TANDBERG
Television

ST.RE.E10141.5
Issue 5
ENGLISH (UK)

REFERENCE GUIDE

TT1280 and TT1282 High Definition Professional Receiver/Decoder

Software Version 2.0.0 (and later)

TT1280 and TT1282 HD Professional Receiver/Decoder

ENGLISH (UK)

READ THIS FIRST!

If you do not understand the contents of this manual
DO NOT OPERATE THIS EQUIPMENT.

Also, translation into any EC official language of this manual can be made available, at your cost.

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LEGGERE QUESTO AVVISO PER PRIMO!

Se non si capisce il contenuto del presente manuale
NON UTILIZZARE L'APPARECCHIATURA.

È anche disponibile la versione italiana di questo manuale, ma il costo è a carico dell'utente.

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Om Ni inte förstår informationen i denna handbok
ARBETA DÅ INTE MED DENNA UTRUSTNING.

En översättning till detta språk av denna handbok kan också anskaffas, på Er bekostnad.

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LUE ENNEN KÄYTTÖÄ!

Jos et ymmärrä käsikirjan sisältöä
ÄLÄ KÄYTÄ LAITETTA.

Käsikirja voidaan myös suomentaa asiakkaan kustannuksella.

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Si vous ne comprenez pas les instructions contenues dans ce manuel
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Vi kan også for Deres regning levere en dansk oversættelse af denne håndbog.

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Si no entiende el contenido de este manual
NO OPERE ESTE EQUIPO.

Podemos asimismo suministrarle una traducción de este manual al (idioma) previo pago de una cantidad adicional que deberá abonar usted mismo.

Issue 5 first published in 2005 by:
TANDBERG TELEVISION LTD

REGISTERED ADDRESS:
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SO30 4DA
UNITED KINGDOM

Registered Company Number 03695535

List of Contents

About This Reference Guide

This Reference Guide provides instructions and information for the installation and operation of the TT1280 and TT1282 1U digital integrated Receiver/Decoder (IRD).

This Reference Guide should be kept in a safe place for reference for the life of the equipment. It is not intended that this Reference Guide will be amended by the issue of individual pages. Any revision will be by a complete reissue. Further copies of this Reference Guide can be ordered from the address shown on *page vii*. If passing the equipment to a third party, also pass the relevant documentation.

Issues of this manual are listed below:

Issue	Date	Software Version	Comments
1	Oct 2003	1.0.0	Initial release.
2	Jan 2004	1.1.5	-48 V version added. IP Input card, RAS and RAS 2 added.
3	Feb 2004	2.0.0	TT1282 added. DTS, Closed Captions, RS-422 data, frame sync and Ethernet HSD added.
4	May 2004	2.0.0	HOM option card added
5	Mar 2006	2.0.0	Inclusion of DVB-S2 information

The following documents are also associated with this equipment:

- ST.US.E10141: User Guide

General

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This product incorporates copyright protection technology that is protected by U.S. patents and other intellectual property rights. Use of this copyright protection technology must be authorized by Macrovision Corporation, and is intended for home and other limited viewing uses only unless authorized by Macrovision. Reverse engineering or disassembly is prohibited.

Warnings, Cautions and Notes.

Heed Warnings

All warnings on the product and in the operating instructions should be adhered to. The manufacturer can not be held responsible for injuries or damage where warnings and cautions have been ignored or taken lightly.

Read Instructions

All the safety and operating instructions should be read before this product is operated.

Follow Instructions

All operating and use instructions should be followed.

Retain Instructions

The safety and operating instructions should be retained for future reference.

WARNINGS...

WARNINGS GIVE INFORMATION WHICH, IF STRICTLY OBSERVED, WILL PREVENT PERSONAL INJURY OR DEATH, OR DAMAGE TO PERSONAL PROPERTY OR THE ENVIRONMENT. THEY ARE BOXED AND SHADED FOR EMPHASIS, AS IN THIS EXAMPLE, AND ARE PLACED IMMEDIATELY PRECEDING THE POINT AT WHICH THE READER REQUIRES THEM.

CAUTIONS...

Cautions give information which, if strictly followed, will prevent damage to equipment or other goods. They are boxed for emphasis, as in this example, and are placed immediately preceding the point at which the reader requires them.

NOTES...

Notes provide supplementary information. They are highlighted for emphasis, as in this example, and are placed immediately after the relevant text.

EMC Compliance

This equipment is certified to the EMC requirements detailed in *Annex B, Technical Specification*. To maintain this certification, only use the leads supplied or, if in doubt, contact Customer Services.

Contact Information

TANDBERG Television Customer Services

Support Services

Our primary objective is to provide first class customer care that is tailored to your specific business and operational requirements. All levels are supported by one or more service performance reviews to ensure the perfect partnership between TANDBERG Television and your business.

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All TANDBERG Products and Systems are designed and built to the highest standards and are covered under a comprehensive 12 month warranty.

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For stand-alone equipment, then TANDBERG Television **BASIC Advantage** is the value for money choice for you. BASIC provides you with year-by-year Service long after the warranty has expired.

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Call TANDBERG Sales for more details.

Where to Find Us

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Australia/NZ:	+612 9360 2053 fieldservice-australia@tandbergtv.com
Internet Address:	http://www.tandbergtv.com

Technical Training

Training Courses

TANDBERG Television provides a wide range of training courses on the operation and maintenance of our products and on their supporting technologies. TANDBERG can provide both regularly scheduled courses and training tailored to individual needs. Courses can be run either at your premises or at one of our dedicated training facilities.

Where to Find Us

For further information on TANDBERG Television's training programme please contact us:

International Telephone:	+44 23 8048 4229
International Facsimile	+44 23 8048 4467
E-mail Address:	training@tandbergtv.com
Internet Address	http://www.tandbergtv.com

Customer Services and Technical Training Postal Address

Tandberg Television
Unit 2
Strategic Park
Comines Way
Hedge End
Southampton
Hampshire
SO30 4DA
United Kingdom

Return of Equipment

If you need to return equipment for repair, please contact the Customer Services Helpdesk on +44 (0) 23 8048 4455. A Returns Authorisation Number (RAN) will be issued and full details of the unit will be logged.

Technical Publications

If you need to contact TANDBERG Television Technical Publications regarding this publication, e-mail: techpubs@tandbergtv.com.

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Chapter 1

Introduction

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1.1 Scope of This Reference Guide

1.1.1 Who Should Use This Reference Guide

This Reference Guide is written for operators/users of the TT1280 and TT1282 Integrated Receiver/Decoder (IRD). It describes the unit's functions and operation. The Reference Guide is written to assist in the installation and day-to-day care and operation of the unit. Maintenance information requiring the covers to be removed is not included.

The TT1280 and TT1282 are usually referred to throughout this Reference Guide as 'IRD(s)' unless there is a specific difference, where they will be referred to by the model number.

WARNING...

DO NOT REMOVE THE COVERS OF THIS EQUIPMENT. HAZARDOUS VOLTAGES ARE PRESENT WITHIN THIS EQUIPMENT AND MAY BE EXPOSED IF THE COVERS ARE REMOVED. ONLY TANDBERG TELEVISION TRAINED AND APPROVED SERVICE ENGINEERS ARE PERMITTED TO SERVICE THIS EQUIPMENT.

CAUTION...

Unauthorised maintenance or the use of non-approved replacements may affect the equipment specification and invalidate any warranties.

1.1.2 What Equipment is Covered by This Reference Guide

The Equipment Models

The IRD described in this Reference Guide is the base model.

Figure 1.1: Front View of a Satellite Receiver

Table 1.1: Equipment Model Descriptions

Model Number	Marketing Code	Description
TT1280 Common Interface	TT1280/CIBAS	MPEG-2 HD Decoder with integrated Common Interface CAM reader, AC mains voltage input. MPEG 4:2:0 video decode only.
TT1280 Common Interface (-48 V version)	TT1280/CIBAS/48V	MPEG-2 HD Decoder with integrated Common Interface CAM reader, -48 Vdc voltage input. MPEG 4:2:0 video decode only.
TT1280 Director (-48 V version)	TT1280/DIRBAS/48V	MPEG-2 HD Decoder with integrated Director Smart Card Reader, -48 Vdc voltage input. MPEG 4:2:0 video decode only.
TT1280 Director	TT1280/DIRBAS	MPEG-2 HD Decoder with integrated Director Smart Card Reader, AC mains voltage input. MPEG 4:2:0 video decode only.
TT1282 Common Interface	TT1282/CIBAS	MPEG-2 HD Decoder with integrated Common Interface CAM reader, AC mains voltage input. MPEG 4:2:0 and 4:2:2 video decode.
TT1282 Director (-48 V version)	TT1282/DIRBAS/48V	MPEG-2 HD Decoder with integrated Director Smart Card Reader, -48 Vdc voltage input. MPEG 4:2:0 and 4:2:2 video decode.

Model Number	Marketing Code	Description
TT1282 Common Interface (-48 V version)	TT1282/CIBAS/48V	MPEG-2 HD Decoder with integrated Common Interface CAM reader, -48 Vdc voltage input. MPEG 4:2:0 and 4:2:2 video decode.
TT1282 Director	TT1282/DIRBAS	MPEG-2 HD Decoder with integrated Director Smart Card Reader, AC mains voltage input. MPEG 4:2:0 and 4:2:2 video decode.

Software Version

This Reference Guide covers the functions of software **version 2.0.0 and later**.

To verify the installed version access the **Systems Menu** (Menu 7.2.1). The menus are described in *Annex C, Menus.*

1.2 Summary of Features

1.2.1 Main Features

The IRD is fully compliant with the appropriate sections of the MPEG-2[1], DVB-S[2] and DSNG[3] specifications and offers the following features:

- Front Panel Controls and Indications:
  - ✧ A vertical split two line x 40 character back-lit dot matrix LCD display with pushbuttons for **Up**, **Down**, **Left**, **Right**, **Edit**, and **Save** to provide information and operator choice entry.
  - ✧ LEDs to indicate lock and general alarm conditions.
- Service Selection:
  - ✧ Chosen from a menu list of available Services carried in the currently received Transport Stream.
  - ✧ Up to 40 preselected choices can be stored within the unit.
- Multiple Inputs (Satellite Receivers):
  - ✧ L-band Satellite Receivers have two inputs (QPSK).
- TTV G.703 (DS3 and E3) Input (Telco Receivers).
- IP Input (Telco Receivers).
- Video Decoding:
  - ✧ MPEG 4:2:0 mode support.
  - ✧ MPEG 4:2:2 mode support (TT1282 only).
- Audio Decoding:
  - ✧ Sampling rates 32, 44.1, 48 kHz.
  - ✧ All MPEG-1 data rates.
  - ✧ All Dolby Digital AC-3 data rates, decoded as a Dolby Stereo downmix.
  - ✧ Linear uncompressed audio, data rates as defined by SMPTE 302M.

[1] Moving Pictures Expert Group: MPEG-2 specification ISO 13818.
[2] European Digital Video Broadcasting (DVB) Project. EN 300 421 Digital broadcasting systems for television, sound and data services: Framing structure, channel coding and modulation for the 11/12 GHz satellite service.
[3] European Digital Video Broadcasting (DVB) Project : EN 301 210 Digital broadcasting systems for television, sound and data services: Framing structure, channel coding and modulation for digital satellite news gathering (DSNG) and other contribution applications by satellite.

- Data:
  - ✧ DTS audio detection and pass-through.
  - ✧ Low Speed Data: RS-232 asynchronous (up to 38.4 kbit/s).
  - ✧ High Speed Data: Ethernet Data-piping (up to 5 Mbit/s) (option).
  - ✧ High Speed Data: RS-422 synchronous (up to 2048 kbit/s) (option).
- Transport Stream Output:
  - ✧ ASI Transport Stream output with maximum data rate 160 Mbit/s.
- Remote Control:
  - ✧ SNMP.
  - ✧ RS-232 (Alteia protocol).
- Clock/Calendar:
  - ✧ Available to co-ordinate universal and local time.
  - ✧ Constantly updated when locked to a valid Transport Stream.
- Transport Stream Demultiplexing:
  - ✧ Maximum capability is 160 Mbit/s, depending on CA in use and input front end.
- Video Decoding:
  - ✧ Maximum Video decoding capability of 50 Mbit/s.
- Audio:
  - ✧ Audio embedding in the digital video output (compressed AC-3 not supported).
- VANC data support:
  - ✧ Closed Captions.
  - ✧ VITC.
- Frame Synchronisation of video output to a composite analogue input.
- Local Control Methods:
  - ✧ Front Panel User Interface.

1.2.2 Inputs

ASI Input (Decoder)

One BNC connector supporting both byte-mode and single packet burst mode.

SSI Input (Decoder)

One BNC connector providing SMPTE 310M compliant input.

Remote Control

An RJ-45 Ethernet connector for connection to a PC or network switch to provide SNMP control.

QPSK L-Band Inputs (Satellite Receivers) (Option)

Two F-type connectors connect the L-band output of a suitable LNB either directly or via a suitable attenuator giving lightning and surge protection.

BPSK/QPSK/8PSK/16QAM (HOM) L-Band Inputs (Satellite Receivers) (Option)

Four F-type connectors connect the L-band output of a suitable LNB either directly or via a suitable attenuator giving lightning and surge protection.

DVB-S QPSK, DVB-S2 QPSK, 8PSK Input (Satellite Receivers)(Option)

Four F-type connectors (TT1280/HWO/DVBS2) or Three F-type connectors + IF Inputs + Constellation output (TT1280/HWO/DVBS2/IF/CONST). Connect the L-Band output of a suitable LNB either directly or via a suitable attenuator giving lightning and surge protection.

TTV G.703 DS3 and E3 Input (Telco Receivers) (Option)

Equipped with a single BNC connector for receiving signals over a PDH Telco network.

IP Input (Telco Receivers) (Option)

A single 10/100BaseT RJ-45 connector for receiving signals over Ethernet.

Frame Synchronisation

A BNC connector accepts a composite video input to which the video output timing can be synchronised.

1.2.3 Outputs

Transport Stream Outputs

- Two BNC connectors output ASI Transport Streams with a maximum data rate of 160 Mbit/s, depending on the CA in use and the input card front-end.

Video Outputs

- One SVGA HD video output carried on a D-type connector.
- Two digital video outputs carried on BNC connectors.

Audio Outputs

- Two 9-way D-type, male connectors decode two PES streams of audio from the Transport Stream. The audio outputs simultaneous analogue and digital. The digital mode can be changed via the user interface.

Data Output

- RS-232 asynchronous low-speed data output carried on a 9-way, D-type, female connector.
- RJ-45 high-speed data over Ethernet output (option).
- RS-422 synchronous high-speed data output carried on a 9-way D-type, female connector.

Alarm Output

A 9-way, D-type connector for interfacing to the alarm and failure monitoring within the equipment. This includes a summary alarm signal that coincides with the general front-panel **ALARM** LED.

There are five relays for failure monitoring (four alarms and one summary alarm). The operator can define (using the Alarm Menu pages) which alarm conditions drive the relays. This is described in *Chapter 5, Alarms* and *Annex C, Menus*.

1.3 The Satellite Receiver

1.3.1 Typical Satellite System

The IRD Satellite Receivers are components of the MPEG-2/DVB compliant range of TANDBERG Television equipment. They are designed for use by broadcasters and distributors of video, audio and data Services over satellite.

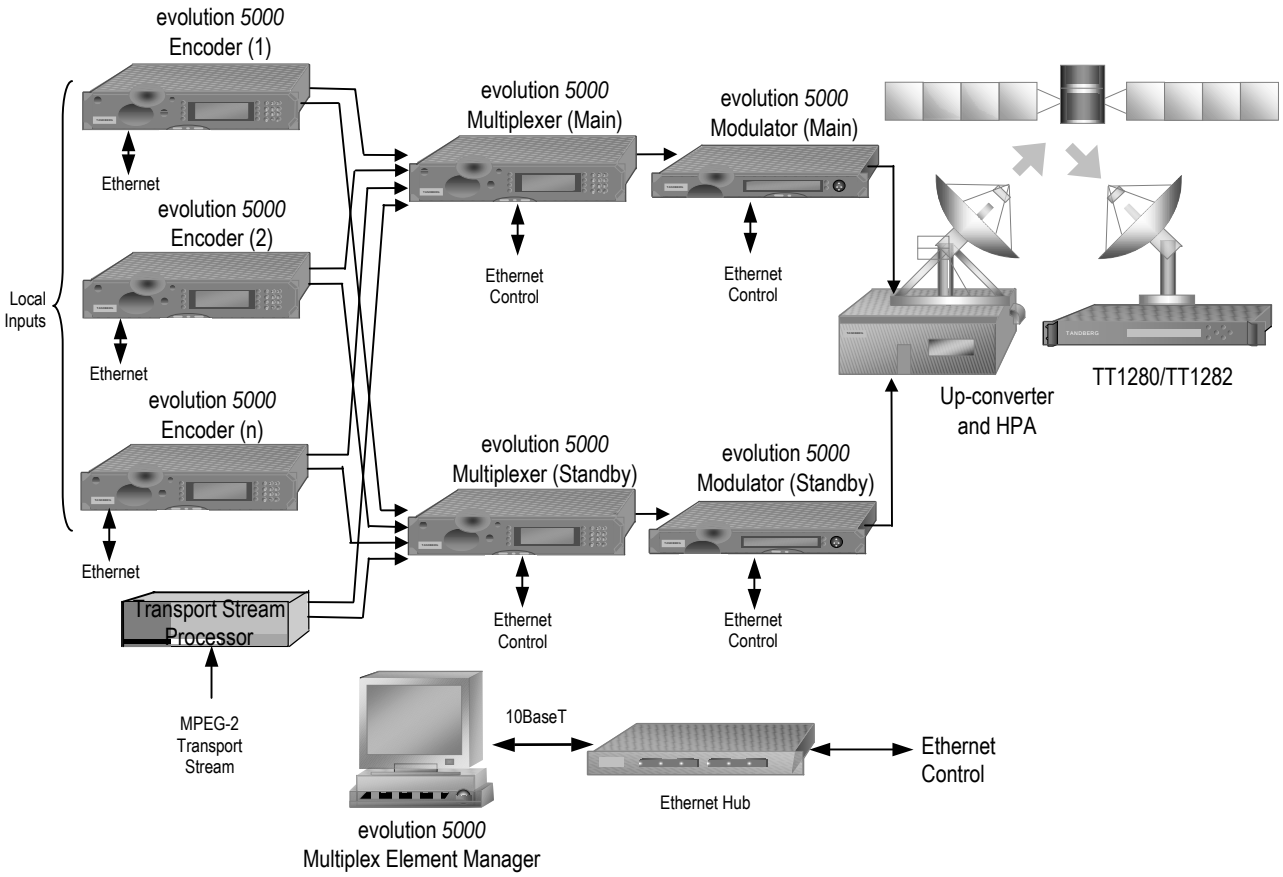

Figure 1.2: Typical Satellite Compression System

1.3.2 Input Connections

The Satellite Receiver interfaces directly to Low-Noise Block (LNB) and accepts an intermediate frequency (IF) input in the band 950 - 2150 MHz (L-band) for operation in the specified symbol-rate range (see *Annex B, Technical Specification*). The unit can provide dc power and polarisation switching to the LNB.

1.3.3 What the Satellite Receiver Does

The Receiver can be tuned to a specified satellite channel frequency and polarisation. The input is down-converted via a Low-Noise Block (LNB) to provide an L-band input to the Receiver. The front-end tuning is microprocessor controlled with a frequency synthesised local oscillator. A software tuning and acquisition algorithm resolves translation errors (mainly due to the LNB).

The signal is then passed to a demodulator that recovers the signal using soft-decision decoding. The resulting stream is Reed-Solomon decoded and descrambled to provide inputs to the Decoder circuit. The received channel may contain multiple Services, therefore the Receiver's demultiplexer is configured to select a single video Service and other audio/data components and present them at the output.

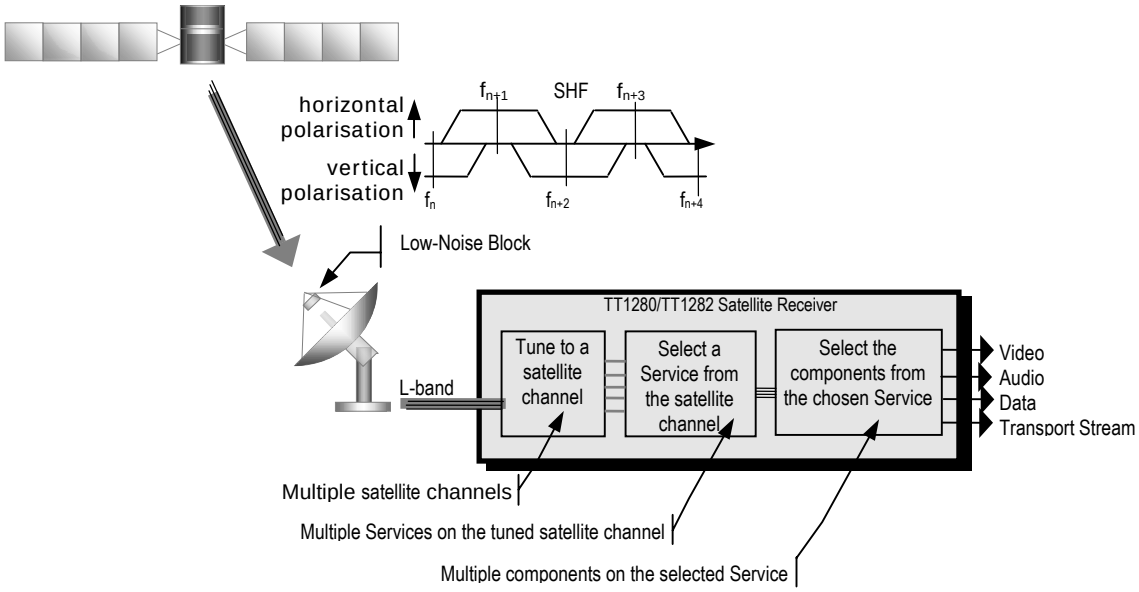

Figure 1.3: What the Satellite Receiver Does

1.4 The Telco Receiver/Decoder

1.4.1 Typical Decoder System

The Decoder is a component of TANDBERG Television's range of equipment. It is designed for use by broadcasters and distributors of video and audio Services. It can be used as a Transport Stream monitor or to decode signals received over a telecommunications network.

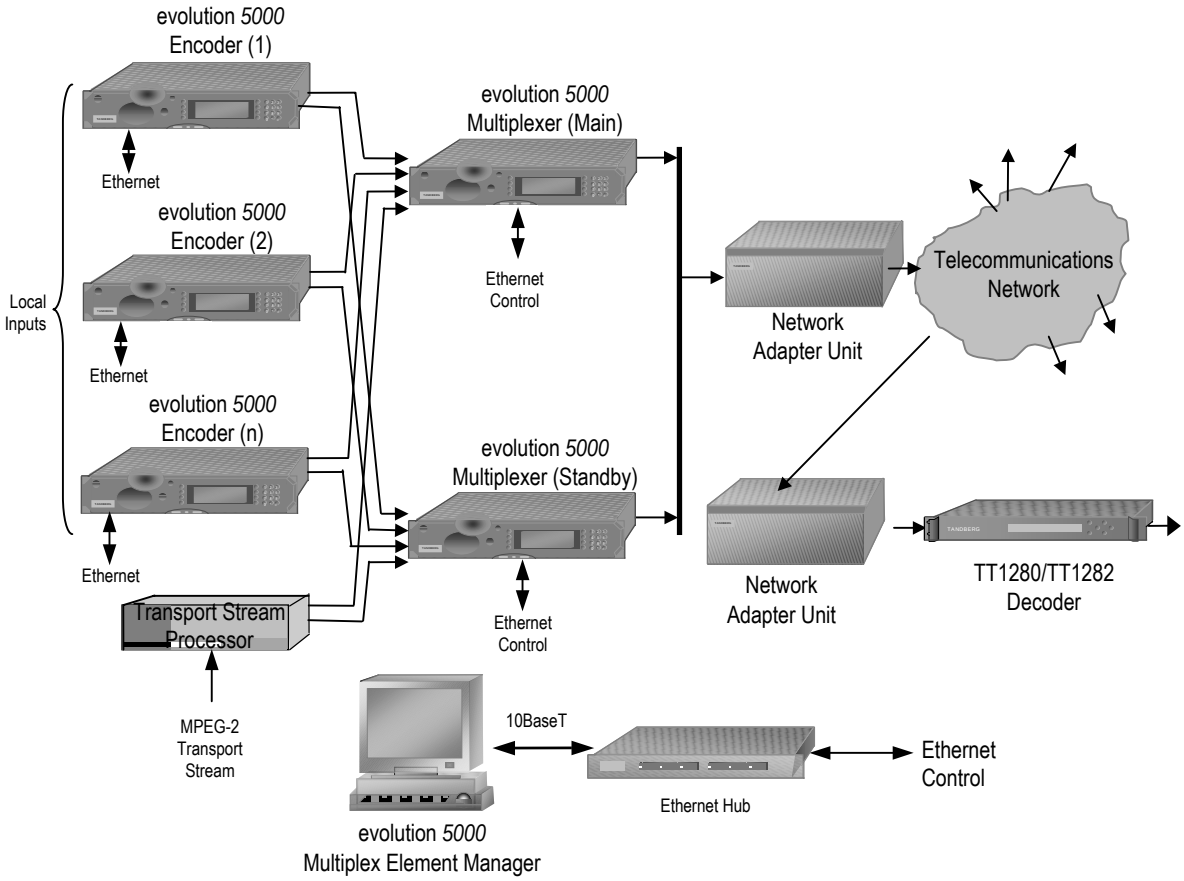

Figure 1.4: Typical Compression System

1.4.2 What the Decoder Does

The ASI interface is used to present the Transport Stream in the format required by the internal Decoder circuitry. At this point, the operation of the unit is the same as the Satellite Receiver.

The Decoder can be used to receive an input signal from a Public Telecom Network via a Network Adapter Unit (NAU). No error correction is supported at the input of the unit so a level of Quality of Service should be negotiated with the Telecom Network Provider.

The Decoder is configured to select a single video Service and other audio/data components from the multiple Services on the incoming Transport Stream and present them at the output.

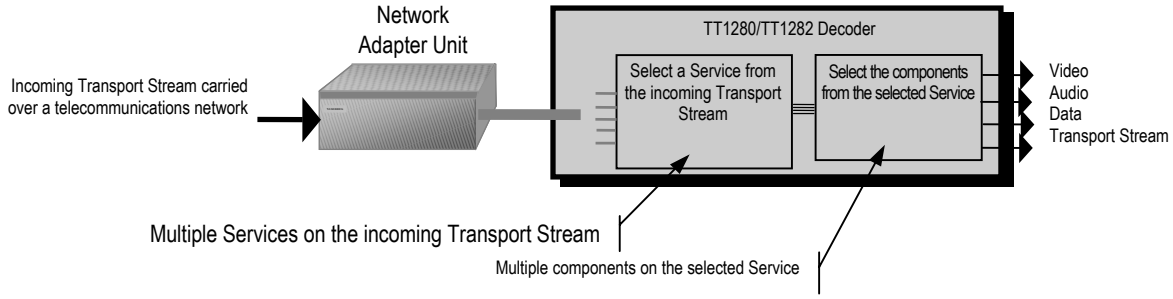

Figure 1.5: Role of the Decoder

1.5 Control Modes

1.5.1 Introduction

The IRD is designed for unattended operation. Once set up, the unit requires no further attention except to ensure the fan is working. There are up to three control modes associated with the Receiver (dependent upon options fitted). The unit remains in the chosen control mode until another mode is requested.

> NOTE...
> Local (Front Panel) Control is the factory default if TANDBERG Director is not installed.

1.5.2 Front Panel (Local) Modes

Operating the IRD from the Front Panel is via two main operating modes: **Navigate** and **Edit**. See *Section 3.3, Front Panel Operating Modes*.

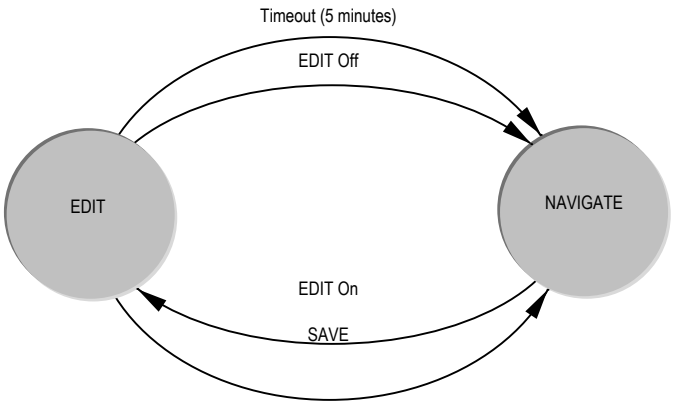

Figure 1.6: Front Panel States

1.6 Guided Tour

1.6.1 Construction

The IRD is constructed using a screened self-ventilated modular system. All operational inputs and outputs are via rear-panel connectors. The unit may be operated freestanding or mounted in a 19-inch rack.

1.6.2 Front Panel Controls

The physical interface for the Front Panel consists of an alphanumeric LCD display, pushbuttons, and status LEDs that are used to set up and monitor the unit. The general layout is shown in *Figure 1.7*. Information on the use of these controls is given in *Chapter 3, Operating the Equipment Locally.*

User input is via six pushbuttons comprising four cursor pushbuttons: **Left**, **Right**, **Up**, and **Down**; and two edit control pushbuttons: **Edit** and **Save**.

Each pushbutton has an integral green LED except **Save**, which has an integral red LED. When lit these LEDs indicate to the user which pushbutton is currently active.

Automatic repeat following an initial delay period is implemented for the **Left**, **Right**, **Up**, and **Down** pushbuttons in software.

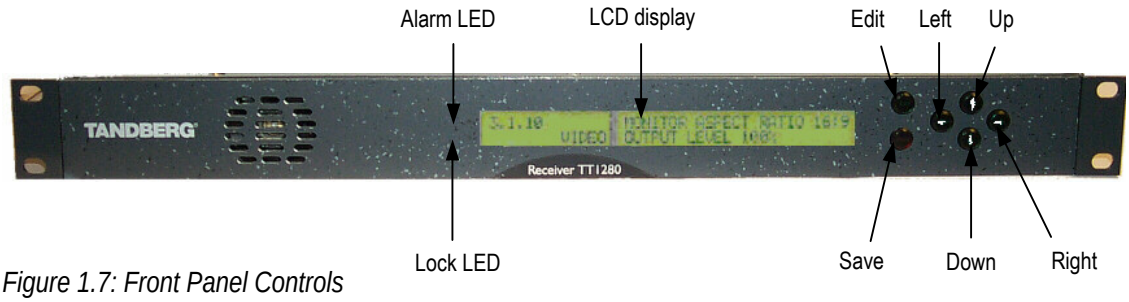

Figure 1.7: Front Panel Controls

1.6.3 Front Panel LEDs

Figure 1.7 shows the location of the LEDs on the front panel. The LEDs indicate the equipment status as follows:

The red **ALARM** LED is used to indicate an IRD fault condition, e.g. a missing or faulty input signal. It should be off for correct operation, although it may be lit briefly during power-up.

The green **LOCK** LED is used to indicate that the IRD is locked to a Transport Stream when lit, and indicates correct conditions and correct system functioning.

1.6.4 Rear Panel

Inputs and outputs to the unit are taken via the rear panel. Connector descriptions are given in *Chapter 2, Installing the Equipment* and *Chapter 6, Options.*

Chapter 2

Installing the Equipment

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2.1 Read This First!

2.1.1 Handling

The IRD must be handled and installed carefully and thoughtfully to prevent safety hazards and damage.

2.1.2 Installing the Equipment

Ensure the personnel designated to fit the unit have the appropriate skills and knowledge. If in any doubt, contact TANDBERG Television Customer Services (see *Preliminary Pages* for contact details).

Installation of the product should follow these instructions, and should only use installation accessories recommended by the manufacturers. When rack mounted, this equipment must have shelf supports as well as being fixed at the front panel.

Do not use this product as a support for any other equipment.

2.1.3 Lifting

In some circumstances the unit might be awkward to lift. In which case, do not attempt to lift or move it without proper assistance or equipment. If in doubt, seek assistance.

2.1.4 Site Requirements

Power Supplies

See *Annex B, Technical Specification* for a full specification.

Environment

See *Annex B, Technical Specification* for a full specification.

Do not install this product in areas of high humidity or where there is danger of water ingress.

Lightning Protection

WARNING...

IF THE RECEIVER HAS BEEN SUBJECT TO A LIGHTNING STRIKE OR POWER SURGE WHICH HAS STOPPED IT WORKING, DISCONNECT THE POWER IMMEDIATELY. DO NOT REAPPLY POWER UNTIL IT HAS BEEN CHECKED FOR SAFETY. IF IN DOUBT, CONTACT TANDBERG TELEVISION CUSTOMER SERVICES.

Where appropriate, ensure this product has an adequate level of lightning protection. Alternatively, during a lightning storm or when it is left unattended and unused for long periods of time, unplug it from the supply outlet and disconnect the output equipment. This prevents damage to the product due to lightning and power line surges.

2.2 Preliminary Checks

2.2.1 Mechanical Inspection

WARNING...

REMOVING THE COVERS OF THIS EQUIPMENT MAY INVALIDATE ANY WARRANTIES, CAUSE A SAFETY HAZARD OR/AND AFFECT THE EMC PERFORMANCE. CHECK WITH TANDBERG TELEVISION CUSTOMER SERVICES.

Inspect the equipment for damage-in-transit. If in doubt, please contact TANDBERG Television Customer Services (see *Preliminary Pages*).

2.2.2 Moving the Equipment Safely

Do not place this product on an unstable cart, stand, bracket, or table. The product may fall, causing serious injury and serious damage to the product. Use only with a cart, stand, bracket or table recommended by TANDBERG Television Ltd.

An appliance and cart combination should be moved with care. Quick stops, excessive force, and uneven surfaces may cause the appliance and cart combination to overturn. Do not move or carry the equipment whilst it is still connected to the supply or other leads, is live, or is in operation.

2.3 Installing the Equipment

2.3.1 Fixing

The IRD is designed for fixed use only and has been shipped with fixing brackets suitable for a standard 19-inch rack. When installed in a rack, it should be secured using the fixing brackets and M6 x 18 mm panhead screw in each corner of the front panel. In addition, support shelves must be used to reduce the weight on the brackets. Ensure it is firmly and safely located and it has an adequate flow of free-air.

A freestanding unit should be installed on a secure horizontal surface where it is unlikely to be knocked or its connectors and leads disturbed.

2.3.2 Ventilation

Openings in the Covers

Side openings in the cabinet, as well as a front-mounted cooling fan, are provided for ventilation. They ensure reliable operation of the product and protect it from overheating. The openings or the fan must not be blocked or covered.

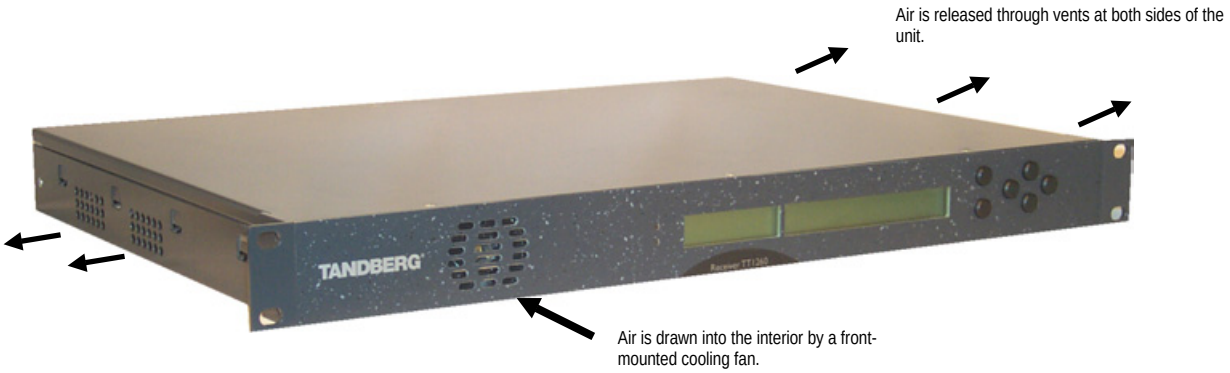


Figure 2.1: Air Flow Through the Equipment

Care in Positioning

CAUTIONS...

1. The fan contained within this unit is not fitted with a dust/insect filter. Pay attention to the environment in which it is to be used.
2. Do not install units so that the air intake of one aligns with the outlet on another. Provide baffles and adequate spacing.

The IRD should never be placed near or over a radiator or other source of heat. It should not be placed in a built-in installation such as a rack unless proper ventilation is provided and the instructions have been adhered to.

Allow at least 40 mm free air-space at each side of the equipment to ensure adequate cooling. Racks containing stacked equipment may need to be forced air-cooled to reduce the ambient temperature within the rack.

Protection from Moisture

Do not install this equipment in areas of high humidity or where there is a danger of water ingress.

2.3.3 Installing Cables - Safety

Power supply cables should be routed so that they are not likely to be walked on or pinched by items placed upon or against them. Pay particular attention to cables at plugs, convenience receptacles, and the point where they exit from the appliance.

Do not run ac power cables in the same duct as signal leads. Do not move or install equipment whilst it is still attached to the mains supply. Ensure safety and ESD precautions are observed whilst inter-connecting equipment.

2.4 EMC Compliance Statements[1]

2.4.1 EN 55022/AS/NZS 3548

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

2.4.2 FCC

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 radio communications. 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 his own expense.

2.5 AC Supply Operating Voltage and Fusing - Safety Information

2.5.1 AC Power Supply

The IRD operates from an wide-ranging mains power supply (100-120 Vac or 220-240 Vac 50/60 Hz nominal) and is designed for use in ambient air temperature in the range 0°C to +50°C. There are no links etc. to be altered for operation from different supply voltages. The full Technical Specification is given in *Annex B, Technical Specification*.

[1] The EMC information was correct at the time of manufacture. The EMC tests were performed with the Technical Earth attached.

WARNINGS...

1. THE TT1280 AND TT1282 SHOULD ONLY BE OPERATED FROM THE TYPE OF POWER SOURCE INDICATED ON THE MARKING LABEL. IF YOU ARE NOT SURE OF THE TYPE TO YOUR BUSINESS, CONSULT YOUR APPLIANCE DEALER OR LOCAL POWER COMPANY. DO NOT OVERLOAD WALL OUTLETS AND EXTENSION CORDS AS THIS CAN RESULT IN A RISK OF FIRE OR ELECTRIC SHOCK.
2. THE TT1280 AND TT1282 RANGE OF RECEIVERS/DECODERS ARE NOT FITTED WITH AN AC POWER ON/OFF SWITCH. ENSURE THE SUPPLY SOCKET OUTLET IS INSTALLED OR LOCATED NEAR THE EQUIPMENT SO THAT IT IS ACCESSIBLE.

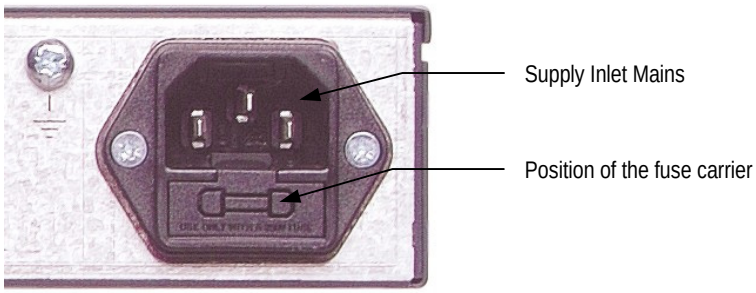


Figure 2.2: AC Power Inlet Assembly

NOTE...

See *Annex B, Technical Specification* for fuse information.

2.5.2 AC Power Supply Cord

General

A two-metre mains supply cord is supplied with this product. It is fitted with a moulded plug suitable for the USA, UK or mainland Europe as advised at the time of ordering.

NOTE...

The IRD is not fitted with an a.c. power supply ON/OFF switch. Ensure the socket-outlet supplying the equipment is installed near the equipment so that it is easily accessible.

Wire Colours

The wires in the supply cord are coloured as shown in *Table 2.1*.

Table 2.1: Supply Cord Wiring Colours

	UK (BS 1363)	EUROPE (CEE 7/7)	USA (NEMA 5-15P)
Earth:	Green-and-yellow	Green-and-yellow	Green
Neutral:	Blue	Blue	White
Live:	Brown	Brown	Black

If the colours do not correspond with the coloured markings identifying the terminals in a locally supplied plug, proceed as in *Table 2.2*. The inclusion of *Table 2.2* is for reference.

Table 2.2: Non Standard Supply Cord Wire Colours

Wire Colour (UK)	Action
green-and-yellow	...must be connected to the terminal in the plug which is marked with the letter E or the safety earth symbol ⏚ or coloured green or green-and-yellow.
blue	...must be connected to the terminal in the plug which is marked with the letter N or coloured black.
brown	...must be connected to the terminal in the plug which is marked with the letter L or coloured red.

2.5.3 Connecting the Equipment to the AC Power Supply

As there is no mains power switch fitted to this unit, ensure the local a.c. power supply is switched OFF before connecting the supply cord.

Connect the mains lead to the IRD and then to the local supply.

2.6 -48 Vdc Power Supply

2.6.1 DC Power Supply

> NOTE...
>
> Only models TT1280/CIBAS/48V, TT1280/DIRBAS/48V, TT1282/CIBAS/48V and TT1282/DIRBAS/48V use a d.c. power supply.

CAUTION...

This product should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supply to your business, consult a qualified electrical engineer.

This product uses a –48 Vdc power supply source (see *Annex B, Technical Specification* for a full power supply specification).

2.6.2 Location of the DC Input Connector

The connector is located at the right-hand rear of the equipment.

WARNING...

THE –48 VDC UNIT IS NOT FITTED WITH AN ON/OFF SWITCH. ENSURE THAT THE SUPPLY HAS A SUITABLE MEANS OF ISOLATION WHICH IS EASILY ACCESSIBLE. FAILURE TO ISOLATE THE EQUIPMENT PROPERLY MAY CAUSE A SAFETY HAZARD.

The equipment fuse is held in an integral fuse carrier at the d.c. power inlet at the rear of the Receiver. See *Annex B, Technical Specification* for d.c. fuse information.

2.6.3 Connecting the Equipment to the DC Power Supply

Connect the Receiver to the local d.c. power supply as follows.

1. **Local DC Power Supply**
   Ensure the power supply is isolated and switched off.
2. **Receiver**
   Ensure the correct fuse type and rating has been fitted to both the equipment and the power cable.
3. **Supply Cord**
   Connect the d.c. lead to the Receiver input connector and then to the local d.c. power supply. Switch on the d.c. power supply.

2.7 Protective Earth / Technical Earth

WARNINGS...

1. THIS UNIT MUST BE CORRECTLY EARTHED THROUGH THE MOULDED PLUG SUPPLIED. IF THE LOCAL MAINS SUPPLY DOES NOT HAVE AN EARTH CONDUCTOR DO NOT CONNECT THE UNIT. CONTACT CUSTOMER SERVICES FOR ADVICE.
2. BEFORE CONNECTING THE UNIT TO THE SUPPLY, CHECK THE SUPPLY REQUIREMENTS IN ANNEX B.

The terminal marked ⏚ at the rear panel is a Technical Earth. Its use is recommended. This is NOT a protective earth for electric shock protection. The terminal is provided to:

1. Ensure all equipment chassis fixed within a rack are at the same technical earth potential. To do this, connect a wire between the Technical Earth terminal and a suitable point on the rack
2. Eliminate the migration of stray charges when connecting between equipment.

The Technical Earth provides a suitable connection between the IRD and the installation to give a low impedance path at normal operating frequencies.

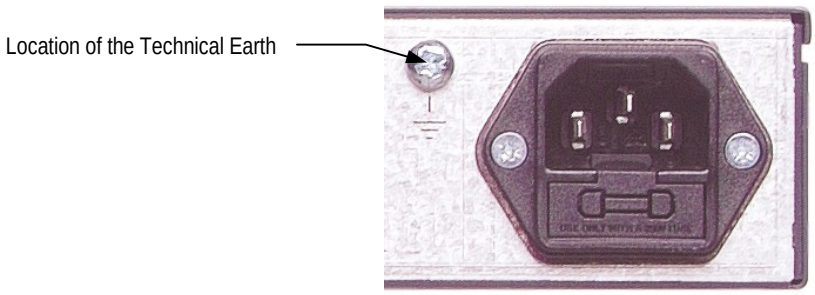


Figure 2.3: Location of the Technical Earth

2.8 Signal Connections

2.8.1 General

> CAUTION...
>
> It is strongly recommended that the terminal marked ⏚ at the rear panel of the equipment is connected to a site Technical Earth before any external connections are made and the equipment is powered. This limits the migration of stray charges.

All signal connections are made via the rear panel. A typical rear panel is shown in *Figure 2.4*. The connections are also shown schematically in *Figure 2.5*, and a full technical specification is given in *Annex B*.
The Receiver provides a flexible Transport Stream input interface.
The status information appropriate to each input type is available to the user via the User Interface, and also via the remote control interfaces.

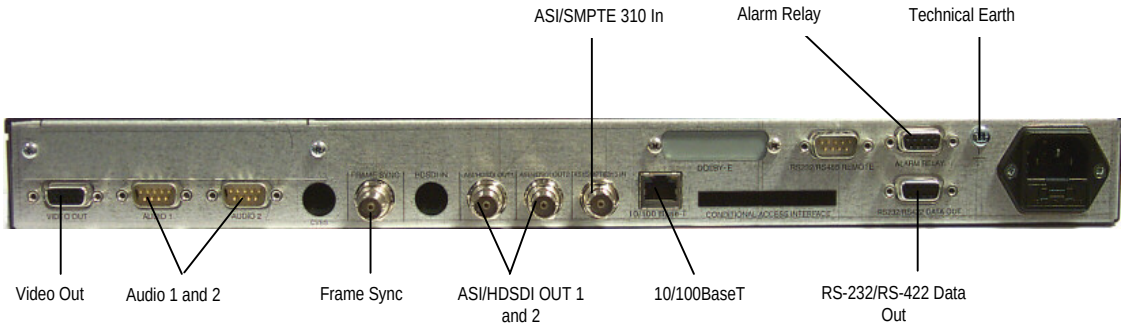


Figure 2.4: Typical Decoder Rear Panel

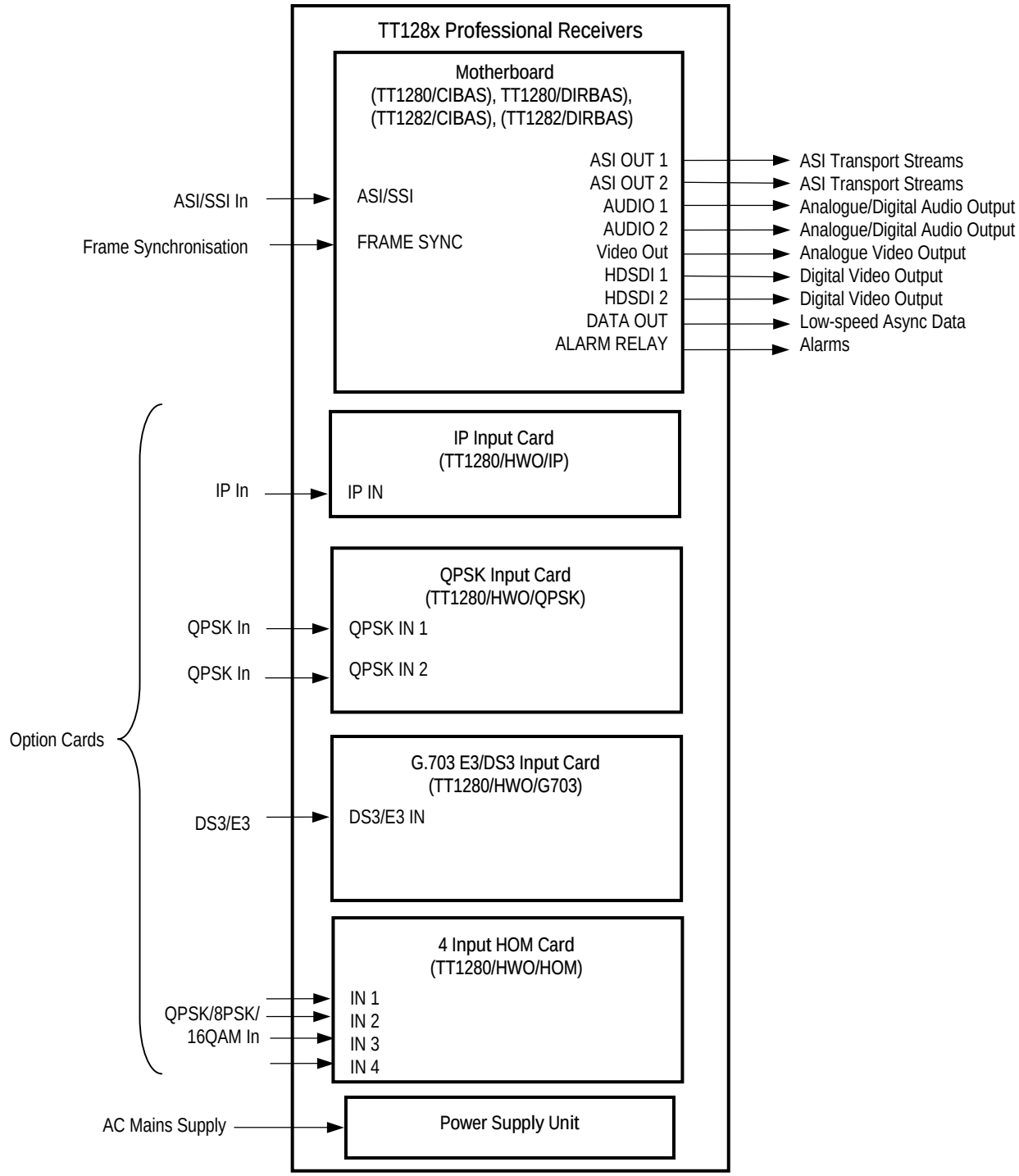


Figure 2.5: Signal Connections

2.8.2 ASI Out

Two BNC sockets output ASI Transport Streams with a maximum data rate of 160 Mbit/s.

> NOTE...
> These sockets are shared with the HD SDI output, under the control of Menu 5.1

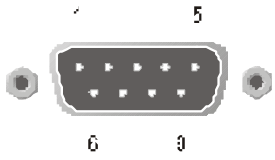
Table 2.3: ASI Out Connector

Item		Specification
Connector type		BNC 75 Ω socket
Connector designation		ASI/HDSDI OUT 1 ASI/HDSDI OUT 2
Pin-outs	Centre Shield	Video output Ground/Chassis

2.8.3 Audio Outputs

A pair of 9-way male D-type connectors provide two stereo channels. Each connector carries a single channel of a stereo pair in both analogue and digital form.

Audio control is through the Service Menu (Menu 3).

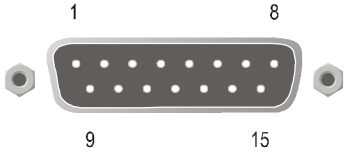


AUDIO 1 / 2

Table 2.4: Analogue Audio Connectors

Item	Specification
Connector type	9-way, D-type, Male
Connector designations	AUDIO 1 AUDIO 2
Pin-outs	Pin 1 — Digital audio + Pin 2 — Ground Pin 3 — Left + Pin 4 — Right + Pin 5 — Ground Pin 6 — Digital audio - Pin 7 — Ground Pin 8 — Left - Pin 9 — Right -
Nominal output impedance	50 Ω
Maximum data rate	3.072 Mbit/s
Analogue Output level	+18 dBm nominal clipping level. Selectable in range 12 to +24 dBm.
Load impedance	≥600 Ω balanced

2.8.4 SVGA Output (RGB HV)



The IRD is equipped with a SVGA 15-pin D-type connector for video output in the standard configuration.

The SVGA connector shall be set to RGB/HV (SVGA) or YPrPb under control of the user interface and remote control interfaces.

Table 2.5: SVGA Connector

Item		Specification	
Connector type		15-way D-type	
Connector designation		Video Out	
Pin-outs	1	Red / Pr	75 Ω, 0,7Vt-t
	2	Green / Y	75 Ω, 0,7Vt-t
	3	Blue / Pb	75 Ω, 0,7Vt-t
	4	NC	
	5	Video GND	
	6	Red GND	
	7	Green GND	
	8	Blue GND	
	9	NC	
	10	Sync GND	
	11	NC	
	12	NC	
	13	H-Sync	
	14	V-Sync	
	15	NC	

2.8.5 Digital Video Output


HDSDI OUT 1/2

The IRD has two ASI/SMPTE 292M (HD-SDI) outputs in the standard configuration.

The output standard (ASI or SMPTE 292) must be selected from the user interface or remote control interface.

The HD-SDI output is coaxial via BNC connectors. Video control is through the Video Menu (Menu 3.1).

Table 2.6: Digital Output Connector

Item		Specification
Connector type		BNC 75 Ω female socket
Connector designation		ASI/HDSDI OUT 1 ASI/HDSDI OUT 2
Pin-outs	Centre Shield	Video output Ground/Chassis

NOTE...
These connectors are shared with the ASI output, under the control of menu 5.1.

2.8.6 Frame Synchronisation

A BNC socket is used by the Decoder to frame lock to an external video source (NTSC, PAL or SECAM). The frame information is input as a composite signal, with or without active video. The user can offset the synchronisation to the video output by ±8 lines of the reference signal, with a resolution of 1 pixel of the reference signal. Lip sync error introduced by the Receiver is in the range -10 ms to +30 ms. This implies audio frame skip and repeat may occur.


FRAME SYNC

This Frame Sync is activated through the Service menu (Menu 3).

Table 2.7: Frame Sync Hi-Z Connector

Item		Specification
Connector type		BNC 75 Ω socket
Connector designation		FRAME SYNC
Pin:	Centre	Analogue Black and Burst Input
	Shield	Ground/Chassis
Impedance		Last unit must be terminated with 75 Ω

2.8.7 Ethernet

The IRD has an Ethernet remote control port for SNMP Control. This is also used for high-speed data over Ethernet output and TANDBERG engineering debug purposes.

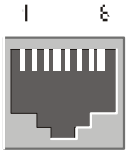
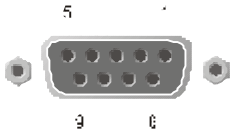

10/100BaseT

Table 2.8: Ethernet Pin-outs

Item	Specification
Connector type	RJ-45 (100BaseT)
Connector designation	10/100BaseT
Pin-outs (Unused pins not connected)	Pin 1 — Tx Out (+) Pin 2 — Tx Out (-) Pin 3 — Rx In (+) Pin 6 — Rx In (-)

2.8.8 Alarm Connector and Relay

The alarm relay connector has a summary and four general purpose relays. The summary relay is activated whenever the unit detects an alarm, or the power is switched off.



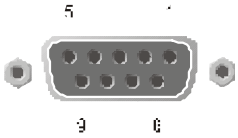
ALARM RELAY

Table 2.9: Alarm Connector

Item		Specification
Connector type		9-way, D-type, Female for the summary alarm relay
Connector designation		ALARM RELAY
Pin-outs	Pin 1	Relay 2, Normally open
	Pin 2	Relay 3, Normally open
	Pin 3	Relay 4, Normally closed
	Pin 4	Relay 1, common pin
	Pin 5	Relay 5, Normally closed
	Pin 6	Relays 2 and 3, common pin
	Pin 7	Relays 4 and 5, common pin
	Pin 8	Relay 1, Normally Closed (Open on Alarm)
	Pin 9	Relay 1, Normally Open (Closed on Alarm)

2.8.9 RS-232 Low-speed Asynchronous and RS-422 High-speed Synchronous Data Outputs

A 9-way, D-type female connector provides a shared simultaneous asynchronous low-speed data and synchronous high-speed data serial communications interface. The status of the data output on this connector is given in the Data menus (Menus 3.4 and 3.5).



RS232/RS422 Data Out

Table 2.10: RS-232 Low-speed/RS-422 High-speed Data Connector

Item	Specification
Connector type	9-way, D-type, Female
Connector designation	RS232/RS422 Data Out
Standards	RS-232 DATA/RS-422 DATA
Configuration	DCE
Pin-outs	Pin 1 — CLK (RS-422) Pin 2 — Receive Data Output (RxD) (RS-232) Pin 3 — Not Used Pin 4 — Not Used Pin 5 — Ground (RS-232) Pin 6 — CLK (inverted) (RS-422) Pin 7 — Not used Pin 8 — DATA (RS-422) Pin 9 — DATA (inverted) (RS-422)

2.9 Option Card Connectors

Option cards are described in *Chapter 6, Options*.

Chapter 3

Operating the Equipment Locally

Contents

List of Figures

List of Tables

3.1 Powering the Equipment

3.1.1 Switching On

> CAUTION...
>
> This equipment should not be operated unless the cooling fan is working and there is free-air flow around the unit.

Connect the signal inputs and ac power supply to the IRD and power up the unit. After a short period of initialisation and the IRD gaining lock, the unit powers up in **Navigate** mode. This is the usual operating condition.

The **Lock** LED will be on (green) when a signal is locked and off when unlocked. See *Figure 3.2* for the location of the Lock LED.

3.1.2 Power-up Operating Modes

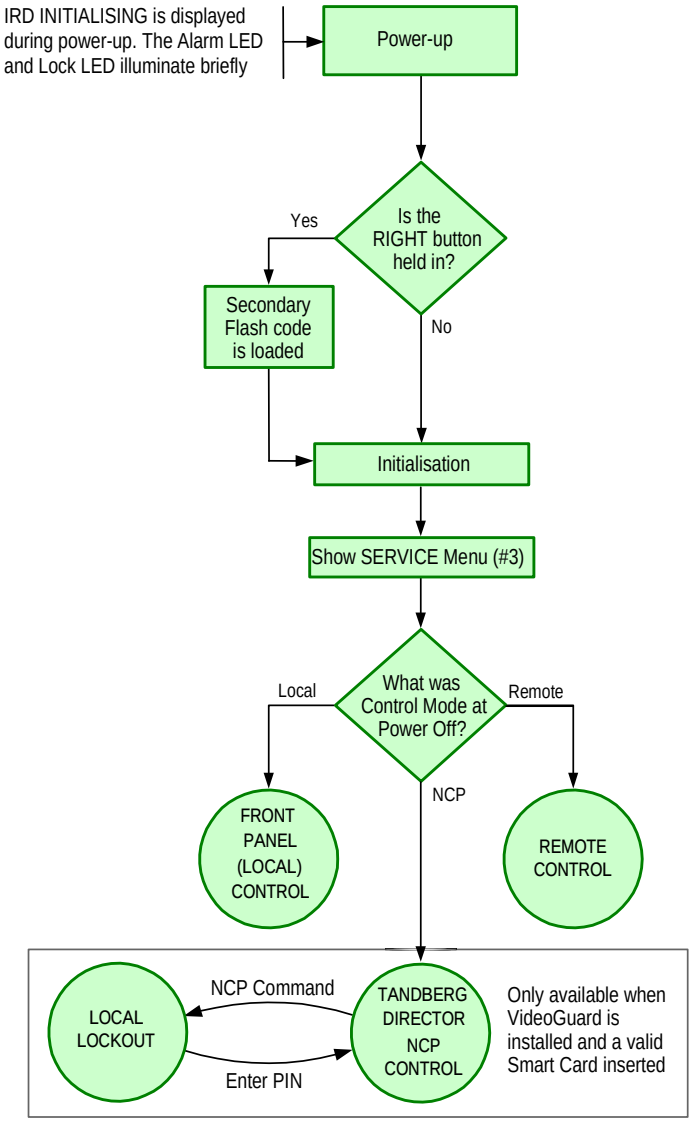


Figure 3.1: Power-up Operating Mode

3.2 Front Panel Controls and Pushbuttons

Front Panel items are described under *Section 1.6, Guided Tour*.

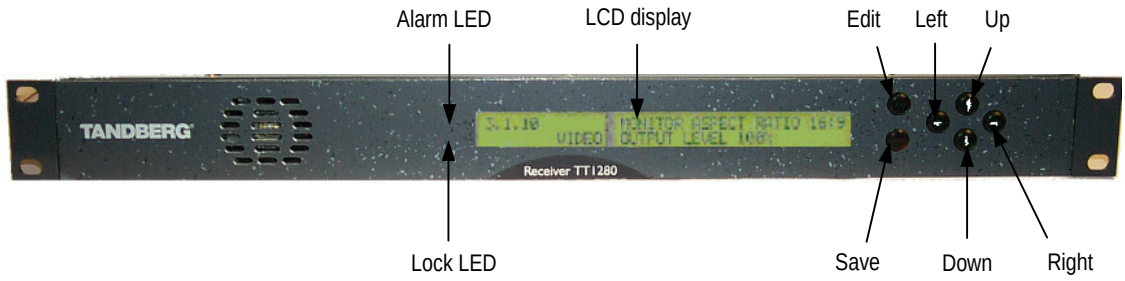


Figure 3.2: Front Panel Controls and Pushbuttons

3.3 Front Panel Operating Modes

3.3.1 General

Operating the IRD from the Front Panel is via two operating modes: **Navigate Mode** *(*see *Section 3.3.2)* and **Edit Mode** *(*see *Section 3.3.3).*

3.3.2 Navigate Mode

Navigate mode allows the user to move between menus and pages within menus (editing the left display area).

Table 3.1: Navigate Mode

Action	Result
Up Pushbutton Pressed	Go to page given by uplink of current page, obtain and display current data.
Down Pushbutton Pressed	Go to page given by down link of current page, obtain and display current data.
Left Pushbutton Pressed	Go to page given by left link of current page, obtain and display current data.
Right Pushbutton Pressed	Go to page given by right link of current page, obtain and display current data.
Edit Pushbutton Pressed	Enter Edit mode at current page (if permitted else no effect).
Save Pushbutton Pressed	No effect.

Pushbutton LEDs will be updated to indicate which pushbutton presses are still valid as each navigation pushbutton press event is processed. For example, a lit **Up** pushbutton LED indicates there are pages above the current one.

3.3.3 Edit Mode

Edit mode edits the right display area and allows the user to alter control parameters that define the IRD behaviour. To enter **Edit** mode press the **Edit** pushbutton when on a page containing an editable control parameter and the front panel is the controlling user interface. Edit may be entered on some special pages at all times, for example on the page defining the controlling user interface.

The Front Panel returns to Navigate mode when **Edit** is pressed again (abort edit with no save) or when **Save** is pressed (save modified parameter values). Processing of events from the front panel event queue depends on the current operating mode of the front panel.

Table 3.2: Edit Mode

Action	Result
Up Pushbutton Pressed	Increases value of current edit parameter by one unit.
Down Pushbutton Pressed	Decreases value of current edit parameter by one unit.
Left Pushbutton Pressed	Moves cursor one edit parameter/parameter digit left (making that the current edit parameter).
Right Pushbutton Pressed	Moves cursor one edit parameter/parameter digit right (making that the current edit parameter).
Edit Pushbutton Pressed	Aborts edit (no save/action of any modified parameters) and returns to Navigate mode, obtain and display current data.
Save Pushbutton Pressed	Save/action new parameter values and returns to Navigate mode, obtain and display current data.

Pushbutton LEDs are updated to indicate which pushbutton presses are still valid as each edit pushbutton press event is processed. For example, when the **Left** pushbutton LED is lit it indicates there are additional editable parameters to the left of the current cursor position.

There is a maximum idle period of five minutes when **Edit** mode will time out and return to **Navigate** mode.

3.4 Using the Local Controls

3.4.1 LCD Menu Descriptions

Detailed LCD menu descriptions are given in *Annex C, Menus*. This chapter concentrates on describing the use of the menus for local operation.

3.4.2 Selecting a Menu Option

Some items shown in the right display area of the front panel LCD display have a set number of options. An example of this is the VIDEO TEST PATTERN (Menu 3.1.6) which has a number of preset Video Test Patterns associated with it. Use the following steps as a general guide to selecting an option.

Table 3.3: Selecting a Menu Option

Step	Action	Result
1	Select the menu and display the required selection.	Normally there is only one selectable item. If there is more than one, use the **Right** and **Left** pushbuttons as described in *Table 3.4.*
2	Press **Edit** on the front panel.	The **Save** button will come on to show that the new option can be stored.
3	Use the arrow pushbuttons to step through the options.	This action scrolls through the options in a continuous loop.
4	Press **Save** to store the option or press **Edit** to cancel the selection and return to the source menu.	

3.4.3 Entering a Menu Value

Some items shown in the right display area of the front panel LCD display have a user-entered value. An example of this is the IP Address (Menu 7.1.3) in which the unit's Network address has to be entered. Use the following steps as a general guide to entering a value.

Table 3.4: Entering a Menu Value

Step	Action	Result
1	Select the menu and display the required selection.	
2	Press **Edit** on the front panel.	The **Save** button will come on to show that the new value can be stored.
3	Use the **Right** or **Left** pushbutton to move the cursor to the required digit.	Each pushbutton has a built-in LED that turns on if the pushbutton function is appropriate to the displayed information.
4	Change the value by using the arrow pushbuttons.	
5	Press **Save** to store the option.	

3.5 Setting Up Preset Services (Menu 1)

3.5.1 Using Preset Services

This group allows up to 40 Services to be stored as presets. Selecting a Service from the preset list in Menu 1 automatically reconfigures the IRD to receive that Service with its associated parameters set as stored.

3.5.2 Setting Up a Preset Service

Follow the steps in *Table 3.5* to store the current Service as a preset.

Table 3.5: Setting Up a Preset Service

Step	Action	Result
1	Use the menus to set up the unit so that the required Service is current. (Refer to *Section 3.6*).	This selects the Service and associated parameters for the preset process.
2	Go to Menu 1 to view the Preset menu.	This displays the menu which allows the Current Service to be stored at a chosen location (01 – 40). If there is no Current Service, the menu display reads NO STORED SERVICE.
3	Select a location to store the preset. The Edit mode cannot be entered unless a valid Service being decoded.	Use Edit and the arrow pushbuttons to step through the stored items. This allows a specific location to be chosen. Any vacant locations are marked by NO STORED SERVICE.
4	Press Save.	This stores the current Service and its associated parameters as a preset in the selected location. This adds the Service to the list displayed on page 1.

3.6 Setting Up the Input (Menu 2)

3.6.1 QPSK Satellite Receiver

Table 3.6: Setting Up the QPSK Satellite Receiver

Step	Action	Result
1	Go to Menu 2.3 and select SOURCE 1.	The Receiver can take its signals from two sources. Set up source 1.
2	Scroll to Menu 2.3.2. Enter the LNB FREQUENCY then press Save.	This sets up the LNB frequency for the selected Source in MHz.
3	Scroll to Menu 2.3.2.1. Enter the SATELLITE FREQUENCY then press Save.	This sets up the Satellite frequency for the selected Source in MHz.
4	Scroll to Menu 2.3.2.2. Enter the SYMBOL RATE then press Save.	Sets the symbol rate for the selected Source in Msymbols/s.
5	Scroll to Menu 2.3.2.3. Enter the MODULATION and FEC RATES then press Save.	This sets up the Modulation (QPSK, 8PSK, 16QAM) and FEC (1/2, 2/3, 3/4, 5/6, 7/8, 8/9) rates for the selected Source. The FEC selection is limited to the valid values of the currently selected modulation type. For AUTO FEC, the Receiver searches for and locks to the correct FEC rate for the received carrier.
6	Scroll to Menu 2.3.2.4. Enter the LNB POWER and VOLTAGE settings then press Save.	Sets the LNB power for the selected Source (ON, OFF, BOOSTED). BOOSTED provides 1V extra power over the ON setting. Also sets the LNB voltage settings (18v – Horiz, 13v – Vert).

Step	Action	Result
7	Scroll to Menu 2.3.2.5. Enter the LNB 22 kHz setting then press Save.	Enables or disables the LNB 22 kHz control tone for the selected Source (On, Off).
8	Scroll to Menu 2.3.2.6. Enter the SEARCH RANGE then press Save.	This sets up the centre frequency Search Range for the selected Source in kHz.
9	Scroll to Menu 2.3 and select SOURCE 2. Repeat steps 2 through 8.	

3.6.2 HOM Satellite Receivers (TT1280/HWO/HOM)

Table 3.7: Setting Up the HOM Satellite Receiver

Step	Action	Result
1	Go to Menu 2.3 and select SOURCE 1.	The Receiver can take its signals from four sources. Set up source 1.
2	Scroll to Menu 2.3.2. Enter the LNB FREQUENCY then press Save.	This sets up the LNB frequency for the selected Source in MHz.
3	Scroll to Menu 2.3.2.1. Enter the SATELLITE FREQUENCY then press Save.	This sets up the Satellite frequency for the selected Source in MHz.
4	Scroll to Menu 2.3.2.2. Enter the SYMBOL RATE then press Save.	Sets the symbol rate for the selected Source in Msymbols/s.
5	Scroll to Menu 2.3.2.3. Enter the MODULATION and FEC RATES then press Save.	This sets up the Modulation (QPSK, 8PSK, 16QAM) and FEC (1/2, 2/3, 3/4, 5/6, 7/8, 8/9) rates for the selected Source. The FEC selection is limited to the valid values of the currently selected modulation type. For AUTO FEC, the Receiver searches for and locks to the correct FEC rate for the received carrier.
6	Scroll to Menu 2.3.2.4. Select the appropriate Input Gain mode then press Save.	High Gain mode should be selected for input signals of low power. Low Gain mode should be selected for input signals of high power.
7	Scroll to Menu 2.3.2.5. Enter the ROLL OFF then press Save.	Sets the Roll Off of the demodulator Root Nyquist Filter. Choose between 35% and 20%. This value should match that set in the transmitting modulator.
8	Scroll to Menu 2.3.2.6. Select the appropriate SPECTRUM SENSE then press Save	Sets the SPECTRUM SENSE to NORMAL, INVERTED or AUTO. This should be set to match the spectrum sense of the received signal.
9	Scroll to Menu 2.3.2.7. Enter the LNB POWER and VOLTAGE settings then press Save.	Sets the LNB power for the selected Source (ON, OFF, BOOSTED). BOOSTED provides 1V extra power over the ON setting. Also sets the LNB voltage settings (18v – Horiz, 13v – Vert).
10	Scroll to Menu 2.3.2.8. Enter the LNB 22 kHz setting then press Save.	Enables or disables the LNB 22 kHz control tone for the selected Source (On, Off).
11	Scroll to Menu 2.3.2.9. Enter the SEARCH RANGE then press Save.	This sets up the centre frequency Search Range for the selected Source in kHz.
12	Repeat steps 2 through 8 for input 2 to 4	

3.6.3 DVB-S2 Satellite Receiver (TT1280/HWO/DVBS2 and TT1280/HWO/DVBS2/IF/CONST)

Table 3.8: Setting Up the DVB-S2 Satellite Receiver

Step	Action	Result
1	Go to Menu 2.3 and select SOURCE 1.	The Receiver can take its signals from four sources. Set up source 1.
2	Scroll to Menu 2.3.2. Enter the LNB FREQUENCY then press Save.	This sets up the LNB frequency for the selected Source in MHz.
3	Scroll to Menu 2.3.2.1. Enter the SATELLITE FREQUENCY then press Save.	This sets up the Satellite frequency for the selected Source in MHz.
4	Scroll to Menu 2.3.2.2. Enter the SYMBOL RATE then press Save.	Sets the symbol rate for the selected Source in Msymbols/s.
5	Scroll to Menu 2.3.2.3. Enter the DVB Modulation Standard then press Save.	This sets up the DVB modulation Standard (DVB-S or DVB-S2). FEC detection is automatic. In DVB-S2 mode the demodulator automatically detects and locks to both QPSK and 8PSK constellations.
6	Scroll to Menu 2.3.2.4. Enter the ROLL OFF then press Save.	Sets the Roll Off of the demodulator Root Nyquist Filter. Choose between 35%, 25%, 20%. This value should match that set in the transmitting modulator.
7	Scroll to Menu 2.3.2.5. Enter the SEARCH RANGE then press Save.	This sets up the centre frequency Search Range for the selected Source in kHz.
8	Scroll to Menu 2.3.2.6. Enter the LNB POWER and VOLTAGE settings then press Save.	Sets the LNB power for the selected Source (ON, OFF, BOOSTED). BOOSTED provides 1V extra power over the ON setting. Also sets the LNB voltage settings (18v – Horiz, 13v – Vert).
9	Scroll to Menu 2.3.2.7. Enter the LNB 22 kHz setting then press Save.	Enables or disables the LNB 22 kHz control tone for the selected Source (On, Off).
10	Repeat steps 2 through 9 for input 2 to 4	

DVB-S2 Input Option Card TT1280/HWO/DVBS2/IF/CONST

The DVB-S2 demod option TT1280/HWO/DVBS2/IF/CONST offers three L-band inputs plus an IF input. If this input option card is fitted in the receiver then note that Menu 2.3.5 sets the IF input frequency. LNB Frequency, Satellite Frequency and LNB Power parameters are not applicable for this input.

The DVB-S2 demod option TT1280/HWO/DVBS2/IF/CONST also offers a constellation output in DVB-S2 mode. This output can be enabled for each L-band/IF input from the menu 2.3.X.6. Enabling this mode disables the demodulator transport stream rendering the receiver unable to decode a service.

3.6.4 Telco Receiver - TTV G.703

Table 3.9 steps through the set up procedure of the Telco Receiver using Menu 2 Input, and the TTV G.703 input.

Table 3.9: Setting Up the TTV G.703 Interface

Step	Action	Result
1	Connect the cable to the TTV G.703 input.	
2	Power up the unit and navigate to Menu 2 Input.	Accesses the Input menu.
3	Press the Right pushbutton to access Menu 2.3.	Selects the G.703 menu.
4	Navigate to INTERLEAVER (Menu 2.3.3), then press Edit. Select Enable or Disable, then press Save.	Sets the required interleaving.
5	Navigate to SIGNAL LEVEL (Menu 2.3.4), then press Edit. Select Normal or Low, then press Save.	Sets the unit sensitivity to the input signal level.
6	Navigate to REED-SOLOMON (Menu 2.3.2), then press Edit. Select ENABLE, then press Save.	Enables FEC functionality.
7	Return to Input Menu 2, it should display the current status. If status is NOT LOCKED, verify that the cable is properly connected and that all values have been entered correctly.	

3.6.5 10/100BaseT IP

Table 3.10 steps through the set up procedure of the Telco Receiver using Menu 2 Input, and the IP input.

Table 3.10: Setting Up the IP Interface

Step	Action	Result
1	Connect the Ethernet cable to the IP input connector.	
2	Power up the unit and navigate to Menu 2 Input.	Accesses the Input menu.
3	Navigate to UDP PORT (Menu 2.3.2), then press Edit. Select the Receive UDP Port number, then press Save.	Edits the UDP Port parameter.
4	Navigate to IP INPUT IP ADDRESS (Menu 2.3.2.1), then press Edit. Select the IP address, then press Save.	Edits the IP Input address parameter.
5	Navigate to IP INPUT SUBNET MASK (Menu 2.3.2.2), then press Edit. Select the Subnet mask, then press Save.	Edits the IP Input subnet mask parameter.
6	Navigate to IP INPUT GATEWAY ADDRESS (Menu 2.3.2.3), then press Edit. Select the Gateway address, then press Save.	Edits the IP Input Gateway address parameter.

Step	Action	Result
7	Navigate to IP INPUT MULTICAST IP ADD (Menu 2.3.2.4), then press Edit. Select the Multicast IP address, then press Save.	Edits the IP Input Multicast IP address parameter.
8	Return to Input Menu 2, it should display the current status. If status is NOT LOCKED, verify that the cable is properly connected and that all values have been entered correctly.	

3.7 Service Configuration (Menu 3)

3.7.1 Selecting and Setting Up a Service

Each Transport Stream may contain many Services. Menu 3 allows a Service to be chosen as current and the profile of its components to be specified. This Service will be used as the power-up default Service until a new Service is selected.

Table 3.11: Selecting a Service

Step	Action	Result
1	Go to Menu 3 and select the required Service. The Edit mode cannot be entered unless there are available Services.	This page shows the total number of Services available in the incoming Transport Stream. Use Edit and the arrow pushbuttons to select the required Service.
2	Press Save.	This stores the Service as the Current Service.

3.7.2 Selecting the Video Component

Table 3.12: Selecting the Video Component

Step	Action	Result
1	Go to Menu 3.1 and press Edit. Select one of the video streams or enter a video stream PID.	Selects the video component.
2	Scroll to Menu 3.1.5 and edit the parameter for setting the response to loss of video (FREEZE FRAME, BLACK FRAME, BLUE FRAME, NO SYNCS, 75% BARS AND RED, BLUE PLUS TEXT, RED PLUS TEXT). Press Save. Perform a system restart (see *Section 3.12 Restarting the Unit*).	Edits the parameter for setting the response to loss of video.
3	Scroll to Menu 3.1.6 and edit the video test pattern to be displayed. Press Save.	Edits the video test pattern to be displayed.
4	Scroll to Menu 3.1.7 and edit the parameter for framesync enable (ENABLED or DISABLED). Press Save.	Edits the parameter for framesync enable.
5	Scroll to Menu 3.1.7.1 and edit the PAL framesync offset range (-199999 to +199999 pixels) and the NTSC framesync offset range (-199999 to +199999 pixels). Press Save.	Edits the PAL framesync offset range and the NTSC framesync offset range.
6	Scroll to Menu 3.1.11.1 and edit the embedded audio data IDs (0X0 – 0xFFF) and audio channel (NONE, ONE, TWO, or ONE and TWO). Press Save.	Edits the embedded audio data IDs and audio channel.

3.7.3 Selecting the Audio Component

Introduction

Automatic audio component selection is based on component order in the PMT as follows:

- Audio 1 selects the first component in the PMT and Audio 2 selects the second component.
- Audio 1 does not select the same component as Audio 2 and vice-versa when component-PIDs are reordered in a new PMT.
- Coding type and language are manually selectable through the User PID and type parameters.

Selecting the Audio Manually

It is possible to manually select any audio component from the active Service by using the front panel controls or via the remote control interface. Select one of the audio components in the list or enter the correct PID. *Table 3.13* describes the procedure for selecting a component.

Table 3.13: Manually Selecting the Audio Components

Step	Action	Result
1	Go to the Menu 3.2 and press Edit. Select one of the audio streams or enter an audio PID.	Selects the audio component.
2	Scroll to Menu 3.2.3 and edit the Audio 1 delay adjustment (range ± 0 to 49.5ms). Press Save.	Edits the Audio 1 delay adjustment.
3	Scroll to Menu 3.2.4 and edit the Audio 1 digital output format (AES3 or AC-3) and output routing (STEREO, MIXED TO BOTH, LEFT TO BOTH, or RIGHT TO BOTH). Press Save.	Edits the Audio 1 digital output format and output routing. Note that when the input signal is STEREO, the Audio digital output format will always be STEREO.
4	Scroll to Menu 3.2.5 and edit the clipping value (12 – 24 dB). Press Save.	Edits the clipping value.
5	Scroll to Menu 3.2.6 and edit the AC-3 downmix parameter (SURROUND STEREO or CONVENTIONAL STEREO) Press Save.	Edits the AC-3 downmix parameter.
6	Go to the Menu 3.3 for Audio 2 and repeat steps 2 through 5.	Selects the audio component.

3.7.4 Setting Up Asynchronous Data (RS-232)

These menu pages allow status monitoring and configuration of the low speed data.

Table 3.14: Setting Up Async Data

Step	Action	Result
1	Go to Menu 3.5 and press **Edit**. Select the data stream PID.	Selects the data stream.
2	Scroll to Menu 3.5.1 and edit the low speed data output (ENABLED or DISABLED). Press **Save**.	The unit receives and displays the correct bit-rate.

3.7.5 Setting Up High-speed Data over Ethernet

These menu pages allow status monitoring and configuration of the high-speed data over Ethernet software option.

Table 3.15: Setting Up High-speed Data over Ethernet

Step	Action	Result
1	Go to Menu 3.7 and press **Edit**. Select the data stream PID.	Selects the data user PID number.
2	Scroll to Menu 3.7.1 and edit the High-speed data output (ENABLED or DISABLED). Press **Save**.	The unit receives and displays the correct bit-rate.
3	Scroll to Menu 3.7.3 and edit the Forward to Gateway ON/OFF and the Gateway IP address menu. Press **Save**.	If the Forward to Gateway option is turned on, the unit will forward the data stream to the gateway address given.

3.7.6 Setting Up High-speed Synchronous Data (RS-422)

These menu pages allow status monitoring and configuration of the synchronous high-speed data.

Table 3.16: Setting Up Synchronous High-speed Data

Step	Action	Result
1	Go to Menu 3.6 and press **Edit**. Select the data stream PID.	Selects the data stream.
2	Scroll to Menu 3.6.1 and edit the High-speed data output (ENABLED or DISABLED). Press **Save**.	The unit receives and displays the correct bit-rate.

3.7.7 Setting Up Closed Captions

Table 3.17: Setting Up Closed Captions

Step	Action	Result
1	Scroll to Menu 3.8.2 and edit the parameter for enabling Closed Captions pass through (ENABLED or DISABLED). Press Save.	Edits the parameter for enabling Closed Captions pass-through.

3.7.8 Setting Up VITC

Table 3.18: Setting Up VITC

Step	Action	Result
1	Scroll to Menu 3.8.1 and edit the parameter for enabling VITC pass through (ENABLED or DISABLED). Press Save.	Edits the parameter for enabling VITC pass-through.

3.7.9 Setting the PCR PID Menu

Table 3.19: Viewing the PCR PID Menu

Step	Action	Result
1	Go to Menu 3.9 and scroll to USER PID and edit the PID for enabling manual selection of the PCR PID.	Gains access to the selection between automatically detected PCR PID or manually entered PCR PID.

3.7.10 Viewing the Network ID Menu

Table 3.20: Viewing the Network ID Menu

Step	Action	Result
1	Go to Menu 3.10.	Gains access to the Network ID and the Original Network ID.

3.8 Setting Up the Conditional Access/Scrambling (Menu 4)

3.8.1 Introduction

Menu 4 allows the status and configuration of the Conditional Access (CA) module to be checked. The structure and content of this group depends on the CA system. The available CA options are as follows:

- Basic Interoperable Scrambling System (BISS), Mode 1 and Mode E only.
- Remote Authorisation System (RAS) and RAS 2
- TANDBERG Director
- DVB Common Interface

BISS (as specified in EBU Tech 3292 May 2002) is standard on all units. It is not possible to have both DVB Common Interface and TANDBERG Director options fitted on the same unit.

3.8.2 Basic Interoperable Scrambling System (BISS) (Menu 4.4)

BISS Mode 1 is similar to RAS in that it uses a fixed control word to encrypt the data in the transport stream. Unlike RAS, the scrambling algorithm is non-proprietary, using the DVB Common Scrambling Algorithm to allow interoperability with other manufacturers' encoding/scrambling equipment.

3.8.3 Remote Authorisation System (RAS) (Menu 4.1)

RAS has two levels of operation: FIXED KEY MODE and DSNG KEY MODE.

FIXED KEY MODE has a fixed control word to encrypt the data in the transport stream.

DSNG KEY MODE is used for fixed head-end systems. Its main functionality is:

- Over-air addressing of Receivers for authorisation/de-authorisation to decrypt the transmission.
- Group operation for authorisation/de-authorisation.
- Periodic control word changes during transmission.

3.8.4 TANDBERG Director (Menu 4.3)

There is a single slot on the IRD pack panel to allow the insertion of a Smart Card for the TANDBERG Director system. Director functionality includes Conditional Access, over-air software download and over-air control.

Other than the insertion of the Smart Card, no specific set-up is required at the IRD for the Conditional Access or software download. For over-air control (NCP) see *Chapter 4, Operating the Equipment Remotely*.

3.8.5 DVB Common Interface (Menu 4.3)

There is a single slot on the IRD pack panel to allow the insertion of a DVB Common Interface (CI) Conditional Access module (CAM) and related conditional access card.

Other than the insertion of the CAM and Access card, no specific set-up is required at the IRD for the DVB Conditional Access.

3.9 Setting Up the Transport Stream Output (Menu 5)

3.9.1 Set-up Procedure

Use *Table 3.21* to step through the Transport Stream Output set-up procedure using Menu 5. This allows the Transport Stream for the current Service to be output on the ASI output connectors.

Table 3.21: Setting Up the Transport Stream Output (TSO)

Step	Action	Result
1	Go to Menu 5 to enter the TRANSPORT STREAM OUTPUT setting. Press Edit then select one of the following: POST INPUT (i.e. as input Transport Stream); POST TS DESCRAMBLE (i.e. post TTV Signal Protection and RAS descrambling); POST ES DESCRAMBLE (i.e. post TTV, RAS, Common Interface, BISS, DIRECTOR descrambling).	The Transport Stream Output will be formatted according to the choice made.
2	Press Save to store the choice.	The Transport Stream Output (TSO) is now set.

3.9.2 Setting the Output Connector

Use *Table 3.22* to step through the Connector configuration procedure using Menu 5.1.

Table 3.22: Setting Up the Output Connector

Step	Action	Result
1	Go to Menu 5.1 to enter the Connector configuration.	Edits the Connector output function for BNC connectors 1 and 2.
2	Press Edit then select one of the following, for each connector: DISABLED ASI HD SDI	The Connectors output will be formatted according to the choice made.
3	Press Save to store the choice.	The Connector output is now set.

3.9.3 Transport Stream Output Bit-rates

The Maximum input/output rates are described in *Table 3.23*.

Table 3.23: Maximum Descrambled Transport Stream Output Bit-rates

Level of Descrambling	TSO Setting	Input	Output
None	POST INPUT	160 Mbit/s	160 Mbit/s
Signal Protection or RAS	POST ES DESCRAMBLE	160 Mbit/s	160 Mbit/s
Common Interface, BISS or Director	POST TS DESCRAMBLE	55 Mbit/s	55 Mbit/s

3.9.4 Transport Stream Packet Lengths

The input transport stream packet lengths may be 188/204/208 bytes. With the transport stream output set to POST INPUT or POST TS DESCRAMBLE, the output packet length is the same as the input. With the transport stream output set to POST ES DESCRAMBLE, the output is always 188 bytes.

3.9.5 ASI Output Mode

- Spread mode in = > spread mode out (except when the TSO is set to POST ES DESCRAMBLE in step 2 in *Table 3.21.* Then the output is always bursted).
- Burst mode in = > burst mode out.

3.10 Setting Up the Alarms (Menu 6)

Menu 6 allows a selection of Alarms to be edited.

Table 3.24: Setting up the Alarms

Step	Action	Result
1	Go to Menu 6.	Accesses the Alarms menu.
2	Scroll to Menu 6.6 and edit the BIT ERROR RATE range (9.9 E-1 to 1.0 E-8) and status (NO ALARM, SET ALARM ONLY, SET ALARM AND RELAY 1, SET ALARM AND RELAY 2, SET ALARM AND RELAY 3, SET ALARM AND RELAY 4, SET RELAY 1 ONLY, SET RELAY 2 ONLY, SET RELAY 3 ONLY, SET RELAY 4 ONLY). Press Save.	Edits the BER alarms menu.
3	Scroll to Menu 6.1 and edit the TRANSPORT STREAM menu (NO ALARM, SET ALARM ONLY, SET ALARM AND RELAY 1 – 4, SET RELAY 1 – 6 ONLY). Press Save.	Edits the Transport Stream alarms menu.
4	Scroll to Menu 6.2 and edit the VIDEO menu (NO ALARM, SET ALARM ONLY, SET ALARM AND RELAY 1 – 4, SET RELAY 1 – 4 ONLY). Press Save.	Edits the Video alarms menu.
5	Scroll to Menu 6.3 and edit the AUDIO 1 menu (NO ALARM, SET ALARM ONLY, SET ALARM AND RELAY 1 – 4, SET RELAY 1 – 4 ONLY). Press Save.	Edits the Audio 1 alarms menu.
6	Scroll to Menu 6.4 and edit the AUDIO 2 menu (NO ALARM, SET ALARM ONLY, SET ALARM AND RELAY 1 – 4, SET RELAY 1 – 4 ONLY). Press Save.	Edits the Audio 2 alarms menu.
7	Scroll to Menu 6.5 and edit the MER menu (NO ALARM, SET ALARM ONLY, SET ALARM AND RELAY 1 – 4, SET RELAY 1 – 4 ONLY). Press Save.	Edits the MER Error Rate (00.0 to 69.9) and status menu.
8	Scroll to Menu 6.7 and edit the TEMPERATURE menu (NO ALARM, SET ALARM ONLY, SET ALARM AND RELAY 1 – 4, SET RELAY 1 – 4 ONLY). Press Save.	Edits the Temperature menu.

3.11 Setting Up System Parameters (Menu 7)

This menu gives access to the Setup Menu to set up and edit System Parameters as well as the IRD Details menu (see *Table 3.26*).

Table 3.25: Setting Up a System

Step	Action	Result
1	Go to Menu 7.	Accesses the System menu.
2	Scroll to Menu 7.1 and edit the Operating Mode (FRONT PANEL, SERIAL REMOTE, NCP or NETWORK (SNMP). Press Save.	Edits the Operating Mode menu.
3	Scroll to Menu 7.1.1 and edit the LCD Contrast (LOW, MEDIUM or HIGH). Press Save.	Edits the LCD Contrast.
4	Scroll to Menu 7.1.2 and edit the SERIAL REMOTE PROTOCOL mode (RS232 ALTEIA or RS485 ALTEIA).	Select the interface needed for serial remote control.
5	Scroll to Menu 7.1.3 and edit the IP Address. Press Save.	Edits the IP Address.
6	Scroll to Menu 7.1.3.1 and edit the Subnet Mask. Press Save.	Edits the Subnet Mask.
7	Scroll to Menu 7.1.3.2 and edit the Gateway address. Press Save.	Edits the Gateway address.
8	Scroll to Menu 7.1.4 and activate/deactivate the Restore system defaults. Press Save.	Edits the Restore System Defaults menu.
9	Scroll to Menu 7.1.5 and edit the Service Hunt Mode (ENABLED or DISABLED). Press Save.	Edits the Service Hunt Mode menu.
10	Scroll to Menu 7.1.6 and edit the Input Stream SI Type (AUTO, ATSC or DVB). Press Save.	Edits the Input Stream SI Type.
11	Scroll to Menu 7.1.7 and edit the Customisation Key. Press Save.	Edits the Customisation Key menu.

Table 3.26: Viewing the IRD Details Menu

Step	Action	Result
1	Go to Menu 7.2.	Accesses the IRD Details Menu and displays the Electronic Serial Number.
2	Scroll to Menu 7.2.1.	Displays the Software Version.
3	Scroll to Menu 7.2.2.	Displays the Firmware Version.
4	Scroll to Menu 7.2.3.	Displays the Hardware Version.
5	Scroll to Menu 7.2.4.	Displays the PLD Version.
6	Scroll to Menu 7.2.5.	Displays the Temperature.

3.12 Restarting the Unit

The **System Restart** submenu allows the user to reboot the unit without having to remove and insert the power cable.

Table 3.27: System Restart Menu

Step	Action	Result
1	Go to Menu 7.3.	Accesses the System Restart menu.
2	Press Edit.	ACTIVATE will be displayed.
3	Press Save to activate.	Unit is restarted.

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Chapter 4

Operating the Equipment Remotely

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4.1 Remote Control

4.1.1 Introduction

The IRD can be remotely controlled in a variety of ways. The basic control methods are:

- TANDBERG Device Controller (TDC)
- Third-party application using TANDBERG SNMP MIB protocol
- Third-party application using Alteia remote control protocol (RS-232/RS-485)
- TANDBERG Director (over-air)

Common for all control methods is that the IRD needs to be set up to accept the remote control handling. Once in remote control mode, it cannot be locally controlled unless the remote control is deactivated.

4.1.2 Remote Protocol Control Documentation

For information about remote control protocols contact TANDBERG Television.

4.1.3 Configuring the Unit for Remote Control Via SNMP Port

For the unit to be controlled via the SNMP Ethernet port, the control mode of the IRD needs to be set to **Network (SNMP)**.

Table 4.1: Configuring the Serial Remote Port and Activating Remote Protocol (SNMP)

Step	Action	Result
1.	Go to menu 7.1.	Displays 'OPERATING MODE'.
2.	Press Edit.	Displays 'FRONT PANEL'.
3.	Press the down pushbutton and select 'NETWORK (SNMP)'.	The settings should be set to match the external control host.
4.	Press Save.	The unit is ready for Remote Control.

NOTE...

The remote control protocols are not contained as a part of the product. An additional licence fee, NDA or other agreement with TANDBERG may be necessary to obtain the information required to control the product remotely.

4.1.4 Configuring the Unit For Remote Control Via the Serial Remote Port

For the unit to be controlled via RS-232 or RS-485, the control mode of the IRD needs to be set to **Serial Remote** and serial remote protocol must be chosen (RS-232 Alteia or RS-485 Alteia).

Table 4.2: Configuring the Serial Remote Port and Activating Remote Protocol

Step	Action	Result
1.	Go to menu 7.1.	Displays 'OPERATING MODE'.
2.	Press Edit.	Displays 'FRONT PANEL'.
3.	Press the down pushbutton and select 'SERIAL REMOTE'.	The settings should be set to match the external control host.
4.	Press Save.	The unit is ready for Remote Control.

Once the communication parameters are entered correctly, set the system into remote mode for the external computer to gain control of the unit:

Step	Action	Result
1.	Go to menu 7.1.2.	Displays 'SERIAL REMOTE PROTOCOL'.
2.	Press Edit.	Toggle between RS-232 Alteia or RS-485 Alteia.
3.	Chose between RS-232 Alteia or RS-485 Alteia.	The settings should be set to match the external control host.
4.	Press Save.	The unit is ready for Remote Control.

4.1.5 Configuring the Unit For Remote Control Over-air

Overview

For the unit to be controlled via over-air control (OAC), the control mode of the IRD needs to be set to Director NCP.

Table 4.3: Activating Director NCP Remote Control

Step	Action	Result
1.	Go to menu 7.1.	Displays 'OPERATING MODE'.
2.	Press Edit.	Displays 'FRONT PANEL'.
3.	Press the down pushbutton and select 'DIRECTOR NCP'.	The settings should be set to match the external control host.
4.	Press Save.	The unit is ready for OAC.

OAC Lockout

Once the unit is in OAC control mode, it is possible for the remote control operator to issue a local lockout command to the Receiver. This will effectively deny the local user access to configuring the unit.

However, if a situation occurs whereby the local user needs to regain control over the unit, without a local lockout relinquish command being sent from the OAC control PC, a four digit Personal Identification Number (PIN) may be entered through the keypad.

CAUTION...

TANDBERG Television Customer Services Help Desk will not be able to provide you with the Local lockout PIN, as it is uniquely created at the time of the lockout.

The user creates the PIN at lockout time. To obtain the PIN, please consult the person responsible for the administration of the unit.

Entering the OAC Lockout PIN

Table 4.4: Entering the OAC Lockout PIN

Step	Action	Result
1.	Go to menu #4.3.6 DIRECTOR.	Displays 'NCP LOCK OVERRIDE PIN'.
2.	Press Edit.	Displays 'ENTER CURRENT PIN'.
3.	Enter the four-digit PIN and press Save.	The unit is ready for local control.

4.2 Returning the Unit to Local Control Mode

Once the unit is in remote control mode, no local controls are available. To reacquire local control, it is necessary to set the remote control parameter back to **Front Panel**.

Table 4.5: Configuring the Unit for Local Control

Step	Action	Result
1.	Go to menu 7.1.	Displays 'OPERATING MODE'.
2.	Press Edit.	Displays 'SERIAL REMOTE' or 'DIRECTOR NCP'.
3.	Press the down pushbutton and select 'FRONT PANEL' and press Save.	The unit is ready to be locally controlled.

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Chapter 5

Alarms

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5.1 Introduction

There are two Front Panel LEDs that indicate the status of the IRD. These are used to indicate abnormal performance of the unit.

5.2 Location of the Alarm and Lock LEDs

The red **ALARM** LED is used to indicate an equipment fault condition, for example a missing or faulty input signal. It should be off during correct operation, although it may be lit briefly during power-up.

The green **LOCK** LED is used to indicate that the equipment is locked to a transport stream when lit, and indicates correct conditions and correct system functioning.

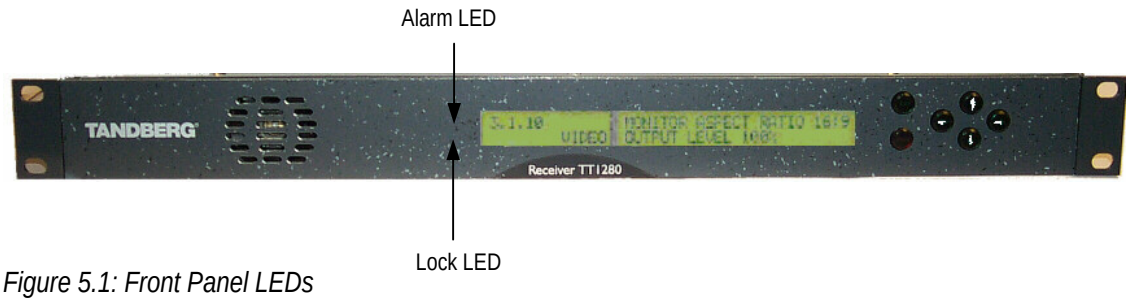

Figure 5.1: Front Panel LEDs

5.3 ALARM LED

The IRD supports a summary alarm signal that is active when one or more of the individual monitored alarm conditions are active. It allows masking of unwanted alarm conditions so that they do not contribute to the summary alarm. Configuration of alarms is via the Front Panel and remote control interfaces. The state of the summary alarm is reflected by the **ALARM** LED on the front panel where red represents an alarm, and off represents no alarm.

This LED provides a high-level indication of an alarm within the unit. The alarm list depends on the unit model. The unit continuously monitors for the following alarm conditions during normal operation: (if not masked, see *Menu 6, Annex C, Menus*):

- No transport stream
- Video not running
- Audio 1 not running
- Audio 2 not running
- Unit temperature

It is possible to signal additional alarms depending on the Transport Stream input type and optional functionality in the unit.

Satellite inputs:

- Bit Error Rate (BER) above (programmable) threshold.
- Modulation Error Ratio (MER) above (programmable) threshold.

Chapter 6

Options

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6.1 Hardware Enabled Options

These options require extra hardware to be fitted to the unit. Contact the Customer Services Helpdesk for details (see *Preliminary Pages*).

6.2 QPSK Input Card (TT1280/HWO/QPSK)

6.2.1 General

The QPSK Input Card supports QPSK demodulation for Satellite Receivers with two L-band inputs.

6.2.2 Connector Details - L-Band Inputs

Connect the L-band output of a suitable LNB to the F-type connector either directly or via a suitable attenuator giving adequate consideration to lightning and surge protection. The active input is chosen using the Input Status Menu (Menu 2).

QPSK IN 1/2

In most cases an attenuator will not be required. The following list summarises the circumstances when one should be used.

When the desired input level is greater than the specified maximum permissible (-25 dBm).

When the downlead is a short length of low-loss cable and the LNB in use has a poor return loss (7 dB min).

When the Receiver is receiving one of many carriers in a multi-carrier FDM system and the level of the wanted signal is close to the specified maximum permissible.

The specification for this connector is given in *Annex B, Technical Specification*.

Table 6.1: QPSK Satellite Receiver (L-band) Connector

Input	Specification
Connector Type	F-type, Female
Connector designation	QPSK IN 1 QPSK IN 2
Pin: Centre Shield	RF Input Ground/Chassis
LNB Supply	Refer to the next caution box
Impedance	75 Ω

CAUTION...

1. The Receiver provides dc power (refer to *Chapter 3, Operating the Equipment Locally*) via the active L-band input connector to drive an LNB (Low Noise Block Down-Converter). Do not connect equipment other than an LNB to this connector. Failure to do this may result in damage to the external equipment
2. The F-type connector is not suitable for repeated connection and disconnection. When intended for use in this way, fit a sacrificial connector and connect to it.

6.3 HOM Input Card (TT1280/HWO/HOM)

6.3.1 General

The Higher Order Modulation Input Card supports QPSK, 8PSK & 16QAM demodulation for Satellite Receivers with four L-band inputs.

6.3.2 Connector Details - L-Band Inputs

Connect the L-band output of a suitable LNB to the F-type connector either directly or via a suitable attenuator giving adequate consideration to lightning and surge protection. The active input is chosen using the Input Status Menu (Menu 2).

IN 1/2/3/4

In most cases an attenuator will not be required. The following list summarises the circumstances when one should be used.

When the desired input level is greater than the specified maximum permissible (-25 dBm).

When the downlead is a short length of low-loss cable and the LNB in use has a poor return loss (7 dB min).

When the Receiver is receiving one of many carriers in a multi-carrier FDM system and the level of the wanted signal is close to the specified maximum permissible.

The specification for this connector is given in *Annex B, Technical Specification*.

Table 6.2: HOM Satellite Receiver (L-band) Connector

Input	Specification
Connector Type	F-type, Female
Connector designation	IN 1, IN 2, IN 3, IN 4
Pin: Centre Shield	RF Input Ground/Chassis
LNB Supply	Refer to the next caution box
Impedance	75 Ω

6.4 DVB-S2 Input Cards (TT1280/HWO/DVBS2 and TT1280/HWO/DVBS2/IF/CONST)

6.4.1 General

The DVB-S2 Input card supports DVB-S, QPSK demodulation and DVB-S2, QPSK and 8PSK demodulation.

Two options are available. TT1280/HWO/DVB-S2 offers four L-band inputs, TT1280/HWO/DVB-S2/IF/CONST offers three L-band inputs plus an IF monitor input plus received constellation output.

6.4.2 Connector Details - L-Band Inputs

Connect the L-band output of a suitable LNB to the F-type connector either directly or via a suitable attenuator giving adequate consideration to lightning and surge protection. The active input is chosen using the Input Status Menu (Menu 2).

IN 1/2/3/4

In most cases an attenuator will not be required. The following list summarises the circumstances when one should be used.

When the desired input level is greater than the specified maximum permissible (-25 dBm).

When the downlead is a short length of low-loss cable and the LNB in use has a poor return loss (7 dB min).

When the Receiver is receiving one of many carriers in a multi-carrier FDM system and the level of the wanted signal is close to the specified maximum permissible.

The specification for this connector is given in *Annex B, Technical Specification*.

Table 6.3: DVB-S2 Satellite Receiver (L-band) Connector

Input	Specification
Connector Type	F-type, Female
Connector designation	IN 1, IN 2, IN 3, IN 4
Pin: Centre Shield	RF Input Ground/Chassis
LNB Supply	Refer to the next caution box
Impedance	75 Ω

6.4.3 Connector Details – IF Monitor Input (TT1280/HWO/DVBS2/IF/CONST)

Connect the IF Monitor input to a suitable IF frequency source e.g. a satellite modulator. The input can be activated using Input Status Menu (Menu 2).

This monitor input is designed to give error free demodulation in the presence of a wanted carrier only, for example when being fed directly from a satellite modulator.

The specification for this connector is given in *Annex B, Technical Specification*.

Table 6.4: DVB-S2 Satellite Receiver (IF Monitor Input) Connector

Input	Specification
Connector Type	BNC, Female
Connector designation	IF
Pin: Centre Shield	IF Input Ground/Chassis
Impedance	75 Ω

6.4.4 Connector Details – Constellation Output (TT1280/HWO/DVBS2/IF/CONST)

Connect the I and Q constellation output connectors to a suitable display device such as an oscilloscope set to X-Y mode.

Constellation output is enabled using the Input Status Menu (Menu 2).

> NOTE...
> Enabling the constellation mode will disable the demodulator's output transport stream rendering the receiver unable to decode a service.
> Constellation output mode is only available when decoding DVB-S2 signals

The specification for this connector is given in *Annex B, Technical Specification*.

Table 6.5: DVB-S2 Satellite Receiver (Constellation Output) Connector

Input	Specification
Connector Type	BNC, Female
Connector designation	I, Q
Pin: Centre Shield	I/Q Output Ground/Chassis
Impedance	75 Ω

6.5 TTV G.703 DS3 and E3 Input Card (TT1280/HWO/G703)

The TTV G.703 input card receives a transport stream directly from a PDH network. The card is user selectable to receive from either a DS3 network or E3 network.

For technical specifications for the TTV G.703 card, see *Annex B, Technical Specification*.

6.6 IP Input Card (TT1280/HWO/IP)

The IP Input card provides a 10/100BaseT Ethernet port, on which a transport stream can be received in UDP packets at up to 50 Mbit/s.

The mapping of MPEG-2 TS packets into IP data frames is done according to the protocol stack shown in *Figure 6.1.* The figure shows the Protocol Stack in use when mapping MPEG-2 into IP frames and Ethernet.

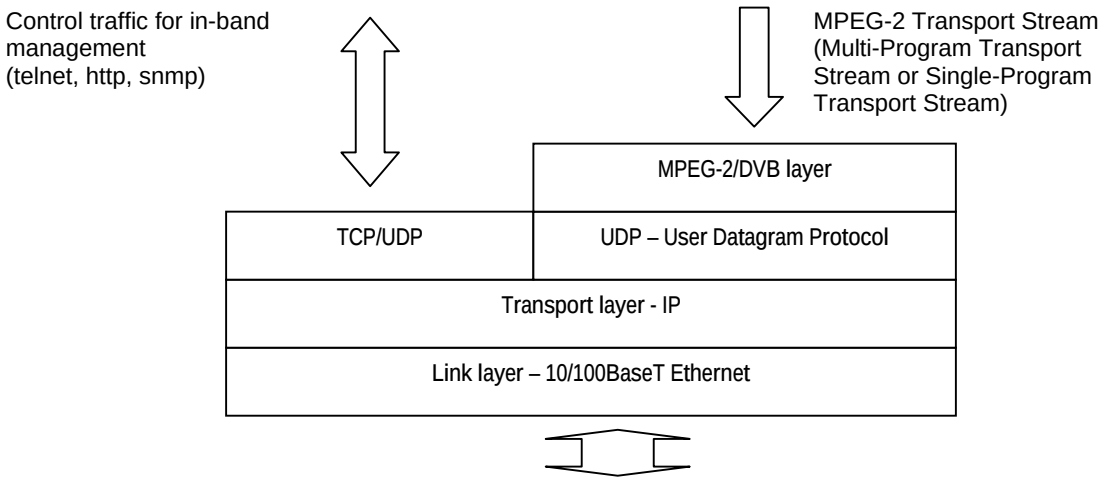

Figure 6.1: The Protocol Stack

The MPEG-2/DVB layer is specified in ISO/IEC IS 13818 – Generic Coding of Moving Pictures and Associated Audio. The UDP layer is compliant with RFC768 – User Datagram Protocol. A configurable number of 188-byte MPEG-2 TS packets are mapped straight into an UDP frame with no additional overhead. The MTU for Ethernet is usually 1500 bytes. This limits the number of MPEG-2 TS packets per UDP frame to lie within one to seven.

The IP layer is according to RFC791 – Internet Protocol Specification.

Figure 6.2 shows a more detailed picture of the MPEG-2 data transfer. TS-packets are mapped in a datagram, using User Data Protocol (UDP), Internet Protocol (IP) and Ethernet.

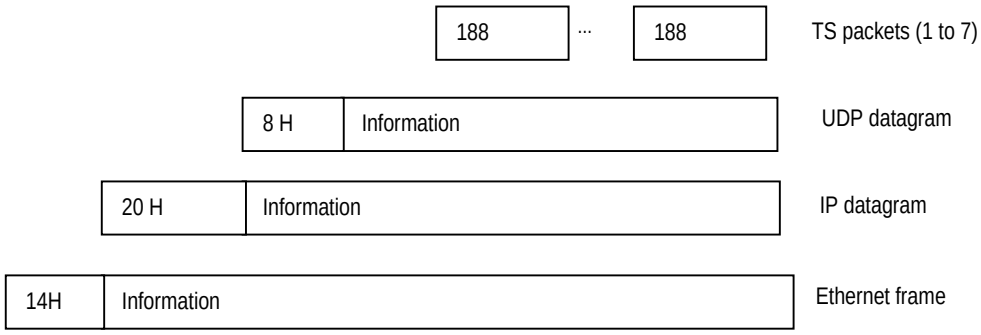

Figure 6.2: Building the Ethernet Frame

6.7 Software Enabled Options

These options may be enabled through software licence keys. Contact the Customer Services Helpdesk for details (see *Preliminary Pages*).

6.8 High Speed Data Over Ethernet (TT1280/SWO/HSETHER)

The IRD can be enabled through a licence key to output high-speed data over the Ethernet port. The IRD uses the Data-Piping protocol to de-encapsulate the data received. The data must be carried as private data on a designated transport stream PID.

Careful consideration needs to be taken to ensure interoperability with the transmitting equipment.

6.9 Dolby Digital Decoder (TT1280/SWO/AC3)

The IRD can be enabled through a licence key to apply Dolby Digital decoding functionality.

6.10 RAS Mode 1 Conditional Access (TT1280/SWO/RAS)

This option enables RAS Mode 1 conditional access descrambling.

6.11 RAS Mode 2 Conditional Access (TT1280/SWO/RAS2)

This option enables RAS Mode 2 conditional access descrambling.

6.12 Director Functionality (TT1280/SWO/DIR)

This option enables Director functionality.

Chapter 7

Preventive Maintenance and Fault-finding

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7.1 Routine Checks

7.1.1 Cooling Fan

There are no routine checks associated with this equipment other than to ensure that the unit is adequately cooled. This equipment must never be operated unless the cooling fan is working. This should be checked periodically.

CAUTION...

The fan contained within this unit is not fitted with an insect/dust filter. Pay particular attention to the environment in which it is going to be used.

Figure 7.1: Cooling Fan Location

7.1.2 Cleaning

Unplug the equipment from the supply before cleaning. Do not use liquid or aerosol cleaners. Use a damp cloth for cleaning the exterior of the Receiver.

7.2 Servicing

7.2.1 Conditions Requiring Servicing

WARNING...

DO NOT ATTEMPT TO SERVICE THIS PRODUCT AS OPENING OR REMOVING COVERS MAY EXPOSE DANGEROUS VOLTAGES OR OTHER HAZARDS. REFER ALL SERVICING TO SERVICE PERSONNEL WHO HAVE BEEN AUTHORISED BY TANDBERG TELEVISION.

The following is a list of conditions that may indicate the need for servicing:

1. When the power supply cord or plug is damaged.
2. If liquid has been spilled, or objects have fallen into the product.
3. If the product has been exposed to rain or water.

4. If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions, as an improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
5. If the product has been dropped or the case has been damaged.
6. When the product exhibits a distinct change in performance.
7. If the equipment has been subject to a lightning strike or power surge.

7.2.2 Replacement Parts

When replacement parts are required, be sure only parts specified by TANDBERG Television Ltd (or having the same characteristics as the original part) have been used. Unauthorised substitutions may result in fire, electric shock or other hazards.

7.2.3 Checks on Completion of Servicing

Upon completion of any service or repairs to this product, ask the service technician to perform safety checks to determine that the product is in a safe operating condition. Also, performance and EMC checks may be required.

7.3 Maintenance and Support Services

7.3.1 Introduction

TANDBERG Television is a leader in the design, integration and implementation of digital broadcasting products and systems. It has a large team dedicated to keeping our customers on air 24 hours a day, 365 days a year.

With regional offices worldwide, and ultra-modern specialist service facilities in the US, UK, Hong Kong and Australia, TANDBERG Television covers the world. There is a customer service centre open round the clock, every day of the year, in your time zone.

TANDBERG's years of design and support experience enable it to offer a range of service options that will meet your needs at a price that makes sense.

It's called the **TANDBERG Advantage**.

7.3.2 Warranty

All TANDBERG Products and Systems are designed and built to the highest standards and are covered under a comprehensive 12 month warranty.

7.3.3 Levels of Continuing TANDBERG Television Service Support

For stand-alone equipment, then TANDBERG Television **BASIC Advantage** is the value for money choice for you.
BASIC provides you with year-by-year Service long after the warranty has expired.

For systems support you can choose either **Gold** or **Silver Advantage**. These packages are designed to save you costs and protect your income through enlisting the help of TANDBERG Television support specialists.

VOYAGER Advantage is the truly mobile service solution. This provides a service specifically designed to keep you mobile and operational.

Call TANDBERG Customer Services for more details.

7.4 Fault-finding

7.4.1 General

The information contained in this chapter is intended to isolate the unit as the faulty equipment if a system failure occurs. If the following information fails to clear the abnormal condition, please contact Customer Services using the information given in the *Preliminary Pages* of this manual.

7.4.2 System Defaults

The system defaults can be restored at any time using the Restore System Defaults option (Menu 7.1.4).

7.4.3 Preliminary Investigations

1. Ensure all leads and connectors are in place and serviceable.
2. Ensure the unit is powered. If not investigate the power source. Check the fuse.
3. Ensure the red alarm LED on the front of the unit is not lit. If it is, investigate the Alarm status (see *Chapter 5, Alarms*).
4. Use the BER display to ensure that the Post Viterbi BER is less than 2.0 E-4. If it is not, check the input to the Receiver.

7.4.4 Ethernet Remote Control

The IRD remote control input operates with SNMP Ethernet format.

CAUTION...

Be sure to set the correct format and address via the front panel before attempting to use this control method. The IRD will ignore any remote control commands if the input is not correctly set.

7.5 Changing the Equipment Fuse

7.5.1 AC User Accessible Fuse Replacement

CAUTION...

This product should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supply to your home or business, consult your appliance dealer or local power company. For products intended to operate from battery power, or other sources, refer to the operating instructions.

The power supply used in this equipment is a wide-ranging, AC power supply unit designed for use in ambient air temperature conditions of 0°C to +50°C for 100-120 Vac and 220-240 Vac, 50-60 Hz (see *Annex B, Technical Specification* for details). There are no links or switches to be altered for operation from different AC supplies.

The IRD is designed for User Accessible Fuse Replacement.

In addition to the fuse in the supply cable plug (if appropriate) there is a fuse held in an integral fuse carrier at the AC power inlet at the rear of the unit.

Table 7.1: Fuse Information

Item	Specification
Fuse	Single pole, fitted in live conductor in power input filter at rear of unit.
Fuse type	5 mm x 20 mm anti-surge (T) HBC, IEC/EN 60127-2 Sheet 5
Fuse rating	2 A, 250 Vac

To replace the AC power fuse perform the following:

WARNING...

BEFORE REPLACING THE REAR PANEL FUSE, DISCONNECT THE EQUIPMENT FROM THE SUPPLY. FAILURE TO DO THIS MAY EXPOSE HAZARDOUS VOLTAGES. UNPLUG THE EQUIPMENT FROM THE LOCAL SUPPLY SOCKET.

1. Ensure that power is turned off and the power cable is disconnected from the AC power inlet.
2. Ease out the fuse carrier by placing a small, flat-bladed screwdriver in the notches at the sides of the carrier.

CAUTION...

When replacing the power input fuse, always ensure that a fuse of the correct type and rating is fitted. Failure to do so results in inadequate protection.

3. Replace the fuse in the carrier.
4. Insert the fuse carrier back in the AC power inlet.

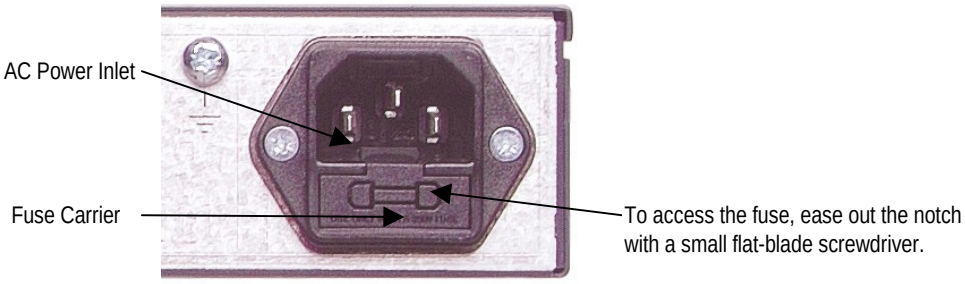

Figure 7.2: Fuse Carrier

If the replacement fuse also blows, do not continue. Disconnect the equipment and contact TANDBERG Customer Services (see *Preliminary Pages*) for advice.

7.5.2 DC User Accessible Fuse Replacement

WARNING...

BEFORE REPLACING THE REAR PANEL FUSE, ISOLATE THE UNIT FROM THE SUPPLY. FAILURE TO ISOLATE THE EQUIPMENT PROPERLY MAY CAUSE A SAFETY HAZARD.

NOTE...

Refer to *Annex B, Technical Specification* for information about the DC fuse.

To replace the DC power fuse:

1. Ensure that DC power is turned off or the power cable is disconnected from the power inlet.
2. Unscrew the fuse carrier and remove the old fuse (see *Figure 7.3*).

CAUTION...

When replacing the power input fuse, always ensure that a fuse of the correct type and rating, is fitted. Failure to do so results in inadequate protection.

3. Insert the new fuse in the carrier.
4. Insert the fuse carrier back in the DC power inlet.

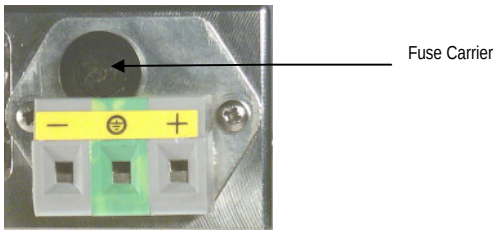

Figure 7.3: Position of Fuse Carrier for -48 Vdc Input

7.6 Disposal

7.6.1 Moulded Plugs

If the moulded plug fitted to the mains cable supplied with this equipment is not required, use another cable. If the supplied plug is to be changed, cut it off and dispose of it safely.

WARNING...

IF THE MOULDED PLUG FITTED TO THE MAINS CABLE SUPPLIED WITH THIS EQUIPMENT IS NOT REQUIRED, PLEASE CUT IT OFF AND DISPOSE OF IT SAFELY. FAILURE TO DO THIS MAY ENDANGER LIFE AS LIVE ENDS MAY BE EXPOSED IF THE REMOVED PLUG IS INSERTED INTO A MAINS OUTLET.

7.6.2 Equipment

Dispose of this equipment safely at the end of its life. Local codes and/or environmental restrictions may affect its disposal. Check with your local authority.

Annex A

Glossary

The following list covers most of the abbreviations, acronyms and terms as used in TANDBERG Television Limited Manuals, User and Reference Guides. All terms may not be included in this Reference Guide.

µm	Micrometre (former name - micron): a unit of length equal to one millionth (10^{-6}) of a metre.
3:2 pulldown	A technique used when converting film material (which operates at 24 pictures per second) to 525-line video (operating at 30 pictures per second).
4:2:0	Digital video coding method in which the colour difference signals are sampled on alternate lines at half the luminance rate.
4:2:2	Digital video coding method in which the colour difference signals are sampled on all lines at half the luminance rate.
422P@ML	422 Profile at Main Level: A subset of the MPEG-2 standard, which supports digital video storage (DVD etc.) and transmissions up to 50 Mbit/s over various mediums. Used for Contribution and Distribution applications.
5B6B	5 Binary Bits Encoded to 6 Binary Bits: Block code.
AC-3	Audio Coding algorithm number 3 (See Dolby Digital).
ACC	Authorisation Control Computer.
ADPCM	Adaptive Differential Pulse Code Modulation: An advanced PCM technique that reduces the bit-rate by coding the difference values between successive samples rather than the absolute value of each sample.
ADT	Audio, Data And Teletext.
AFC	Automatic Frequency Control.
AFS	Automation File Server.
AGC	Automatic Gain Control.
AMOL I and II	Automatic Measure of Line-ups I and II: Used by automated equipment to measure programme-viewing ratings.
ASI	Asynchronous Serial Interface.
ASIC	Application-Specific Integrated Circuit: A customised chip designed to perform a specific function.
Async	Asynchronous.
ATM	Asynchronous Transfer Mode: A connection orientated, cell based, data transport technology designed for Broadband ISDN (B-ISDN). It provides a circuit-switched bandwidth-on-demand carrier system, with the flexibility of packet switching. It offers low end-to-end delays and (negotiable on call set-up) Quality of Service guarantees. Asynchronous refers to the sporadic nature of the data being transmitted. Cells are transmitted only when data is to be sent; therefore the time interval between cells varies according to the availability of data.
ATSC	Advanced Television Standards Committee: An organisation founded in 1983 to research and develop a digital TV standard for the U.S.A. In late 1996, the FCC adopted the ATSC standard, the digital counterpart of the NTSC standard.

B3ZS	Bipolar with Three Zero Substitution: A method of eliminating long zero strings in a transmission. It is used to ensure a sufficient number of transitions to maintain system synchronisation when the user data stream contains an insufficient number of 1s to do so. B3ZS is the North American equivalent of the European HDB3.
Backward Compatibility	Refers to hardware or software that is compatible with earlier versions.
BAT	Bouquet Association Table: Part of the service information data. The BAT provides information about bouquets. It gives the name of the bouquet and a list of associated services.
baud rate	The rate of transfer of digital data when the data comprises information symbols that may consist of a number of possible states. Equivalent to bit-rate when the symbols only have two states (1 and 0). Measured in Baud.
BER	Bit Error Rate: A measure of transmission quality. The rate at which errors occur in the transmission of data bits over a link. It is generally shown as a negative exponent, (e.g. 10^{-7} means that 1 in 10,000,000 bits are in error).
BISS	Basic Interoperable Scrambling System: Non-proprietary encryption from EBU (Tech3290).
BISS-E	Basic Interoperable Scrambling System: with Encrypted keys.
Bit-rate	The rate of transfer of digital data when the data comprises two logic states, 1 and 0. Measured in bit/s.
Block; Pixel Block	An 8-row by 8-column matrix of luminance sample values, or 64 DCT coefficients (source, quantised, or dequantised).
Bouquet	A collection of services (TV, radio, and data, or any combination of the three) grouped and sold together, and identified in the SI as a group. A single service may be in several bouquets.
B-Picture; B-Frame	Bi-directionally Predictive Coded Picture/Frame: A picture that is coded using motion-compensated prediction from previous I or P frames (forward prediction) and/or future I or P frames (backward prediction). B frames are not used in any prediction.
BPSK	Binary Phase Shift Keying: A data modulation technique.
Buffer	A memory store used to provide a consistent rate of data flow.
BW	Bandwidth: The transmission capacity of an electronic line such as (among others) a communications network, computer bus, or broadcast link. It is expressed in bits per second, bytes per second or in Hertz (cycles per second). When expressed in Hertz, the frequency may be a greater number than the actual bits per second, because the bandwidth is the difference between the lowest and highest frequencies transmitted. High bandwidth allows fast transmission or high-volume transmission.
Byte-mode	Each byte is delivered separately in the ASI Transport Stream, with stuffing data added between the Bytes to increase the data rate to 270 Mbit/s. See DVB Document A010 rev. 1, Section B3.3, (ASI) Layer-2 Transport Protocol.
CA	Conditional Access: The technology used to control the access to viewing services to authorised subscribers through the transmission of encrypted signals and the programmable regulation of their decryption by a system such as viewing cards.
CAT	Conditional Access Table: Part of the MPEG-2 Program Specific Information (PSI) data. Mandatory for MPEG-2 compliance if CA is in use.
C-Band	The portion of the electromagnetic spectrum, which spans the frequency range of approximately 4 GHz to 6 GHz. Used by communications satellites. Preferred in tropical climates because it is not susceptible to fading.
CCIR	*See:* ITU-R.
CCITT	*See:* ITU-T.
Channel	A narrow range of frequencies, part of a frequency band, for the transmission of radio and television signals without interference from other channels. In the case of OFDM, a large number of carriers spaced apart at precise frequencies are allocated to a channel.
Channel Coding	A way of encoding data in a communications channel that adds patterns of redundancy into the transmission path in order to improve the error rate. Such methods are widely used in wireless communications.
Chrominance	The colour part of a TV picture signal, relating to the hue and saturation but not to the luminance (brightness) of the signal. In a composite-coded colour system, the colour information (chrominance, often referred to as chroma) is modulated onto a high frequency carrier and added to the monochrome-format video signal carrying the luminance (Y). In a component-coded colour system, the two colour-difference signals (R-Y)(B-Y) usually referred to as C_RC_B (digital) or P_RP_B (analogue), are used to convey colour information. When C_RC_B (P_RP_B) is added to the luminance (Y), the complete picture information is conveyed as YC_RC_B (YP_RP_B).
Closed Captioning	A TV picture subtitling system used with 525-line analogue transmissions.
CODE	Create Once Distribute Everywhere.
Codec	The combination of an Encoder and a complementary Decoder located respectively at the input and output of a transmission path.

COFDM	Coded OFDM: COFDM adds forward error correction to the OFDM transmission consisting of Reed-Solomon (RS) coding followed by convolutional coding to add extra bits to the transmitted signal. This allows a large number of errors at the receive end to be corrected by convolutional (Viterbi) decoding followed by RS decoding.
Compression	Reduction in the number of bits used to represent the same information. For the purposes of a broadcast system, it is the process of reducing digital picture information by discarding redundant portions of information that are not required when reconstituting the picture to produce viewing clarity. Compression allows a higher bite-rate to be transmitted through a given bandwidth.
Compression System	Responsible for compressing and multiplexing the video / audio / data bit-streams, together with the authorisation stream. The multiplexed data stream is then ready for transmission.
C_RC_B	Digital Colour difference signals. These signals, in combination with the luminance signal (Y), define the colour and brightness of each picture element (pixel) on a TV line. *See:* Chrominance
CRC	Cyclic Redundancy Check: A mathematical algorithm that computes a numerical value based on the bits in a block of data. This number is transmitted with the data and the receiver uses this information and the same algorithm to ensure the accurate delivery of data by comparing the results of algorithm and the number received. If a mismatch occurs, an error in transmission is presumed.
CVCT	Cable Virtual Channel Table (ATSC).
dB	Decibels: A ratio of one quantity to another using logarithmic scales to give results related to human aural or visual perception. dB is a ratio whereas dBm, for example, is an absolute value, quoted as a ratio to a fixed point of 0 dBm. 0 dBm is 1 mW at 1 kHz terminated in 600Ω. 0 dBmV is 1 mV terminated in 75Ω.
DCE	Data Communications Equipment: Typically a modem. It establishes, maintains and terminates a session on a network but in itself is not the source (originator) or destination (end receiving unit) of signals (e.g. a computer, see DTE). A DCE device may also convert signals to comply with the transmission path (network) format.
DCT	Discrete Cosine Transform: A technique for expressing a waveform as a weighted sum of cosines. Raw video data is not readily compressible. DCT is not in itself a compression technique but is used to process the video data so that it is compressible by an encoder. DCT processes the picture on an 8x8-pixel block basis, converting the data from an uncompressible X Y form (as displayed by an oscilloscope) to a compressible frequency domain form (as displayed by a spectrum analyser). Can be forward DCT or inverse DCT.
DDS	Direct Digital Synthesiser.
Decoder	The unit containing the electronic circuitry necessary to decode encrypted signals. Some Decoders are separate from the receiver but in satellite TV broadcasting, the term is often used interchangeably as a name for an Integrated Receiver Decoder (IRD). The term IRD, or IRD / Decoder, is usually associated with satellite TV broadcasting while Cable systems are based on Converters or on Set-Top Boxes / Converters.
Decoding Time-stamp	A field that may be present in a PES packet header that indicates the time that an access unit is to be decoded in the system target Decoder.
DID	Data Identifier.
Differential Coding	Method of coding using the difference between the value of a sample and a predicted value.
DIL	Dual In Line: The most common type of package for small and medium scale integrated circuits. The pins hang vertically from the two long sides of the rectangular package, spaced at intervals of 0.1 inch.
DIN	Deutsches Institut für Normung: German Standards Institute.
Dolby Digital	Formerly AC-3. An audio coding system based on transform coding techniques and psychoacoustic principles.
Downlink	The part of the satellite communications circuit that extends from the satellite to an Earth station.
Downconvert	The process by which the frequency of a broadcast transport stream is shifted to a lower frequency range.
DPCM	Differential Pulse Code Modulation: An audio digitisation technique that codes the difference between samples rather than coding an absolute measurement at each sample point.
DSNG	Digital Satellite News-Gathering.
DSP	Digital Signal Processor.
DTE	Data circuit Terminating Equipment: A communications device that originates (is the source) or is the end receiving unit (destination) of signals on a network. It is typically a terminal or computer.
DTH	Direct To Home. The term used to describe uninterrupted transmission from the satellite directly to the subscriber, that is, no intermediary cable or terrestrial network utilised.
DTS	Digital Theater Systems: A motion picture digital sound system.
DVB	Digital Video Broadcasting: A European project which has defined transmission standards for digital broadcasting systems using satellite (DVB-S), cable (DVB-C) and terrestrial (DVB-T) medium, created by the EP-DVB group and approved by the ITU. Specifies modulation, error correction, etc. (see EN 300 421 for satellite, EN 300 429 for cable and EN 300 744 for terrestrial).

DVB SI	Digital Video Broadcasting Service Information.
DVB-PI	DVB-Professional Interfaces: TTV Lan search shows – DVB Physical Interfaces
Earth	Technical Earth: Ensures that all equipment chassis within a rack are at the same potential, usually by connecting a wire between the Technical earth terminal and a suitable point on the rack. This is sometimes known as a Functional earth. Protective Earth: Used for electric shock protection. This is sometimes known as a safety earth.
EBU	European Broadcast Union.
ECM	Entitlement Control Message.
EDI	Ethernet Data Input
EIA	Electronics Industries Association (USA).
EIT	Event Information Table: Equipment: A component of the DVB-Service Information (SI) stream generated within an Encoder, containing information about events or programmes such as event name, start time, duration, etc. System: EIT (Present/Following) contains the name of the current and next event. It may include an optional descriptor (synopsis) giving brief details of content. EIT (Schedule) is used to produce a full EPG. The EIT is the only DVB-SI table, which can be encrypted.
Elementary Stream	A generic term for a coded bit-stream, be it video, audio or other.
EMC	Electromagnetic Compatibility.
EMM	Entitlement Management Message.
Encryption	Encoding of a transmission to prevent access without the appropriate decryption equipment and authorisation.
EPG	Electronic Programme Guide: On-screen programme listing using thumbnail pictures and/or text.
Ethernet	The most widely used local area network (LAN) defined by the IEEE as the 802.3 standard. Transmission speeds vary according to the configuration. Ethernet uses copper or fibre-optic cables.
ETS	European Telecommunications Standard.
ETSI	European Telecommunications Standards Institute.
FCC	Federal Communications Commission.
FDM	Frequency Division Multiplex: A common communication channel for a number of signals, each with its own allotted frequency.
FEC	Forward Error Correction: A method of catching errors in a transmission. The data is processed through an algorithm that adds extra bits and sends these with the transmitted data. The extra bits are then used at the receiving end to check the accuracy of the transmission and correct any errors.
FFT	Fast Fourier Transformation: A fast algorithm for performing a discrete Fourier transform.
FIFO	First In, First Out: A data structure or hardware buffer from which items are taken out in the same order they were put in. Also known as a shelf from the analogy with pushing items onto one end of a shelf so that they fall off the other. A FIFO is useful for buffering a stream of data between a sender and receiver that are not synchronised - i.e. they not sending and receiving at exactly the same rate.
Footprint	The area of the Earth's surface covered by a satellite's downlink transmission. Also (generally) the area from which the satellite can receive uplink transmissions.
FTP	File Transfer Protocol: A protocol used to transfer files over a TCP/IP network (Internet, UNIX, etc.). For example, after developing the HTML pages for a Web site on a local machine, they are typically uploaded to the Web server, using FTP. Unlike e-mail programs in which graphics and program files have to be attached, FTP is designed to handle binary files directly and does not add the overhead of encoding and decoding the data.
G.703	The ITU-T standard which defines the physical and electrical characteristics of hierarchical digital interfaces.
GOP	Group of Pictures: MPEG video compression works more effectively by processing a number of video frames as a block. The TANDBERG Television Encoder normally uses a 12 frame GOP; every twelfth frame is an I frame.
GUI	Graphical User Interface: The use of pictures rather than just words to represent the input and output of a program. A program with a GUI runs under a windowing system and has a screen interface capable of displaying graphics in the form of icons, drop-down menus and a movable pointer. The on-screen information is usually controlled / manipulated by a mouse or keyboard.
HOM	Higher Order Modulation. 8PSK and 16QAM.
HDTV	High Definition Television.
HPA	High Power Amplifier: Used in the signal path to amplify the modulated and up-converted broadcast signal for feeding to the uplink antenna.
HSYNC	Horizontal (line) SYNCs.

Hub	A device in a multipoint network at which branch nodes interconnect.
ICAM	Integrated Conditional Access Module: Embedded in the IRD and responsible for descrambling, plus packet filtering and reception. It also contains the physical interface to the subscriber's viewing card.
IEC	International Electrotechnical Committee.
IF	Intermediate Frequency: Usually refers to the 70 MHz or 140 MHz output of the Modulator in cable, satellite and terrestrial transmission applications.
Interframe Coding	Compression coding involving consecutive frames. When consecutive frames are compared, temporal redundancy is used to remove common elements (information) and arrive at difference information. MPEG-2 uses B and P frames, but since they are individually incomplete and relate to other adjacent frames, they cannot be edited independently.
Intraframe Coding	Compression coding involving a single frame. Redundant information is removed on a per frame basis. All other frames are ignored. Coding of a macroblock or picture that uses information only from that macroblock or picture. Exploits spatial redundancy by using DCT to produce I frames; these are independent frames and can be edited.
IP	Internet Protocol: The IP part of TCP/IP. IP implements the network layer (layer 3) of the protocol, which contains a network address and is used to route a message to a different network or sub-network. IP accepts packets from the layer 4 transport protocol (TCP or UDP), adds its own header to it and delivers a datagram to the layer 2 data link protocol. It may also break the packet into fragments to support the Maximum Transmission / Transfer Unit (MTU) of the network.
I-picture; I-frame	Intracoded Picture/Frame: A picture / frame, which is coded using purely intracoding with reference to no other field or frame information. The I frame is used as a reference for other compression methods.
IPPV	Impulse Pay Per View: One-time events, purchased at home (on impulse) using a prearranged SMS credit line.
IRD	Integrated Receiver Decoder: The Receiver with an internal MPEG Decoder, which is connected to the subscriber's TV. The IRD is responsible for receiving and de-multiplexing all signals. The unit receives the incoming signal and if CA is active, decodes the signal when provided with a control word by the viewing card. Domestic IRDs are also known as Set-Top Units or Set-Top Boxes.
IRE	Institute of Radio Engineers: No longer in existence but the name lives on as a unit of video amplitude measurement. This unit is 1% of the range between blanking a peak white for a standard amplitude signal.
ISDN	Integrated Services Digital Network: The basic ISDN service is BRI (Basic Rate Interface), which is made up of two 64 kbit/s B channels and one 16 kbit/s D channel (2B+D). If both channels are combined into one, called bonding, the total data rate becomes 128 kbit/s and is four and a half times the bandwidth of a V.34 modem (28.8 kbit/s). The ISDN high-speed service is PRI (Primary Rate Interface). It provides 23 B channels and one 64 kbit/s D channel (23B+D), which is equivalent to the 24 channels of a T1 line. When several channels are bonded together, high data rates can be achieved. For example, it is common to bond six channels for quality videoconferencing at 384 kbit/s. In Europe, PRI includes 30 B channels and one D channel, equivalent to an E1 line.
ISO	International Standards Organisation.
ISOG	Inter-union Satellite Operations Group.
ITS	Insertion Test Signal: A suite of analogue test signals placed on lines in the VBI. Also known as VITS.
ITT	Invitation To Tender.
ITU-R	International Telecommunications Union - Radiocommunications Study Groups (was CCIR).
ITU-T	International Telecommunications Union - Telecommunications Standardisation Sector (was CCITT).
JPEG	Joint Photographic Experts Group: ISO/ITU standard for compressing still images. It has a high compression capability. Using discrete cosine transform, it provides user specified compression ratios up to around 100:1 (there is a trade-off between image quality and file size).
kbit/s	1000 bits per second.
Kbit	1024 bits, usually refers to memory capacity or allocation.
Ku-band	The portion of the electromagnetic spectrum, which spans the frequency range of approximately 12 GHz to 14 GHz. Used by communications satellites. Preferred for DTH applications because this range of frequency is less susceptible to interference.
LAN	Local Area Network: A network, which provides facilities for communications within a defined building or group of buildings in close proximity.
L-band	The frequency band from 950 MHz to 2150 MHz, which is the normal input-frequency-range of a domestic IRD. The incoming signal from the satellite is down-converted to L-band by the LNB.
LED	Light Emitting Diode.

LNB	Low Noise Block Down-Converter: The component of a subscriber satellite transmission receiving dish which amplifies the incoming signal and down-converts it to a suitable frequency to input to the IRD (typically 950 MHz - 1600 MHz).
LO	Local Oscillator.
LSB	Least significant bit.
Luminance	The television signal representing brightness, or the amount of light at any point in a picture. The Y in YC_RC_B.
LVDS	Low Voltage Differential Signal: LVDS is a generic multi-purpose Interface standard for high speed / low power data transmission. It was standardised in ANSI/TIA/EIA-644-1995 Standard (aka RS-644).
Macroblock	A 16x16-pixel area of the TV picture. Most processing within the MPEG domain takes place with macro blocks. These are converted to four 8x8 blocks using either frame DCT or field DCT. Four 8 x 8 blocks of luminance data and two (4:2:0 chrominance format), four (4:2:2) or eight (4:4:4) corresponding 8 x 8 blocks of chrominance data coming from a 16 x 16 section of the luminance component of the picture. Macroblock can be used to refer to the sample data and to the coded representation of the sample values and other data elements.
Mbit/s	Million bits per second.
MCC	Multiplex Control Computer: A component of a System 3000 compression system. The MCC sets up the configuration for the System 3000 Multiplexers under its control. The MCC controls both the main and backup Multiplexer for each transport stream.
MCPC	Multiple Channels Per Carrier.
MEM	Multiplex Element Manager: A GUI based control system, part of the range of TANDBERG Television compression system control element products. The evolution 5000 MEM holds a model of the system hardware. Using this model, it controls the individual system elements to configure the output multiplexes from the incoming elementary streams. The MEM monitors the equipment status and controls any redundancy switching.
MMDS	Multichannel Microwave Distribution System: A terrestrial microwave direct-to-home broadcast transmission system.
Motion Compensation	The use of motion vectors to improve the efficiency of the prediction of sample values. The prediction uses motion vectors to provide offsets into the past and/or future reference frames or fields containing previously decoded sample values that are used to form the prediction error signal.
Motion Estimation	The process of estimating motion vectors in the encoding process.
Motion Vector	A two-dimensional vector used for motion compensation that provides an offset from the co-ordinate position in the current picture or field to the co-ordinates in a reference frame or field.
MP@ML	Main Profile at Main Level: A subset of the MPEG-2 standard, which supports digital video storage (DVD etc.) and transmissions up to 15 Mbit/s over various mediums.
MP@HL	Main Profile at High Level: A subset of the MPEG-2 standard, which supports digital video storage (DVD etc.) and transmissions up to 80 Mbit/s over various mediums.
MPEG	Moving Pictures Experts Group: The name of the ISO/IEC working group, which sets up the international standards for digital television source coding.
MPEG-2	Industry standard for video and audio source coding using compression and multiplexing techniques to minimise video signal bit-rate in preparation for broadcasting. Specified in ISO/IEC 13818. The standard is split into layers and profiles defining bit-rates and picture resolutions.
MSB	Most significant bit.
Msymbol/s	(Msym/s) Mega (million) Symbols per second (10^6 Symbols per second).
Multiplex	A number of discrete data streams (typically 8 to 12), from encoders, that are compressed together in a single DVB compliant transport stream for delivery to a Modulator.
MUSICAM	Masking pattern adapted Universal Sub-band Integrated Coding And Multiplexing: An audio bit-rate reduction system relying on sub-band coding and psychoacoustic masking.
Mux	Multiplexer: Transmission Multiplexer: receives EMMs from the ACC, ECMs from the BCC, video/audio data from the encoders, and the SI stream from the SIC. It then multiplexes them all into a single DVB-compliant transport stream, and delivers the signal to the uplink after modulation. The Multiplexer also contains the cypher card, which scrambles the services according to the control words supplied by the BCC.
Network	In the context of broadcasting: a collection of MPEG-2 transport stream multiplexes transmitted on a single delivery system, for example, all digital channels on a specific cable system.
NICAM	Near Instantaneously Companded Audio Multiplex: Official name is NICAM 728. Used for digital stereo sound broadcasting in the UK employing compression techniques to deliver very near CD quality audio. 728 refers to the bit-rate in kbit/s.

NIT	Network Information Table: Part of the service information data. The NIT provides information about the physical organisation of each transport stream multiplex, and the characteristics of the network itself (such as the actual frequencies and modulation being used).
nm	Nanometre: a unit of length equal to one thousand millionth (10^{-9}) of a metre.
NTSC	National Television Systems Committee: The group, which developed analogue standards used in television broadcast systems in the United States. Also adopted in other countries (e.g. Mexico, Canada, Japan). This system uses 525 picture lines and a 59.97 Hz field frequency.
NVOD	Near Video On Demand: Method of offering multiple showings of movies or events. The showings are timed to start at set intervals, determined by the broadcaster. Each showing of a movie or event can be sold to subscribers separately.
NVRAM	Non-volatile Random Access Memory: Memory devices (permitting random read / write access) that do not lose their information when power is removed. Stores the default configuration parameters set by the user.
OFDM	Orthogonal FDM: A modulation technique used for digital TV transmission in Europe, Japan and Australia; more spectrally efficient than FDM. In OFDM, data is distributed over a large number of carriers spaced apart at precise frequencies. The carriers are arranged with overlapping sidebands in such a way that the signals can be received without adjacent channel interference.
OPPV	Order ahead Pay Per View: An advance purchase of encrypted one-time events with an expiry date.
OSD	On-screen display: Messages and graphics, typically originating from the SMS, and displayed on the subscriber's TV screen by the IRD, to inform the subscriber of problems or instruct the subscriber to contact the SMS.
Packet	A unit of data transmitted over a packet-switching network. A packet consists of a header followed by a number of contiguous bytes from an elementary data stream.
PAL	Phase Alternating Line: A colour TV broadcasting system where the phase of the R-Y colour-difference signal is inverted on every alternate line to average out errors providing consistent colour reproduction.
PAT	Program Association Table: Part of the MPEG-2 Program Specific Information (PSI) data and is mandatory for MPEG-2 compliance. The PAT points (maps) to the PMT.
PCM	Pulse Code Modulation: A process in which a signal is sampled, each sample is quantised independently of other samples, and the resulting succession of quantised values is encoded into a digital signal.
PCR	Program Clock Reference: A time-stamp in the transport stream from which the Decoder timing is derived.
PDC	Programme Delivery Control (VBI): A Teletext service allowing simple programming (i.e. VideoPlus) of VCR recording times. If the desired program is rescheduled, PDC updates the programming information in the VCR.
Pel	Picture Element: Also known as a pixel. The smallest resolvable rectangular area of an image either on a screen or stored in memory. On screen, pixels are made up of one or more dots of colour. Monochrome and grey-scale systems use one dot per pixel. For grey-scale, the pixel is energised with different intensities, creating a range from dark to light (a scale of 0-255 for an eight-bit pixel). Colour systems use a red, green and blue dot per pixel, each of which is energised to different intensities, creating a range of colours perceived as the mixture of these dots. If all three dots are dark, the result is black. If all three dots are bright, the result is white.
PES	Packetised Elementary Stream: A sequential stream of data bytes that has been converted from original elementary streams of audio and video access units and transported as packets. Each PES packet consists of a header and a payload of variable length and subject to a maximum of 64 kbytes. A time-stamp is provided by the MPEG-2 systems layer to ensure correct synchronisation between related elementary streams at the Decoder.
PID	Packet Identifier: The header on a packet in an elementary data stream, which identifies that data stream. An MPEG-2 / DVB standard.
PIN	Personal Identification Number: A password used to control access to programming and to set purchase limits. Each subscriber household can activate several PINs and may use them to set individual parental rating or spending limits for each family member.
Pixel	PIX (picture) Element: The digital representation of the smallest area of a television picture capable of being delineated by the bit-stream. See Pel for more information.
pk-pk	peak to peak: Measurement of a signal or waveform from its most negative point to its most positive point.
PLL	Phase-Locked Loop. A phase-locked loop is a control system which controls the rotation of an object by comparing its rotational position (phase) with another rotating object as in the case of a sine wave or other repeating signal. This type of control system can synchronise not only the speed, but also the angular position of two waveforms that are not derived from the same source.
PMT	Program Map Table: Part of the MPEG-2 Program Specific Information (PSI) data and is mandatory for MPEG-2 compliance. Each service has a PMT, which lists the component parts (elementary streams of video, audio, etc.) for the various services being transmitted.

P-picture/P-frame	A picture / frame produced using forward prediction. It contains predictions from either previous I frames or previous P frames. The P frame is used as a reference for future P or B frames.
ppm	Parts per million.
PPV	Pay Per View: A system of payment for viewing services based on a usage / event basis rather than on on-going subscription. Subscribers must purchase viewing rights for each PPV event that they wish to view. PPV events may be purchased as IPPV or OPPV.
Program	PC - A sequence of instructions for a computer. TV - A concept having a precise definition within ISO 13818-1 (MPEG-2). For a transport stream, the timebase is defined by the PCR. The use of the PCR for timing information creates a virtual channel within the stream.
Programme	A linking of one or more events under the control of a broadcaster. For example, football match, news, film show. In the MPEG-2 concept, the collection of elementary streams comprising the programme, have a common start and end time. A series of programmes are referred to as events.
P_RP_B	Analogue Colour difference signals. Refer to C_RC_B for an explanation.
PROM	Programmable Read-Only Memory: A device, which may be written once with data for permanent storage, and then read whenever required. Special types of PROM permit the erasure of all data by Ultraviolet light (EPROM) or by application of an electronic signal (EEPROM).
PS	Program Stream: A combination of one or more PESs with a common timebase.
PSI	Program Specific Information: Consists of normative data, which is necessary for the demultiplexing of transport streams and the successful regeneration of programs. (*See also:* SI).
PSIP	Program System Information Protocol: The ATSC equivalent of SI for DVB.
PSK	Phase Shift Keying: A method of modulating digital signals particularly suited to satellite transmission.
PSR	Professional Satellite Receiver: *See also:* IRD.
PSU	Power Supply Unit.
PTS	Presentation Time Stamp (ATSC).
QAM	Quadrature Amplitude Modulation: A method of modulating digital signals, which uses combined techniques of phase modulation and amplitude modulation. It is particularly suited to cable networks.
QPSK	Quadrature Phase Shift Keying: A form of phase shift keying modulation using four states.
QSIF	Quarter Screen Image Format.
Quantise	A process of converting analogue waveforms to digital information. 8-bit quantisation as set out in ITU-R Rec. 601. uses 256 levels in the range 0 – 255 to determine the analogue waveform value at any given point. The value is then converted to a digital number for processing in the digital domain.
RAM	Random Access Memory: A volatile storage device for digital data. Data may be written to, or read from, the device as often as required. When power is removed, the data it contains is lost.
RAS	Remote Authorization System: A TANDBERG TV proprietary public-key encryption system used to prevent unauthorized viewing of a TV programme or programmes.
RF	Radio Frequency.
ROM	Read Only Memory: A non-volatile storage device for digital data. Data has been stored permanently in this device. No further information may be stored (written) there and the data it holds cannot be erased. Data may be read as often as required.
RS	Reed-Solomon coding: An error detection and correction, coding system. 16 bytes of Reed-Solomon Forward Error Correction code are appended to the packet before transmission, bringing the packet length to 204 bytes. The 16 bytes are used at the receiving end to correct any errors. Up to eight corrupted bytes can be corrected.
RLC	Run Length Coding: Minimisation of the length of a bit-stream by replacing repeated characters with an instruction of the form 'repeat character *x y* times'.
SCPC	Single Channel Per Carrier.
Spectral Scrambling	A process (in digital transmission) used to combine a digital signal with a pseudo-random sequence, producing a randomised digital signal that conveys the original information in a form optimised for a broadcast channel.
Scrambling	Alteration of the characteristics of a television signal in order to prevent unauthorised reception of the information in clear form.
SDI	Serial Digital Interface.
SDT	Service Description Table: Provides information in the SI stream about the services in the system; for example, the name of the service, the service provider, etc.
SELV	Safety Extra Low Voltage (EN 60950).

STB	Set-Top Box: A box that sits on top of a television set and is the interface between the home television and the cable TV company. New technologies evolving for set-top boxes are video-on-demand, video games, educational services, database searches, and home shopping. The cable equivalent of the IRD.
STT	System Time Table (ATSC).
SFN	Single Frequency Network: The SFN technique allows large geographic areas to be served with a common transmission multiplex. All transmitters in the network are synchronously modulated with the same signal and they all radiate on the same frequency. Due to the multi-path capability of the multi-carrier transmission system (COFDM), signals from several transmitters arriving at a receiving antenna may contribute constructively to the total wanted signal. The SFN technique is not only frequency efficient but also power efficient because fades in the field strength of one transmitter may be filled by another transmitter.
SI	Service Information: Digital information describing the delivery system, content and scheduling (timing) of broadcast data streams. DVB-SI data provides information to enable the IRD to automatically demultiplex and decode the various streams of programmes within the multiplex. Specified in ISO/IEC 13818[1]. (DVB)
Single Packet Burst Mode	A burst of ASI bytes (either 188 or 204, depending on packet length) is contiguously grouped into an MPEG-2 Transport Stream packet. Stuffing data is added between the packets to increase the data rate to 270 Mbit/s. See DVB Document A010 rev. 1, Section B3.3, (ASI) Layer-2 Transport Protocol.
Smart Card	A plastic card with a built-in microprocessor and memory used for identification, financial transactions or other authorising data transfer. When inserted into a reader, data is transferred to and from the host machine or a central computer. It is more secure than a magnetic stripe card and it can be disabled if the wrong password is entered too many times. As a financial transaction card, it can be loaded with digital money and used in the same way as cash until the balance reaches zero. The file protocol is specific to its intended application.
SMATV	Satellite Mast Antenna Television: A distribution system, which provides sound and television signals to the households of a building or group of buildings, typically used to refer to an apartment block.
SMPTE	Society of Motion Picture and Television Engineers.
SMS	Subscriber Management System: A system which handles the maintenance, billing, control and general supervision of subscribers to conditional access technology viewing services provided through cable and satellite broadcasting. An SMS can be an automatic (e.g. Syntellect) system where subscribers order entitlements by entering information via a telephone. Alternatively, an SMS can be a manual system, which requires subscribers to speak with an operator who then manually enters their entitlement requests. Some systems support multiple SMSs.
SNG	Satellite News-Gathering.
SNMP	Simple Network Management Protocol.
Spatial Redundancy	Information repetition due to areas of similar luminance and/or chrominance characteristics within a single frame. Removed using DCT and Quantisation (Intra-Frame Coding).
SPI	Synchronous Parallel Interface.
Statistical Redundancy	Data tables are used to assign fewer bits to the most commonly occurring events, thereby reducing the overall bit-rate. Removed using Run Length Coding and Variable Length Coding.
TAXI	Transparent Asynchronous Tx / Rx Interface: A proprietary high-speed data interface.
TCP / IP	Transmission Control Protocol/Internet Protocol: A set of communications protocols that may be used to connect different types of computers over networks.
TDM	Time Division Multiplex: One common, communications channel carrying a number of signals, each with its own allotted time slot.
TDT	Time and Date Table: Part of the DVB Service Information. The TDT gives information relating to the present time and date.
Temporal Redundancy	Information repetition due to areas of little or no movement between successive frames. Removed using motion estimation and compensation (Inter-Frame Coding).
Time-stamp	A term that indicates the time of a specific action such as the arrival of a byte or the presentation of a presentation unit.
TOT	Time Offset Table: This optional SI table supports the use of local offsets as well as the UTC time/date combination. The purpose of the table is to list by country the current offset from UTC and the next expected change to that offset (to track when daylight saving occurs). The offset resolution is to within 1 minute over a range of ±12 hours from UTC.

Transport Stream	A set of packetised elementary data streams and SI streams, which may comprise more than one programme, but with common synchronisation and error protection. The data structure is defined in ISO/IEC 13818-1 [1] and is the basis of the ETSI Digital Video Broadcasting standards.
Transport Stream Packet Header	A data structure used to convey information about the transport stream payload.
TS	Transport Stream.
TSDT	Transport Stream Descriptor Table: A component of the MPEG-2 PSI data. This table describes which type of Transport stream it is in (i.e. DVB, ATSC etc.). It may also contain other descriptors.
TSP	Transport Stream Processor.
TVCT	Terrestrial Virtual Channel Table (ATSC).
U	44.45 mm (rack height standard).
UART	Universal Asynchronous Receiver Transmitter: A device providing a serial interface for transmitting and receiving data.
UHF	Ultra High Frequency: A portion of the electromagnetic spectrum covering 300 MHz to 3000 MHz (3 GHz).
Upconvert	The process by which the frequency of a broadcast transport stream is shifted to a higher frequency range.
Uplink	The part of the communications satellite circuit that extends from the Earth to the satellite.
UPS	Uninterruptable Power Supply: A method of supplying backup power when the electrical power fails or drops to an unacceptable voltage level. Small UPS systems provide battery power for a few minutes; enough to power down the computer in an orderly manner. This is particularly important where write back cache is used. Write back cache is where modified data intended for the disk, is temporarily stored in RAM and can be lost in the event of a power failure. Sophisticated systems are tied to electrical generators that can provide power for days. UPS systems typically provide surge suppression and may provide voltage regulation.
UTC	Universal Time Co-ordinate: An internationally agreed basis for timekeeping introduced in 1972 and based on international atomic time (corresponds to Greenwich Mean Time or GMT).
VCT	Virtual Channel Table (ATSC).
VHF	Very High Frequency: A portion of the electromagnetic spectrum covering 30 MHz to 300 MHz.
VITC	Vertical Interval Time Code.
VITS	Vertical Interval Test Signal: *See:* ITS.
VPS	Video Programming System: A German precursor to PDC
WSS	Wide Screen Switching: Data used in wide-screen analogue services, which enables a receiver to select the appropriate picture display mode.
WST	World System Teletext: System B Teletext. Used in 625 line / 50 Hz television systems (ITU-R 653).
XILINX	A type of programmable Integrated Circuit.
Y (Luminance)	Defines the brightness of a particular point on a TV line. The only signal required for black and white pictures.

Annex B

Technical Specification

Contents

List of Tables

B.1 Output

B.1.1 Supported Video Resolutions

The IRD supports 4:2:0 MP@HL and 4:2:2 P@ML (TT1282 only) with video resolutions described in *Table B.1*.

Table B.1: Supported Video Resolutions

Input Resolutions (H x V)	Frame Rates	Output Format (H x V)	Specification
1920 x 1080 1440 x 1080 1280 x 1080	23.976 24	1920 x 1080 SF	SMPTE RP211
1920 x 1080 1440 x 1080 1280 x 1080	25 29.97 30	1920 x 1080 interlaced	SMPTE 274M
1280 x 720	50 59.94 60	1280 x 720 progressive	SMPTE 296M

B.1.2 Supported Video Bit-rates

The equipment supports decoding of non-encrypted compressed video at rates of up to 50 Mbit/s.

B.1.3 Performance Figures

Table B.2: Video Performance

Parameter	Value for Y, R, G, B	Value for Pb, Pr	Condition	Notes
Amplitude	700 mV ± 2%	700 mV ± 2%	100% colour bar	
DC offset	± 10 mV	± 10 mV	black field	
Bandwidth	DC to 30 MHz ± 0.1 dB	DC to 15 MHz ± 0.1 dB	sweep	
Group delay	DC to 30 MHz < 50 ns	DC to 15 MHz < 100 ns		
Noise	DC to 30 MHz < -50 dB	DC to 15 MHz < -50 dB	100% ramp	
Out-of-band noise	30 MHz to 100 MHz < -50 dB	15 MHz to 100 MHz < -50 dB	sweep	
Linearity	< 5%	< 5%	5 step	
Inter-channel delay	< 10 ns	< 10 ns	100% colour bar	
Interchannel crosstalk	< -40 dB	< -40 dB	multiburst	
Blanking rise and fall time	100 ns ± 50 ns	200 ns ± 50 ns	flat field	20% to 80%
Active line width inequality	<50 ns	<50 ns	flat field	
Output impedance	75 Ω	75 Ω		
Return loss	DC to 50 MHz > 40 dB	DC to 25 MHz > 40 dB		

B.1.4 HD SDI

HD SDI output supports:

- Embedded Decoded Audios
- Closed Captioning (EIA 708B)
- VITC

B.2 Audio Decoding and Output Stage

B.2.1 General

The IRD is capable of simultaneously decoding two PES streams of audio from the transport stream. Each of the decoders is identical in operation, but act completely independently of the other, with the following exceptions:

- Both decoders must be decoding channels that have the same sampling rate
- Both decoders are not required to simultaneously decode the same PES stream

Each channel supports extraction of four types of coded audio from the Transport Stream as follows:

- MPEG-1, Layer 2 Audio (Musicam): ISO/IEC 13818-3
- Dolby Digital AC-3 Audio: ATSC document A/52
- Linear Audio: SMPTE 302M – 2000
- DTS Audio pass-through

Audio component selection is automatic or may be specified from the User Interface or remote interfaces. The IRD automatically detects the audio type of the selected audio component and applies the appropriate algorithm. Audio component selection is based on the position of the component descriptor in the PMT. Audio 1 takes the first component, Audio 2 the second. These may be overridden by selecting User-specified component PIDs.

B.2.2 MPEG Audio

The IRD supports decoding of MPEG audio as follows:

- Compression layers: MPEG-1 layers I and II
- Sampling rates (kHz): 32, 44.1, 48
- Maximum compressed data rate: 384 kbit/s (layer II)

B.2.3 Dolby Digital AC-3 Audio

The IRD is able to decode and output the primary stereo pair of a Dolby Digital AC-3 encoded audio stream. When there is data encoded on the audio surround channels, the Decoder applies downmixing, so that either a surround encoded stereo pair (LtRt downmix) or a conventional stereo pair (LoRo downmix) is available at the output.

The IRD is not able to decode and output all 5.1 channels individually as separate channels.

It is possible to output the compressed Dolby Digital stream from the digital audio output, allowing it to be decoded to 5.1 channels by an external Decoder.

Sampling rates (kHz): 32, 44.1, 48

Maximum compressed data rate: 640 kbit/s

> NOTE...
>
> Support for Dolby Digital decoding requires approval and licensing from Dolby. The compressed Dolby Digital stream is not embedded on the SDI output.

B.2.4 Linear Audio

The IRD is able to receive audio data in the form of linear PCM digital audio data, up to 20 bits in resolution, and makes it available for output as either analogue or digital audio.

B.2.5 DTS Audio

The IRD is able to detect DTS audio Modes 1, 2 or 3. DTS audio is presented in AES format at the digital audio output.

B.3 Audio Output Format

B.3.1 General

The IRD provides an independent stereo pair output for each audio channel. Analogue audio is always output and the following digital audio formats can be chosen from the User Interface and remote control interfaces:

- AES3 format
- Dolby Digital (AC-3) compressed format

Digital Audio embedded into the HD Serial Digital Video Output is always output using the DIDs for channel mapping specified at the user interface.

B.3.2 Analogue Audio

The IRD supports level control of the audio outputs. Independent control of each output of each stereo pair is provided via the User Interface and remote interfaces.

Audio output connector type: 2 x 9 way female D-type

Output level: +18 dBm nominal clipping level. Selectable in range +12 to +24 dBm.

Output impedance: 50 Ω (nominal).

Table B.3: Analogue Audio Performance Specifications

Parameter	Conditions	Limit
Gain	0 dBm input level	±1 dB
Frequency response	100 Hz - 15 kHz, 0 dBm input level	±0.2 dB
	20 Hz - 20 kHz, 0 dBm input level	+0.5 dB, -1 dB
Cross talk	0 dB input level, 100 Hz	-80 dB
	0 dB input level, 1 kHz	-70 dB
	0 dB input level, 10 kHz	-60 dB
Distortion	+8 dBm input level, 100 Hz	-70 dB
	+8 dBm input level, 6.3 kHz	-70 dB
Noise	RMS	-65 dB
Phase	40 Hz to 15 kHz	±2°
Lip sync delay	Depends on synchroniser configuration	±5 ms

B.3.3 Audio Routing

The IRD supports the following routing of audio signal:

- STEREO (Channel 1 left, Channel 2 right)
- MIXED TO BOTH (Channel 1 and 2 on left and right)
- LEFT TO BOTH (Channel 1 on left and right)
- RIGHT TO BOTH (Channel 2 on left and right)

When the input signal is STEREO, the Audio digital output format will always be STEREO.

Where a dual mono service is available, it is possible to configure the output as MIXED TO BOTH, LEFT TO BOTH and RIGHT TO BOTH.

B.3.4 Lip Sync

The audio at the output remains synchronous to the decoded video by default (i.e. where both video and audio streams are available from the same service). In such circumstances the video and audio streams share the same PCR.

The lip sync error (delay from presentation of video until presentation of audio) introduced by the Receiver is in the range of ±5 ms.

The lip sync delay between stereo pair 1 and 2 is ±2 ms because the PTS will be presented independently for each pair.

When using frame sync the lip sync error is up to 40 ms due to audio frame skip and repeats.

B.3.5 Supported Audio Specifications

Table B.4: Supported Audio Specifications

Specification	Description
ISO/IEC 13818-3	Generic Coding of Moving Pictures and Associated Information: (MPEG-2) Audio.
ATSC A-52	Digital Audio Compression Standard (Dolby Digital).
SMPTE 302M	Linear Audio (TANDBERG Television's interpretation of the specification).

B.3.6 Supported Audio Bit-rates

Table B.5: Supported Audio Data Bit-rates (MPEG-2)

Mono kbit/s	Stereo kbit/s	Mono kbit/s	Stereo kbit/s
32	64	96	192
48	96	112	224
56	112	128	256
64	128	160	320
80	160	192	384

B.3.7 Digital Audio Outputs

Digital audio outputs comply with E1A-422[1] and have a maximum data rate of 3.072 Mbit/s.

Digital audio is output on two 9-way, D-type connectors.

Audio output: balanced 2 – 7 volts.

B.4 Input Specifications

B.4.1 QPSK Satellite Receivers

General

Table B.6: QPSK Satellite Receiver Input Specification

Parameter	Specification
L-band input	
Safety status	SELV
Number of inputs	2
Input connector type	F-type, female 75 Ω
Input impedance	75 Ω
Return loss	> 9 dB
Isolation between inputs	> 40 dB typical
Frequency	
Tuning range[2]	Fc = 950 to 2150 MHz
Tuning step	100 kHz
Carrier frequency search range	0 to ± 5 MHz
Receive spectrum sense	Normal and inverted
Power	
Input power level per carrier	-65 to –25 dBm
Total L-band input power	< -10 dBm
Oscillator power at the L-band input	< -63 dBm, F = Fc and Fc/2

[1] EIA-422-A-1978: Electrical characteristics of balanced voltage digital interface circuits.
[2] The displayed frequency is either L-band or SHF dependent on the LNB frequency and the SHF carrier frequency set in the satellite receiver input menu.

Parameter	Specification
Modulation	
Signal type	QPSK per EN 300 421[3]
Convolutional FEC rates	1/2, 2/3, 3/4, 5/6, 7/8
Symbol rate range	Rs = 1.0 to 45.0 MSymbol/s
Symbol rate step	1 Symbol/s
Symbol rate lock range	± 120 ppm
Bit-rate R188 range	See *Table B.8* for QPSK bit-rate R188 limits
Eb/No ratio	See *Table B.7*
Miscellaneous	
Phase noise tolerance	SSB phase-noise power spectral density < K + 8.5*Log(Rs)[4] (typical) at δF = 10 kHz Phase noise power spectral density of the form C – 20*Log(δF) δF = Frequency offset from carrier Rs = Symbol-rate (Msymbol/s) Convolutional FEC rate — K 1/2 — -77 2/3 — -74 3/4, 5/6, 7/8 — -71
LNB power and control	See *Table B.9*

Table B.7 shows the Eb/No requirements to ensure error free demodulation for all supported FEC rates.

Table B.8 shows the minimum and maximum possible bit-rates for all FEC rates.

Table B.7: QPSK L-band Satellite Input — Eb/No Ratio

Convolutional FEC Rate	Eb/No Ratio (dB) in IF Loop for correct MPEG-2 system operation
1/2	4.5
2/3	5.0
3/4	5.5
5/6	6.0
7/8	6.4

Eb/No ratio is referred to user bit-rate Ru188. See EN 300 421 specification. For more detailed specification information and advice on performance in specific applications, please contact TANDBERG Television Customer Services.

[3] EN 300 421: Digital broadcasting systems for television, sound and data services; Framing structure, channel coding and modulation for 11/12 GHz satellite services.

[4] These specifications apply in the presence of thermal noise at the threshold Eb/N_0 ratio given in *Table B.7*.

Table B.8: QPSK Bit-rate R188 Limits (Mbit/s)

FEC	R188min	R188max
1/2	1.000000	41.470588
2/3	1.228758	55.294118
3/4	1.382353	62.205882
5/6	1.535948	69.117647
7/8	1.612745	72.573529

LNB Power and Control

The IRD provides LNB power and control signals through the active RF input connector. LNB power and controls are enabled through the Satellite Input Menu, see *Annex C, Menus*.

The IRD supports voltage controlled LNBs only. The LNB power circuit provides automatic protection against short circuits in the LNB or its cable. When the short circuit has been removed recovery is automatic. Switchable boost of the LNB voltage to allow for losses in long cables and control of 22 kHz tone insertion are provided. The LNB power characteristics are as per *Table B.9*.

Table B.9: LNB Power and Control

Parameter	Specification	
	Voltage V (nominal)	Receiver Polarisation[5]
Voltage	13	Vertical/circular right
	18	Horizontal/circular left
Current	350 mA maximum	
LNB control	22 ± 2 kHz tone	
Tone amplitude	0.6 ±0.2 Vp-p	
Boost voltage	1 V typical	

[5] Receive Polarisation: As specified in ETS 300 784: Satellite Earth Station and Systems (SES); Television Receive-only (TVRO) earth stations operating in the 11/12 GHz frequency bands.

B.4.2 HOM Satellite Receivers

General

Table B.10: HOM Satellite Receiver Input Specification

Parameter	Specification
L-band input	
Safety status	SELV
Number of inputs	4
Input connector type	F-type, female 75 Ω
Input impedance	75 Ω
Return loss	> 12 dB
Isolation between inputs	55 dB typical (non-adjacent inputs) 45 dB typical (adjacent inputs)
Frequency	
Tuning range[6]	Fc = 950 to 2150 MHz
Tuning step	1 kHz
Carrier frequency search range	0 to ± 5 MHz (BPSK, QPSK) 0 to ± 2 MHz (8PSK, 16QAM)
Receive spectrum sense	Normal and inverted
Power	
Input power level per carrier	-65 to –25 dBm
Total L-band input power	< -10 dBm
Oscillator power at the L-band input	< -80 dBm, 589 < Fosc < 2150 MHz
Modulation	
Convolutional FEC rates	1/2, 2/3, 3/4, 5/6, 7/8
Symbol rate range	Rs = 5.0 to 45.0 MSymbol/s
Symbol rate step	1 Symbol/s
Symbol rate lock range	± 120 ppm
Eb/No ratio	See *Table B.7*
Miscellaneous	
Phase noise tolerance	SSB phase-noise power spectral density < K + 8.5*Log(Rs)[7] (typical) at δF = 10 kHz Phase noise power spectral density of the form C – 20*Log(δF) δF = Frequency offset from carrier Rs = Symbol-rate (Msymbol/s) Convolutional FEC rate K 1/2 -77 2/3 -74 3/4, 5/6, 7/8 -71
LNB power and control	See *Table B.9*

Table B.7 shows the Eb/No requirements to ensure error free demodulation for all supported FEC rates.

[6] The displayed frequency is either L-band or SHF dependent on the LNB frequency and the SHF carrier frequency set in the satellite receiver input menu.
[7] These specifications apply in the presence of thermal noise at the threshold Eb/N_0 ratio given in *Table B.7*.

Table B.11: L-band Satellite Input — Eb/No Ratio

Convolutional FEC Rate	Eb/No Ratio (dB) in IF Loop for correct MPEG-2 system operation
1/2 QPSK	4.5
2/3 QPSK	5.0
3/4 QPSK	5.5
5/6 QPSK	6.0
7/8 QPSK	6.4
2/3 8PSK	6.9
5/6 8PSK	8.9
8/9 8PSK	9.4
3/4 16QAM	9.0
7/8 16QAM	10.7

Eb/No ratio is referred to user bit-rate Ru188. See EN 300 421 specification. For more detailed specification information and advice on performance in specific applications, please contact TANDBERG Television Customer Services.

LNB Power and Control

The IRD provides LNB power and control signals through the active RF input connector. LNB power and controls are enabled through the Satellite Input Menu, see *Annex C, Menus*.

The IRD supports voltage controlled LNBs only. The LNB power circuit provides automatic protection against short circuits in the LNB or its cable. When the short circuit has been removed recovery is automatic. Switchable boost of the LNB voltage to allow for losses in long cables and control of 22 kHz tone insertion are provided. The LNB power characteristics are as per *Table B.12.*

Table B.12: LNB Power and Control

Parameter	Specification	
	Voltage V (nominal)	Receiver Polarisation[8]
Voltage	13	Vertical/circular right
	18	Horizontal/circular left
Current	350 mA maximum	
LNB control	22 ± 2 kHz tone	
Tone amplitude	0.6 ±0.2 Vp-p	
Boost voltage	1 V typical	

[8] Receive Polarisation: As specified in ETS 300 784: Satellite Earth Station and Systems (SES); Television Receive-only (TVRO) earth stations operating in the 11/12 GHz frequency bands.

B.4.3 DVB-S2 Satellite Receivers

General

Table B.13: DVB-S2 Satellite Receiver Input Specification

Parameter	Specification
L-band input	
Safety status	SELV
Number of inputs	4 (TT1280/HWO/DVBS2) 3 (TT1280/HWO/DVBS2/IF/CONST)
Input connector type	F-type, female 75 Ω
Input impedance	75 Ω
Return loss	> 11 dB
Isolation between inputs	> 60 dB, typically 70 dB
L-band Frequency	
Tuning range[9]	Fc = 950 to 2150 MHz
Tuning step	1 kHz
Carrier frequency search range	± 1 to ± 5 MHz
Receive spectrum sense	Normal and inverted
L-band Power	
Input power level per carrier	-65 to –25 dBm
Total L-band input power	< -10 dBm
Oscillator power at the L-band input	< -65 dBm, 950 < Fosc < 2150 MHz
IF Monitor Input	
Safety Status	SELV
Number of inputs	0 (TT1280/HWO/DVBS2) 1 (TT1280/HWO/DVBS2/IF/CONST)
Input connector type	BNC, female 75 Ω
Input impedance	75 Ω
Return loss	-19 dB typical
Tuning range	Fc = 50 to 180 MHz
Tuning Step	1 kHz
Input power level per carrier	-40 to –25 dBm
DVB-S Modulation (EN 300 421)	
Modulation	QPSK
Convolutional FEC rates	1/2, 2/3, 3/4, 5/6, 7/8
Symbol rate range	Rs = 1.0 to 45.0 MSymbol/s
Symbol rate step	1 Symbol/s
Symbol rate lock range	± 100 ppm
Eb/No ratio	See *Table B.14*
DVB-S2 Modulation (EN 302 307)	
DVB-S2 Mode	Broadcast Services
Modulation	QPSK, 8PSK

[9] The displayed frequency is either L-band or SHF dependent on the LNB frequency and the SHF carrier frequency set in the satellite receiver input menu.

Parameter	Specification
QPSK LDPC FEC rates	1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9. 9/10
8PSK, LDPC FEC rates	3/5, 2/3, 3/4, 5/6, 8/9, 9/10
LDPC FEC Frame length	Normal
Pilot tones	Automatic detection
Symbol rate range	Rs = 5 to 31 MSymbol/s
Symbol rate step	1 Symbol/s
Symbol rate lock range	± 100 ppm
Maximum Channel bit rate	90 Mbit/s
Maximum user bit rate	81 Mbit/s
Es/No (C/No) ratio	See *Table B.15*
Constellation Output[10]	
Availability	TT1280/HWO/DVBS2/IF/CONST only
Safety status	SELV
Number of outputs	2 (I & Q)
Output connector type	BNC, female 75 Ω
Output impedance	75 Ω
Miscellaneous	
DVB-S Phase noise tolerance[11]	SSB phase-noise power spectral density < -68 – 10*log(Rs/20) dBc/Hz at δF = 10 kHz offset Phase noise power spectral density of the form C – 20*Log(δF) δF = Frequency offset from carrier Rs = Symbol-rate (Msymbol/s)
DVB-S2 Phase noise tolerance[12]	-25 dBc/Hz at δF = 100 Hz -50 dBc/Hz at δF = 1 kHz -73 dBc/Hz at δF = 10 kHz -93 dBc/Hz at δF = 100 kHz -103 dBc/Hz at δF = 1 MHz -114 dBc/Hz at δF > 10 MHz
LNB power and control	See *Table B.16*

Table B.14 shows the Eb/No requirements for DVB-S and *Table B.15* for DVB-S2 Es/No requirements to ensure error free demodulation for all supported FEC rates.

Table B.14: DVB-S2 Satellite Receiver Input – DVB-S Eb/No Ratio

Convolutional FEC Rate	Eb/No Ratio (dB) in IF Loop for correct MPEG-2 system operation
1/2	4.5
2/3	5.0
3/4	5.5
5/6	6.0
7/8	6.4

[10] Enabling this feature disables output transport stream and renders the receiver unable to decode a service. Operational for DVB-S2 modes only.
[11] These specifications apply in the presence of thermal noise at the threshold Eb/N_0 ratio given in Table B.14
[12] These specifications apply in the presence of thermal noise at the threshold Es/No ratio given in XXXX and assume a degradation to the thermal noise performance of 0.3 dB.

Eb/No ratio is referred to user bit-rate Ru188. See EN 300 421 specification. For more detailed specification information and advice on performance in specific applications, please contact TANDBERG Television Customer Services.

Table B.15: DVB-S2 Satellite Receiver Input – DVB-S2 Es/No Ratio

LDPC FEC Rate	DVB-S2 Theoretical[13] Es/No Ratio (dB) in perfect linear channel for correct MPEG-2 system operation
1/2 QPSK	1.00
3/5 QPSK	2.23
2/3 QPSK	3.10
3/4 QPSK	4.03
4/5 QPSK	4.68
5/6 QPSK	5.18
8/9 QPSK	6.20
9/10 QPSK	6.42
3/5 8PSK	5.50
2/3 8PSK	6.62
3/4 8PSK	7.91
5/6 8PSK	9.35
8/9 8PSK	10.69
9/10 8PSK	10.98

For more detailed specification information and advice on performance in specific applications, please contact TANDBERG Television Customer Services.

LNB Power and Control

The IRD provides LNB power and control signals through the active RF input connector. LNB power and controls are enabled through the Satellite Input Menu, see *Annex C, Menus*.

The IRD supports voltage controlled LNBs only. The LNB power circuit provides automatic protection against short circuits in the LNB or its cable. When the short circuit has been removed recovery is automatic. Switchable boost of the LNB voltage to allow for losses in long cables and control of 22 kHz tone insertion are provided. The LNB power characteristics comply with IEC 1319-1 and are as per *Table B.16.*

[13] Add 0.2 dB (0.4 dB for FEC 3/5) to any system calculation for modulator – demodulator implementation margin

Table B.16: LNB Power and Control

Parameter	Specification	
	Voltage V (nominal)	Receiver Polarisation[14]
Voltage	13	Vertical/circular right
	18	Horizontal/circular left
Current	350 mA maximum	
LNB control	22 ± 2 kHz tone	
Tone amplitude	0.65 ±0.2 Vp-p	
Boost voltage	1 V typical	

B.4.4 TTV G.703 (DS3 and E3) OTTV G.703 (DS3 and E3) (Option Card)

Table B.17: TTV G.703 Input Specification

Input	Specification
Safety status	SELV
Connector type	BNC, Female
Input impedance	75 Ω
Data rate	DS3: 45 Mbit/s
	E3: 34 Mbit/s
Network Type	PDH
Network Specification	CCITT (ITU-T) G.703
Reed-Solomon	On/Off, Not available in 188-packet mode
De-Interleaver	On/Off, Not available in 188-packet mode
Status LED	Green: Lock, Red: No Lock
Output Connector	Not in use

B.4.5 DVB-ASI Input

Table B.18: DVB-ASI Copper

Input	Specification
Safety status	SELV
Connector type	BNC, Female
Input impedance	75 Ω
Data rate range	0.350 - 160 Mbit/s
Error decoding	None

B.4.6 10/100BaseT IP Input (Option Card)

Table B.19: 10/100BaseT IP Input Specifications

[14] Receive Polarisation: As specified in ETS 300 784: Satellite Earth Station and Systems (SES); Television Receive-only (TVRO) earth stations operating in the 11/12 GHz frequency bands.

Input	Specification
Safety status	SELV
Connector type	8 way RJ-45
Connector Designation	10/100 BT
Signal Type	10/100BaseT Ethernet (IEEE 802.3/802.3u)
Data Rate	1.5 – 50 Mbit/s

B.4.7 SSI Input (SMPTE 310M)

Table B.20: SSI Input (SMPTE 310M) Specifications

Input	Specification
Safety status	SELV
Connector type	BNC, Female
Input impedance	75 Ω
Data Rate Range	0 – 19.39 MHz
Error decoding	None

B.4.8 Frame Sync Connector

The Decoder can frame lock to an external video source. The frame information is input as a composite synchronous signal, with or without active video. The user can offset the sync to the video output by ±32,000 HD pixels, with a resolution of one pixel.

It is possible to connect multiple Receivers to the same reference signal. This input requires an external 75 Ω termination.

Table B.21: Frame Sync Connector

Item		Specification
Safety status		SELV
Connector type		BNC, Female
Connector designation		Frame Sync
Pin:	Centre	Analogue Black and Burst Input
	Shield	Ground/Chassis

B.5 Output Specifications

B.5.1 Video Outputs

Analogue HD Video

Table B.22: Analogue Video Output Connectors

Item	Specification
Safety status	SELV

Connector type	15-way D-type
Connector designation	Video Out
Video standards	1080 interlaced
Video level (luminance)	700 mV ± 30 mV

Digital Video

Table B.23: Digital Video Output Connectors

Item	Specification
Safety status	SELV
Connector type	BNC, Female, 75 Ω
Connector designation	HD SDI 1 HD SDI 2
Output standard (USA)	ANSI/SMPTE 292M
SDI output level	800 mV pk-pk nominal ±10%
Jitter Performance, Nominal	SMPTE Recommended Practices RP 192 –1996 Jitter Measurement Procedures in Bit-Serial Digital Interfaces

B.5.2 Audio Outputs

Table B.24: Analogue and Digital Audio Output Connector

Item	Specification
Safety status	SELV
Connector type	2 x 9-Way D-type
Connector designation	AUDIO 1 AUDIO 2
Output level	+18 dBm nominal clipping level. Selectable in range 12 to +24 dBm.
Nominal output impedance	50 Ω
Load impedance	≥600 Ω
Compressions layers	MPEG-2 layer 1 and 2, linear audio and Dolby Digital (AC-3)
Sampling rates	32 kHz, 44.1 kHz and 48 kHz
Output formats	Analogue, AES3 and Dolby Digital AC-3

B.5.3 Data Outputs

RS-232 Asynchronous (Low-speed) Data and RS-422 Synchronous (High-speed) Data

Table B.25: RS-232 Asynchronous (Low-speed) Data Connector

Item	Specification
Safety status	SELV
Connector type	9-Way D-type
Connector designation	RS232/RS422 DATA OUT
Data-rates (bit/s)	1200; 2400; 4800; 9600; 19 200; 38 400
Standards	EIA RS-232C / ITU-T BT. V.24/V.28
Line length	< 15 metres

Table B.26: RS-422 Synchronous (High-speed) Data Connector

Item	Specification
Safety status	SELV
Connector type	9-Way D-type
Connector designation	RS232/RS422 DATA OUT
Data-rates (bit/s)	Integer multiples of 56 kbit/s and 64 kbit/s
Standards	EIA RS-422/ ITU-T V.11
Line length	< 1200 metres

High-Speed Data over Ethernet

This connector is located at the back of the unit using the RJ-45 Ethernet port and is enabled through the licence key (TT1280/SWO/HSETHER).

Table B.27: High-speed Data Over Ethernet Connector

Item	Specification
Safety status	SELV
Connector Type	RJ-45 (100BaseT)
Connector designation	
Data-rates (bit/s)	5 Mbit/s
Standards	ETSI EN 301 192 v.1.2.1 (1999-06), section 4
De-encapsulation type	Data Piping (Proprietary)

B.5.4 SNMP Remote Control Connector

Table B.28: SNMP Control Connector

Item	Specification
Safety status	SELV
Connector type	RJ-45 (100BaseT)
Connector designation	10/100BaseT
Standard	TANDBERG SNMP Control MIB

B.5.5 Alarm Connectors

Table B.29: Relay Alarm Output Specification

Item	Specification
Safety status	SELV
Connector type	9-way D-type female
Connector designation:	ALARM
Contact Configuration	SPDT (Change-over) All volt-free contacts, fully isolated.
Contact Rating	1 A at 24 Vdc 1 A at 50 Vac
Maximum Switching Current	1 A

Item	Specification
Maximum Switching Voltage	50 Vdc / 30 Vac
Maximum Switching Power	24 W / 60 VA
Minimum Switching Load	0.1 mA, 100 mVdc

B.6 Environmental

B.6.1 Conditions

Table B.30: Environmental Conditions

Operational	Specification
Temperature	0°C to +50°C ambient air temperature with free airflow
Humidity	0% to 95% (non-condensing)
Cooling requirements	Convection cooling/free airflow
Handling/movement	Fixed (non-mobile) use only
Storage/Transportation	
Temperature	-20°C to +70°C (-4°F to +158°F)
Humidity	0% to 95% (non-condensing)

B.6.2 Physical

Table B.31: Physical Parameters

Parameter	Specification
Height	44.3 mm
Width	442 mm (without rack fixing brackets) 482 mm (with rack fixing brackets)
Depth	350 mm (including connectors)
Rack mounting standard	1U x 19-inch (1U ≡ 44.45 mm)
Weight	Weight 4.5 - 5.0 kg depending on configuration

B.7 Power Supply

B.7.1 AC Mains Input

This equipment is fitted with a wide-ranging power supply. It is suitable for supply voltages of 100-120 Vac -10% +6% or 220-240 Vac -10% +6% at 50/60 Hz nominal.

Table B.32: AC Power Supply Specification

Item	Specification
Power distribution system	Type TN ONLY (EN 60950 para 1.2.12.1): Power distribution system having one point directly earthed, the exposed conductive parts of the installation being connected to that point by protective earth conductors. This equipment must NOT be used with single-phase three-wire and PE, TT or IT Type Power distribution systems.
Connection to supply	Pluggable Equipment Type A (EN 60950 para 1.2.5): Equipment which is intended for connection to the building power supply wiring via a non-industrial plug and socket-outlet or a non-industrial appliance Coupler or both. Correct mains polarity must always be observed. Do not use reversible plugs with this equipment.
Class of equipment	Class I Equipment (EN 60950 para 1.2.4): electric shock protection by basic insulation and protective earth.
Rated voltage	100-120/220-240 Vac (single phase)
Rated frequency	50/60 Hz
Voltage selection	Wide-ranging
Rated current	1.5 A (100-240 Vac range)
Input connector	CEE 22/IEC 3-pin male receptacle
Fuse	Fuse in live conductor in power input filter at rear of unit. Do not use reversible plugs with this equipment.
Fuse type	Bussmann S505 Littelfuse 215 5x20 mm time delay (T) 1500 A breaking capacity (HBC) IEC/EN 60127-2 Sheet 5
Fuse current rating	2 A 250 V T HBC
Power consumption	45 W typical (NO options fitted) 180 W maximum

B.7.2 DC Supply Input (-48 V Version)

NOTES...

1. Only models TT1280/CIBAS/48V, TT1280/DIRBAS/48V, TT1282/CIBAS/48V and TT1282/DIRBAS/48V use a DC power supply.
2. Ensure correct polarity is maintained.
3. The unit must have a protective earth.

Table B.33: DC Power Supply Specification

Item	Specification
Rated voltage	For connection to –48 Vdc supplies only. (PSU input tolerance –40 to –60 Vdc). Correct polarity must always be observed.
Rated current	2 A
Input connector	Terminal block
Fuse	Fuse in –48 Vdc connector at rear of unit.
Fuse type	Bussmann S505 Littelfuse 215 5x20mm time delay (T) 1500A breaking capacity (HBC) IEC/EN 60127-2 Sheet 5
Fuse current rating	5 A 250 V T HBC
Power consumption	45 W typical (NO options fitted) 180 W maximum

B.8 Cable Types

The signal cable types (or similar) in *Table B.34* are those recommended by TANDBERG Television in order to maintain product EMC compliance.

Table B.34: Suitable Signal Cable Types

Signal Type	Connector	Cable
RS-232/RS-422 Data Out	9-way D-type Male	Belden 8162 CM 2PR24 shielded E108998 (typical)
Alarm Relay	9-way D-type Male	Belden 8162 CM 2PR24 shielded E108998 (typical)
ASI/HDSDI Out 1 and 2	BNC	Canford Audio BBC 1/3 PSF (type 2 video cable)
ASI/SMPTE 310 In	BNC	Canford Audio BBC 1/3 PSF (type 2 video cable)
Frame Sync	BNC	Canford Audio BBC 1/3 PSF (type 2 video cable)
Ethernet (100BaseT)	RJ-45	CAT 5E Data Cable S-FTP
Audio 1 and 2	9-way D-type Male to XLR	Canford Audio Cable DST 110 Ω
Video Out	15-way D-type Male	Five-way screened Haurtian computer cable EL164535 'D'

B.9 Compliance[15]

B.9.1 Safety

This equipment has been designed and tested to meet the requirements of the following:

EN 60950	European	Safety of information technology equipment.
IEC 60950	International	Safety of information technology equipment.

In addition, the equipment has been designed to meet the following:

UL 60950	USA	Safety of information technology equipment.

B.9.2 EMC[16]

This equipment has been designed and tested to meet the following:

EN 55022 and CISPR22	European International	Emission Standard Limits and methods of measurement of radio frequency interference characteristics of information technology equipment - Class A.
EN 61000-3-2[17]	European	Electromagnetic Compatibility (EMC), Part 3 Limits; Section 2. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase).
EN 61000-3-3[17]	European	Electromagnetic Compatibility (EMC), Part 3. Limits; Section 3. Limitation of voltage fluctuations and flicker in low voltage supply systems for equipment with rated current ≤ 16 A.
EN 55024	European	Information technology equipment - Immunity characteristics - Limits and methods of measurement.
FCC	USA	Conducted and radiated emission limits for a Class A digital device, pursuant to the Code of Federal Regulations (CFR) Title 47-Telecommunications, Part 15: Radio frequency devices, subpart B - Unintentional Radiators.

[15] The version of the standards shown is that applicable at the time of manufacture.
[16] The EMC tests were performed with the Technical earth attached, and configured using recommended cables.
[17] Applies only to models of the Product using ac power sources.

B.9.3 CE Marking

The CE mark is affixed to indicate compliance with the following directives:

89/336/EEC of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.

73/23/EEC of 19 February 1973 on the harmonisation of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits.

1999/5/EC of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity. (If fitted with telecom type interface modules).

> NOTE...
> The CE mark was first affixed to this product in 2003.

B.9.4 C-Tick Mark

The C-Tick mark is affixed to denote compliance with the Australian Radiocommunications (Compliance and Labelling – Incidental Emissions) Notice made under s.182 of Radiocommunications Act 1992.

> NOTE...
> The C-Tick mark was first affixed to this product in 2003.

Annex C

Menus

Contents

List of Figures

List of Tables

C.1 LCD Menus

C.1.1 Using the Menus

Detailed description of the use of menus is given in *Chapter 3, Operating the Equipment Locally*.

C.1.2 Menu Descriptions

This annex describes the front panel LCD menus.

When the unit is first powered up, it progresses through a series of start-up pages on the LCD display.

The menu is created in a tree structure, where each branch may contain items, new branches, or both.

An item is viewed as an information string on the left side of the LCD, with an editable or selectable item on the right side, or an information string.

A path to a new sub branch is viewed as an information string on the left side of the LCD, where the string starts with a **>** character. The **>** symbolises the arrow pushbutton to press, to enter the submenu.

C.2 Menu Pages - Main Menu

The main menu displays the highest points of each submenu. These points represent the main functional areas of the IRD.

Table C.1: Main Menu Items

Display Title: Main Menu	Description	Section
Presets	Enters the Presets menu.	*C.4*
Input	Enters the Input menu.	*C.5*
Service	Enters the Service menu.	*C.5.7*
CA	The Conditional Access menu is not available in software version 1.0.	
Output	Enters the Output menu.	*C.7*
Alarms	Enters the Alarms menu.	*C.8*
System	Enters the System menu.	*C.9*

C.3 The Menu Structure

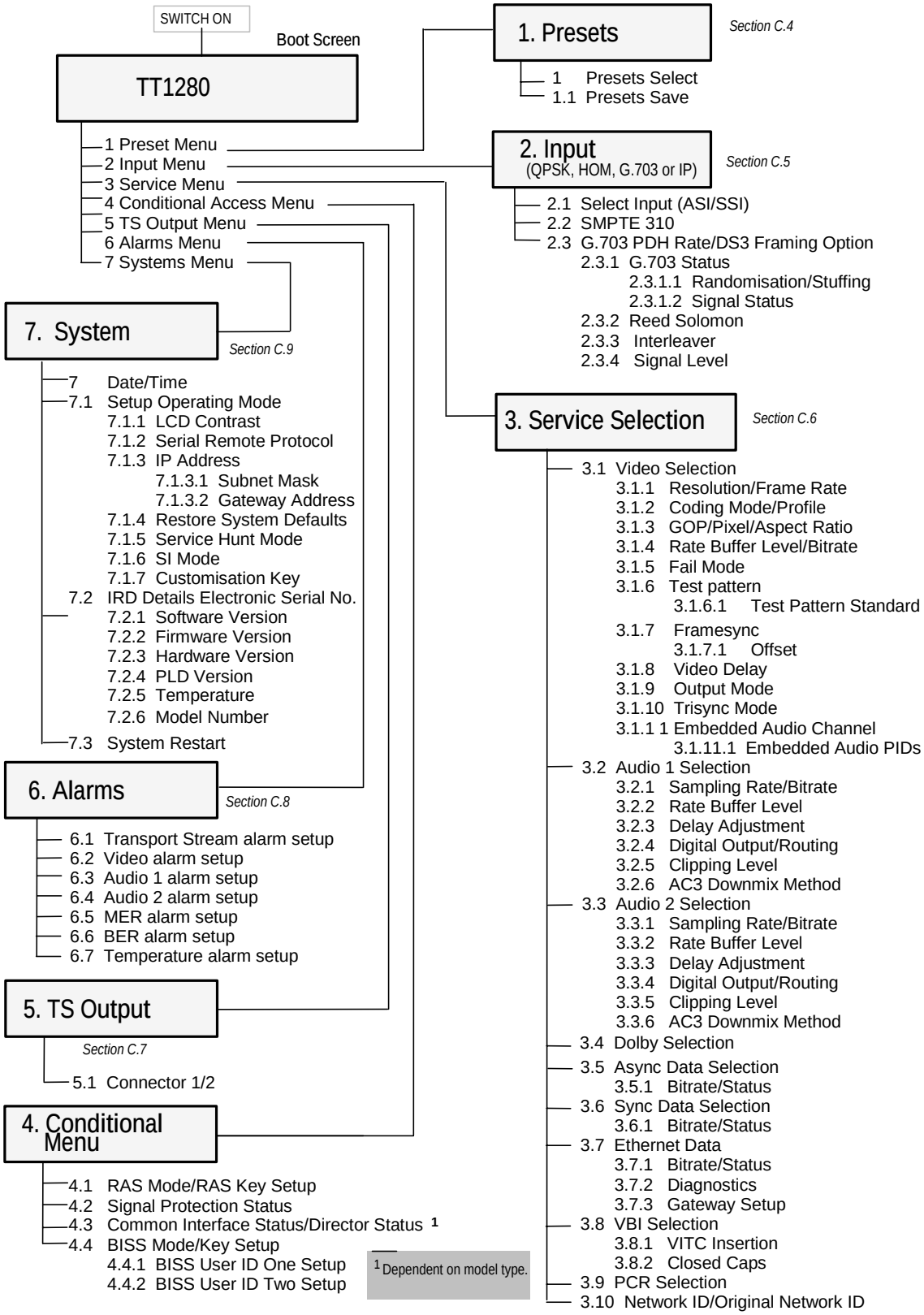

Figure C.1: Menu Structure

C.4 Presets Menu Items (Menu 1)

The **Presets** menu contains up to 40 editable preset numbers in the range 01 – 40. Selecting a Service via the Presets menu automatically reconfigures the input of the IRD. Each preset can have a selected language, network name and service provider associated with it.

Table C.2: Presets Menu Items

Display Title: Presets	Description
Select #YY of 40 XXXXXXXXXXXXXXXXXXXXXXXX	Where YY is the EDITABLE preset number in the range 01 – 40; XXXXXXXXXXXXXXXXXXXXXXXX is the stored preset service name
Save XXXXXXXXXXXXXXXXXXXXXXXX as #YY of 40	Where XXXXXXXXXXXXXXXXXX is the current service name from the SDT; YY is the EDITABLE preset number in the range 01 – 40

C.5 Input Status Menu (Menu 2)

C.5.1 Overview

The **Input Status** menu is the primary reference for transport stream lock status.

Table C.3: Input Status Menu Items

Display Title: Input	Description	Section
WWWWWWWWWW ZZZ TID XXXXX Bit-rate YYY.YY Mbit/s	WWWWWWWWWW is the transport lock status (LOCKED, NOT LOCKED) XXXXX is the transport stream ID YY.YY is the Transport stream rate (YYY.YY above 100 Mbit/s) ZZZ indicates the packet byte length of the current TS (188, 204)	
Input Selection	The submenu allows the user to select the TS source.	*C.5.2*
Input Selection Option	The submenu accesses the option card parameters.	*C.5.4*

C.5.2 Input Selection Menu

The **Input Selection** menu allows the user to select the Transport Stream source.

Table C.4: Input Selection Menu

Display Title: Input	Description
Select XXXX	XXXX is the editable input source selection (ASI, SMPTE 310, any option cards).

C.5.3 SSI Menu

When the **SSI** (SMPTE 310) source is selected this menu allows the user to monitor the signal lock status.

Table C.5: Input Selection Menu

Display Title: SMPTE 310	Description
WWWWWWWWW	Displays the signal lock status (LOCKED, NOT LOCKED).

C.5.4 QPSK Satellite Option Menu

When a QPSK Input interface is used, the Input menu allows the user to edit the QPSK parameters.

Table C.6: QPSK Satellite Menu

Display Title: Input	Description
Quality PV BER -1 -3 -5 1.0 E-8 XXXXXXXXXXXXXXX XXXXXXXX	XXXXXXXXXXXXXXX is a bar-graph indicating the current level ($10 \times ^{-1}$ to $^{-5}$ range)
Eb/N0 margin XXX.X dB	XXX.X is a measure of the signal to noise ratio (first X is + or -)
Select Source Select Source X	X is the EDITABLE input source selection 1 or 2
Source 1 LNB Frequency XXXXX.X MHz	Sets the LNB frequency for Source 1. XXXXX.X is the LNB frequency in MHz
Satellite Frequency XXXXX.X MHz	Sets the Satellite frequency for Source 1. XXXXX.X is the Satellite frequency in MHz.
Symbol rate XX.XXXXXX Msymb/s	Sets the symbol rate for Source 1. XX.XXXXXX is the symbol rate in Msymb/s
Modulation FEC XXXX XXXX	XXXX sets the modulation type (QPSK) and XXXX the FEC (1/2, 2/3, 3/4, 5/6, 7/8) for Source 1. The FEC selection is limited to the valid values of the currently selected modulation type. For AUTO FEC, the Receiver searches for and locks to the correct FEC rate for the received carrier.
LNB Power XXXXXXX At YYY	XXXXXXX sets the LNB power for Source 1 (ON, OFF, BOOSTED) BOOSTED provides 1V extra power over the ON setting. YYY selects the rating of the power output (18v – Horiz, 13v – Vert)
LNB 22 kHz XXXXXXXX	XXXXXXXX enables or disables LNB 22 kHz control tone for Source 1. (On, Off)
Search range XXXXX kHz	Sets the centre frequency search range for Source 1. XXXXX is the search range in kHz
Source 2	Same Sub-Menus as for Source 1

C.5.5 HOM Satellite Option Menu

When a Higher Order Modulation Input interface is used, the Input menu allows the user to edit the HOM parameters.

Table C.7: HOM Satellite Menu

Display Title: Input	Description
Quality PV BER -1 -3 -5 XX.LXE-8 XXXXXXXXXXXXXX XXXXXXXX	XXXXXXXXXXXXXX is a bar-graph indicating the current level (10 x $^{-1}$ to $^{-5}$ range)
Eb/N0 XXX.X dB	XXX.X is a measure of the signal to noise ratio (first X is + or -)
Select Source Select Source X	X is the EDITABLE input source selection 1, 2, 3 or 4
Source 1 LNB Frequency XXXXX.X MHz	Sets the LNB frequency for Source 1. XXXXX.X is the LNB frequency in MHz
Satellite Frequency XXXXX.X MHz	Sets the Satellite frequency for Source 1. XXXXX.X is the Satellite frequency in MHz.
Symbol rate XX.XXXXXX Msymb/s	Sets the symbol rate for Source 1. XX.XXXXXX is the symbol rate in Msymb/s
Modulation FEC XXXX XXXX	XXXX sets the modulation type (QPSK) and XXXX the FEC (1/2, 2/3, ¾, 5/6, 7/8) for Source 1. The FEC selection is limited to the valid values of the currently selected modulation type. For AUTO FEC, the Receiver searches for and locks to the correct FEC rate for the received carrier.
Input Gain XXXX	Sets the input gain of the HOM card. Where XXXX is either LOW or HIGH
Roll Off XXX	Roll off of the input. Where XXX is either 20% or 35%
Spectrum Sense XXXXXX	Spectrum sense of the incoming signal. Where XXXXXX is either NORMAL or INVERTED.
LNB Power XXXXXXX At YYY	XXXXXXX sets the LNB power for Source 1 (ON, OFF, BOOSTED) BOOSTED provides 1V extra power over the ON setting. YYY selects the rating of the power output (18v – Horiz, 13v – Vert)
LNB 22 kHz XXXXXXXX	XXXXXXXX enables or disables LNB 22 kHz control tone for Source 1. (On, Off)
Search range XXXXX kHz	Sets the centre frequency search range for Source 1. XXXXX is the search range in kHz
Source 2	Same Sub-Menus as for Source 1
Source 3	Same Sub-Menus as for Source 1
Source 4	Same Sub-Menus as for Source 1

C.5.6 TTV G.703 (DS3 and E3) Option Menu

When a TTV G.703 input interface is used, the Input menu allows the user to edit the set-up parameters

Table C.8: TTV G.703 Menu

Display Title: Input	Description
STATUS	
PDH Rate XXXXX	XXXXX is the framing mode of the TTV G.703 input module (None, C-Bit, M13)
RANDOMISATION XXXX STUFFING PKTS YYYY	XXXX (ACTIVE, NOT ACTIVE) YYYY (PRESENT, NOT PRESENT)
SETUP	
REED-SOLOMON DECODER XXXXX	XXXXX is the EDITABLE Reed-Solomon option. (DISABLED, ENABLED)
INTERLEAVER XXX	XXX.X is the EDITABLE Interleaver option (DISABLED, ENABLED)
INPUT SENSITIVITY XXXX	XXXX is the EDITABLE Signal Level option (NORMAL, LOW)

C.5.7 10/100BaseT IP Input Option Menu

When a 10/100BaseT input interface is used, the Input menu allows the user to edit the set-up parameters

Table C.9: IP Input Menu

Display title: Input	Description
STATUS	
Last IP Received From XXXX.XXXX.XXXX.XXXX	XXXX.XXXX.XXXX.XXXX is the IP address the last MPEG-2 packet was received from.
Encapsulation Mode YYYY	YYYY (UDP ONLY, RTP ONLY, RTP FEC MODE)
XXXX	XXXX status (NO DATA, LINK DOWN, OUT OF REGULATION)
SETUP	
UDP PORT NUMBER XXXXX	XXXXX shows the EDITABLE UDP Port Number on which the IP Input Card is listening for packets.
IP ADDRESS XXXX.XXXX.XXXX.XXXX	XXXX.XXXX.XXXX.XXXX is the EDITABLE IP address of the IP input card.
NETWORK MASK XXXX.XXXX.XXXX.XXXX	XXXX.XXXX.XXXX.XXXX is the EDITABLE subnet mask of the IP input card.
DEFAULT GATEWAY XXXX.XXXX.XXXX.XXXX	XXXX.XXXX.XXXX.XXXX is the EDITABLE gateway address of the IP input card.
MULTICAST IP ADDRESS XXXX.XXXX.XXXX.XXXX	XXXX.XXXX.XXXX.XXXX is the EDITABLE multicast IP address of the IP input card.

C.6 Service Menu (Menu 3)

C.6.1 Overview

The **Service** menu allows access to the currently available services. This group provides a summary of the data streams associated with the decoded service. In the case of multiple streams of the same component type, each stream can be selected independently.

After making a selection (in EDIT mode using page 1), and selecting the required component data streams (using the other pages), pressing SAVE makes it the current service. The audio and data modules will decode according to the default parameters set in other pages.

Table C.10: Service Menu

Display Title: Service	Description	Section
Video	The Video signal status submenu contains information about the currently decoded MPEG-2 video.	*C.6.2*
Audio 1	The Audio 1 signal status submenu contains information about the audio format and quality of the currently decoded audio stream on the primary audio output.	*C.6.3*
Audio 2	The Audio 2 signal status submenu contains information about the audio format and quality of the currently decoded audio stream on the secondary audio output.	*C.6.4*
Dolby	The Dolby status submenu contains information about the audio format and quality of the currently decoded audio stream on the Dolby Decoder card (if fitted).	
Async Data	The Async Data submenu allow status monitoring and configuration of the low and high speed data.	*C.6.5*
Ethernet Data	The Ethernet Data sub menu allows status monitoring and configuration of the High Speed Data over Ethernet.	*C.6.6*
VBI	The VBI status submenu displays the current status of the VBI components.	*C.6.8*
PCR PID	The PCR PID submenu displays the Program Clock Reference packet identifier and its status.	*C.6.9*
Network ID	The Network ID submenu displays the network ID and the Original Network ID from the current Service Description Tables.	*C.6.10*

C.6.2 Video Menu

The **Video** signal status submenu contains information about the currently decoded MPEG-2 video.

Table C.11: Video Menu

Display Title: Video	Description
XX Stream PID ZZZZ YYYY	XX is the number of video streams ZZZZ is the currently selected video stream PID YYYY is the currently selected video stream status (OK, STOP, FAIL)
Resolution XXXXXXXXX Frame Rate YY.YY Hz	XXXXXXXXX is the current video resolution (e.g. 1920 x 1080) YY.YY is the current video frame rate (25 Hz, 29.97 Hz)
Coding mode XXXXX Profile YYYYY	Coding mode is the current video coding (4:2:0, 4:2:2) Is the current video profile (ML@HL)

Display Title: Video	Description
GOP Structure Y.....Y	Y.....Y video GOP structure and length
Pixel Aspect Ratio YYY	YYY is the current video aspect ratio (16:9)
Rate Buffer Level XXX%	XXX is the current video rate buffer level fill percentage
Bit-rate YY.YY Mbit/s	YY.YY is the current video stream bit-rate
Fail mode YYYYYYYYYYYY	YYYYYYYYYYYY is the editable parameter for setting the response to loss of video (FREEZE FRAME, BLACK FRAME, NO SYNCS, BLUE FRAME, 75% BARS AND RED, BLUE PLUS TEXT, RED PLUS TEXT)
Test Pattern XXXXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXXXX is the editable video test pattern to be displayed: NONE, 75% BARS AND RED, MOVING BAR, BORDER, 100% COLOUR BARS, PATHOLOGICAL, MULTIBURST, MONITOR LINEUP, CONTRAST
Test Pattern Standard XXXXXXXX	XXXXXXXX is the editable standard for the test pattern: AUTO, 1080i 30Hz, 1080i 29.97Hz, 1080i 25Hz, 1080i 24Hz, 1080i 23.976Hz, 720p 60Hz, 720p 59.94Hz, 720p 50Hz
Framesync XXXXXXX YYYYYYYY	XXXXXXX is the editable parameter for Framesync enable (ENABLED, DISABLED) YYYYYYYY shows the presence of a framesync input (SIGNAL NOT PRESENT, SIGNAL PRESENT, FRAME RATE MISMATCH, SIGNAL LOCKED);
Framesync PAL Offset XXXXXX Framesync NTSC Offset YYYYYY	XXXXXX is the editable PAL framesync offset range –199999 to+199999 pixels YYYYYY is the editable NTSC framesync offset range –199999 to +199999 pixels
4:2:0 Delay XX ms	XX is the editable parameter for delaying 4:2:0 video frames (0 to 100 ms)
4:2:2 Delay YY ms	YY is the editable parameter for delaying 4:2:2 video frames (0 to 100 ms)
Output Mode YYY%	YYY is the editable video output mode (RGB, YPbPr)
Trisync Mode	Trisync on (NONE, ALL, GREEN)
Embedded Audio Data IDs XXX	XXX is the editable embedded audio data IDs (0x0 – 0xFFF)
Channel YYYY	YYYY is the editable audio channel (NONE, ONE, TWO, ONE and TWO)

C.6.3 Audio 1 Menu

The **Audio 1** signal status submenu contains information about the audio format and status of the currently decoded audio stream on the primary audio output.

Table C.12: Audio 1 Menu

Display Title: Audio 01			Description
XX Streams	PID	YYYY	XX is the number of Audio streams present YYYY is the currently selected audio1 PID ZZZZ is the stream status (OK, STOP, FAIL) VVV is the audio layer (MUS, LIN, DD) WWWWWWW is the audio language
WWWW WWWW W	VVV	ZZZZ	
Sampling Rate XX.X kHz			XX.X is the Audio 1 sample rate
Bit-rate YYY kbit/s			YY is the Audio 1 bit-rate
Rate Buffer Level			Audio 1 percentage rate buffer level
Delay Adjustment XXX.X ms			XXX.X is the Audio 1 decoding delay (range +/- 0 to 49ms)
Digital Output XXXXX			XXXXX is the editable Audio 1 digital output format (AES3, AC-3)
Routing YYYYYY			YYYYYY is the editable Audio 1 output routing (STEREO, MIXED TO BOTH, LEFT TO BOTH, RIGHT TO BOTH)
Clipping Level XX dB			XX is the editable Audio 1 clipping value (12 – 24 dB)
AC3 Downmix Method			XXXXXXXXXXXXX is the editable Dolby Digital AC-3 downmix parameter (SURROUND STEREO, CONVENTIONAL STEREO)
XXXXXXXXXXXXX			

C.6.4 Audio 2 Menu

The **Audio 2** signal status submenu contains information about the audio format and status of the currently decoded audio stream on the secondary audio output.

Table C.13: Audio 2 Menu

Display Title: Audio 02			Description
XX Streams	PID	YYYY	XX is the number of Audio streams present YYYY is the currently selected audio1 PID ZZZZ is the stream status (OK, STOP, FAIL) VVV is the audio layer (MUS, LIN, DD) WWWWWWW is the audio language
WWWW WWWW W	VVV	ZZZZ	
Sampling Rate XX.X kHz			XX.X is the Audio 2 sample rate
Bit-rate YYY kbit/s			YY is the Audio 2 bit-rate
Rate Buffer Level			Audio 1 percentage rate buffer level
Delay Adjustment XXX.X ms			XXX.X is the Audio 2 decoding delay (range +/- 0 to 49ms)
Digital Output XXXXX			XXXXX is the editable Audio 2 digital output format (AES3, AC-3)
Routing YYYYYY			YYYYYY is the editable Audio 2 output routing (STEREO, MIXED TO BOTH, LEFT TO BOTH, RIGHT TO BOTH)
Clipping Level XX dB			XX is the editable Audio 2 clipping value (12 – 24 dB)
AC3 Downmix Method			XXXXXXXXXXXXX is the editable Dolby Digital AC-3 downmix parameter (SURROUND STEREO, CONVENTIONAL STEREO)
XXXXXXXXXXXXX			

C.6.5 Async Data Menu

The **Async Data** submenu allows status monitoring and configuration of the low speed data.

Table C.14: Async Data Menu

Display Title: Async Data	Description
WW Streams PID XXXX YYYYYYYYYY	WW is the number of Low speed data streams present XXXX is the currently selected LSD PID YYYYYYYYYY is the stream status (PRESENT, NOT PRESENT)
Bit-rate YYYYYYYY ZZZZ	XXXXX is the Asynchronous data bit-rate (Up to 38400 bit/s) YYYYYYYY is editable control (ENABLED, DISABLED) ZZZZ is the output status (OK, STOP, FAIL)

C.6.6 Sync Data Menu

The **Sync Data** submenu allows status monitoring and configuration of the RS-422 high speed data.

Table C.15: Sync Data Menu

Display Title: Sync Data	Description
WW Streams PID XXXX YYYYYYYYYY	WW is the number of High speed data streams present XXXX is the currently selected HSD PID YYYYYYYYYY is the stream status (PRESENT, NOT PRESENT)
Bit-rate YYYYYYYY ZZZZ	XXXXX is the Synchronous data bit-rate (Up to 2048 kbit/s) YYYYYYYY is editable control (ENABLED, DISABLED) ZZZZ is the output status (OK, STOP, FAIL)

C.6.7 Ethernet Data Menus

The **Ethernet Data** submenu allows status monitoring and configuration of the high-speed data over Ethernet option.

Table C.16: High Speed Data Over Ethernet Menu

Display Title: Ethernet Data	Description
User PID XXXX YYY PIPE ZZZZ	XXXX is the currently selected HSD PID YYY is the stream status (PRESENT, NOT PRESENT) ZZZZ is the status of the service (OK, STOP, FAILED)
Bit-rate X.XX YYY ZZZZ	XXXXX is the data bit-rate YYY is editable control (ENABLED, DISABLED) ZZZZ is the output status (OK, STOP, FAIL)
Packet Lost Frame Lost	XXXXX is the number of Packets lost YYYY is the number of framed Lost
Forward to Gateway XXX Gateway YYY.YYY.YYY.YYY	XXX is the editable Gateway option (ON, OFF) When XXX is set to ON, the destination Gateway can be set.

C.6.8 VBI Menu

The **VBI** status submenu displays the current status of the VBI components.

> NOTE...
> The VITC menu functionality is not supported in software version 1.0.0.

Table C.17: VBI Menu

Display Title: VBI	Description
Closed Captions XXXXXXXXXXX YYYYYYY ZZZZ	XXXXXXXXXXX indicates the presence of Closed Captions (PRESENT, NOT PRESENT) YYYYYYY is the editable parameter for enabling Closed Captions pass through (ENABLED, DISABLED) ZZZZ indicates the status of the output (OK, STOP, FAIL)

C.6.9 PCR PID Menu

The **PCR PID** submenu displays the Program Clock Reference packet identifier and its status.

Table C.18: PCR PID Menu

Display Title: PCR PID	Description
PCR PID XXXX YYYYYYYYYY	XXXX is the PCR PID YYYYYYYYYY is (PRESENT, NOT PRESENT)

C.6.10 Network ID Menu

The **Network ID** submenu displays the network ID and the Original Network ID from the current Service Description Tables.

Table C.19: Network ID Menu

Display Title: Network ID	Description
Network ID XXXXX Original Network ID YYYYY	XXXXX is the network ID from the current SDT (or ----- when SDT not available) YYYYY is the original network ID from the current SDT (or ----- when SDT not available)

C.7 Transport Stream Output Menu

C.7.1 Overview

The **Transport Stream Output** submenu allows editing of the position of the ASI output.

Table C.20: Transport Stream Output Menu

Display Title: Transport Stream Output	Description
XXXXXXXXXXX	Position of TS output (POST INPUT, POST ES DESCRAMBLE, POST TS DESCRAMBLE).

C.7.2 Output Connector Selector Submenu

This menu allows editing of the output connector functionality.

Table C.21: Output Connector Selector Submenu

Display Title: Output	Description
Connector 1	Selection of output type (ASI, DISABLED, HD SDI).
Connector 2	Selection of output type (ASI, DISABLED, HD SDI).

C.8 Alarms Menu (Menu 6)

C.8.1 Overview

The **Alarms** menu provides a summary of the alarm status.

Table C.22: Alarms Menu

Display Title: Alarms	Description	Section
Transport Stream Alarm Setup	Transport Stream alarm and relay settings.	*C.8.2*
Video Alarm Setup	Video alarm and relay settings.	*C.8.3*
Audio 1 Alarm Setup	Audio 1 alarm and relay settings.	*C.8.4*
Audio 2 Alarm Setup	Audio 2 alarm and relay settings.	*C.8.5*
Satellite BER Alarm Setup	Satellite BER alarm and relay settings.	*C.8.6*
COFDM MER Alarm Setup	COFDM MER alarm and relay settings	*C.8.7*
Temperature Alarm Setup	Temperature alarm and relay settings.	*C.8.8*

C.8.2 Transport Stream Alarm Setup Menu

Table C.23: Transport Stream Alarm Setup Menu

Display Title: Alarms	Description
IF NO TRANSPORT STREAM YYYYYYYYYYYYYYY	YYYYYYYYYYYYYY is editable: NO ALARM SET ALARM ONLY SET ALARM AND RELAY 1 SET ALARM AND RELAY 2 SET ALARM AND RELAY 3 SET ALARM AND RELAY 4 SET RELAY 1 ONLY SET RELAY 2 ONLY SET RELAY 3 ONLY SET RELAY 4 ONLY

C.8.3 Video Alarm Setup Menu

Table C.24: Video Alarm Setup Menu

Display Title:	Description
IF VIDEO NOT RUNNING	YYYYYYYYYYYYYY is editable:
YYYYYYYYYYYYYY	NO ALARM
	SET ALARM ONLY
	SET ALARM AND RELAY 1
	SET ALARM AND RELAY 2
	SET ALARM AND RELAY 3
	SET ALARM AND RELAY 4
	SET RELAY 1 ONLY
	SET RELAY 2 ONLY
	SET RELAY 3 ONLY
	SET RELAY 4 ONLY

C.8.4 Audio 1 Alarm Setup Menu

Table C.25: Audio 1 Alarm Setup Menu

Display Title:	Description
IF AUDIO 01 NOT RUNNING	YYYYYYYYYYYYYY is editable:
YYYYYYYYYYYYYY	NO ALARM
	SET ALARM ONLY
	SET ALARM AND RELAY 1
	SET ALARM AND RELAY 2
	SET ALARM AND RELAY 3
	SET ALARM AND RELAY 4
	SET RELAY 1 ONLY
	SET RELAY 2 ONLY
	SET RELAY 3 ONLY
	SET RELAY 4 ONLY

C.8.5 Audio 2 Alarm Setup Menu

Table C.26: Audio 2 Alarm Setup Menu

Display Title:	Description
IF AUDIO 02 NOT RUNNING YYYYYYYYYYYYYY	YYYYYYYYYYYYYY is editable: NO ALARM SET ALARM ONLY SET ALARM AND RELAY 1 SET ALARM AND RELAY 2 SET ALARM AND RELAY 3 SET ALARM AND RELAY 4 SET RELAY 1 ONLY SET RELAY 2 ONLY SET RELAY 3 ONLY SET RELAY 4 ONLY

C.8.6 Satellite BER Alarm Setup Menu

Table C.27: Satellite BER Alarm Setup Menu

Display Title: ALARMS	Description
VVVV WWWW UUU XXXXX YYYYYY ZZZZZZ	VVVV is BER, or NONE WWWW is LOCK XXXXX is VIDEO YYYYYY is AUDIO1 ZZZZZZZ is AUDIO2 UUU is MER
If BER exceeds X.X E-X YYYYYYYYYYYYYY	X.X E-X is editable 9.9 E-1 to 1.0 E-8 YYYYYYYYYYYYYY is editable: NO ALARM SET ALARM ONLY SET ALARM AND RELAY 1 SET ALARM AND RELAY 2 SET ALARM AND RELAY 3 SET ALARM AND RELAY 4 SET RELAY 1 ONLY SET RELAY 2 ONLY SET RELAY 3 ONLY SET RELAY 4 ONLY

C.8.7 MER Alarm Setup Menu

Table C.28: MER Alarm Setup Menu

Display Title:	Description
IF MER LESS THAN XX.X	YYYYYYYYYYYYY is editable 0 to 69.9:
YYYYYYYYYYYYY	NO ALARM
	SET ALARM ONLY
	SET ALARM AND RELAY 1
	SET ALARM AND RELAY 2
	SET ALARM AND RELAY 3
	SET ALARM AND RELAY 4
	SET RELAY 1 ONLY
	SET RELAY 2 ONLY
	SET RELAY 3 ONLY
	SET RELAY 4 ONLY

C.8.8 Temperature Alarm Setup Menu

Table C.29: Temperature Alarm Setup Menu

Display Title:	Description
IF Temperature exceeds 65° C	YYYYYYYYYYY is editable:
YYYYYYYYYYY	NO ALARM
	SET ALARM ONLY
	SET ALARM AND RELAY 1
	SET ALARM AND RELAY 2
	SET ALARM AND RELAY 3
	SET ALARM AND RELAY 4
	SET RELAY 1 ONLY
	SET RELAY 2 ONLY
	SET RELAY 3 ONLY
	SET RELAY 4 ONLY

C.9 System Menu (Menu 7)

C.9.1 Setup Menu

The **Setup** submenu allows the user to edit the operating mode, LCD contrast, serial remote protocol, IP address, subnet mask, service hunt mode, and the customisation key.

Table C.30: Setup Menu

Display Title: Setup	Description
Date: XX/XX/XXXX Time: YY:YY:YY	XX/XX/XXXX is the system date from the TDT YY:YY:YY is the system time from the TDT
Operating Mode XXXXXXXXXXXXX	XXXXXXXXXXXXX is editable: FRONT PANEL SERIAL REMOTE (not supported in software version 1.0.0) NETWORK (SNMP)
LCD Contrast XXXXXX	XXXXXX is editable in the range: LOW MEDIUM HIGH
Serial Remote Protocol XXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXX is editable: RS-232 TTV, RS-232 ALTEIA AT ADDR YYY, RS-485 ALTEIA AT ADDR YYY where YYY is IRD address from 000 to 999.
IP Address XXX.XXX.XXX.XXX	XXX.XXX.XXX.XXX is the editable IP address
Subnet Mask XXX.XXX.XXX.XXX	XXX.XXX.XXX.XXX is the editable subnet mask
Gateway Address XXX.XXX.XXX.XXX	XXX.XXX.XXX.XXX is the editable Gateway address
Syslog Address XXX.XXX.XXX	XXX.XXX.XXX is the editable Syslog address.
Restore System Defaults	Restores system defaults.
Service Hunt Mode XXXXXXXX	XXXXXXXX is the editable parameter for setting automatic service selection (ENABLED, DISABLED)
SI Mode XXX	XXX is the editable parameter for SI detection (AUTO, ATSC, DVB)
Customisation Key XXXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXXX is the editable parameter for entering customisation keys

C.9.2 IRD Details Menu

The **IRD Details** submenu displays the software, firmware, hardware, PLD version and electronic serial number of the IRD.

Table C.31: IRD Details Menu

Display Title: IRD Details	Description
Electronic Serial Number XXXXX	XXXXX is the unit serial number
Software Version XX.XX.XX	XX.XX.XX is the software version number
Firmware Versions XX.XX	XX.XX is the firmware 1 version number XX.XX is the firmware 2 version number
Hardware Version XXXX	XXXX is the hardware version number
PLD Versions XXXX	XXXX is the PLD 1 version number XXXX is the PLD 2 version number
Temperature XX.X	XX.X is the unit temperature
Model Number XXXXXX	XXXXXX is either TT1280 or TT1282

C.9.3 System Restart Menu

The **System Restart** submenu allows the user to perform a software restart without having to remove and insert the power cable.

Table C.32: System Restart Menu

Display Title: System Restart	Description
Restart Activate	Software restart. Press Edit to cancel and Save to activate.

Annex D

Language Abbreviations

Languages are shown in alphabetical order.

NO	LANGUAGE	ABBREVIATION
5	ARABIC	ARA
	BASA	BAS
14	BENGALI	BEN
135	CHINESE	CHI
19	CZECH	CZE
21	DANISH	DAN
82	DUTCH	DUT
25	ENGLISH	ENG
31	FINNISH	FIN
34	FRENCH	FRE
22	GERMAN	GER
24	GREEK	GRK
40	GUJARATI	GUJ
52	HEBREW	HEB
42	HINDI	HIN
44	HUNGARIAN	HUN
50	ICELANDIC	ICE
49	INDONESIAN	IND
36	IRISH	IRI
51	ITALIAN	ITA
53	JAPANESE	JAP
55	JAVANESE	JAV
61	KOREAN	KOR
	MALAY	MAY
83	NORWEGIAN	NOR
90	PORTUGESE	POR
94	ROMANIAN	ROM
95	RUSSIAN	RUS
27	SPANISH	SPA
112	SWEDISH	SWE
117	THAI	THA
123	TURKISH	TUR
128	URDU	URD
130	VIETNAMESE	VIE

The following non-ISO[1] languages are supported.

NOTE...

Only applicable for a transport stream going to an Alteia Receiver.

LANGUAGE	ABBREVIATION
MAIN	ONE
AUX	TWO
INTERNATIONAL SOUND	INT
AUDIO 1	AAA
AUDIO 2	AAB
AUDIO 3	AAC
AUDIO 4	AAD
AUDIO 5	AAE
AUDIO 6	AAF
AUDIO 7	AAG
AUDIO 8	AAH
AUDIO 9	AAI
AUDIO 10	AAJ
AUDIO 11	AAK
AUDIO 12	AAL
AUDIO 13	AAM
AUDIO 14	AAN
AUDIO 15	AAO
AUDIO 16	AAP

The non-ISO languages allow tagging of audio without reference to specific languages. The system can then transmit two languages (Main and Auxiliary) which could be any type of audio.

NOTE...

The non-ISO languages need to be user defined in the MEM or Mobile Contribution Encoder for them to be available.

For language codes not supported by the IRD, the Receiver will list 'undefined' as the language descriptor. This does not affect the way the audio is selected.

[1] International Standards Organisation.

Annex E

Factory Defaults

Units are shipped with the following factory default parameters. These can be restored at any time using the System Menu. All other parameters are unaffected by restoring the factory defaults.

Menu	Description	Default
#2 Input	SELECT INPUT	ASI
#2 Input QPSK/8PSK/16 QAM	SOURCE	1
	LNB FREQUENCY	10750.0 MHz
	SATELLITE FREQUENCY	12168.0 MHz
	SYMBOL RATE	27.5 Msym/s
	MODULATION FEC	QPSK auto
	LNB POWER	OFF
	LNB 22 kHz	Disabled
	SEARCH RANGE	3000 kHz (5000 kHz)
	REED-SOLOMON	DISABLED
TTV G.703	INTERLEAVER	DISABLED
	SIGNAL LEVEL	NORMAL
#3 Service	FAIL MODE	FREEZE FRAME
	TEST PATTERN	NONE
	FRAME SYNC	DISABLED
	FSYNC PAL OFFSET	+0000
	FSYNC NTSC OFFSET	+0000
	4:2:0 DELAY	0 ms
	4:2:2 DELAY	0 ms
	OUTPUT MODE	RGB
	TRISYNC MODE	ON ALL
	EMBEDDED AUDIO CHANNEL	ONE and TWO
	EMBEDDED AUDIO DID 1	2E7H
	EMBEDDED AUDIO DID 2	1E5H
	DELAY ADJUSTMENT	+0.0 ms
	DIGITAL OUTPUT	AES3
	ROUTING	STEREO

Menu	Description	Default
	CLIPPING LEVEL	18 dB
	AC3 DOWNMIX METHOD	SURROUND STEREO
	ASYNC DATA	ENABLED
	SYNC DATA (High Speed Ethernet Data Not Fitted)	ENABLED
	ETH.NET DATA (High Speed Ethernet Data Fitted)	ENABLED
	VITC INSERTION	ENABLED
	CLOSED CAPTION	ENABLED
	PCR PID	
#5 Output	TS OUTPUT	POST INPUT
	CONNECTOR 1	DISABLED
	CONNECTOR 2	DISABLED
#6 Alarm	IF NO TRANSPORT STREAM	NO ALARM
	IF VIDEO NOT RUNNING	NO ALARM
	IF AUDIO 1 NOT RUNNING	NO ALARM
	IF AUDIO 2 NOT RUNNING	NO ALARM
	IF MER LESS THAN 0.00	NO ALARM
	IF BER EXCEEDS 1.0 E-8	NO ALARM
	IF TEMPERATURE EXCEEDS 65	NO ALARM
#7 Setup	OPERATING MODE	FRONT PANEL
	LCD CONTRAST	MEDIUM
	SERIAL REMOTE CONTROL	RS-232 TTV
	IP ADDRESS	155.155.155.201
	SUBNET MASK	255.255.255.000
	GATEWAY ADDRESS	155.155.155.001
	SYSLOG IP ADDRESS	NOT SET
	SERVICE HUNT MODE	ENABLED
	SI MODE	AUTO
	CUSTOMISATION KEY	UNAFFECTED
	SW VERSION/ FW VERSION/ HW VERSION/ PLD VERSION/ ELECTRONIC SERIAL NUMBER	UNAFFECTED