gain Slope):	max ± 2.5 dB / 40 MHz (IF 70 MHz), max ± 4 dB / 80 MHz (IF 140 MHz) (programmable)
Group Delay (± 18 MHz):	Linear: 0.03 ns / MHz max. Parabolic: 0.01 ns / MHz ² max. Ripple: 1 ns peak to peak max.
Group Delay (± 36 MHz):	Linear: 0.015 ns / MHz max. Parabolic: 0.005 ns / MHz ² max. Ripple: 2 ns peak to peak max.
Intermodulation (3rd Order):	-36 dBc max (f _{in} : 67.5 and 72.5 MHz, P _{in} : 2 x -25 dBm, P _{out} : 2 x 0 dBm)
AM / PM conversion:	0.1 ° / dB (P _{out} = 0 dBm)
Spurious Outputs:	Signal related: < -60 dBc (Δf < 1 MHz), < -70 dBc (Δf ≥ 1 MHz) Signal independent: < -70 dBm
Frequency Stability:	± 1 x 10 ⁻⁷ , 0°C to 50°C ± 2 x 10 ⁻⁸ , 0°C to 50°C (after 30 min warm up) ± 1.5 x 10 ⁻⁹ per day (fixed temperature after 24 h warm up)
Reference Input:	Frequency: 10 MHz or 5 MHz Level: -3...10 dBm Modes: internal, external, auto (senses reference input) Connector: BNC female
Reference Output:	Frequency: 10 MHz Level: 0 ± 3 dBm Connector: BNC female
Monitoring and Control Interface:	Protocol: SNMP Connection: UDP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45 Protocol: HTTP (web browser interface) Connection: TCP/IP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45 Protocol: Multipoint Connection: RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45
Alarm Interface: Mute Input:	Alarm: two potential free contacts (DPDT), Mute Input: TTL logic input with internal pull up Connector DSUB09 female
Temperature Range:	HCU: -30°C to 60°C operating (10 minutes warm up at -30°C) SCU: 0°C to 50°C operating -30°C to 80°C storage
Relative Humidity:	< 95 % non condensing
User Interface:	SCU: LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys HCU: VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys
Power Supply:	85...264 V AC, 40...70 Hz
Power Consumption:	Max: 33 VA / 20 W Typ: 29 VA / 18 W (single converters)
Mains Fuse:	2 x 3.15 A time-lag fuse
Dimension and Weight:	483 x 44 x 500 mm ³ , 1 RU (19") appr. 8.4 kg

Specifications are subject to change

Satellite Upconverter

Indoor Version

Single / Dual / Triple Band Upconverter or Dual Channel Upconverter S-Type (standard version), H-Type (extended temperature range)

Order Information:

HCU-[RF Band(s)]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Single or Dual converter
HCUx-[RF Band(s)]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Multiband converter
SCU-[RF Band(s)]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Single or Dual converter
SCUx-[RF Band(s)]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Multiband converter
x=2: Dualband converter, x=3: Triband converter

Possible Options are: **FAN** (internal Fan)
IFT (additional IF test output)
VFD (VFD display, standard with HCU-type converters)

Examples:

HCU-C-70-50 (C-band upconverter)
SCU-Ku-140-75-FAN (Ku-band upconverter with internal Fan)
HCU-C-70/140-50 (C-Band upconverter dual IF 70 and 140 MHz)
HCU3-CXKu-70-50 (Triband upconverter)
SCU-CKu-70-75 (Dual channel upconverter C-band and Ku-band, identical IF and impedance)
SCU-C-70-75/Ku-140-50-FAN (Dual channel upconverter C-band and Ku-band with Fan, different IF and impedance)

Satellite Downconverter

Indoor Version

Single / Dual / Triple Band Downconverter or Dual Channel Downconverter S-Type (standard version), H-Type (extended temperature range)

Downconverter Type:	HCD-S / SCD-S	HCD-S4 / SCD-S4	HCD-C / SCD-C	HCD-C1 / SCD-C1
RF-Input Frequency:	S-Band 2.025...2.290 GHz**	S-Band 2.0...2.6 GHz	C-Band 3.4...4.2 GHz	C-Band 3.4...4.8 GHz
Intermediate Frequency:	2450 MHz for 70 MHz IF Output 2440 MHz for 140 MHz IF Output	3050 MHz for 70 MHz IF Input 3040 MHz for 140 MHz IF Input	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 60 - 80 - 90 - 98 - 103 ¹⁾ - 112 ¹⁾	- 60 - 80 - 90 - 98 - 101 ¹⁾ - 111 ¹⁾	- 53 - 73 - 83 - 93 ¹⁾ - 98 ¹⁾ - 108 ¹⁾
max. values in dBc/ Hz ¹⁾ 0°C to 50°C, outside this temperature range degraded by max 5 dB.				
Test Output (Fixed Oscillator):	2520 MHz (70 MHz IF) 2580 MHz (140 MHz IF) -6 ± 3 dBm, Connector SMA female	3120 MHz (70 MHz IF) 3160 MHz (140 MHz IF) -6 ± 3 dBm SMA female	2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ± 3 dBm, Connector SMA female	2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ± 3 dBm, Connector SMA female
Test Output (Microwave Oscillator):	4.475...4.74 GHz (70 MHz IF) 4.465...4.73 GHz (140 MHz IF) -7 ± 3 dBm SMA female	5.05...5.65 GHz (70 MHz IF) 5.04...5.64 GHz (140 MHz IF) -7 ± 3 dBm SMA female	5.55...6.35 GHz (70 MHz IF) 5.54...6.34 GHz (140 MHz IF) -7 ± 3 dBm SMA female	5.55...6.95 GHz (70 MHz IF) 5.54...6.94 GHz (140 MHz IF) -7 ± 3 dBm SMA female

Downconverter Type:	HCD-X	HCD-Ku / SCD-Ku	HCD-Ku4 / SCD-Ku4	
RF-Input Frequency:	X-Band 7.25...7.75 GHz	Ku-Band 10.70...12.75 GHz	Ku-Band 9.3...9.5 GHz	
Intermediate Frequency:	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 53 - 73 - 83 - 93 ¹⁾ - 98 ¹⁾ - 108 ¹⁾	- 50 - 70 - 80 - 90 - 95 ¹⁾ - 105 ¹⁾	
max. values in dBc/ Hz ¹⁾ 0°C to 50°C, outside this temperature range degraded by max 5 dB.				
Test Output (Fixed Oscillator):	2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ± 3 dBm, Connector SMA female	2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ± 3 dBm, Connector SMA female	2220 MHz (70 MHz IF) 2280 MHz (140 MHz IF) -6 ± 3 dBm, Connector SMA female	
Test Output (Microwave Oscillator):	9.40...9.90 GHz (70 MHz IF) 9.39...9.89 GHz (140 MHz IF) -7 ± 3 dBm SMA female	12.85...14.90 GHz (70 MHz IF) 12.84...14.89 GHz (140 MHz IF) -7 ± 3 dBm SMA female	11.45...11.65 GHz (70 MHz IF) 11.44...11.64 GHz (140 MHz IF) -7 ± 3 dBm SMA female	

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Satellite Downconverter

Indoor Version

Single / Dual / Triple Band Downconverter or Dual Channel Downconverter S-Type (standard version), H-Type (extended temperature range)

Specifications continued:

Downconverter Type:	HCD-Ka3-2 / SCD-Ka3-2	HCD-Ka6 / SCD-Ka6	HCD-Ka7 / SCD-Ka7	
RF-Input Frequency:	Ka-Band 17.7...19.5 GHz 19.4...21.2 GHz (automatically switched)	Ka-Band 18.1... 21.2 GHz	Ka-Band 25.5... 27.5 GHz	
Intermediate Frequency:	2450 MHz for 70 MHz IF Output 2440 MHz for 140 MHz IF Output	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input t	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input t	
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 50 - 70 - 80 - 90 - 95 ¹⁾ - 105 ¹⁾	- 56 - 66 - 76 - 86 - 88 ¹⁾ - 101 ¹⁾	
	max. values in dBc/ Hz ¹⁾ 0°C to 50°C, outside this temperature range degraded by max 5 dB.			
Test Output (Fixed Oscillator):	2380 MHz (70 MHz IF) 2300 MHz (140MHzIF) -6 ± 3 dBm SMA female	2380 MHz (70 MHz IF) 2300 MHz (140MHzIF) -6 ± 3 dBm SMA female	2380 MHz (70 MHz IF) 2300 MHz (140MHzIF) -6 ± 3 dBm SMA female	
Test Output (Microwave Oscillator):	15.25...18.75 GHz (70 MHz IF) 15.26...18.76 GHz (140 MHz IF) - 7 ± 3 dBm SMA female	15.65...18.75 GHz (70 MHz IF) 15.66...18.76 GHz (140 MHz IF) - 7 ± 3 dBm SMA female	11.525...12.525 GHz (70 MHz IF) 11.53...12.53 GHz (140 MHz IF) - 7 ± 3 dBm SMA female	

Specifications continued next page

Satellite Downconverter

Indoor Version

Single / Dual / Triple Band Downconverter or Dual Channel Downconverter S-Type (standard version), H-Type (extended temperature range)

Specifications continued:

Conversion Scheme:	Dual down-conversion, no frequency inversion
Frequency Resolution:	10 Hz
RF-Input Characteristics:	Impedance: 50 Ω Return Loss: >20 dB Max. input level: < approx. -25 dBm (operational) < approx. +10 dBm (damage level) LO Leakage: -80 dBm max. RF-Connector: SMA female (Standard) K female (RF Input > 22 GHz)
IF-Output Characteristics:	Frequency: 70 \pm 20 MHz or 140 \pm 40 MHz (optional: both \rightarrow [IF-Band] = 70/140) Impedance: 50 or 75 Ω Return Loss: 26 dB min 1 dB Compression Point: >10 dBm, 13 dBm typical Output Muting: >60 dB (by command or sense input or by alarm condition) IF-Signal Monitor: -20 dB of IF-output IF-Connectors: BNC female
Transfer Characteristics:	Max. Conversion Gain: 45 dB (Standard) 40 dB (SCD/HCD Ka6, SCD/HCD Ka7) Attenuation Range: 0...30 dB, Step 0.1 dB (Conversion Gain 45...15 dB) Gain Accuracy: \pm 1 dB Level Stability: \pm 0.25 dB/day (constant temperature) Amplitude Response: \pm 0.2 dB / \pm 18 MHz, \pm 0.25 dB / \pm 20 MHz, \pm 0.4 dB / \pm 40 MHz Image Rejection: >80 dB Noise Figure: <12 dB, 10 dB typical
Equalizer (Gain Slope):	max \pm 2.5 dB / 40 MHz (IF 70 MHz), max \pm 4 dB / 80 MHz (IF 140 MHz) (programmable)
Group Delay (\pm 18 MHz):	Linear: 0.03 ns / MHz max. Parabolic: 0.01 ns / MHz ² max. Ripple: 1 ns peak to peak max.
Group Delay (\pm 36 MHz):	Linear: 0.015 ns / MHz max. Parabolic: 0.005 ns / MHz ² max. Ripple: 2 ns peak to peak max.
Intermodulation (3rd Order):	-60 dBc max (Δf_{in} : 5 MHz, P_{in} : 2 x -40 dBm, P_{out} : 2 x -10 dBm)
AM / PM conversion:	0.1 $^\circ$ / dB (P_{out} = 0 dBm)
Spurious Outputs:	Signal related: < - 60 dBc (Δf < 1 MHz), < -70 dBc (Δf \geq 1 MHz) Signal independent: < - 76 dBm (< - 80 dBm typical)
Frequency Stability:	\pm 1 x 10 ⁻⁷ , 0 $^\circ$ C to 50 $^\circ$ C \pm 2 x 10 ⁻⁸ , 0 $^\circ$ C to 50 $^\circ$ C (after 30 min warm up) \pm 1.5 x 10 ⁻⁹ per day (fixed temperature after 24 h warm up)
Reference Input:	Frequency: 10 MHz or 5 MHz Level: -3...10 dBm Modes: internal, external, auto (senses reference input) Connector: BNC female
Reference Output	Frequency: 10 MHz Level: 0 \pm 3 dBm Connector: BNC female
Monitoring and Control Interface:	Protocol: SNMP Connection: UDP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45 Protocol: HTTP (web browser interface) Connection: TCP/IP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45 Protocol: Multipoint Connection: RS232 or RS422/RS485 (configurable), connector DSUB09 female or TCP/IP over Ethernet (10 or 100 Mbit/s, auto sensing), connector RJ-45
Alarm Interface: Mute Input:	Alarm: two potential free contacts (DPDT), Mute Input: TTL logic input with internal pull up Connector DSUB09 female
Temperature Range:	HCU : -30 $^\circ$ C to 60 $^\circ$ C operating (10 minutes warm up at -30 $^\circ$ C) SCU : 0 $^\circ$ C to 50 $^\circ$ C operating - 30 $^\circ$ C to 80 $^\circ$ C storage
Relative Humidity:	< 95 % non condensing
User Interface:	SCU: LCD-Display 2 x 40 characters, 4 cursor keys, 4 function keys HCU: VFD-Display 2 x 40 characters, 4 cursor keys, 4 function keys
Power Supply:	85...264 V AC, 40...70 Hz
Power Consumption:	Max: 33 VA / 20 W Typ: 29 VA / 18 W (single converters)
Mains Fuse:	2 x 3.15 A time-lag fuse
Dimension and Weight:	483 x 44 x 500 mm ³ , 1 RU (19") appr. 8.2 kg

Specifications are subject to change

Satellite Downconverter

Indoor Version

Single / Dual / Triple Band Downconverter or Dual Channel Downconverter S-Type (standard version), H-Type (extended temperature range)

Order Information:

HCD-[RF Band(s)]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Single or Dual converter
HCDx-[RF Band(s)]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Multiband converter
SCD-[RF Band(s)]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Single or Dual converter
SCDx-[RF Band(s)]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Multiband converter
x=2: Dualband converter, x=3: Triband converter

Possible Options are: **FAN** (internal Fan)
VFD (VFD display, standard with HCD-type converters)
ALC-BW (Automatic level control- Filter bandwidth, see product:
Automatic Level Control)
2RFI (two switchable RF inputs)

Examples:

HCD-C-70-50 (C-band downconverter)
SCD-Ku-140-75-FAN (Ku-band downconverter with internal Fan)
HCD-C-70/140-50 (C-Band downconverter dual IF 70 and 140 MHz)
HCD3-CXKu-70-50 (Triband downconverter)
SCD2-CKu-70-75 (Dualband downconverter)
SCD-CKu-70-75 (Dual channel downconverter C-band and Ku-band, identical IF and impedance)
SCD-C-70-75/Ku-70-50-FAN (Dual channel downconverter C-band and Ku-band with Fan,
different IF and impedance)

Satellite Up- and Downconverter, Outdoor Version

Single / Dual / Triple Band
S-, C-, X-, Ku-, K-, Ka-Band



WORK Microwave provides its proven up- and downconverters, also in an outdoor housing, which can be used under all weather conditions. The units can be operated over a temperature range -30°C to 60°C (-22°F to 140°F). In the non-operating mode they survive temperatures of -50°C to 80°C (-58°F to 176°F) without any damage. Same as the 19" rack converter units, they meet the requirements for modern satellite transmission such as TV up-link and high-speed data network. Because of their rugged construction and low power consumption, they are most suitable for fixed satellite earth stations, satellite news gathering (SNG) vehicles, Fly-Aways and other mobile applications (we offer special housings for compact mobile applications), see next page "SPECIALS AND OEM PRODUCTS").

Technology of the 4th Generation

All WORK Microwave outdoor converters are equipped with the most modern technology of WORK Microwave's 4th generation satellite converters. This design allowed us to reduce the number of components by more than 30%. In addition significant circuit improvements were made. This design results in an AC power consumption of typically 35 VA / 27 W. The housing includes special internal heat dissipation structures, resulting in a completely passively cooled unit. All this leads to higher reliability and longer lifetime.

Outdoor installation

WORK Microwave's outdoor converters are best fit to be mounted directly to the antenna. They do not require additional protection against water. The housing provides environmental protection according to IP67 (temporary flooding) when all cables are connected and sealed appropriately. Special environmental protection sleeves for the coaxial connectors allow optimal sealing from the housing to the cable. Additionally the housing should be mounted with the connector side down. Alternatively the connector panel can be in a vertical position.

S-, C-, X-, KU- and K-, single, dual or triple band

WORK Microwave is offering the satellite outdoor converters as single band units covering S-, C-, X-, Ku-, K-Band and Ka-Band or as Dual or Triple band units covering a combination of these frequency bands. They support the standard IF-frequency of 70 ± 20 MHz or/and 140 ± 40 MHz. The conversion is performed without spectral inversion. All WORK Microwave upconverters offer an increased power output ($P_{1\text{dB}} = +10$ dBm) in all versions.

High signal integrity

The extreme low phase noise of the oscillators guarantees a very good signal quality. Low spurious emissions allow using the converters also in environments with demanding requirements, like high power video uplinks. Sophisticated temperature compensation guarantees gain stability over the full temperature range.

Operating and control – easy integration into your system

The converters can be operated via remote control (RS 232, RS422/485). Detailed monitoring of the system status and a summary alarm output (dual change over switch contacts) are provided. For the remote control either ASCII string based commands as well as addressable, packet based commands are provided.

A separate 19" rack mount remote control unit allows remote control of one or more units. The front panel of this unit is similar to the front panel of the 19" rack mount type.

Specials and OEM products

WORK Microwave is specialized to offer custom tailored products. More than 40% of our converters are sold as OEM products with our customer's brand name and logo on it.

We offer specials as follows:

- Modified or smaller housings
- Different IF or RF frequency, a Ka-Band (28GHz) version is under development
- Customized M&C interface and control syntax
- Extended storage or operating temperature range
- Military versions for hostile environment (shock, vibration, humidity)

Key features

- 70 MHz or 140 MHz IF bands available
- Optional switchable IF 70 and 140 MHz (IF 70/140)
- Extreme low power consumption typical 29 VA / 18 W (single band unit) 35VA / 25W (triple band units)
- Extreme low phase noise (< -50 dBc/Hz @10 Hz)

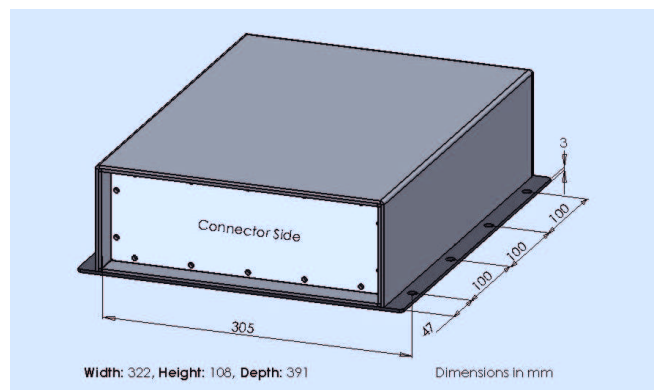
- Long term stability 10⁻⁷ / year
- Output power +10 dBm (1dB compression point)
- Low spurious emissions < - 80 dBm at full gain (high performance series)
- Adjustable equalizer ± 2.5 dB / 40 MHz
- Digital gain compensation
- Operating temperature range -30 °C to 60 °C (-22 °F to 140 °F), storage temperature -50 °C to 80 °C (-58 °F to 140 °F)
- Remote control through RS232 and RS422/485 (2-wire or 4-wire bus) interfaces
- Packet command syntax supports RS485 bus systems and allows addressed operation
- Summary alarm output (dual change over switch contacts) and transmit mute input
- IP 67 protected housing
- CE compliant
- **3 years warranty**

Order information

For the Outdoor version only the High Performance type is available due to environmental conditions which require the extended temperature range.

Open questions, demo units

If you need more information about WORK Microwave's 4th satellite converter generation or if you would like to have a demo unit, please contact us via e-mail: sales@work-microwave.de or call us. We are glad to assist you.



Dimensions of Outdoor Housing

Satellite Upconverter

Outdoor Version

Single / Dual / Triple Band
S-, C-, X-, Ku-, K-, Ka-Band
H-Type (extended temperature range)

Upconverter Type:	HCU-S-OD	HCU-C-OD	HCU-C1-OD	HCU-X-OD
RF-Output Frequency:	S-Band 2.025...2.110 GHz	C-Band 5.85...6.65 GHz	C-Band 5.85...7.025 GHz	X-Band 7.90...8.40 GHz
Intermediate Frequency:	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2610 MHz for 70 MHz IF Input 2600 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 60 - 80 - 90 - 100 - 105 ¹⁾ - 112 ¹⁾	- 55 - 75 - 85 - 95 - 100 ¹⁾ - 110 ¹⁾	- 53 - 73 - 83 - 93 - 98 ¹⁾ - 108 ¹⁾
max. values in dBc/ Hz ¹⁾ 0°C to 50°C, outside this temperature range degraded by max 5 dB.				

Upconverter Type:	HCU-Ku-OD	HCU-K-OD	HCU-Ka-OD	Other bands
RF-Output Frequency:	Ku-Band 12.75...14.50 GHz	K-Band 17.3...18.4 GHz	Ka-Band 29.7...31.5 GHz	available on request as for HCU / SCU Indoor units
Intermediate Frequency:	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	2450 MHz for 70 MHz IF Input 2440 MHz for 140 MHz IF Input	
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 50 - 70 - 80 - 90 - 95 ¹⁾ - 105 ¹⁾	- 50 - 70 - 80 - 90 - 95 ¹⁾ - 105 ¹⁾	- 56 - 66 - 76 - 86 - 88 ¹⁾ - 101 ¹⁾
max. values in dBc/ Hz ¹⁾ 0°C to 50°C, outside this temperature range degraded by max 5 dB.				

Conversion Scheme:	Dual up-conversion, no frequency inversion
Frequency Resolution:	10 Hz
IF-Input Characteristics:	Frequency: 70 ± 20 MHz or 140 ± 40 MHz (optional: both: [IF-Band] = 70/140, not in combination with Dualband or Triband units) Impedance: 50 or 75 Ω Return Loss: 26 dB min IF-Connectors: N female
RF-Output Characteristics:	Impedance: 50 Ω Return Loss: >20 dB ** 1 dB Compression Point: >10 dBm Output Muting: >60 dB (by command or sense input or by alarm condition) RF-Connectors: SMA female
Transfer Characteristics:	Max. Conversion Gain: 40 dB Attenuation Range: 0...30 dB, Step 0.1 dB (Conversion Gain 40...10 dB) Gain Accuracy: ± 1 dB Level Stability: ± 0.25 dB/day (constant temperature) Amplitude Response: ±0.2 dB / ± 18 MHz, ± 0.25 dB / ±20 MHz, ±0.4 dB / ± 40 MHz Image Rejection: >80 dB Noise Figure: <25 dB, 20 dB typical
Equalizer (Gain Slope):	max ± 2.5 dB / 40 MHz (IF 70 MHz), max ± 4 dB / 80 MHz (IF 140 MHz) (programmable)
Group Delay (± 18 MHz):	Linear: 0.03 ns / MHz max. Parabolic: 0.01 ns / MHz ² max. Ripple: 1 ns peak to peak max.
Group Delay (± 36 MHz):	Linear: 0.015 ns / MHz max. Parabolic: 0.005 ns / MHz ² max. Ripple: 2 ns peak to peak max.
Intermodulation (3rd Order):	-36 dBc max (f _{in} : 67.5 and 72.5 MHz, P _{in} : 2 x -25 dBm, P _{out} : 2 x 0 dBm)
AM / PM conversion:	0.1 ° / dB (P _{out} = 0 dBm)
Spurious Outputs:	Signal related: < - 60 dBc (Δf < 1 MHz), < -70 dBc (Δf ≥ 1 MHz) Signal independent: < - 70 dBm
Frequency Stability:	± 1 x 10 ⁻⁷ 0°C to 50°C ± 2 x 10 ⁻⁸ 0°C to 50°C (after 30 min warm up) ± 1.5 x 10 ⁻⁹ per day (fixed temperature after 24 h warm up)

Specifications continued next page

Satellite Upconverter

Outdoor Version

Single / Dual / Triple Band

S-, C-, X-, Ku-, K-Band

H-Type (extended temperature range)

Specifications continued:

Reference Input (Option):	Frequency: 10 MHz or 5 MHz Level: -3...10 dBm Modes: internal, external, auto (senses reference input) Impedance: 50 Ω Connector: SMA female
Reference Output (Option):	Frequency: 10 MHz Level: 0 ± 3 dBm Impedance: 50 Ω Connector: SMA female
Monitoring and Control Interface:	RS232 or RS422/RS485 Alarm Output: Two potential free contacts (DPDT) 24 V DC output: max 0,3 A 6,5 V DC output: max 0,2 A Mute Input: TTL logic input with internal pull up (Connector type: MIL-C-26482: MS 3120 E 14-19 S)
Temperature Range:	HCU : -30°C to 60°C operating (10 minutes warm up at -30°C) -30°C to 80°C storage
Relative Humidity:	100 %
Power Supply:	85...264 V AC, 40...70 Hz
Power Consumption:	Max: 33 VA / 20 W Typ: 29 VA / 18 W (single converters)
Mains Power Input:	Amphenol: C16-1 male
Dimension and Weight:	322 x 108 x 322 mm ³ appr. 8.4 kg
Degree of Protection:	IP 67 (acc. IEC 529)

Specifications are subject to change

Order Information:

HCU-[RF Band(s)]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Single or Dual upconverter
HCUx-[RF Band(s)]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Multiband upconverter
 x=2: Dualband converter, x=3: Triband converter

Possible Options are: **RIN** (reference input)
ROUT (reference output)

Examples:

HCU-X-OD-70-50 (X-band upconverter)

HCU3-CXKu-70-50 (triband upconverter)

HCU-Ku-OD-70-50-RIN (Ku band upconverter with reference input)

HCU-Ku-OD-70/140-50 (Ku band upconverter with 70/140 MHz IF switchable)

Satellite Downconverter

Outdoor Version

Single / Dual / Triple Band

S-, C-, X-, Ku-Band

H-Type (extended temperature range)

Downconverter Type:	HCD-S-OD	HCD-C-OD	HCD-C1-OD	
RF-Input Frequency:	S-Band 2.2...2.3 GHz	C-Band 3.4...4.2 GHz	C-Band 3.4...4.8 GHz	
Intermediate Frequency:	2450 MHz for 70 MHz IF Output 2440 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 60 - 80 - 90 - 100 - 105 ¹⁾ - 112 ¹⁾	- 56 - 76 - 86 - 96 - 101 ¹⁾ - 111 ¹⁾	- 56 - 76 - 86 - 96 - 101 ¹⁾ - 111 ¹⁾
max. values in dBc/ Hz ¹⁾ 0°C to 50°C, outside this temperature range degraded by max 5 dB.				

Downconverter Type:	HCD-X-OD	HCD-Ku-OD	HCD-Ku4-OD	Other bands
RF-Input Frequency:	X-Band 7.25...7.75 GHz	Ku-Band 10.70...12.75 GHz	Ku-Band 9.3...9.5 GHz	available on request as for HCD / SCD Indoor units
Intermediate Frequency:	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	2150 MHz for 70 MHz IF Output 2140 MHz for 140 MHz IF Output	
Phase Noise:	10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz	- 53 - 73 - 83 - 93 - 98 ¹⁾ - 108 ¹⁾	- 50 - 70 - 80 - 90 - 95 ¹⁾ - 105 ¹⁾	- 50 - 70 - 80 - 90 - 95 ¹⁾ - 105 ¹⁾
max. values in dBc/ Hz ¹⁾ 0°C to 50°C, outside this temperature range degraded by max 5 dB.				

Conversion Scheme:	Dual down-conversion, no frequency inversion	
Frequency Resolution:	10 Hz	
RF-Input Characteristics:	Impedance:	50 Ω
	Return Loss:	>20 dB
	Max. input level:	< approx. -25 dBm (operational) < approx. +10 dBm (damage level)
	LO Leakage:	-80 dBm max.
	RF-Connector:	SMA female
IF-Output Characteristics:	Frequency:	70 ± 20 MHz or 140 ± 40 MHz (optional: both: [IF-Band] = 70/140, not in combination with Dualband or Triband units)
	Impedance:	50 or 75 Ω
	Return Loss:	26 dB min
	1 dB Compression Point:	>10 dBm, 13 dBm typical
	Output Muting:	>60 dB (by command or sense input or by alarm condition)
	IF-Signal Monitor:	-20 dB of IF-output
	IF-Connectors:	N female
Transfer Characteristics:	Max. Conversion Gain:	45 dB
	Attenuation Range:	0...30 dB, Step 0.1 dB (Conversion Gain 45...15 dB)
	Gain Accuracy:	± 1 dB
	Level Stability:	± 0.25 dB/day (constant temperature)
	Amplitude Response:	±0.2 dB / ± 18 MHz, ± 0.25 dB / ±20 MHz, ±0.4 dB / ± 40 MHz
	Image Rejection:	>80 dB
	Noise Figure:	<12 dB, 10 dB typical
Equalizer (Gain Slope):	max ± 2.5 dB / 40 MHz (IF 70 MHz), max ± 4 dB / 80 MHz (IF 140 MHz) (programmable)	
Group Delay (± 18 MHz):	Linear:	0.03 ns / MHz max.
	Parabolic:	0.01 ns / MHz ² max.
	Ripple:	1 ns peak to peak max.
Group Delay (± 36 MHz):	Linear:	0.015 ns / MHz max.
	Parabolic:	0.005 ns / MHz ² max.
	Ripple:	2 ns peak to peak max.
Intermodulation (3rd Order):	-60 dBc max (Δf _{in} : 5 MHz, P _{in} : 2 x -40 dBm, P _{out} : 2 x -10 dBm)	
AM / PM conversion:	0.1 ° / dB (P _{out} = 0 dBm)	
Spurious Outputs:	Signal related:	< - 60 dBc (Δf < 1 MHz), < -70 dBc (Δf ≥ 1 MHz)
	Signal independent:	< - 76 dBm (< - 80 dBm typical)

Specifications continued next page

Satellite Downconverter

Outdoor Version

Single / Dual / Triple Band

S-, C-, X-, Ku-, K-Band

Specifications continued:

Frequency Stability:	$\pm 1 \times 10^{-7}$, 0°C to 50°C $\pm 2 \times 10^{-8}$, 0°C to 50°C (after 30 min warm up) $\pm 1.5 \times 10^{-9}$ per day (fixed temperature after 24 h warm up)
Reference Input (Option):	Frequency: 10 MHz or 5 MHz Level: -3...10 dBm Modes: internal, external, auto (senses reference input) Impedance: 50 Ω Connector: SMA female
Reference Output (Option):	Frequency: 10 MHz Level: 0 ± 3 dBm Impedance: 50 Ω Connector: SMA female
Monitoring and Control Interface:	RS232 or RS422/RS485 Alarm Output: Two potential free contacts (DPDT) 24 V DC output: max 0,3 A 6,5 V DC output: max 0,2 A Mute Input: TTL logic input with internal pull up (Connector type: MIL-C-26482: MS 3120 E 14-19 S)
Temperature Range:	HCU : -30°C to 60°C operating (10 minutes warm up at -30°C) -30°C to 80°C storage
Relative Humidity:	100 %
Power Supply:	85...264 V AC, 40...70 Hz
Power Consumption:	Max: 33 VA / 20 W Typ: 29 VA / 18 W (single converters)
Mains Power Input:	Amphenol: C16-1 male
Dimension and Weight:	322 x 108 x 392 mm ³ appr. 8.4 kg
Degree of Protection:	IP 67 (acc. IEC 529)

Specifications are subject to change

Order Information:

HCD-[RF Band]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Single converter
HCDx-[RF Band(s)]-[IF Band in MHz]-[IF Imp in Ω]-[Options] Multiband converter
 x=2: Dualband converter, x=3: Triband converter

Possible Options are: **RIN** (reference input)
ROUT(reference output)

Examples:

HCD-X-OD-70-50 (X-band downconverter)
HCD3-CXKu-70-50 (triband downconverter)
HCD-Ku-OD-70-50-RIN (Ku band downconverter with reference input)
HCD-Ku-OD-70/140-50 (Ku band downconverter with 70/140 MHz IF switchable)