



64 x 64 L-band Hurricane Matrix

ultra compact, with configurable inputs & outputs

Typical applications:

- Managing multiple inputs for growing satellite teleports
- Extended L-band frequency for Ka-band & HTS applications
- Routing live traffic to multiple modems

ETL's new ultra compact Hurricane matrix provides routing for up to 64 input and output feeds, with integrated LNB powering in a 4U high chassis. The configurable design offers a range of input and output modules (IO modules) with features to suit specific RF needs for each satellite feed. The matrix can be expanded from 8x8 up to 64x64 in blocks of 8.



★ **Configurable** input and output modules with features to suit specific RF needs for each satellite feed, including fixed gain, variable gain, LNB powering & fibre inputs

IO Module Options

STANDARD



H-IO-01

- Passive input or output module (0 dB gain matrix)
- RF power monitoring

VARIABLE GAIN



H-IN-02 &
H-IN-05
H-OP-08

- Variable gain input module (-10 to +20 dB, in 0.5 dB steps)
- Variable slope (0 to 6 dB, in 1 dB steps)
- 13/18V & 22kHz tone LNB powering (H-IN-05 only)
- RF power monitoring

FIBRE INPUT



H-IN-03

- Optical fibre input module
- AGC with settable output power level
- RF power monitoring

LNB POWER



H-IN-04

- Passive input module (0 dB gain matrix)
- 13/18V & 22kHz tone LNB powering
- RF power monitoring

🖥️ **Compact** 4U high chassis providing 64 inputs x 64 outputs with integrated LNB powering. Expandable in blocks of 8.

🛡️ **Resilience** from dual redundant power supplies & dual redundant CPU modules

👤 **Minimal training** with capacitive touchscreen controls, intuitive HMI and an improved web browser interface

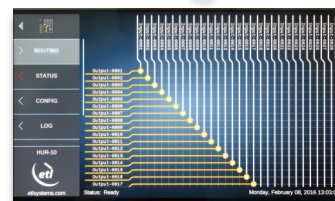
⚡ **LNB Powering** 13/18V & 22kHz tone available

✅ **Minimal downtime** in the unlikely event of a failure all active components can be hot-swapped without the need to re-boot the matrix. This includes power supplies, CPU modules, RF modules & fan trays

📡 **850-2450 MHz** operating frequency range. Ka-band ready.

⚡ **Power savings** as only active signal routes are powered. This provides a greatly reduced power consumption compared to traditional matrices

❄️ **Temperature monitoring** with intelligent fan speed control





ETL Systems

Excelling in RF Engineering

Model Number:
HUR-10

Flexibility & Reliability

Tune the matrix for optimum system performance



Hurricane Rear Panel



IO (Input and Output) modules can be mixed and configured to exact earth station requirements within the same matrix.

- For distant antennas, fibre modules can be used on the inputs of the matrix
- For large antennas, passive input or output modules can be installed to provide unity gain
- For smaller antennas or weak signals, variable gain, active input modules are ideal

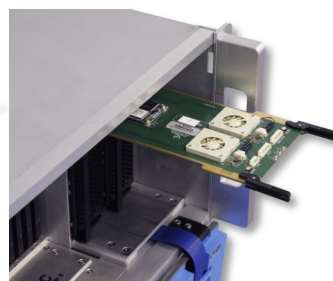
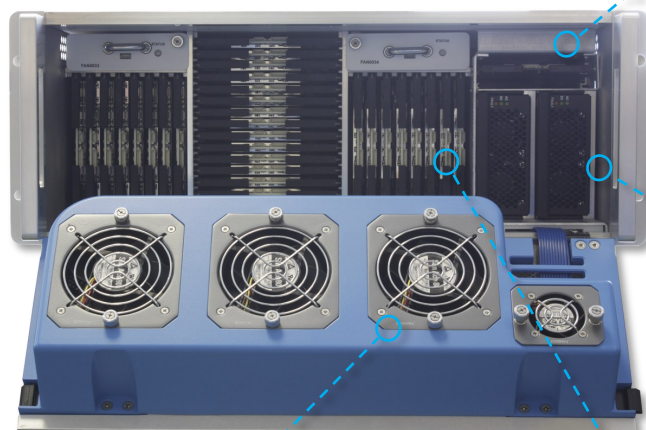


Impedance mismatch problems can be avoided with the option of mixed impedances on IO modules (input to input or input to output).

32 input modules and 32 output modules are installed on a fully populated 64 x 64 matrix.

Enhanced resilience

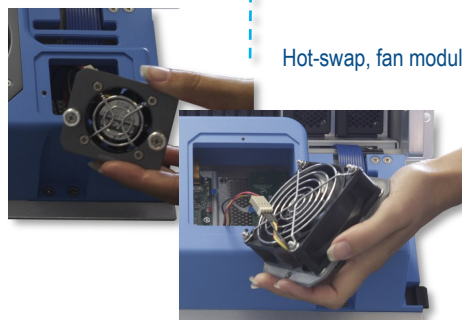
Hurricane Internal View



Hot-swap, dual redundant CPU modules



Hot-swap, dual redundant power supplies



Hot-swap, fan modules



Hot-swap, input matrix cards (IMC), middle matrix cards (MMC) and output matrix cards (OMC)

Note 1: The specification is subject to regular reviews and will be updated from time to time as part of our continuing product development and improved specification accuracy.
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Configuration Options:

Active Input Module (H-IN-02) with Passive Output Module (H-IO-01) - No LNB option

Active Input Module (H-IN-05) with Passive Output Module (H-IO-01) - LNB option

Technical specifications and operating parameters					
Capacity		64 inputs x 64 outputs			
Routing		Distributive, non-blocking		Any input can be connected to any number of outputs	
Frequency Range		850-2450 MHz (Extended L-band)			
Variable Gain Range	Gain Max.	+20 dB ± 2 dB		Mean Gain	
	Gain Min.	-10 dB ± 2 dB			
Gain Step		0.5 ± 0.25 dB			
Gain Tracking 0 dB gain setting		4 dB		Difference in mean gain between any two outputs when the same input is routed to both	
Variable Slope Control		0 to 6 dB ± 1 dB		Positive slope. Pivot point at 2150 MHz	
Slope Step		1 dB ± 0.5 dB			
RF Connectors & impedances		50Ω SMA (S5)	50Ω BNC (B5)	75Ω BNC (B7)	75Ω F-type (F7)
Gain Flatness Typical values when slope is set to 0 dB. Any gain setting.	Full band (850-2450 MHz)	±2.75 dB	±2.80 dB	±3.0 dB	±3.0 dB
	Full band (850-2150 MHz)	±2.50 dB	±2.60 dB	±2.75 dB	±2.75 dB
	Any 36 MHz	±0.50 dB	±0.60 dB	±0.65 dB	±0.65 dB
Input Return Loss	Typical	18 dB	18 dB	16 dB	16 dB
	Minimum	14 dB	14 dB	12 dB	12 dB
Output Return Loss	Typical	18 dB	18 dB	16 dB	16 dB
	Minimum	14 dB	14 dB	12 dB	12 dB
Noise Figure	@ +20 dB gain	9 dB typical		12.5 dB typical	
	@ 0 dB gain	24 dB typical		24 dB typical	
	@ -10 dB gain	34 dB typical		34 dB typical	
Group Delay Variation Peak - peak across specified bandwidth	850-2150 MHz	±1.5 ns			
	850-2450 MHz	±2 ns			
	Any 36 MHz	±0.5 ns			
Isolation At 0 dB gain & 0 dB slope settings	I/P - I/P	70 dB typical, 55 dB minimum (Between any 2 input ports)			
	O/P - O/P	70 dB typical, 55 dB minimum (Between any 2 output ports)			
	I/P - O/P	60 dB typical, 50 dB minimum (Between any pair of input & output ports)			
Output P1dB 1 dB Gain Compression, output power		+5 dBm typical, +3 dBm minimum			
OIP3 3rd order intercept point, output power		+15 dBm typical, +12 dBm minimum			
OIP2 2nd order intercept point, output power		+28 dBm typical, +25 dBm minimum			
RF Input Power Sensing Range		0 to -65 dBm, 45 dBm instantaneous dynamic range, auto-sensing level			
Input RF Power		+20 dBm (100mW) Absolute maximum, damage level			
LNB Powering Available with H-IN-05 input IO module		Voltages: 0/13/18VDC @ 400mA, 0/22 kHz tone, user selectable		Current: 250 mA nominal, 400 mA max Fitted with short circuit protection	

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Configuration Options:

Passive Input Module (H-IO-01) with Passive Output Module (H-IO-01) - **No LNB option**
Passive Input Module (H-IN-04) with Passive Output Module (H-IO-01) - **LNB option**

Technical specifications and operating parameters					
Capacity		64 inputs x 64 outputs			
Routing		Distributive, non-blocking		Any input can be connected to any number of outputs	
Frequency Range		850-2450 MHz (Extended L-band)			
Gain		0 dB ± 2 dB		Mean Gain	
Gain Tracking 0 dB gain setting		4 dB		Difference in mean gain between any two outputs when the same input is routed to both	
RF Connectors & impedances		50Ω SMA (S5)	50Ω BNC (B5)	75Ω BNC (B7)	75Ω F-type (F7)
Gain Flatness Any gain setting	Full band (850-2450 MHz)	±2.75 dB	±2.80 dB	±3.0 dB	±3.0 dB
	Full band (850-2150 MHz)	±2.50 dB	±2.60 dB	±2.75 dB	±2.75 dB
	Any 36 MHz	±0.50 dB	±0.60 dB	±0.65 dB	±0.65 dB
Input Return Loss	Typical	18 dB	18 dB	16 dB	16 dB
	Minimum	14 dB	14 dB	12 dB	12 dB
Output Return Loss	Typical	18 dB	18 dB	16 dB	16 dB
	Minimum	14 dB	14 dB	12 dB	12 dB
Noise Figure		24 dB typical			
Group Delay Variation Peak - peak across specified bandwidth	850-2150 MHz	±1.5 ns			
	850-2450 MHz	±2 ns			
	Any 36 MHz	±0.5 ns			
Isolation At 0 dB gain & 0 dB slope settings	I/P - I/P	70 dB typical, 55 dB minimum (Between any 2 input ports)			
	O/P - O/P	70 dB typical, 55 dB minimum (Between any 2 output ports)			
	I/P - O/P	60 dB typical, 50 dB minimum (Between any pair of input & output ports)			
Output P1dB 1 dB Gain Compression, output power		+5 dBm typical, +3 dBm minimum			
OIP3 3rd order intercept point, output power		+15 dBm typical, +12 dBm minimum			
OIP2 2nd order intercept point, output power		+28 dBm typical, +25 dBm minimum			
RF Input Power Sensing Range		0 to -65 dBm, 45 dBm instantaneous dynamic range, auto-sensing level			
Input RF Power		+20 dBm (100mW) Absolute maximum, damage level			
LNB Powering Available with H-IN-05 input IO module		Voltages: 0/13/18VDC @ 400mA, 0/22 kHz tone, user selectable		Current: 250 mA nominal, 400 mA max Fitted with short circuit protection	

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Configuration Options:
Optical Input Module (H-IN-03) with Passive Output Module (H-IO-01)

Technical specifications and operating parameters

Input Plane: Optical Input Ports						
Capacity		64 inputs				Non-blocking
Optical Input Wavelength Range		1100 to 1650 nm				Will support lower wavelengths
Optical Input Power Range		-9.5 to +3.5 dBm				
Input Optical Connector Options		FC/APC & SC/APC				Single mode fibre, angle polished connectors only
Output Plane: RF Output Ports						
RF Output Frequency Range		850 - 2450 MHz (Extended L-band)				
Gain Tracking		4 dB				Difference in mean gain between any two outputs when the same input is routed to both
RF Connectors & impedances		50Ω SMA (S5)	50Ω BNC (B5)	75Ω BNC (B7)	75Ω F-type (F7)	
Output Return Loss	Typical	18 dB	18 dB	16 dB	16 dB	
	Minimum	14 dB	14 dB	12 dB	12 dB	
System Performance: RF to Fibre & back to RF						
Gain		0 dB (±2 dB)				Test Condition: when passive IO module H-IN-02-XX is fitted at input and output ports
Output RF Connectors		50Ω SMA (S5)	50Ω BNC (B5)	75Ω BNC (B7)	75Ω F-type (F7)	Test Condition: when passive IO module H-IN-02-XX is fitted at input and output ports
Gain Flatness	Full band 850-2450 MHz	±2.75 dB	±2.80 dB	±3.00 dB	±3.00 dB	
	Full band 850-2150 MHz	±2.50 dB	±2.60 dB	±2.75 dB	±2.75 dB	
	Any 36 MHz	±0.50 dB	±0.60 dB	±0.65 dB	±0.65 dB	
Gain Flatness	850-2450 MHz	±1.75 dB				Test condition: Full TX & RX link with 1m fibre link using transmitter SRY-TX-L1-103 (1310nm). Fixed gain mode.
	850-2150 MHz	±1.25 dB				
	Any 36 MHz i/p >-50 dBm	±0.35 dB				
	Any 36 MHz i/p <-50 dBm	±0.5 dB				
Output AGC Flatness	850-2450 MHz	±1.75 dB				Test condition: Full TX & RX link with 1m fibre link using transmitter SRY-TX-L1-103 (1310nm). Input levels within –10 to –40 dBm.
	850-2150 MHz	±1.50 dB				
Group Delay Variation	850-2150 MHz	±1.5 ns				Peak-Peak across specified bandwidth. Typical values. Test condition: Full TX &RX link with 1m fibre link using transmitter SRY-TX-L1-103 (1310nm). Fixed gain mode
	850-2450 MHz	±2 ns				
	Any 36 MHz	±0.5 ns				
Isolation	Input - Input	70 dB typical, 55 dB minimum				Between any 2 relevant ports. Test condition: Full TX &RX link with 1m fibre link using transmitter SRY-TX-L1-103 (1310nm). Fixed gain mode
	Output - Output	70 dB typical, 55 dB minimum				
	Input - Output	60 dB typical, 50 dB minimum				
Noise Figure		10dB typical, 12dB maximum				Test condition: SRY-TX-L1-103, 0 dB optical link loss, -50 dBm RF i/p power, -10 dBm o/p power
CNR (any 36MHz)		+18 dB typical, +12 dB minimum				
Output P1		+5 dBm typical, +1 dBm minimum				Test condition: SRY-TX-L1-103, 0 dB optical link loss, -50 dBm RF i/p power, -10 dBm o/p power
Output IP3		18 dBm typical, 12 dBm minimum				Test condition: SRY-TX-L1-103, 1m fibre, 10 dB gain, -22 dBm tones at 2150 and 2152 MHz
SFDR		105 dB typical, 100 dB minimum				Test condition: SRY-TX-L1-103, 1m fibre, 10 dB gain, -22 dBm tones at 2150 and 2152 MHz



Configuration Options:
Passive Input Module H-IO-01 with Active Output Module H-OP-08

Technical specifications and operating parameters						
Capacity		64 inputs and 64 outputs			Non-blocking	
Operating Frequency Range		850 to 2450 MHz				
Variable Gain Range Maximum Gain: Minimum Gain: Variable Gain Step:		+20dB (± 2.5 dB) -10dB (± 2.5 dB) 0.5 dB (± 0.25 dB)			Relative to the mean gain across the frequency range.	
Gain Tracking		4 dB			Worst case difference in gain between any channel at a given frequency.	
Variable Slope (Tilt) Control: Slope Step:		0 dB to - 6dB (± 1 dB) 0.5 dB (± 0.5dB)			Positive Slope with pivot point at 2150MHz	
Connectors & impedances		50Ω SMA (S5)	50Ω BNC (B5)	75Ω BNC (B7)	75Ω F-type (F7)	Optical input port is also available with IO module H-IN-03-XX
Input Return Loss		Typ. 17 dB Min. 13 dB	Typ. 17 dB Min. 13 dB	Typ. 16 dB Min. 12 dB	Typ. 16 dB Min. 12 dB	
Output Return Loss		Typ. 17 dB Min. 13 dB	Typ. 17 dB Min. 13 dB	Typ. 16 dB Min. 12 dB	Typ. 16 dB Min. 12 dB	
Gain Flatness	L-band 950-2150 MHz	±1.75 dB	±1.75 dB	±2.75 dB	±2.75 dB	Typical values when slope is set to 0dB , at any gain setting.
	Full band 850-2450 MHz	±2.50 dB	±2.50 dB	±3.00 dB	±3.00 dB	
	Any 36 MHz	±0.50 dB	±0.50 dB	±0.65 dB	±0.65 dB	
Group Delay Variation	950-2150 MHz	±0.5 ns pk-pk				Peak to peak, across the specified bandwidth.
	850-2450 MHz	±0.5 ns pk-pk				
	Any 36 MHz	±0.25 ns pk-pk				
Noise Figure (Typ.): L-band (Up to 2150 MHz) Full band (Up to 2450 MHz)		22 25		25 28		Maximum (worst case) = Typ. + 2dB
RF Input Power Sensing Range:		-5 to –55 dBm				
Absolute Maximum RF Input Power:		+20 dBm (100mW)				No damage level. Operation beyond this level may cause damage to the product.
Input P1dB (Typ.): At +20dB Gain: At 0dB Gain: At –10dB Gain:		-8 dBm -6 dBm -2 dBm		-10 dBm -8 dBm -4 dBm		Measured at 0dB slope setting
Output IP3 (Typ.): At +20dB Gain: At 0dB Gain: At –10dB Gain:		+25 dBm + 8 dBm + 0 dBm		+ 27 dBm + 10 dBm + 2 dBm		Measured at 0dB slope setting
Isolation Values: at 0dB Gain and 0dB Slope Settings						
Input– Input		Typ. 70 dB Min. 60 dB				Between any pair of input ports.
Output– Output		Typ. 70 dB Min. 60dB				Between any pair of output ports.
Input– Output		Typ. 60 dB Min. 50 dB				Between any pair of input & output ports.
Spectral Purity						
Signal Related Spurs (Max.)		-60 dBc				Relative to carrier, in the 850-2450MHz band.
Non-Signal Related Spurs (Typ.)		-110dBm in 10kHz				Measured in a 10kHz bandwidth, DC-6GHz
LNB Power: available with H-IN-04-XX input IO module						
LNB Powering		Yes				User Selectable
LNB Voltages		0/13/18VDC				User Selectable
LNB Current (Max.)		400 mA max				Fitted with short circuit protection
22KHz tone:		0/22 kHz				ON/OFF User Selectable



Common System Performance - applicable to all IO modules

Technical specifications and operating parameters

LNB Powering (via IO module)		
LNB Power		Dependent on IO module - refer to IO module User selectable on inputs, up to maximum of 180W (e.g. 25 LNB feeds at 400mA each)
LNB Current Alarm	Over-current	450mA
	Under-current	50mA
LNB Short Circuit Protection		Electronic fuse Automatic reset when short removed

System Control		
Remote Control		
Serial Port (RS232 or RS422/485) Ethernet port (RJ45) 10/100/1000 Base Tx ETL protocol over TCP, supports up to 32 concurrent connections SNMP Web browser interface, for 5 connections Grass Valley NVision NV9000 (in development)		
Local Control		
HMI capacitive touch screen		
Secure Communications		
HTTPS (in development) SNMPv3 (in development) IPSEC (in development)		
Alarms		Dry contact (D-type) & via communication Summary alarm on dry contact. Comprehensive alarm status on communication protocols & front panel
Switching Time		10ms max Measured from receipt of command on serial port to establishment of RF signal
RF Level Alarms		
Configurable upper and lower RF level alarms		
Amplifier Status		All RF amplifiers monitored Local & remote reporting
Temperature Monitoring		All cards & modules individually monitored Alarms when pre-set limits are exceeded
Fan Speed Monitoring		All fans fitted with electronic tachometers Alarm on over or under speed
PSU Loading		Monitor unit power consumption Local & remote reporting

Environmental		
Operating temperature		0 to 45°C
Location		Indoor use only
Storage temperature		-20°C to +75°C
Humidity		20 to 90% non-condensing Relative humidity
Maximum Altitude		10,000 feet AMSL Above Mean Sea Level

Physical	
All RF cards	Hot-swap
PSU modules	Dual redundant & hot-swap. No external PSU required for LNB power.
CPU's	Dual redundant & hot-swap.
IO modules	Hot-swap
Dimensions	4U high x 650mm deep x 19" wide
Weight	40 kg
Colour	RAL9023 – Pearl Dark Grey

Power		
PSU Power		85-264Vac (47/63Hz) Fused, 4A
Power Consumption		450W (TBC)
MTBF	150,000 hours (17.1 years) TBC	Fully populated 64x64 chassis
	200,000 hours (22.8 years) TBC	Each IO module
	180,000 hours (20.5 years) TBC	Each active RF card
MTTR		20 minutes Assumes recommended spares are available

Absolute Maximum Ratings		
Max DC Voltage on IO Ports		48Vdc All ports are DC blocked

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