ETL Systems

Excelling in RF Engineering

Model Number:
HAR-40

128 x 128 L-band Harrier Matrix ultra compact, with configurable inputs & outputs

Typical applications:

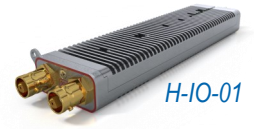
- Managing multiple inputs for growing satellite teleports
- Extended L-band frequency for Ka-band & HTS applications
- Routing live traffic to multiple modems

ETL's new ultra compact 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.

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.

LNB Powering 13/18V & 22kHz tone available

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

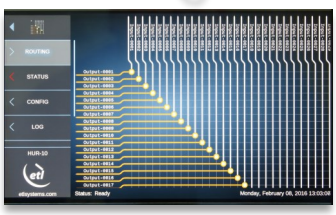
Resilience from dual redundant power supplies & dual redundant CPU modules

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

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

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

Temperature monitoring with intelligent fan speed control



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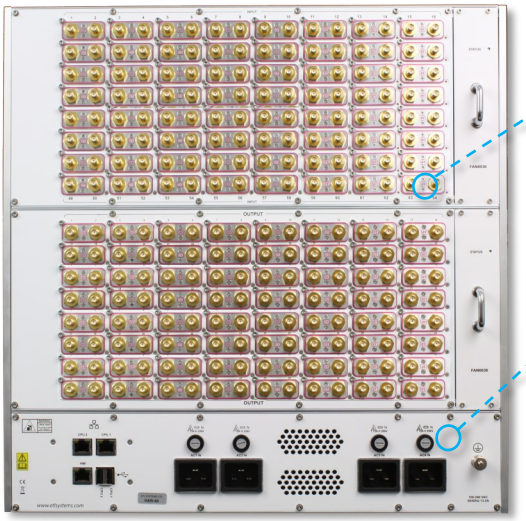
Flexibility & Reliability

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.

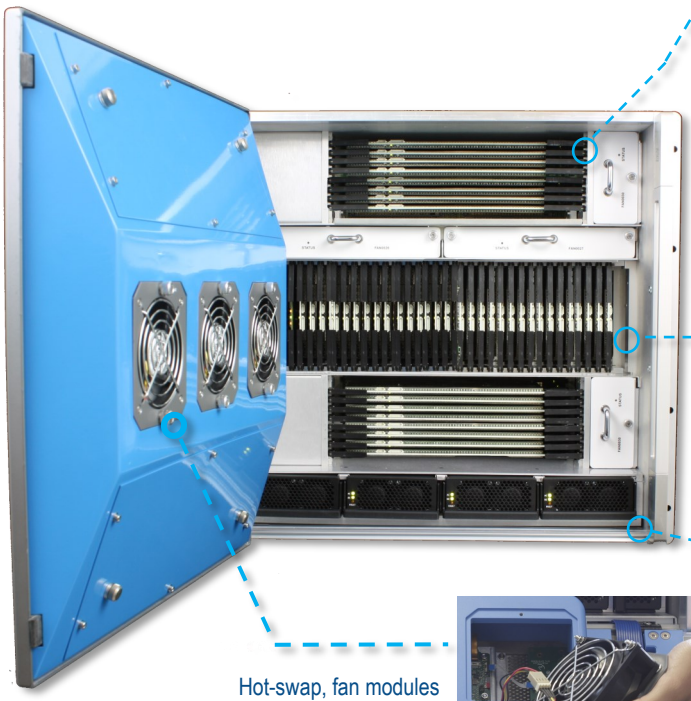
- For distant antennas, fibre modules can be used on the inputs of the matrix
- For large antennas, passive input or output modules can be installed to provide unity gain
- For smaller antennas or weak signals, variable gain, active input modules are ideal

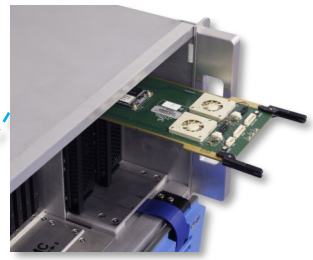
Impedance mismatch problems can be avoided with the option of mixed impedances on IO modules (input to input or input to output).

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

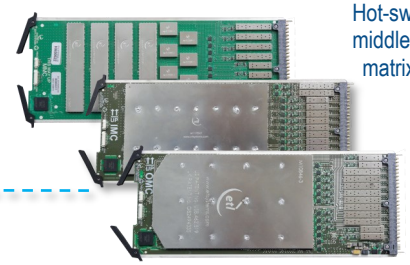
Enhanced resilience

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.
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Model Number: HAR-40

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 (± 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		±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			
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.[2]), +60 dB (min.)		Between any pair of input ports	
	O/P - O/P		+80 dB (typ.[2]), +60 dB (min.)		Between any pair of output ports	
	I/P - O/P		+60 dB (typ.[2]), +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)		±1.50 dB	±1.50 dB	±1.75 dB	±1.75 dB
	Full band (850-2450 MHz)		±2.50 dB	±2.50 dB	±2.75 dB	±2.75 dB
	Any 36 MHz		±0.50 dB	±0.50 dB	±0.65 dB	±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			1.2			

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Model Number: HAR-40

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-I0-01 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 Full TX &RX link with 1m fibre link using transmitter SRY-TX-L1-103 (1310nm). Fixed gain mode	
	850-2450 MHz	±2 ns pk-pk			
	Any 36 MHz	±0.5 ns pk-pk			
Isolation	I/P - I/P	70 dB (typ.[2]), 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.[2]), 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.[2]), 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		1.3			

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Model Number: HAR-40

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 (± 2.5 dB)		Relative to the mean gain across the frequency range	
	Minimum gain		-10 dB (± 2.5 dB)			
	Variable gain step		0.5 dB (± 0.25 dB)			
Gain Tracking (Typ.)			4 dB			
Variable Slop (Tilt) Control			0 dB to -6 dB (± 1 dB)		Positive Slope with pivot point at 2150MHz	
Slope Step			0.5dB (± 0.5 dB)			
Group Delay Variation (Typ.)	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			
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.[2]), +60 dB (min.)		Between any pair of input ports	
	O/P - O/P		+70 dB (typ.[2]), +60 dB (min.)		Between any pair of output ports	
	I/P - O/P		+60 dB (typ.[2]), +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)		±1.75 dB	±1.75 dB	±2.75 dB	±2.75 dB
	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
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			1.3			

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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[4]	
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
RF Level Alarms	Configurable upper and lower RF input level alarms	Local and remote reporting
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
	1800W	Maximum allowed AC power consumption for any configuration includ-ing LNB powering
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 (ºC)	0 to 45°C	
Gain Stability versus Tem-perature	0.05dB/°C	
Storage Temperature (ºC)	-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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ESATCOM INC
Esatcom Inc
www.esatcom.com
Tel: 718.276.0800
Email: sales@esatcom.com

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