

LH1000



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**Metrodata
LH1000 LAN to HSSI Converter
Installation Guide**

Metrodata Ltd
Fortune House
Crabtree Office Village
Eversley Way
Egham
Surrey TW20 8RY
United Kingdom

tel: +44 (0) 1784 744700
fax: +44 (0) 1784 744730
email: support@metrodata.co.uk
website: www.metrodata.co.uk/support

Part No: 76-02-053C

1 INTRODUCTION

1. 1 About the LH1000

The Metrodata LH1000 is used to extend a LAN segment via a satellite modem across a satellite link to a remote site. LAN data is adapted to a synchronous format using HDLC as a transport mechanism. Frame integrity is ensured by appending a 16 bit FCS to the LAN packet before transmission. At the far end, incoming packet integrity is checked using the 16 bit FCS, which is stripped for good packets before forwarding to the LAN port. If the FCS is incorrect, the packet is discarded.

The LH1000 has an auto-negotiating 10/100BaseT Ethernet port and two alternative DTE ports for satellite modem connection mounted on the rear panel of the unit. The ports are a HSSI DTE port and a multi-serial DTE port. The interface cable connecting the multi-standard port to the satellite modem determines the interface standard to be used from a choice of RS232, EIA-530, X.21, V.35 or RS449/V.36. The maximum speed of the multi-standard port is 20Mbps, and it is up to 100Mbps for the alternative HSSI DTE port. The LH1000 provides independent selection for Transmit and Receive directions offering either HSSI or Multi-standard DTE interfaces.

LH1000 units must be used in pairs, one at each end of a satellite link

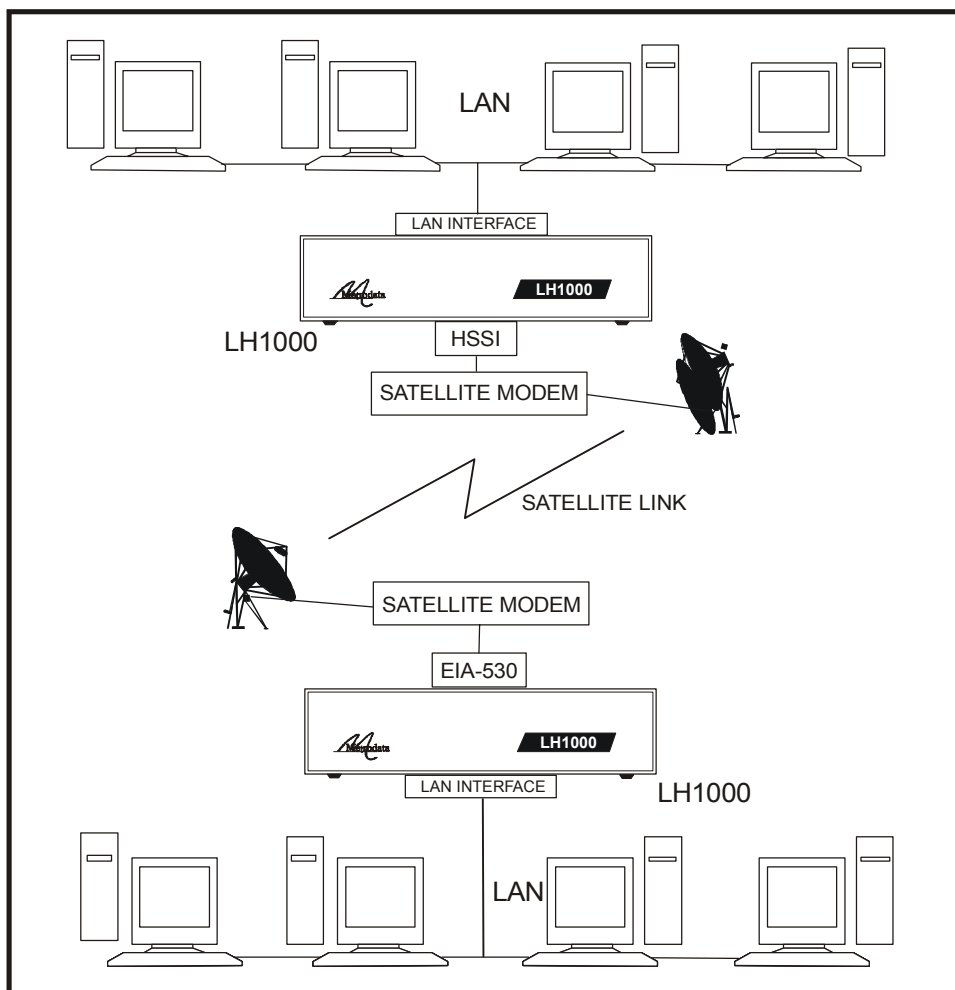


Figure 1. 1 LH1000 installation

The LAN interface performs address learning and filtering and will discard all errored packets, including short (runt) packets and FCS errored packets. The LAN interface supports VLAN tagged frames and will forward frames sized up to 1536 bytes. Frames longer than this are discarded.

There is always an LH1000 at each end of the link, and maximum efficiency is achieved by not transmitting the 4 byte FCS field of the MAC frame end to end, but recalculating it before transmission at the far end.

The theoretical maximum performance of the LH1000 at standard network speeds is given below. Note that a variable number of flags are set between frames, depending on the line speed.

Data rate Mbps	Flags between frames	Performance without FCS in pkts/sec
2.048	1	4063
8.448	2	16500
34.368	5	64119
44.736	6	82235
51.840	7	93913
65.0	8	116071
100.0	23	143410

Figure 1. 2 Performance of LH1000

1. 2 Safety

The LH1000 should not be connected to cabling which would be required by BS6701 to be equipped with over-voltage protection. The following ports are designated SELV (Safety Extra Low Voltage) within the scope of EN41003:

10/100 BaseT Ethernet port
 HSSI port (max 100 Mbps)
 Multi standard DTE port (max 20 Mbps)

These ports should only be connected to SELV ports on other equipment in accordance with EN60950 clause 2.3.

1. 3 Electromagnetic Compatibility

In order to ensure EMC compliance all signal and data cables and connectors must use a screened connector shell with a screened cable. The cable screen must be terminated to the screened connector shell and not connected to any pins of the connector. Failure to use the correct connector may compromise EMC compliance.

1. 4 EN55022 Declaration

The LH1000 is a Class A product. In a domestic environment it may cause radio interference in which case the user may be required to take adequate measures.

1. 5 FCC Declaration

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radiocommunications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at its own expense.

1. 6 Power Supply

The LH1000 is powered by an internal mains-fed power supply. The input voltage is 100-250VAC, 50/60Hz with an input current of 50 mA. An alternative unit fitted with a nominal -48VDC power supply is available, the supply definition being minus 36-72VDC, 200-100mA.

The LH1000 must be connected to safety earth for correct operation. The LH1000 power supply should be connected to a supply socket that is physically located close to the LH1000 and is easily accessible.

Safety Notes: Excessive voltages are present inside the unit. There are no user serviceable parts inside the unit, and the cover should not be removed by unqualified personnel. The unit must not be exposed to damp or condensing conditions.

2 LH1000 DESCRIPTION OF PARTS

2.1 Rear panel

All connections into and out of the LH1000 are made through the rear panel which is shown in schematic form for both AC and DC models below.

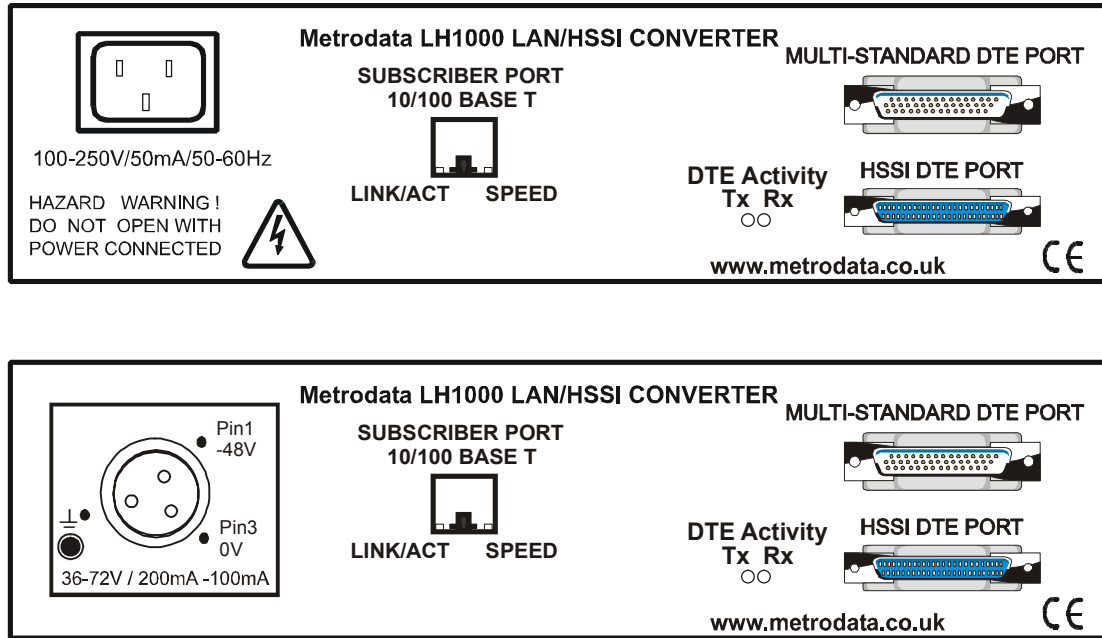


Figure 2. 1 LH1000 AC and DC rear panels

2.2 Power Supply

The LH1000 is powered by a mains supply with an input voltage of 100-250VAC 50-60Hz and with an input current of 50 mA. The LH1000 is provided ex-factory with a 1A internal fuse. Mains power is connected via the IEC inlet on the rear of the unit.

An alternative -48VDC powered unit is available. The input voltage and current ranges are minus 36 to minus 72 volts DC, 200 - 100mA. A Buccaneer type socket is fitted to the rear panel, and a plug is provided with the unit for the customer's own wiring. The connections are labelled on the rear panel of the LH1000.

On some units, an additional Ground stud may be located on the rear panel to permit a separate Ground connection to be made.

Pin no	Connection
1	-48VDC
2	Ground
3	0VDC

Figure 2. 2 -48VDC connections

Note: The LH1000 must be connected to safety earth for correct operation.

2.3 LAN port

The LAN port is presented on an RJ45 female connector mounted on the rear panel of the LH1000.

The port automatically senses the LAN interface and switches between MDI and MDI-X configurations. This removes the potential requirement for Crossover cables when connecting LANs to the LH1000 whatever LAN equipment is being used. The port also automatically negotiates the LAN speed and operates at either 10 Mbps or 100 Mbps, and negotiates whether operation should be in full or half duplex mode, providing that it is negotiating with another auto-negotiating port. If it negotiates with a fixed port, it can identify the speed, but it cannot distinguish the full/half duplex mode status, and consequently selects half duplex operation. Such operation is prone to errors and should be avoided by setting bit-switch 7 to the 100M FD position.

There is a miniature LED on the lower right corner of each RJ45 socket on the rear panel which is illuminated yellow when operation is at 100 Mbps. The miniature LED on the lower left corner of each RJ45 socket is illuminated green when the link is up, and flashes when there is activity on the link. The RJ45 connector layout for an auto-sensing MDI/MDI-X port is shown below:

Pin No	MDI Signal	MDI-X Signal
1	Tx Data +ve	Rx Data +ve
2	Tx Data -ve	Rx Data -ve
3	Rx Data +ve	Tx Data +ve
4	Not used	Not used
5	Not used	Not used
6	Rx Data -ve	Tx Data -ve
7	Not used	Not used
8	Not used	Not used

Figure 2.3 LAN port connector layout

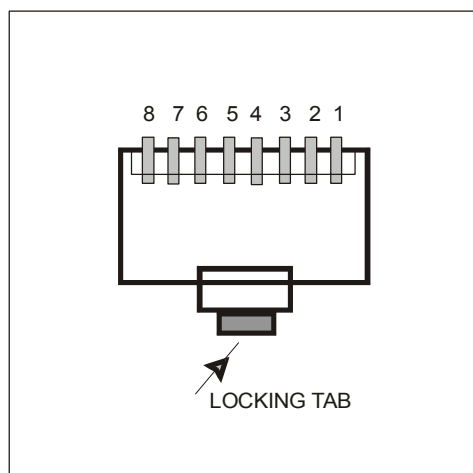


Figure 2.4 RJ45 connector layout

2. 4 Serial DTE ports

The LH1000 has two serial port options mounted on the rear panel of the DSU. One is a HSSI port and the second is a multi-serial port which can be configured to RS-232, EIA-530, X.21, RS-449/V.36 or V.35 using an appropriate cable.

Bit-switches numbers 1 & 2 on the base panel are used to select independently the Tx and Rx interface ports required (HSSI or Multi-standard). If the LH1000 is operating uni-directionally, both Tx and Rx should be set to the same interface type.

2 . 4. 1 HSSI DTE Port

The SCSI-2 50-way rear panel connector layout is shown below. The port operates to a maximum speed of 100Mbps at the supplied DCE clock rate.

Pin	Direction	Sig	Signal name	Pin	Direction	Sig	Signal name
1		SG	Signal Ground	26		SG	Signal Ground
2	Input	RT	Receive Timing(A)	27	Input	RT	Receive Timing(B)
3	Input	CA	DCE Available(A)	28	Input	CA	DCE Available(B)
4	Input	RD	Receive Data(A)	29	Input	RD	Receive Data(B)
5				30			
6	Input	ST	Send Timing(A)	31	Input	ST	Send Timing(B)
7		SG	Signal Ground	32		SG	Signal Ground
8	Output	TA	DTE Available(A)	33	Output	TA	DTE Available(A)
9	Output	TT	Terminal Timing(A)	34	Output	TT	Terminal Timing(A)
10				35			
11	Output	SD	Send Data(A)	36	Output	SD	Send Data(B)
12				37			
13		SG	Signal Ground	38		SG	Signal Ground
14				39			
15				40			
16				41			
17				42			
18				43			
19		SG	Signal Ground	44		SG	Signal Ground
20				45			
21				46			
22				47			
23				48			
24				49			
25		SG	Signal Ground	50		SG	Signal Ground

Figure 2. 5 HSSI DTE connector layout

HSSI operates as a co-directionally clocked interface with clock and data travelling in the same direction along the cable. Therefore, round trip delays are not an issue. For the co-directional interface the DCE supplies the Send Timing to the LH1000. The LH1000 then uses this clock to return Terminal Timing along with Send Data.

Bit-switches 1 and 2 on the base panel are used to select the Tx & Rx interface ports required (HSSI or Multi-standard).

2 . 4. 2 Multi-serial DTE Port

The low speed multi-serial interface is presented on a 44-way high density female connector. The multi-serial DTE port automatically detects the cable type and automatically configures itself for that interface standard e.g. EIA-530, RS-232 etc..

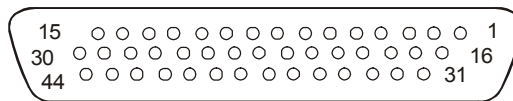


Figure 2. 6 Low speed DTE female interface connector

The local signals that are used by the interface to select the correct interface standard are:

- Cable On Connect to Signal Ground (HD-pin 44)
- Mode DCE Leave unconnected to select DTE interface

The table below defines the signal combinations used to select the appropriate interface.

Interface Type	Mode 2 (Pin29)	Mode 1 (Pin 27)	Mode 0 (Pin 25)
RS-232	Leave open	Leave open	Loop to HD-44 Pin 26
EIA-530	Loop to HD-44 Pin 30	Leave open	Loop to HD-44 Pin 26
X.21	Loop to HD-44 Pin 30	Leave open	Leave open
RS-449/V.36	Loop to HD-44 Pin 30	Leave open	Loop to HD-44 Pin 26
V.35	Leave open	Loop to HD-44 Pin 28	Loop to HD-44 Pin 26

Figure 2. 7 Mode signal definitions

2 . 4 . 3 Multi-serial DTE interface connector

The rear panel HD44 multi-serial connector layout is shown below:

Pin	Sig	Direction	Signal name	Pin	Sig	Direction	Signal name
1	RTS	Output	Ready to Send(A)	23	SG		Signal Ground
2				24	TXD	Output	Send Data(A)
3	RXD	Input	Receive Data(A)	25		Local	Mode 0
4				26	SG		Signal Ground
5	TRXC	Input	Send Timing(A)	27		Local	Mode 1
6	SG		Signal Ground	28	SG		Signal Ground
7	XCLK	Output	Terminal Timing(A)	29		Local	Mode 2
8	CTS	Input	Clear to Send(A)	30	SG		Signal Ground
9	TXD	Output	Send Data(A)	31	DTR	Output	Data Terminal Ready(A)
10	SG		Signal Ground	32	SG		Signal Ground
11				33	RXC	Input	Receive Timing(A)
12	SG		Signal Ground	34	DCD	Input	Data Carrier Detect(A)
13		Local	Mode DCE	35	SG		Signal Ground
14	SG		Signal Ground	36	DSR	Input	Data Set Ready(B)
15			Shield	37	XCLK	Output	Terminal Timing(A)
16	RTS	Output	Ready to Send(B)	38	CTS	Input	Clear to Send(A)
17	DTR	Output	Data Terminal Ready(B)	39	SG		Signal Ground
18	RXD	Input	Receive Data(B)	40			
19	RXC	Input	Receive Timing(B)	41	SG		Signal Ground
20	DCD	Input	Data Carrier Detect(B)	42			
21	TRXC	Input	Send Timing(A)	43	SG		Signal Ground
22	DSR	Input	Data Set Ready(A)	44		Local	Cable On

Figure 2. 8 LH1000 HD-44 Multi-serial connector layout

2.4.4 Multi-serial interface cable specifications

DSU Connection			EIA-530	RS-449	X.21	V.35	RS-232
HD-44 Male			DTE DB-25 Male	DTE DB37 Male	DTE DB15 Male	DTE MRAC Male	DTE DB25 Male
Pin	Signal	Direction	Pin Number	Pin Number	Pin Number	Pin Number	Pin Number
1	RTS-A	Output	4	7	3	C	4
2	TM	Output	18	10		L	18
3	RXD-A	Input	3	6	4	R	3
4	LL	INput	25	18		NN	25
5	TRXC-B	Bidirectional	12	23	13*	AA	
6	Signal Ground						
7	XCLK-B	Output	11	35		W	
8	CTS-A	Input	5	9	5	D	5
9	TXD-B	Output	14	22	9	S	
10	Signal Ground						
11	Cable Type 0		HD-44 pin 10		HD-44 pin 10		HD-44 pin 10
12	Signal Ground						
13	DCE_SELECT						
14	Signal Ground		7	19	8	B	7
15	Shield		1	1	1	A	1
16	RTS-B	Output	19	25	10		
17	DTR-B	Output	23	30			
18	RXD-B	Input	16	24	11	T	
19	RXC-B	Input	9	26	13*	X	
20	DCD-B	Bidirectional	10	31			
21	TRXC-A	Bidirectional	15	5	6*	Y	15
22	DSR-A	Input	6	11		E	6
23	Signal Ground						
24	TXD-A	Output	2	4	2	P	2
25	Mode 0		HD-44 pin 26	HD-44 Pin 26		HD-44 pin 26	HD-44 pin 26
26	Signal Ground						
27	Mode 1					HD-44 pin 28	
28	Signal Ground						
29	Mode 2		HD-44 pin 30	HD-44 pin 30	HD-44 pin 30		
30	Signal Ground						
31	DTR-A	Output	20	12		H	20
32	Signal Ground						
33	RXC-A	Input	17	8	6*	V	17
34	DCD-A	Bidirectional	8	13		F	8
35	Signal Ground						
36	DSR-B	Input	22	29			
37	XCLK-A	Output	24	17		U	24
38	CTS-B	Input	13	27	12		
39	Signal Ground						
40	Cable Type 1		HD-44 pin 39	HD-44 pin 39			HD-44 pin 39
41	Signal Ground						
42	Cable Type 2		HD-44 pin 41	HD-44 pin 41	HD-44 pin 41	HD-44 pin 41	
43	Signal Ground						
44	Cable Fitted		HD-44 Pin 43	HD-44 Pin 43	HD-44 Pin 43	HD-44 Pin 43	HD-44 Pin 43
Part No for 1.5 metre cable			80-415-0002	80-415-0004	80-415-0006	80-415-0008	80-415-0010
Part No for 3 metre cable			80-43-0002	80-43-0004	80-43-0006	80-43-0008	80-43-0010

Note: * indicates 2 signals on this pin. Connector shields must be connected to cable screens

2 . 4. 5 Multi-serial Interface Cables

Metrodata supplies DTE cables for the multi-serial interface as tabulated below:

DTE Interface	Connector type (DTE end)	Metrodata Part Number	
		Cable 1.5m	Cable3.0 m
RS-232	25 way D, Male	80-415-0010	80-43-0010
EIA-530	25 way D, Male	80-415-0002	80-43-0002
X.21	15 way D, Male	80-415-0006	80-43-0006
RS-449/V.36	37 way D, Male	80-415-0004	80-43-0004
V.35	MRAC, Male	80-415-0008	80-43-0008

Figure 2. 9 Metrodata DTE interface cables

2 . 4. 6 Uni-directional operation

When operating uni-directionally, it is recommended that the LH1000 base panel bit-switches are set to the same interface type i.e. both Tx and Rx to be HSSI or both multi-serial.

Note that the LH1000 will **only** operate when the incoming control signal is in the *ASSERTED* state.

When the LH1000 is used in a normal bi-directional manner and connected to a demodulator or satellite modem, the incoming control signal will be *ASSERTED* by the external equipment.

If the LH1000 is used in a uni-directional manner the incoming control signal must be provided by looping the outgoing and incoming control signals for both of the (A) and (B) pairs. The LH1000 will then be able to operate uni-directionally.

If the Rx interface port is HSSI then the incoming control signal is CA, and the outgoing control signal is TA.

If the Rx interface port is multi-serial then the incoming control signal is DCD, and the outgoing control signal is RTS.

3 INSTALLATION & SET-UP

3.1 Setting-up the Bit-switches

The bit-switches on the base of the unit must be set-up before making any connections to the unit. There is an explanatory label on the unit's base which defines the bit-switch set-up options.

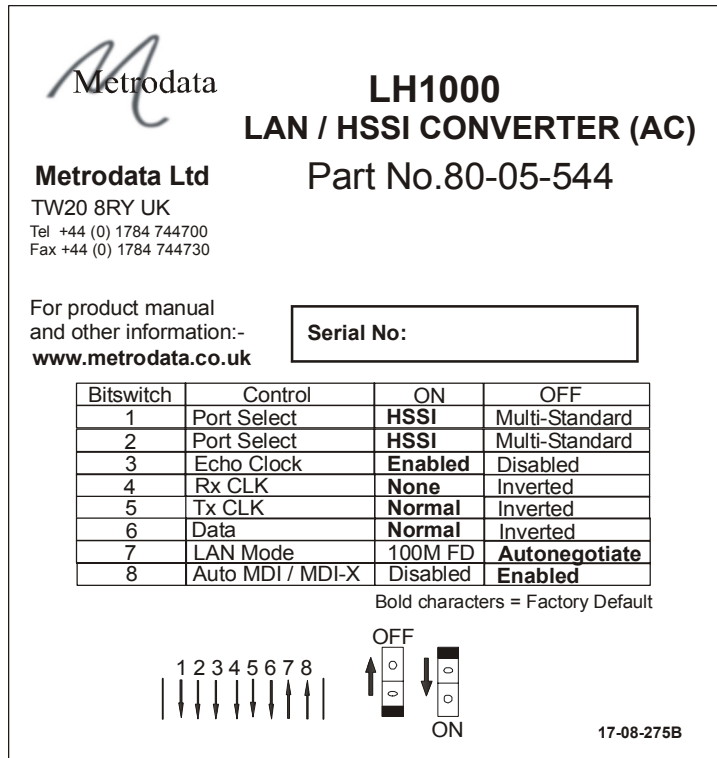


Figure 3. 1 LH1000 Base Panel label

3.1.1 Bit-switch definitions

The default settings of the bit-switch are shown in bold:

Bit-switch	Control	On	Off
1	Tx Port select	HSSI	Multi-Standard
2	Rx Port select	HSSI	Multi-Standard
3	Echo Clock	Enabled	Disabled
4	Rx CLK	Normal	Inverted
5	Tx CLK	Normal	Inverted
6	Data	Normal	Inverted
7	LAN Mode	100M FD	Auto-negotiate
8	Auto MDI/MDI-X	Disabled	Enabled

Figure 3. 2 Bit-switch definitions

Note that on early models of the LH1000 bit-switch 7 enabled transmission of the MAC FCS. Bit-switch 7 has now been re-assigned as LAN MODE, and MAC FCS is always discarded.

3 . 1. 2 Tx Port Select

Bit-switch ON: Select HSSI DTE Port, support operation up to 100Mbps

Bit-switch OFF: Select Multi-standard DTE Port, Support operation up to 20Mbps.

The cable fitted determines the interface standard selected from the options:

RS-232, EIA-530, X.21, V.35, RS-449/V.36

3 . 1. 3 Rx Port Select

Bit-switch ON: Select HSSI DTE Port, support operation up to 100Mbps

Bit-switch OFF: Select Multi-standard DTE Port, Support operation up to 20Mbps.

The cable fitted determines the interface standard selected from the options:

RS-232, EIA-530, X.21, V.35, RS-449/V.36

3 . 1. 4 Echo Clock

Bit-switch ON (Enabled): Echo the DCE supplied Transmit Clock as XCLK and also retime the Transmit Data to XCLK to ensure co-directional clocking.

Bit-switch OFF (Disabled): Use the DCE Supplied Transmit Clock to transmit the Transmit Data in contra-directional mode, XCLK forced high.

3 . 1. 5 Rx CLK

Bit-switch ON: Normal Mode, sample the Received data on the Falling Edge

Bit-switch OFF: Inverted Mode, sample the Received data on the Rising Edge

3 . 1. 6 Tx CLK

Bit-switch ON: Normal Mode, Output the Transmit Data on the Rising Edge

Bit-switch OFF: Inverted Mode, Output the Transmit Data on the Falling Edge

3 . 1. 7 Data

Bit-switch ON: Normal Mode

Bit-switch OFF: Inverted Mode

3 . 1. 8 LAN mode

Bit-switch ON: 100 Mbps Full Duplex operation.

Bit-switch OFF: Auto-negotiate Mode (default).

Note that this option enables 100M full duplex connection to be implemented. Auto-negotiation as used by the LH1000 is IEEE802.3ab compliant and does not distinguish between full versus half duplex modes when connected to fixed ports.

3 . 1. 9 Auto MDI/MID-X

With switch set to ON, the LAN ports automatically sense the interface and switch between MDI and MDI-X connections.

With switch set to OFF, the LAN ports are fixed as MDI-X for direct connection to a PC. This may be necessary for reliability when connecting some older non-auto hubs.

3 . 1. 10 MAC FCS

Note that on later models the LH1000 always strips the MAC FCS from the ethernet packet. On early models of the LH1000, MAC FCS inclusion was optional by setting bit-switch 7.

3.2 Connecting up

Safety Notice: Ports that are identified as SELV in this manual should only be connected to SELV ports on other equipment in accordance with EN 60950 clause 2.3.

Step 1: Mounting.

The LH1000 is housed in a convenient 1U table top enclosure. 19 inch rack-mount options are also available, as well as rack nests for two or 18 units.

Step 2: Set up Bit-switches

These switches are located on the base of the unit and are used to configure the unit.

Step 3: Power Supply

Finally, connect the main power lead and re-check all connections for security. Then turn on the power supply.

Warning: Do not connect the LH1000 to excessive voltage. Read the safety information before continuing.

Step 4: LAN ports

Connect the LH1000 to the RJ45 LAN port on the rear panel. The indicator lights on the lower corners of the RJ45 socket indicate the LAN speed and activity status.

Step 5: HSSI or Multi-standard port

Connect the satellite modem to the required port using an appropriate cable type for the modem interface. Remember to set the Port Select bit-switch to the correct connector type (HSSI or Multi-Standard) before connecting. The DTE activity LED on the rear panel will indicate the link status.

3.3 Optional rackmounting

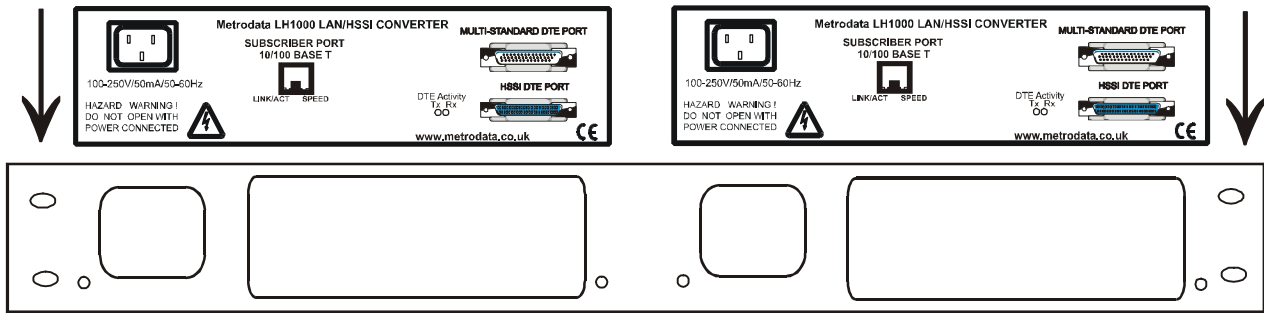
Rackmounting kits may be used to mount two LH1000 units side by side in a 19" rack.

The first two of these kits have a flat mounting plate with separate cut-outs for power cables and signal cables. 80-05-252 is suitable for AC mains powered units, while 80-05-254 is suitable for units powered by -48VDC.

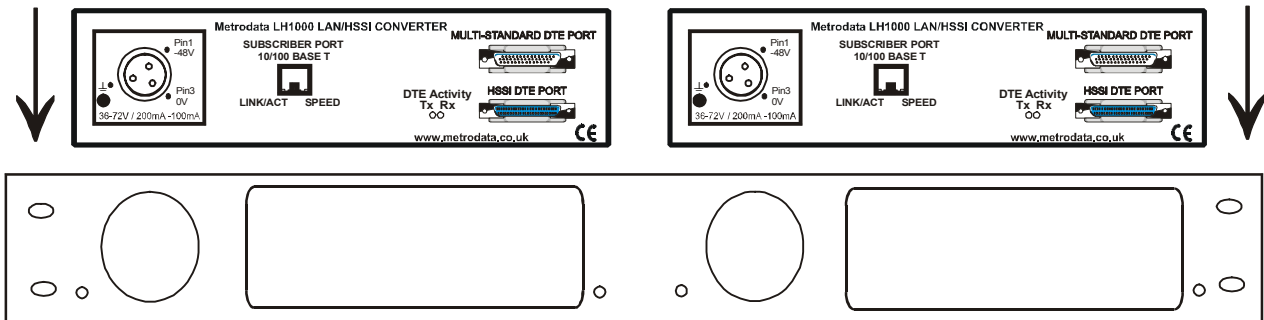
The third kit, Part no 80-05-256, has a recessed plate to permit fibre bends to be made within the envelope of a 19" rack. It also has a single cut-out for all connections to the rear of the LH1000. The installation method is the same in all cases.

First remove the two rear panel screws securing each unit's lid. Fasten the two LH1000 units to the rackmount adaptor plate using the screws that you have removed, as shown in the illustrations below.

Then secure the rack mounting plate complete with the two LH1000 units to the 19" rack using the locating holes at the ends of the adaptor plate. If you have set the bit-switches on the base plate of the units before fixing them to the adaptor plate, check that the settings are still correct.

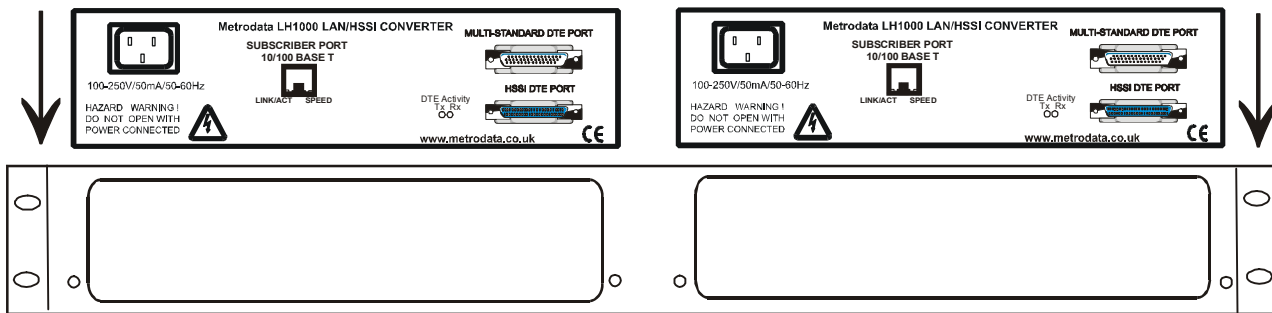


Part No: 80-05-252



Part No: 80-05-254

Figure 3. 3 2-unit flush AC & DC rackmounting schematics



Part No: 80-05-256

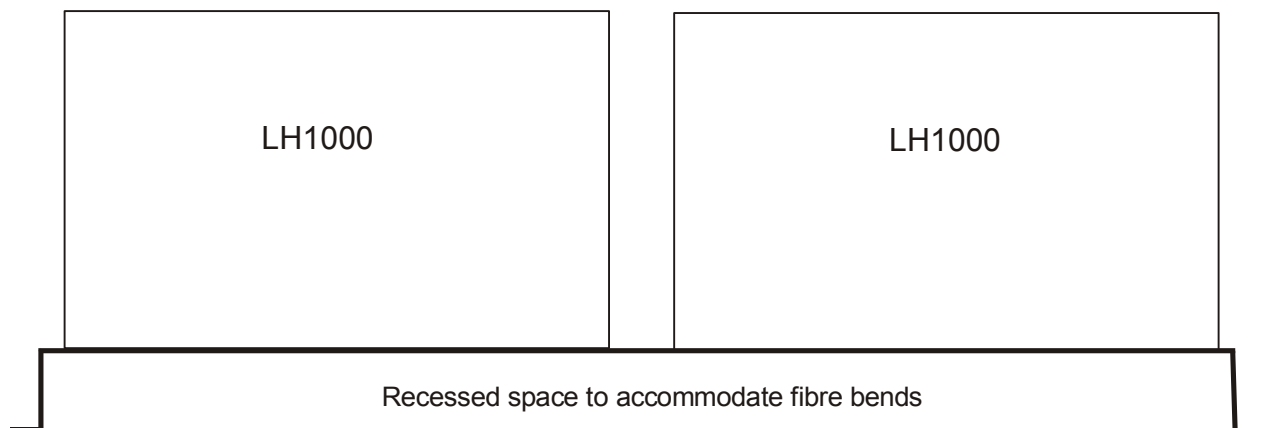


Figure 3. 4 2-unit recessed rackmounting plan & elevation

4 TROUBLESHOOTING & TESTING

4.1 Establish and verify the LAN link

Connect the LAN cable to the LAN port. If the LED on the bottom left hand corner of the RJ45 socket goes green, or flashes green, then there is a LAN connection. If the LED remains unilluminated, there is no LAN connection, and investigatory action should be taken on the LAN and/or its cables.

It may be useful to set the AUTO MDI/MDI-X bit-switch to *DISABLED*, in which case the port presents a fixed MDI-X interface to the LAN.

Note that for 100M full duplex operation between the LH1000 and a fixed (i.e. non-negotiating) LAN port, Bit-switch 7 must be set to 100M FD. If this is not done, the LH1000 will operate at the correct speed, but in half duplex mode, and with a heavy error count.

4.2 Clock inversion

Using the Multi-interface with long cables may introduce data errors owing to transit delays. These may be resolved by inverting the clocks. Invert the Rx clock using bit-switch 4, and the Tx clock using bit-switch 5. Inverting the Tx clock is most likely to solve the problem.

5 LH1000 SPECIFICATIONS

DTE Interfaces	Definition
DTE Interfaces	Interface selected by base panel bit-switch
Framing	Unframed
Encapsulation	HDLC
Clocking options	HSSI port: DCE supplied clock Multi-standard port: DCE supplied clock
Line Rate	HSSI: 100Mbps Multi-standard: 20 Mbps
Max packet rate	143410 64 byte packets per second, full duplex at 100Mbps
LED Indicators	DTE Tx and Rx Activity, LAN Speed & Activity
Alarms & Loopbacks	None
LAN Port	Definition
LAN Interface	RJ45, Auto switched MDI or MDI-X, or fixed MDI selected by bit-switch
Operating mode	Autonegotiated 10/100 Mbps Full / Half Duplex, or Fixed 100M FD
Port filtering rate	148810 packets per second, 64 byte packets
MAC address table	4096 entries
Min/Max Packet size	64 bytes / 1538 bytes (larger packets are discarded)
General	Definition
Power supply	100-250 VAC, 50-60 Hz, 25 mA or -36 to -72 VDC, 100-200mA
Dimensions	202 x 132 x 44 mm (w x d x h) Enclosure only 202 x 132 x 47 mm (w x d x h) Overall including feet
Environmental	Range
Ambient Temperature	0 degC to +50 degC
Storage Temperature	-20 degC to +70 degC
Relative Humidity	0% - 95% non condensing
Barometric Pressure	86 KPa - 106 KPa

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