



# 128 x 128 L-band Harrier Matrix

ultra compact, with configurable inputs & outputs

ETL's new ultra compact Harrier matrix provides routing for up to 128 input and output feeds, with integrated LNB powering in a 10U 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 128x128 in blocks of 8.

**Typical applications:**

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



**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

## Module Options

**PASSIVE INPUT/OUTPUT**



H-IO-01

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

**ACTIVE INPUT**



H-IN-02

- Active variable gain input module (-10 to +20 dB, in 0.5 dB steps)
- Variable slope (0 to 6 dB, in 1 dB steps)
- RF power sensing

**ACTIVE FIBRE INPUT**



H-IN-03

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

**PASSIVE LNB INPUT**



H-IN-04

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

**ACTIVE LNB INPUT**



H-IN-05

- Active variable gain input module (-10 to +20 dB, in 0.5 dB steps)
- Variable slope (0 to 6 dB, in 1 dB steps)
- LNB powering
- RF power sensing

**ACTIVE OUTPUT**



H-OP-08

- Active variable gain input module (up to +30 dB)
- Variable slope
- RF power sensing

**Compact** 10U high chassis providing 128 inputs x 128 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

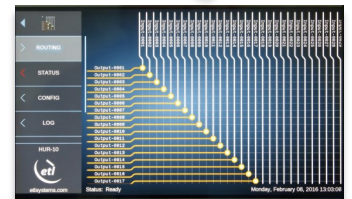
**LNB Powering** 13/18V & 22kHz tone available

**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

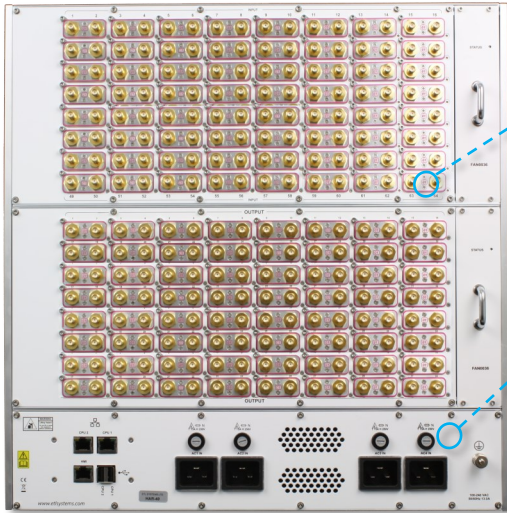
**Temperature monitoring** with intelligent fan speed control





## Flexibility & Reliability

### Tune the matrix for optimum system performance



Harrier 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

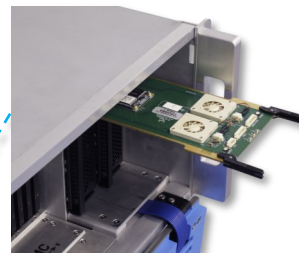
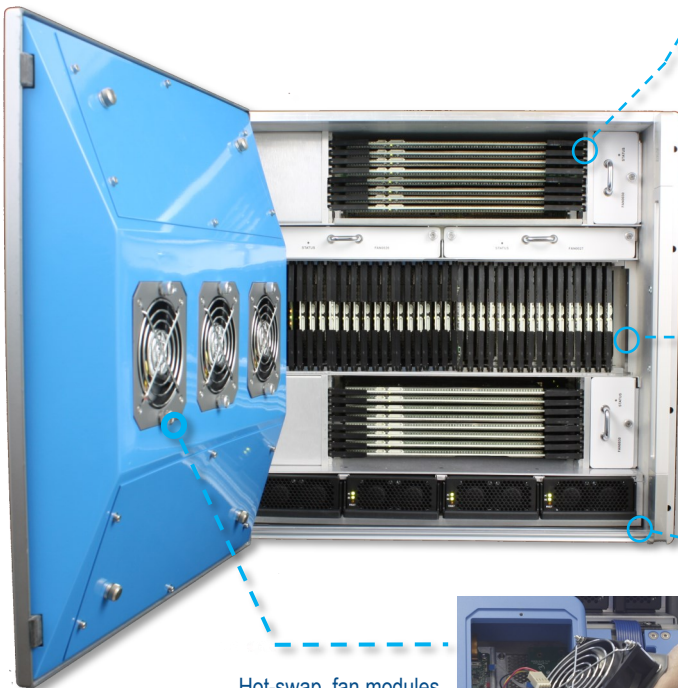


Impedance mismatch problems can be avoided with the option of mixed impedances on IO modules (input to input or input to output).

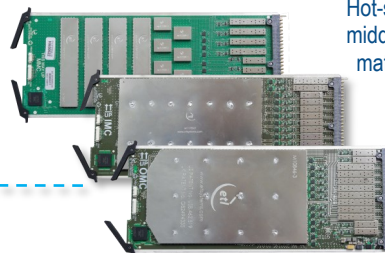
64 input modules and 64 output modules are installed on a fully populated 128 x 128 matrix.

## Enhanced resilience

Harrier Internal View



Hot-swap, dual redundant CPU modules



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



Hot-swap, dual redundant power supplies



Hot-swap, fan modules

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.  
Note 2: Operation beyond the quoted limits stated above may cause instantaneous and permanent damage.



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		128 inputs x 128 outputs		Non-blocking	
Frequency Range		850-2450 MHz (Extended L-band)			
Gain		0 dB ( $\pm 2.0$ dB)		Relative to the mean gain across the frequency range	
Gain Tracking (Typ.)		4 dB		Difference in mean gain between any two outputs when the same input is routed to both. Measured at 0dB gain	
Noise Figure (Typ.)	L-band (up to 2150 MHz)	20 dB		Maximum (worst case) = Typ. +2dB	
	Full band (up to 2450 MHz)	22 dB			
Group Delay Variation (Max.)	950-2150 MHz	$\pm 0.5$ ns pk-pk		Peak to peak, across the specified bandwidth	
	850-2450 MHz	$\pm 0.5$ ns pk-pk			
	Any 36 MHz	$\pm 0.25$ ns pk-pk			
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	
Isolation	I/P - I/P	+80 dB (typ.), +60 dB (min.)		Between any pair of input ports	
	O/P - O/P	+80 dB (typ.), +60 dB (min.)		Between any pair of output ports	
	I/P - O/P	+60 dB (typ.), +50 dB (min.)		Between any pair of input and output ports	
Input P1dB 1dB gain compression point, output power	Typical	+0 dBm			
	Worst case typical	-2 dBm			
Output IP3 3rd order intercept point, output power	850-2150 MHz	Typical	+15 dBm	Worst case typical -2 dBm	
	850-2450 MHz	Typical	+10 dBm	Worst case typical -2 dBm	
Signal Related Spurs (Max.)		-60 dBc		Relative to carrier in the 850-2450 MHz band	
Non-Signal Related Spurs (Typ.)		-110dBm in 10kHz		Measured in a 10 kHz bandwidth, DC-6GHz	
LNB Powering Available with H-IN-04 input IO module	LNB Voltages	0/13/18VDC User selectable			
	LNB Current (Max.)	400mA max Fitted with short circuit protection			
	22KHz tone	0/22 kHz tone ON/OFF User selectable			
Connector & Impedances		50Ω SMA	50Ω BNC	75Ω BNC	75Ω F-type
Gain Flatness (Typ.)	L-band (950-2150 MHz)	$\pm 1.50$ dB	$\pm 1.50$ dB	$\pm 1.75$ dB	$\pm 1.75$ dB
	Full band (850-2450 MHz)	$\pm 2.50$ dB	$\pm 2.50$ dB	$\pm 2.75$ dB	$\pm 2.75$ dB
	Any 36 MHz	$\pm 0.50$ dB	$\pm 0.50$ dB	$\pm 0.65$ dB	$\pm 0.65$ dB
Input Return Loss	Typical	17 dB	17 dB	16 dB	16 dB
	Minimum	13 dB	13 dB	12 dB	12 dB
Output Return Loss	Typical	17 dB	17 dB	16 dB	16 dB
	Minimum	13 dB	13 dB	12 dB	12 dB
Spec Version		1.1			

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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	128 inputs		Non-blocking		
Optical Input Wavelength Range	1100 to 1650 nm				
Optical Input Power Range	-9.5 dBm to +5 dBm				
Input Optical Connector Options	FC/APC & SC/APC		Single mode fibre, Angle Polished Connectors only		
Output Plane: RF Output Ports					
Output RF Frequency Range	850-2450 MHz (Extended L-band)				
Output Gain Tracking (Typ.)	4 dB		Difference in mean gain between any two outputs when the same input is routed to both. Measured at 0dB gain		
Output Connector & Impedances	50Ω SMA	50Ω BNC	75Ω BNC	75Ω F-type	
Output Return Loss	Typical	14 dB	14 dB	12 dB	12 dB
	Minimum	10 dB	10 dB	10 dB	10 dB
System performance: (RF to fibre & back to RF)					
Gain	0 dB (± 2 dB)		Test condition: When passive IO module H-IO-01 is fitted at the output ports		
Output AGC Flatness (Typ.)	±3.5 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		
Output Connector & Impedances	50Ω SMA	50Ω BNC	75Ω BNC	75Ω F-type	
Gain Flatness (Typ.)	Full band (850-2450 MHz)	±2.75 dB	±2.80 dB	±3.00 dB	±3.00 dB
	L-band (950-2150 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
Test condition: Full TX &RX link with 1m fibre link using transmitter SRY-TX-L1-103 (1310nm). Fixed gain mode.					
Group Delay Variation (Max.)	950-2150 MHz	±1.5 ns pk-pk		Peak to peak, across the specified bandwidth	
	850-2450 MHz	±2 ns pk-pk		Full TX &RX link with 1m fibre link using transmitter SRY-TX-L1-103 (1310nm). Fixed gain mode	
	Any 36 MHz	±0.5 ns pk-pk			
Isolation	I/P - I/P	70 dB (typ. <sup>2</sup> ), 55 dB (min.)		Between any pair of input ports Test condition: Full TX &RX link with 1m fibre link using transmitter SRY-TX-L1-103 (1310nm). Fixed gain mode	
	O/P - O/P	70 dB (typ. <sup>2</sup> ), 55 dB (min.)		Between any pair of output ports Test condition: Full TX &RX link with 1m fibre link using transmitter SRY-TX-L1-103 (1310nm). Fixed gain mode	
	I/P - O/P	60 dB (typ. <sup>2</sup> ), 50 dB (min.)		Between any pair of input and output ports Test condition: Full TX &RX link with 1m fibre link using transmitter SRY-TX-L1-103 (1310nm). Fixed gain mode	
Noise Figure (Typ.)	10 dB		Test condition: SRY-TX-L1-103, 0 dB optical link loss, -50 dBm RF i/p power, -10 dBm o/p power		
CNR (any 36 MHz)	38 dB (min.)				
Output P1 (Typ.)	+1 dBm		Test condition: SRY-TX-L1-103, 0 dB optical link loss, -50 dBm RF i/p power, -10 dBm o/p power		
Output IP3	Typical	18 dBm		Test condition: SRY-TX-L1-103, 1m fibre, 10 dB gain, -22 dBm tones at 2150 and 2152 MHz	
	Minimum	12 dBm			
SFDR	Typical	105 dB			
	Minimum	100 dB			
Spec Version	1.2				

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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		128 inputs x 128 outputs		Non-blocking
Frequency Range		850-2450 MHz (Extended L-band)		
Variable Gain Range	Maximum gain	+20 dB ( $\pm 2.5$ dB)		Relative to the mean gain across the frequency range
	Minimum gain	-10 dB ( $\pm 2.5$ dB)		
	Variable gain step	0.5 dB ( $\pm 0.25$ dB)		
Gain Tracking (Typ.)		4 dB		
Variable Slop (Tilt) Control		0 dB to -6 dB ( $\pm 1$ dB)		Positive Slope with pivot point at 2150MHz
Slope Step		0.5dB ( $\pm 0.5$ dB)		
Group Delay Variation (Typ.)	950-2150 MHz	$\pm 0.5$ ns pk-pk		Peak to peak, across the specified bandwidth
	850-2450 MHz	$\pm 0.5$ ns pk-pk		
	Any 36 MHz	$\pm 0.25$ ns pk-pk		
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
Isolation	I/P - I/P	+70 dB (typ. <sup>2</sup> ), +60 dB (min.)		Between any pair of input ports
	O/P - O/P	+70 dB (typ. <sup>2</sup> ), +60 dB (min.)		Between any pair of output ports
	I/P - O/P	+60 dB (typ. <sup>2</sup> ), +50 dB (min.)		Between any pair of input and output ports
Signal Related Spurs (Max.)		-60 dBc		Relative to carrier in the 850-2450 MHz band
Non-Signal Related Spurs (Typ.)		-110dBm in 10kHz		Measured in a 10 kHz bandwidth, DC-6GHz
LNB Powering Available with H-IN-05 input IO module		0/13/18VDC @ 400mA max 0/22 kHz tone User selectable		
Connector & Impedances		50Ω SMA	50Ω BNC	75Ω BNC 75Ω F-type
Gain Flatness (Typ.)	L-band (950-2150 MHz)	$\pm 1.75$ dB	$\pm 1.75$ dB	$\pm 2.75$ dB $\pm 2.75$ dB
	Full band (850-2450 MHz)	$\pm 2.50$ dB	$\pm 2.50$ dB	$\pm 3.00$ dB $\pm 3.00$ dB
	Any 36 MHz	$\pm 0.50$ dB	$\pm 0.50$ dB	$\pm 0.65$ dB $\pm 0.65$ dB
Input Return Loss	Typical	17 dB	17 dB	16 dB 16 dB
	Minimum	13 dB	13 dB	12 dB 12 dB
Output Return Loss	Typical	17 dB	17 dB	16 dB 16 dB
	Minimum	13 dB	13 dB	12 dB 12 dB
Noise Figure (Typ.)	At +20 dB gain	9 dB		10 dB
	At 0 dB gain	24 dB		25 dB
	At -10 dB gain	34 dB		35 dB
Input P1dB (Typ.) measured at 0dB slope setting	At +20 dB gain	-20 dBm		-17 dBm
	At 0 dB gain	-3 dBm		0 dBm
	At -10 dB gain	+6.5 dBm		+9 dBm
Output IP3 (Typ.) measured at 0dB slope setting	L-band (up to 2150 MHz)	At +20 dB Gain	+15 dBm	
		At 0 dB Gain	+12 dBm	
		At -10 dB Gain	+10 dBm	
	Full band (up to 2450 MHz)	At +20 dB Gain	+13 dBm	
		At 0 dB Gain	+10 dBm	
		At -10 dB Gain	+8 dBm	
Spec Version		1.2		

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Technical Specifications and Operating Parameters	
Capacity	128 inputs and 128 outputs, configurable in banks of 8 inputs/ outputs
Frequency	850 to 2450 MHz
Connector & impedances	50Ω SMA, 50Ω BNC, 75Ω BNC & 75Ω F-type

LNB Powering			
LNB Power		Dependent upon IO modules	
LNB Current Alarm	Over-current	450 mA	Factory defaults (User settable)
	Under-current	50 mA	
LNB Short Circuit Protection		Electronic fuse	Automatic reset when short removed

Control, Monitoring and Alarms		
Remote Control & Monitoring	Ethernet – RJ45 connector 10/100/1000BaseTx ETL Protocol over TCP SNMP Web Interface Grass Valley NVision NV9000 <sup>4</sup>	
HMI	Capacitive touch screen	
Secure Communications	HTTPS SNMPv3 IPSEC	
ETL Protocol Over TCP	Supports up to 32 concurrent connections	
Web Browser	Full remote control via web browser for 5 connections	
Alarms	Comprehensive alarm status via HMI display and communication protocols	
Switching Time	50ms max	Measured from receipt of command on serial port to establishment of RF signal  Local and remote reporting
RF Level Alarms	Configurable upper and lower RF input level alarms	
Amplifier Status	Monitored	
Temperature Monitoring	Monitored individually	
Fan Monitoring		
PSU Loading		

Non RF Parameters		
All Active Cards	Hot swappable	
PSU Modules	Dual redundant hot swappable	No external PSU required for LNB power
CPUs	Dual redundant hot swappable	
IO Modules	Hot swappable	
Power Requirement	85-264Vac 47-63Hz	Fused 15A
AC Power Consumption	1200W	With passive input and output modules, 128 paths routed Maximum allowed AC power consumption for any configuration including LNB powering
	1800W	
MTBF	150,000 hours (17.1 years)	128x128 chassis without LRUs
MTBF (IO Modules)	200,000 hours (22.8 years)	Each IO module
MTBF (RF Cards)	180,000 hours (20.5 years)	Each active RF card
MTTR	10 minutes	Assumes recommended spares are available

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

Physical Dimensions & Parameters	
Weight	Up to 100 kg
Dimensions	10U high x 650mm deep x 19" wide
Front Panel Colour	Pearl Dark Grey - RAL9023

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

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