

**Multi Rate Transponder and Converter
for
Wavelength Division Multiplexing**

Revision history

The latest version is always available in pdf-format on our web-site:

<http://www.network-electronics.com/>

Current revision of this document is the uppermost in the table below.

Revision	Replaces	Date	Change Description
2	1	2007-10-29	New front page and removed old logo.
1	0	2007-10-05	Added Materials Declaration and EFUP
0	A	16.03.04	First official release
A		15.03.04	Preliminary version

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1. General

The flashlink[®] SDI-TR-D15xx/-C1xxx is a multi bit-rate converter and transponder module providing high performance media conversion for various signal formats from 19.4Mbps up to 622Mbps. The unit can be configured as an Electrical to Optical or an Optical to Electrical converter, or as an Optical to Optical Transponder. This state of the art unit offers a high sensitivity PIN diode and narrowband ultra-stabilised DWDM or CWDM laser technology. Unmatched signal accuracy, even in critical applications with pathological signal patterns makes the SDI-TR the first choice for all optical transport demands.

The flashlink[®] DWDM and CWDM system uses only wavelengths in accordance with the ITU-T G.692 recommendation. If the module is to be used together with existing third party DWDM or CWDM systems the exact wavelength needs to be specified.

The SDI-TR can transport all SD signal formats in addition to DVB-ASI and SMPTE 310. It can also perform optical refreshing, reclocking and wavelength swapping for a DWDM / CWDM wavelength for SDH/SONET in addition to all the broadcast signal formats.

The input sensitivity is typically better than -30dBm. This will allow for a range of 70km, using high quality Single Mode fiber at 270Mbps, for a 16 channel DWDM system.

The optical output comes with a sophisticated 1550nm DFB DWDM / CWDM laser covering the demands of short, medium and long haul applications. The open system platform of Network Electronics DWDM / CWDM multiplexing technology allows easy interoperability with third party fiber optical systems.

The electrical input is equipped with a multi rate cable equaliser providing an equalisation of typically 250m of high quality coax cable at 270Mbps. A distribution amplifier with 2 outputs reduces the need for additional DA's (for DVB-ASI only one can be used).

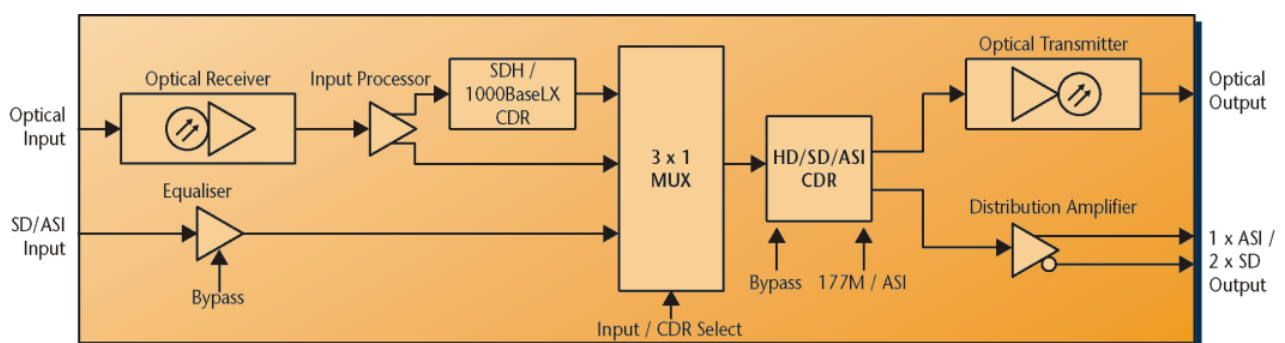


Figure 1 - SDI-TR-D15xx/-C1xxx Multi Rate Transponder for DWDM or CWDM

SDI-TR-D15xx is available in 32 versions:

Part number	Wavelength	Part number	Wavelength
SDI-TR -D1549.32	1549.32nm laser	SDI-TR -D1550.92	1550.92nm laser
SDI-TR -D1552.52	1552.52nm laser	SDI-TR -D1554.13	1554.13nm laser
SDI-TR -D1555.75	1555.75nm laser	SDI-TR -D1557.36	1557.36nm laser
SDI-TR -D1558.98	1558.98nm laser	SDI-TR -D1560.61	1560.61nm laser
SDI-TR -D1530.33	1530.33nm laser	SDI-TR -D1531.90	1531.90nm laser
SDI-TR -D1533.47	1533.47nm laser	SDI-TR -D1535.04	1535.04nm laser
SDI-TR -D1536.61	1536.61nm laser	SDI-TR -D1538.19	1538.19nm laser
SDI-TR -D1539.77	1539.77nm laser	SDI-TR -D1541.35	1541.35nm laser
SDI-TR -D1531.12	1531.12nm laser	SDI-TR -D1532.68	1532.68nm laser
SDI-TR -D1534.25	1534.25nm laser	SDI-TR -D1535.82	1535.82nm laser
SDI-TR -D1537.40	1537.40nm laser	SDI-TR -D1538.98	1538.98nm laser
SDI-TR -D1540.56	1540.56nm laser	SDI-TR -D1542.14	1542.14nm laser
SDI-TR -D1548.51	1548.51nm laser	SDI-TR -D1550.12	1550.12nm laser
SDI-TR -D1551.72	1551.72nm laser	SDI-TR -D1553.33	1553.33nm laser
SDI-TR -D1554.94	1554.94nm laser	SDI-TR -D1556.55	1556.55nm laser
SDI-TR -D1558.17	1558.17nm laser	SDI-TR -D1559.79	1559.79nm laser

Optionally all wavelengths in the ITU-T G.692 recommendation are available on request.

SDI-TR-C1xxx is available in 8 versions:

Part number	Wavelength	Part number	Wavelength
SDI-TR -C1470	1470nm laser	SDI-TR -C1550	1550nm laser
SDI-TR -C1490	1490nm laser	SDI-TR -C1570	1570nm laser
SDI-TR -C1510	1510nm laser	SDI-TR -C1590	1590nm laser
SDI-TR -C1530	1530nm laser	SDI-TR -C1610	1610nm laser

2. Specifications

Optical Input

Data rate optical:	19.4 to 622 Mbps
Sensitivity:	
for SDI (270Mbps)	better than -30dBm
for SDH / SONET (622Mbps)	better than -28dBm
Detector overload threshold:	min. -6dBm
Optical wavelength:	2 nd & 3 rd opt. window 1310nm & 1550nm
Transmission circuit fiber:	Multi Mode 50/125um, Single Mode Compatible
Connector return loss:	>40dB w/SM fiber
Detector damage threshold:	>+1dBm
Connector	SC/UPC

Optical Output

Transmission circuit fiber:	Single Mode
Light source:	DFB Laser
Optical power:	0dBm, \pm 1dB
Extinction Ratio:	\geq 10:1
Optical centre wavelength:	According to ITU-T G.692 for DWDM ITU-T G.694.2 for CWDM
Max. wavelength drift:	
for DWDM:	\pm 0.16nm @ temp. range: 0 to +40 °C
for CWDM:	\pm 6nm @ temp. range: 0 to +40 °C
Jitter (UI=Unit Interval):	0.135 UI max. @ 270Mbps
Connector return loss:	>40dB w/SM fiber
Maximum reflected power:	4%
Connector:	SC/UPC

Electrical

Power:	+5V DC / 10W Max. 5W typically
Control:	Control system for access to setup and module status with BITE (Built-In Test Equipment)

Electrical Input

Data rate NRZ:	19.4 to 540 Mbps
Equalisation:	Automatic Cable equaliser and reclocker can be bypassed to support bitrates down to 2Mbps.
Impedance:	75 ohm
Return loss:	>15dB @ 270MHz
Signal level:	nom. 800mV
Connector:	BNC

Electrical Output

Number of outputs:	2
Connector:	BNC
Impedance:	75 ohm
Return loss:	>15dB @ 270MHz
Jitter:	max 0.2UI
Peak to peak signal level:	0.8V ± 0.1V
Signal polarity	1 non inverting, 1 inverting

Standards

Supported standards for electrical and optical ports:

SMPTE:	SMPTE259M, SMPTE297, SMPTE305M, SMPTE310,
DVB-ASI:	EN50083-9
ITU-T:	G.694.1, G.694.2

Additional supported standards for the optical ports, only optical transponder configuration:

SDH / SONET:	STM1 / OC3 STM4 / OC12
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3. Format Configuration

The SDI-TR can support a number of different formats. The correct configuration can either be set with a DIP switch or with the GYDA Control System. The layout of SDI-TR is shown in the drawing below with the DIP switch to the upper left position.

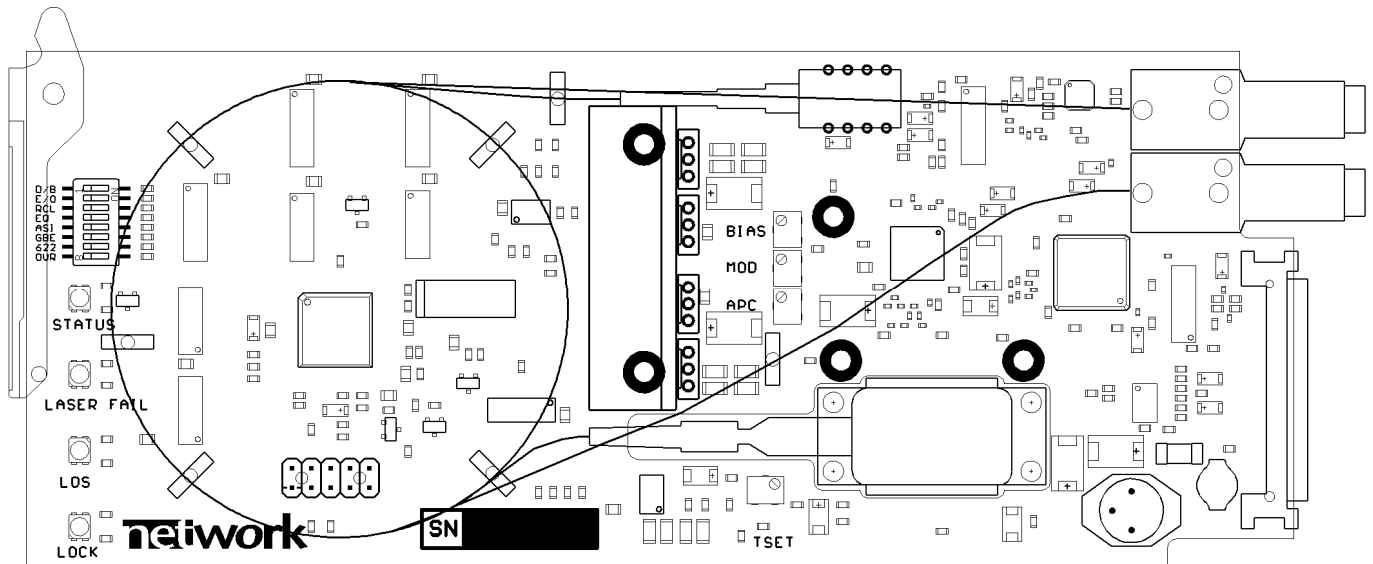


Figure 2 - SDI-TR-D15xx/-C1xxx board layout.

DIP switch configuration must be set according to the table below:

Switch #	Label	Function DIP=ON	Function DIP=OFF	Comment
1	D/B	Broadcast format support	Datacom format support	Format mode
2	E/O	Optical input selected	Electrical input selected	Transponder mode
3	RCL	Reclocker ON	Reclocker Bypass	Reclocker mode
4	EQ	Cable equaliser ON	Cable equaliser Bypass	Equaliser mode
5	ASI	DVB-ASI Reclocker support	SDI 177Mbps Reclocker support	Only when Broadcast format support selected
6	GBE	Not used	SDH/SONET Reclocking Selected	Only when Datacom format support selected
7	622	STM-4 / OC-12 Reclocking (622Mbps)	STM-1 / OC-3 (optical) Reclocking (155Mbps)	Only when Datacom format support selected
8	OVR	Override GYDA control Config. with DIP switch	GYDA control Config. with GYDA	Select configuration from GYDA

All DIP switches are off when pointing towards the release handle.

When a “Broadcast format support” is selected, all clock rates for SDI and DVB-ASI are automatically configured by the module itself.

3.1 Configuration Examples

Typical configurations for SDI-TR:

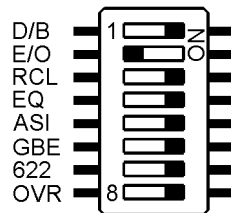


Figure 3 – SDI and DVB-ASI Electrical to Optical Converter

Figure 4 – SDI and DVB-ASI Optical to Electrical Converter and Optical to Optical Transponder

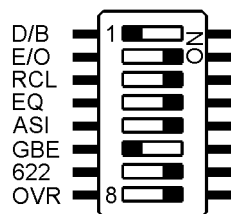
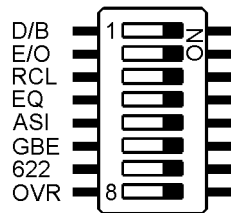


Figure 5 - SDH/SONET - STM-4/OC-12 Optical to Optical Transponder

4. Connector module

The SDI-TR-D15xx/-C1xxx has a dedicated connector module: MR-TR-C1. This module is mounted at the rear of the sub-rack. The module is shown in figure 7.

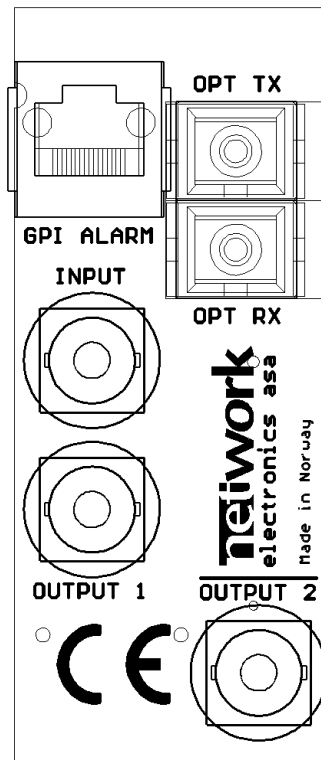


Figure 7 - Overview of the MR-TR-C1 connector module

In typical use a SDI-TR / SDI-TR-D15xx / SDI-TR-C1xxx module at each end will be used. The electrical input signal is connected to the INPUT BNC on the transmitting MT-TR, and the electrical output is connected to the OUTPUT 1 or OUTPUT 2 BNC on the receiving SDI-TR. Please note that OUTPUT 2 has an inverted signal, so formats like DVB-ASI can not use be used on this output.

4.1 Mounting the connector module.

The details of how the connector module is mounted, is found in the user manual for the sub-rack frame FR-2RU-10-2.

This manual is also available from our web site: <http://www.network-electronics.com/>

4.2 Terminal format support

The different input and output ports on SDI-TR can support a number of formats. The table below shows which signal formats are supported on the selected terminals.

Terminal format support:

Terminal	Function	Supported Format	Mode
INPUT	Electrical Input	SDI, DVB-ASI, SMPTE310, Transparent*	Input
OPT RX	Optical Input (Receiver)	SDI, DVB-ASI, SMPTE310, STM-1 opt., STM-4, OC-3 opt., OC-12, Transparent*	Input
OUTPUT 1	Electrical Output – None inverted	SDI, DVB-ASI, SMPTE310, Transparent*	Output
OUTPUT 2	Electrical Output – Inverted	SDI, Transparent*	Output
OPT TX	Optical Output (Transmitter)	SDI, DVB-ASI, SMPTE310, STM-1 opt., STM-4, OC-3 opt., OC-12, Transparent*	Output
GPI ALARM	Open Collector Alarms	Wired alarms	OC Output

* SDI-TR has a “Transparent mode”. In this mode all reclockers and CDR’s are switched off and no jitter attenuation will be performed. This mode may be used for non-standard or unsupported bit rates over shorter distances and up to 1 Gbps.

5. Module status

The status of the module can be monitored in three ways.

1. GYDA System Controller (optional).
2. GPI at the rear of the sub-rack.
3. LED’s at the front of the sub-rack.

Of these three, the GPI and the LED’s are mounted on the module itself, whereas the GYDA System Controller is a separate module giving detailed information on the card status. The functions of the GPI and the LED’s are described in sections 5.1 and 5.2. The GYDA controller is described in a separate user manual.

5.1 GPI ALARM – Module Status Outputs

These outputs can be used for wiring up alarms for third party control systems. The GPI outputs are open collector outputs, sinking to ground when an alarm is triggered. The GPI connector is shown in figure 8.

Electrical Maximums for GPI outputs

Max current: 100mA

Max voltage: 30V

SDI-TR module GPI pinning:

Signal	Name	Pin #	Mode
Status	General error status for the module.	Pin 1	Open Collector
Laser Fail	Laser Fail Alarm	Pin 2	Open Collector
LOS	Los Of Signal	Pin 3	Open Collector
LOCK	Reclocker in Lock	Pin 4	Open Collector
Ground	0 volt pin	Pin 8	0V.

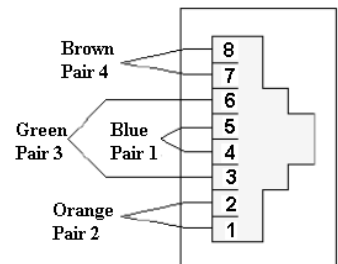
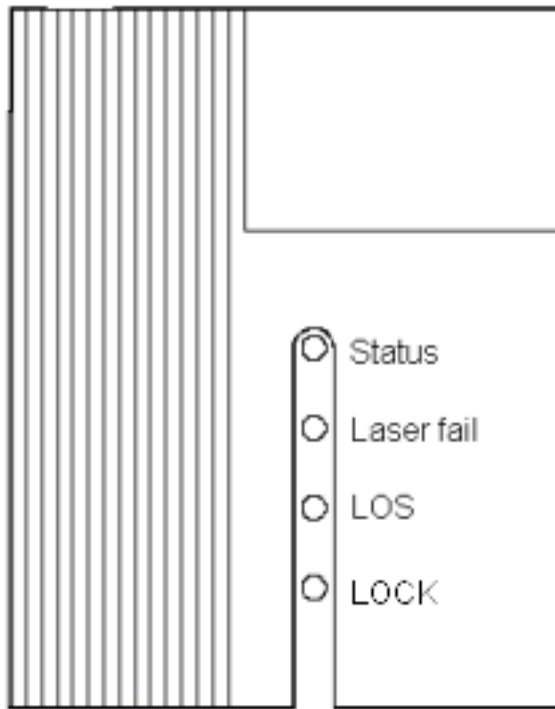


Figure 8 - GPI Outlet

5.2 Front Panel - Status Monitoring

The status of the module can be easily monitored visually by the LED's at the front of the module. The LED's are visible through the front panel as shown in figure 9 below.



(Text not printed on the front panel).

Figure 9 - Front panel indicator overview for SDI-TR-D15xx and SDI-TR-13T/15T

The SDI-TR has 4 LED's each showing a status corresponding to the GPI pinning. The position of the different LED's is shown in figure 9.

Diode \ state	Red LED	Green LED	No light
Status	Module is faulty	Module is OK Module power is OK	Module has no power
Laser fail	Laser is malfunctioning and the APC can no longer keep the output power within range.	Laser is OK	
LOS	Loss of signal No optical input signal.	Optical input signal Present	
LOCK	Re-clocker is out of lock	Re-clocker is in lock on a supported signal format	

6. Laser safety precautions

Guidelines to limit hazards from laser exposure.

All the available EO units in the flashlink® range include a laser.

Therefore this note on laser safety should be read thoroughly.

The lasers emit light at wavelengths around 1310 nm or 1550 nm. This means that the human eye cannot see the beam, and the blink reflex can not protect the eye. (The human eye can see light between 400 nm to 700 nm).

A laser beam can be harmful to the human eye (depending on laser power and exposure time). Therefore:

!! BE CAREFUL WHEN CONNECTING / DISCONNECTING FIBER PIGTAILS (ENDS).

NEVER LOOK DIRECTLY INTO THE PIGTAIL OF THE LASER/FIBER.

NEVER USE MICROSCOPES, MAGNIFYING GLASSES OR EYE LOUPES TO LOOK INTO A FIBER END.

USE LASER SAFETY GOGGLES BLOCKING LIGHT AT 1310 nm AND AT 1550 nm

Instruments exist to verify light output power: Power meters, IR-cards etc.

flashlink® features:

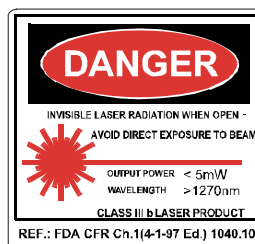
All the laser module cards in the flashlink® product range, are Class 1 laser products according to IEC 825-1 1993, and class I according to 21 CFR 1040.10 when used in normal operation.

More details can be found in the user manual for the FR-2RU-10-2 frame.

Maximum output power* : 5 mW.

Operating wavelengths: > 1270 nm.

**Max power is for safety analysis only and does not represent device performance.*



Declaration of conformity with CE

This apparatus meets the requirements of EN 55103-1 (November 1996) with regard to emissions, and EN 55103-2 (November 1996) with regard to immunity; it thereby complies with the Electromagnetic Compatibility Directive 89/336/EEC.

General environmental requirements for Network flashlink[®] equipment

1. The equipment will meet the guaranteed performance specification under the following environmental conditions:
 - Operating room temperature range 0°C to 40°C
 - Operating relative humidity range up to 90% (non-condensing)

2. The equipment will operate without damage under the following environmental conditions:
 - Temperature range -10°C to 50°C
 - Relative humidity range up to 95% (non-condensing)

3. Electromagnetic compatibility conditions:
 - Emissions EN 55103-1 (Directive 89/336/EEC)
 - Immunity EN 55103-2 (Directive 89/336/EEC)

Product Warranty

The warranty terms and conditions for the product(s) covered by this manual follow the General Sales Conditions by Network Electronics ASA. These conditions are available on the company web site of Network Electronics ASA:

www.network-electronics.com

Materials declaration and recycling information

Materials declaration

For product sold into China after 1st March 2007, we comply with the “Administrative Measure on the Control of Pollution by Electronic Information Products”. In the first stage of this legislation, content of six hazardous materials has to be declared. The table below shows the required information.

組成名稱 Part Name	Toxic or hazardous substances and elements					
	鉛 Lead (Pb)	汞 Mercury (Hg)	鎘 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr(VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
SDI-TR-D15xx / SDI-TR-C1xx	X	O	O	O	O	O
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006.						

Environmentally-friendly use period

The manual must include a statement of the “environmentally friendly use period”. This is defined as the period of normal use before any hazardous material is released to the environment. The guidance on how the EFUP is to be calculated is not finalised at the time of writing. See <http://www.aeanet.org/GovernmentAffairs/qfLeOpAaZXaMxqGjSFbEidSdPNtpT.pdf> for an unofficial translation of the draft guidance. For our own products, Network Electronics has chosen to use the 50 year figure recommended in this draft regulation.

Network Electronics suggests the following statement on An “Environmentally Friendly Use Period” (EFUP) setting out normal use:

EFUP is the time the product can be used in normal service life without leaking the hazardous materials. We expect the normal use environment to be in an equipment room at controlled temperature range (0°C - 40°C) with moderate humidity (< 90%, non-condensing) and clean air, not subject to vibration or shock.

Further, a statement on any hazardous material content, for instance, for a product that uses some tin/lead solders:

Where a product contains potentially hazardous materials, this is indicated on the product by the appropriate symbol containing the EFUP. The hazardous material content is limited to lead (Pb) in some solders. This is extremely stable in normal use and the EFUP is taken as 50 years, by comparison with the EFUP given for Digital Exchange/Switching Platform in equipment in Appendix A of “General Rule of Environment-Friendly Use Period of Electronic Information Products”. This is indicated by the product marking:



It is assumed that while the product is in normal use, any batteries associated with real-time clocks or battery-backed RAM will be replaced at the regular intervals.

The EFUP relates only to the environmental impact of the product in normal use, it does not imply that the product will continue to be supported for 50 years.

Recycling information

Network Electronics provides assistance to customers and recyclers through our web site <http://www.network-electronics.com>. Please contact Network Electronics' Customer Support for assistance with recycling if this site does not show the information you require.

Where it is not possible to return the product to Network Electronics or its agents for recycling, the following general information may be of assistance:

- Before attempting disassembly, ensure the product is completely disconnected from power and signal connections.

- All major parts are marked or labelled to show their material content.

- Depending on the date of manufacture, this product may contain lead in solder.

Some circuit boards may contain battery-backed memory devices.