



***RE 662 ISDN Layer II Encoder and  
RE 663 ISDN Layer II Decoder  
Operator Manual***

***re***

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## **SAFETY PRECAUTIONS FOR LINE-POWERED EQUIPMENT**

All line-powered equipment can be dangerous. Therefore, certain basic rules and precautions must be observed to ensure the best possible safety for users, service personnel, as well as third parties. At RE TECHNOLOGY AS we have taken great care during the design and production of our equipment. However, safety may be impaired by incorrect installation, handling, or intervention.

### **WARNING**

Ensure that the line cable, connectors, and power outlet all have the correct configuration, to establish a protective earth. Disconnecting the protective earth conductor, inside or outside the equipment, may potentially be hazardous to the operator. Removing the covers may expose parts carrying potentially dangerous voltages.

### **INSTALLATION**

This is a Safety Class I unit which requires protective earthing via the IEC power inlet. Before switching on, the unit must be connected via the third wire in the power cable to a protective earth contact in the line socket. The protective action must not be negated by using an extension cord (power cable) without a protective conductor (protective earth). Grounding one conductor of a two-conductor outlet is not sufficient protection. Ensure that the line fuse has the correct value according to the voltage and power consumption. If the unit requires separate signal grounding, through external connections to the unit chassis, do not disconnect the protective earth.

### **SERVICE**

Only trained service personnel should attempt to dismantle and repair the unit. Take great care during the installation and service of the unit, especially when adjusting or measuring an open unit under voltage. Before removing any covers, switch off the unit and remove the line cable from the power outlet.

Capacitors inside the unit may hold dangerous charges for a considerable time after the unit has been switched off. If it is necessary to replace components in the line connected partition or area, use only new parts of the correct and approved type. Take special care to maintain or re-establish the protective earthing. The conductivity must be measured after the service or repair is finished. Do not remove any warning labels. Replace any damaged or illegible labels with new labels.

### **BACK-UP BATTERIES**

For units with lithium back-up batteries, ensure, when replacing them, that they are of the same type and are correctly installed before you switch the power on to the unit. Do not recharge the batteries or expose them to temperatures above 100 °C (212 °F). Dispose of used batteries responsibly, according to your national/local guidelines. The batteries contain chemicals which are harmful to the environment. When you dispose of the unit itself, first remove the batteries and dispose of them separately.

### **SAFETY SYMBOLS**



Warning. The unit will be marked with this symbol when it is necessary for the user to refer to the manual.



Ground terminal (sometimes used in the manual to indicate circuit common connected to the chassis).



Attention. Observe precautions for handling Electrostatic Sensitive Devices.



Danger. Live voltage exceeding 1000 V.



Warning label for laser radiation. The product is marked with this symbol if it is necessary to protect against laser radiation which is invisible and can cause permanent damage to the eye.

**Use of Product Names.** The product names mentioned herein are used for identification purposes only, and may be trademarks and/or registered trademarks of their respective companies.

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**IMPORTANT**

There are currently a number of different ISDN standards used worldwide.

When power is applied to the RE 662 and RE 663, the front panel ISDN display shows the codec's current setting.

Do not connect the RE 662 and RE 663 to ISDN if the standard shown differs from the one used in your country.

You may, however, change the ISDN standard in the codec's setup. See "Setup Menu" on page 38 for further information.



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## 1. Introduction

The RE 662 and RE 663 Codec is a full-featured audio codec intended for cost-effective transportation of audio signals on ISDN networks. Each ISDN Basic Rate Interface offers the user access to two unrestricted bi-directional 64 kbit/s channels at a cost comparable to that of standard telephone lines.

The RE 662 Encoder and the RE 663 Decoder can encode and decode a stereo or two-channel mono program according to the ISO/IEC 11172-3 Layer II standard. It can also encode and decode a mono signal according to the ITU-T Rec. G.722 standard. The codec accepts standard analog audio formats, and if you have the digital audio option installed it also accepts digital AES/EBU or S/PDIF audio formats.

The Layer II bit reduction technique enables transmission of a medium-quality audio signal using as little as 64 kbit/s, and hence stereo or dual-channel transmission using both 64 kbit/s circuits (B-channels) in a single basic rate.

For applications in which a higher sound quality is required the 384 kbit/s option can be installed. The codec is then capable of combining up to three Basic Rate Interfaces into a virtual higher bit-rate, a feature which allows the codec to operate at bit rates up to 384 kbit/s.

For inter-networking with 56 kbit/s networks (for example the North American Switched-56) a V.110 rate adaption protocol is used to rate-adapt up to two B-channels to 56 kbit/s transmission yielding a virtual bit rate of 112 kbit/s.

As ISDN is a bi-directional network, the encoder can be combined with an RE 661 Layer II Decoder to use bi-directional operation. Similarly, the decoder can be combined with the RE 660 Layer II Encoder. Alternatively, the reverse direction (from decoder to encoder) can be accessed via two 64 kbit/s RS-422 interfaces. Note, that this requires a particular factory configuration and must be specified when placing the order for the codec.

In any aspect of audio transmission, the RE 662 and RE 663 Codec offers high quality and reliability. Contribution of programs, such as TV news feeds, weather reports, remote pick-ups, satellite back hauls, and coverage of concerts, festivals or stadium events, is one main application. Another main application of the codec is program distribution, such as studio-to-studio connections, Studio-to-Transmitter Links (STL), Inter City Relays (ICR) and satellite and microwave transmissions.

To serve the need for additional data capacity, the codec provides an in-band asynchronous RS-232 data channel.

For the codec's Layer II operation, note the following:

- The RE 662 always calculates and inserts the header CRC and sets the Protection bit to ON in the outgoing Layer II data stream. The RE 663 handles the header CRC according to the status Protection bit in the incoming Layer II data stream.
- The RE 662 always resets the Copyright and the Home/Original bits to zero in the outgoing Layer II data stream. The RE 663 does not use either of these two bits.

## **2.1 Options for the Codec**

### **2.1.1 Digital Audio Option**

The digital audio option is a small piggy-back add-on circuit board located in the upper left corner on the Layer II encoder/decoder board.

This option is factory-installed and provides the encoder with a digital audio input possibility and the decoder with a digital audio output and a digital audio SYNC input possibility in order to supply a locked output. Both the digital audio input for the RE 662 Encoder and the digital audio output from the RE 663 Decoder are internally rate-adapted to the transmission network (sampling rate conversion), thus eliminating the need for locking the connected digital audio equipment. Both the input and the output can be rate-converted to any of the three sampling frequencies, 32, 44.1 or 48 kHz, independently of the sampling frequency used in the transmission

### **2.1.2 384 kbit/s option**

The 384 kbit/s option is a factory-installed option providing the codec with the B-channel equalizer board. The functionality of the B-channel equalizer board is described in Chapter 5.

### **2.1.3 Locking the ISDN Keyboard**

The ISDN keyboard can be locked by means of a factory-installed option. When the keyboard is locked, all ISDN keys are locked, except the [Arrow Up] and [Arrow Down] keys. Thus, you cannot enter numbers, make calls etc., but you can still see the status of the ISDN lines on the unit.

When the keyboard is locked, the serial control and the remote control are locked as well.

### **2.1.4 Blanking the ISDN Numbers**

The display of ISDN numbers can be blanked by means of a factory-installed option. When the display of numbers is blanked, you cannot see the following on the display and on the serial interface:

- Connected numbers
- Called numbers
- Numbers in number groups

These numbers are displayed as “--” both on the display and on the serial interface.



### 3. Installation

#### 3.1 Initial Inspection

When unpacking the RE 662 and RE 663, check the codec, all accessories and the packing material for any physical damage. If any item is damaged, please notify the carrier and your local RE representative, or RE TECHNOLOGY AS directly. In case of complaints please keep the packing material for later inspection by the carrier.

When units are stacked on top of each other, precautions must be taken to avoid thermal stress. Cooling takes place through convection, and not by means of fans. Do not place the unit directly onto a surface. Ensure that there is always a minimum of 1 U (44 mm) airspace between the bottom of the unit and any surface, thus allowing air to circulate freely. Units can be stacked on top of each other using external air separation plates. There must be at least one unit height of free air between every unit.

#### 3.2 Mechanical Installation

The encoder and the decoder are intended for mounting in a 19" rack. Each unit occupies two height units.

To meet the EMC requirements, the units must be installed using correctly shielded cables of good quality for all external connections.

This implied that all multi-conductor and ISDN cables must have conductive connector housing with shield clamps, and the coaxial cables must be of the double-braided type.

#### 3.3 Electrical Installation

##### Power

The encoder and the decoder operate from a 90 to a 250 V AC power supply. A protective, slow blow 500 mA fuse is located at the power inlet.

**NOTE** The codec is grounded via the third wire in the power cable. If the codec is operated from AC outlets without a ground connector, the unit must be grounded by means of the brass M5 protective ground terminal.

## 3.4 Internal Settings

### 3.4.1 General

You can change the codec's internal settings to suit your needs with respect to input and output impedance, clipping and maximum output level, and the format of the digital audio signals for the inputs and output.

To do this, you must first remove the top plate of the encoder and/or decoder, and if the B-channel equalizer board is installed you must remove it as described in Chapter 3.4.2. This gives you access to the encoder/decoder Layer II board on which various numbered jumpers are located. Once you have access to the jumpers, you can set them as you require, according to the tables given in Chapters 3.4.3 to 3.4.6.

### 3.4.2 Getting Access to the Jumpers

#### Removing the Top Plate

To remove the top plate, unscrew the ten screws located around the edges of the top plate. Seen from above, from left to right, are the B-channel Equalizer board (if installed), the Triple Basic Rate Interface (ISDN) board and the power supply.

#### Removing the B-channel Equalizer Board

If the B-channel equalizer board is installed, you can remove it as follows:

1. Remove the top plate.
2. Disconnect the two ribbon cables connecting the B-channel Equalizer board to the ISDN board.  
To do this, grip the two shorter edges of each connector between thumb and forefinger and pull upwards.
3. Disconnect the two ribbon cables connecting the B-channel Equalizer board to the RE 660/RE 661 /X21 Connector A and B ports.  
To do this, pull the white connectors out of the board.
4. Unscrew the four screws holding the B-channel Equalizer board in place.  
You can now remove the B-channel Equalizer board.

**NOTE** Alternatively, if you are careful, you can leave the cables in place and still gain access to the jumpers.

### 3.4.3 Analog Audio Inputs/Outputs

Input Impedance	JP3	JP10
600 $\Omega$ <sup>a)</sup>	2-3	2-3
>25 k $\Omega$	1-2	1-2

Table 3.1 Encoder Input Impedance

Output Impedance	TP1	TP5	TP6	TP7
600 $\Omega$	2-3	2-3	2-3	2-3
< 60 $\Omega$ <sup>a</sup>	1-2	1-2	1-2	1-2

Table 3.2 Decoder Output Impedance

a. Factory setting

### 3.4.4 Clipping Level

Clipping Level	TP8	TP7	TP6	TP5	TP9	TP10	TP12	TP11
21 dBu	2-3	2-3	1-2	2-3	2-3	2-3	1-2	2-3
18 dBu	2-3	2-3	2-3	1-2	2-3	2-3	2-3	1-2
15 dBu <sup>a)</sup>	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3
12 dBu	2-3	1-2	1-2	2-3	2-3	1-2	1-2	2-3
9 dBu	2-3	1-2	2-3	1-2	2-3	1-2	2-3	1-2
6 dBu	2-3	1-2	2-3	2-3	2-3	1-2	2-3	2-3
3 dBu	1-2	2-3	1-2	2-3	1-2	2-3	1-2	2-3
0 dBu	1-2	2-3	2-3	1-2	1-2	2-3	2-3	1-2
-3 dBu	1-2	2-3	2-3	2-3	1-2	2-3	2-3	2-3

Table 3.3 Encoder Clipping Level

a. Factory setting

### 3.4.5 Output Level

Output Level	JP8	JP7	JP9	JP10	JP14	JP13	JP12	JP6
24 dBu	2-3	1-2	1-2	1-2	2-3	1-2	1-2	1-2
21 dBu	1-2	2-3	1-2	1-2	1-2	2-3	1-2	1-2
18 dBu	1-2	1-2	1-2	1-2	1-2	1-2	1-2	1-2
15 dBu <sup>a)</sup>	2-3	1-2	1-2	2-3	2-3	1-2	1-2	2-3
12 dBu	1-2	2-3	1-2	2-3	1-2	2-3	1-2	2-3
9 dBu	1-2	1-2	1-2	2-3	1-2	1-2	1-2	2-3
1 dBu	2-3	1-2	2-3	1-2	2-3	1-2	2-3	1-2
-2 dBu	1-2	2-3	2-3	1-2	1-2	2-3	2-3	1-2
-3 dBu	1-2	1-2	2-3	1-2	1-2	1-2	2-3	1-2

*Table 3.4 Layer II Decoder Output Level with output impedance <60 Ω*

a. Factory setting

**NOTE** 15 dBu = 6.16 Vp, 18 dBu = 8.70 Vp, 21 dBu = 12.30 Vp.

If the output impedance is set to 600 Ω, and the output is loaded into 600 Ω, all output levels will be 6 dB lower than stated in Table 3.4.

### 3.4.6 Digital Audio Inputs/Outputs

These settings are only relevant if you have the digital audio option installed.

Digital Audio Input Format	JP1 (on option)	JP2 (on option)
AES/EBU <sup>a)</sup>	1-2	1-2
S/PDIF	2-3	2-3

*Table 3.5 Encoder, Digital Audio Input Format*

a. Factory Setting

Digital Audio Output Format	JP3 (on option)	JP4 (on option)	JP3 (on main board)
AES/EBU <sup>a)</sup>	1-2	1-2	1-2
S/PDIF	2-3	2-3	2-3

*Table 3.6 Decoder, Digital Audio Output Format*

a. Factory Setting

Digital Audio SYNC Input Format	JP1 (on option)	JP2 (on option)
AES/EBU <sup>a)</sup>	1-2	1-2
S/PDIF	2-3	2-3

*Table 3.7 Decoder, Digital Audio SYNC Input Format*

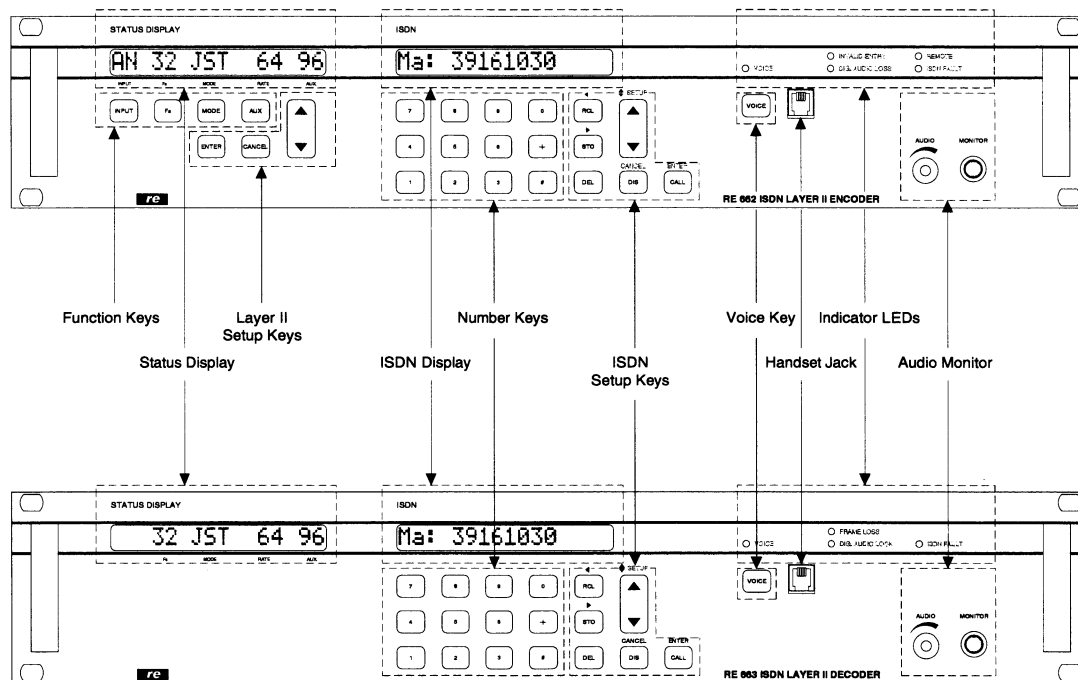
a. Factory setting



## 4. Front and Rear Panels

### 4.1 Front Panels

Fig. 4.1 shows the front panels of the encoder and the decoder.



*Fig. 4.1 RE 662 & RE 663 ISDN Layer II Codec, Front Panels*

#### 4.1.1 RE 662 ISDN Layer II Encoder

##### Status Display

This display shows the status of the Layer II or G.722 transmission.

##### Function Keys

Pressing one of the function keys Input, Fs, Mode or Aux gives access to the status display.

**NOTE** The network transmission rate is automatically determined by the number of established ISDN B-channels; the current rate is shown in the status display.

If you do not have the 384 kbit/s option installed, a virtual bit rate of 128 or 112 (two B-channels) is shown as X64 or X56 when Layer II is selected as coding mode, and as D64 or D56 when G.722 is selected as coding mode.

### Setup Keys

**Arrow Up  
Arrow Down**



Scrolls through the field values.

**Enter key**



Accepts any changes made, and enters the configuration as shown.

**Cancel key**

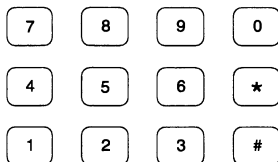


Cancels any changes not yet entered to the configuration.

### ISDN Display

This display shows the status of the ISDN connections, see “ISDN Messages” on page 67.

### Number Keys



These keys function like ordinary telephone number keys.

### ISDN Setup Keys

**Arrow Up  
Arrow Down**



Scrolls through status messages, the numbers of the established connections and other information. You can also use these keys to scroll through the numbers of a number group and the names of the number groups. If you press both [Arrow Up] and [Arrow Down] at the same time, you gain access to a setup menu. See Chapter 6.3.14 for further details.

**RCL**  
**Recall key**

Recalls a stored number group.

**STO**  
**Store key**

Stores the ISDN number displayed. Up to six numbers can be stored in each number group.

**DEL**  
**Delete key**

Deletes 1 digit at a time.

**DIS**  
**Disconnect key**

Disconnects the audio number in the ISDN display. If you hold the key down, all ISDN audio connections are disconnected.

**CALL key**

Makes an audio call to the number in the ISDN display. If a number group is displayed, all numbers in the group are called.

**VOICE key**

Makes a voice call to the number in the ISDN display, or disconnects the voice number in the ISDN display.

**Hand-set Jack**

Jack used for connecting the hand-set used for voice calls.

**Indicator LEDs****O VOICE**

A yellow LED indicates that a voice call is active. In the case of an incoming voice call, the LED flashes, and a buzzer sounds. The LED remains lit during the call.

**O INVALID  
ENTRY**

A red LED indicates that a key selection or remote entry is invalid. An invalid entry occurs, for example, if you have selected digital audio input and you then try to select a coding mode that differs from the one signaled in the digital audio input signal.

**O DIG. AUDIO  
LOSS<sup>1)</sup>**

A red LED indicates that the digital audio input signal is missing when digital audio input is selected. Note, that this is only possible with the digital audio option installed.

---

1) When the LED is lit, the alarm relay output signals fail.

**O REMOTE**

A yellow LED indicates that remote control in the encoder is enabled. Consequently, the encoder cannot be set up from the front panel.

**O ISDN FAULT<sup>2)</sup>**

A red LED indicates that one or more of the calls you tried to establish did not come through or failed during operation.

**Audio Monitor**

Audio Monitor with volume control. If the encoder accepts both analog and digital audio inputs, the monitor circuit converts a digital audio input into analog form. When the analog audio input is used, the monitor DAC is fed from the digital audio output of the audio ADC. This enables analog headphone monitoring of digital audio inputs as well as “digital” monitoring of analog audio input signals, allowing the monitor to be used to verify the digitization of analog audio input signals.

**4.1.2 RE 663 ISDN Layer II Decoder****Status Display**

The status of the ISDN Layer II transmission can be seen on the status display. The status display of the decoder contains the same information as that of the encoder except that there is no audio input signal indication.

**ISDN Display**

As described for RE 662 ISDN Layer II Encoder, on page 14.

**Number Keys**

As described for RE 662 ISDN Layer II Encoder, on page 14.

**ISDN Setup Keys**

As described for RE 662 ISDN Layer II Encoder, on page 14.

**Hand-set Jack**

As described for RE 662 ISDN Layer II Encoder, on page 15.

---

2) When the LED is lit, the alarm relay output signals fail.

## Audio Monitor

As described for RE 662 ISDN Layer II Encoder, on page 16.

## Indicator LEDs

### O VOICE

See RE 662 Voice LED description on page 15.

### O FRAME LOSS<sup>3)</sup>

A red LED indicates that the decoder is unable to synchronize to the received digital signal. Frame loss typically occurs if the data input is neither an MPEG Layer II nor a G.722 encoded signal, or when no ISDN circuits are established.

### O DIG. AUDIO LOCK

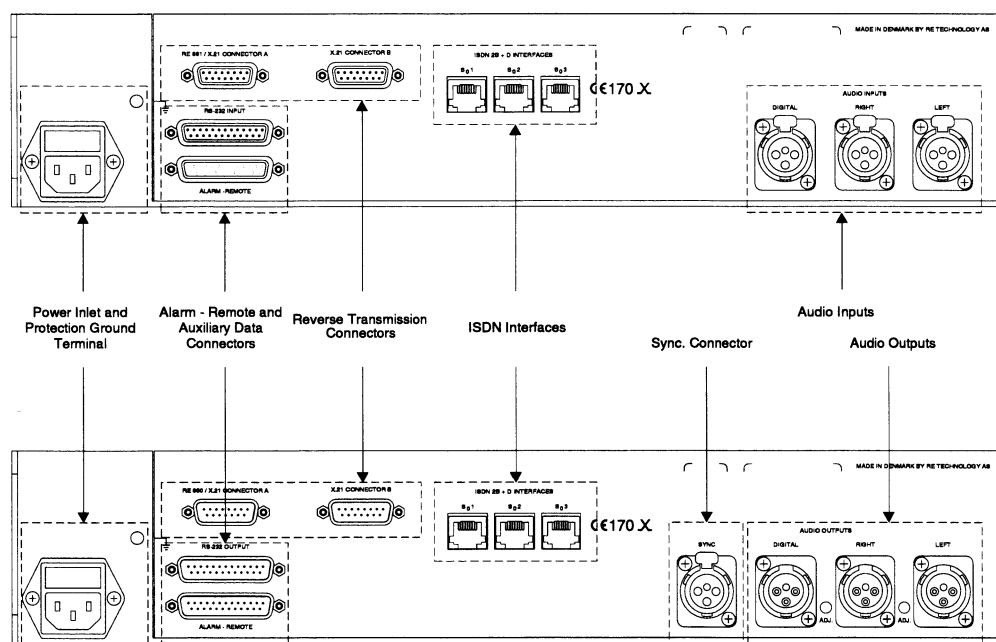
A green LED indicates that the digital audio output signal is locked to an externally applied reference input via the digital Audio SYNC Connector. Note that this is only possible with the digital audio option installed.

### O ISDN FAULT<sup>3)</sup>

See RE 662 ISDN Fault LED description on page 16.

## 4.2 Rear Panels

Fig. 4.2 shows the rear panels of the encoder and decoder.



*Fig. 4.2 RE 662 & RE 663 ISDN Layer II Codec, Rear Panels*

3) When the LED is lit, the alarm relay output signals fail.

### 4.2.1 RE 662 ISDN Layer II Encoder

#### Power Inlet and Protective Ground

The power supply accepts an AC line input voltage in the range from 90 to 250 V via an IEC plug. The protective ground is a brass M5 protective ground terminal or the protective ground in the line socket.

A protective, slow blow 500 mA fuse is located in the power inlet. When power is applied, the characters in the status display light up. If the RE 662 Encoder loses power during operation, the last entered configuration is automatically recalled on resumption of power to the encoder.

#### Alarm-Remote and Auxiliary Data Connectors

The Alarm-Remote connector is used for remote control and alarm indication (digital audio loss or ISDN fault). See “Remote Operation” on page 47 for further details.

The alarm output is a simple relay contact output, signaling terminal fail/no fail.

The RS-232 interface is the interface for the auxiliary data channel that can be used for transmission of background information or, for example, distribution of dynamic RDS/RBDS data. With Layer II coding, the baud rate is selected by means of the front panel keys; with G.722 coding it is fixed at 9600 baud. The remote control interface provides an on/off function for the auxiliary data channel.

Furthermore, the RS-232 interface can be used for inspecting and controlling the settings of the ISDN interface and for setting up or disconnecting calls. For further information, see Chapter 10.2. The RS-232 interface is also used for performing software upgrades.

For information on ASTRA and DAB, see Chapter 10.3.

#### Reverse Transmission Connectors (X.21/RE 661)

ISDN is a bi-directional network where all the B-channels have both a transmit and a receive direction. The transmit direction is used for transmission of Layer II data from the encoder to the decoder. The receive direction (from decoder to encoder), like the transmit direction, is combined into a virtual bit rate equal to the number of B-channels used in the transmission. The X.21/RE 661 connector A can be connected to an RE 661 Layer II Decoder to utilize bi-directional Layer II transmission while the X.21 connector B is idle. Alternatively, the encoder can use the receive direction of B-channel a and B-channel b (S<sub>0</sub>1) for two X.21 transparent 64 kbit/s channels (56 kbit/s when inter-networking with Switched 56 kbit/s terminals).

The selection between the two reverse transmission modes is factory-set.

## ISDN Interfaces

The S<sub>0</sub>1, S<sub>0</sub>2 and S<sub>0</sub>3 connectors are the connectors for the three Basic Rate Interfaces. S<sub>0</sub>1 provides access to B-channels a and b, S<sub>0</sub>2 gives access to B-channels c and d, and S<sub>0</sub>3 supports B-channels e and f.

If you do not have the 384 kbit/s option installed, you can only use the B-channels a and b (S<sub>0</sub>1) for audio calls, but all channels a-f (S<sub>0</sub>1, S<sub>0</sub>2 and S<sub>0</sub>3) can be used for one voice call.

If you do not connect all 3 S-bus connections on the RE 662/RE 663 be sure to use the S<sub>0</sub>1 ISDN interface first, then the S<sub>0</sub>2, and only the S<sub>0</sub>3 if you use all 3 S-bus connections.

## Audio Inputs

This section comprises three audio connectors. One left and one right 3-pin XLR female connector are used for analog audio inputs. If the digital audio option is installed, a 3-pin XLR female connector can be used for digital audio input according to the AES/EBU or the S/PDIF specification.

To select between the two digital formats, analog audio input impedance, and clipping level, see “Internal Settings” on page 8.

## NOTES

- The audio input used for mono signals (Layer II 1CH or G.722) is the Left input.
- If digital audio input and G.722 coding mode is selected, make sure that “no pre-emphasis” is signaled in the digital audio signal. “No pre-emphasis” is always signaled to the decoder when G.722 coding mode is selected.

### 4.2.2 RE 663 ISDN Layer II Decoder

## Power Inlet and Protective Ground

See RE 662 Encoder, Power Inlet and Protective Ground on page 18.

## Alarm-Remote and Auxiliary Data Connectors

The Alarm-Remote connector is used for remote monitoring of the functions on the status display and remote control of group calls from the number groups 00 through 09.

The alarm output is a simple relay-contact output, signaling terminal fail/no fail.

The Auxiliary Data interface is an RS-232 interface. It can be used for transparent transmission of data or for control of the codec.

Furthermore, the RS-232 interface can be used for inspecting and controlling the settings of the ISDN interface and for setting up or disconnecting calls. For further information, see Chapter 10.2. The RS-232 interface is also used for performing software upgrades.

For information on Astra and DAB, see Chapter 10.3.

### **Reverse Transmission Connectors (X.21/RE 660)**

These are similar to those described for the RE 662 Encoder (see RE 662 Encoder, Reverse Transmission on page 18). In this case, however, the RE 663 connects to the RE 660 Layer II Decoder. See “Reverse Transmission Connector” on page 51 for information on the connector needed.

### **Level Adjustment**

By means of a screwdriver and two holes in the rear panel, the analog audio level can be fine adjusted by  $\pm 2$  dB.

### **ISDN Interfaces**

See RE 662 Encoder, ISDN Interfaces on page 19.

### **Audio Outputs**

This section comprises four audio connectors. One left and one right 3-pin XLR male connector are used for analog audio output. If the digital audio option is installed, a 3-pin XLR male connector outputs for digital audio output according to the AES/EBU or the S/PDIF specification. Both the analog audio and the digital audio outputs are active. During frame loss, the analog audio and digital audio outputs are muted. To select between the two digital formats, analog audio output impedance, and maximum output level, see “Internal Settings” on page 8.

### **NOTES**

- If Layer II coding is selected, and the RE 663 Decoder receives a Layer II stream containing a mono signal, the decoded audio mono signal is fed to both the left and right analog audio outputs.
- If G.722 coding is selected, the signal is output on the left XLR analog output connector.

- If G.722 coding is selected, only “no pre-emphasis” can be signaled from the encoder, that is, the audio output is always signaled with “no pre-emphasis” when G.722 coding mode is selected.
- If S/PDIF is selected for the digital audio output, pre-emphasis can only be signaled as no emphasis or 50/15  $\mu$ s pre-emphasis. If, however, the encoder signals ITU-T J.17 pre-emphasis to the decoder, the decoder signals 50/15  $\mu$ s pre-emphasis in the S/PDIF digital output.

### **Digital Audio SYNC Connector**

The 3-pin XLR female digital audio SYNC input connector is used to lock the digital audio output to an external reference, such as a studio reference. The reference input can also be used to choose the sampling frequency for the digital audio output signal. Sampling rate conversion and/or sampling rate equalization occurs in the decoder, eliminating the need for additional outboard rate converters.



## 5. Principle of Operation

This chapter is intended to provide a general description of how the RE 662 ISDN Layer II Encoder and the RE 663 ISDN Layer II Decoder operate, thus making it easier for the reader to understand the codec's overall concept.

Detailed descriptions of the codec's individual circuits are found in the RE 662 ISDN Layer II Encoder and RE 663 ISDN Layer II Decoder Service Manual (order number 983-486).

An RE 662 ISDN Layer II Encoder comprises two to four circuit boards; a Layer II encoder board, a Triple Basic Rate Interface board and, if the 384 kbit/s option is installed, a B-channel Equalizer board. Furthermore, a small digital input option board can be installed.

The Triple Basic Rate Interface connects directly to ISDN and is able to connect and disconnect B-channels (64 kbit/s). The Triple Basic Rate Interface can handle up to 6 B-channels, yielding a total transmission capacity of 384 kbit/s.

If the 384 kbit/s option is installed, the B-channel Equalizer's task is to split a serial data signal conveying the Layer II frames into a number of parallel 64 kbit/s data streams, one for each established B-channel. In addition, the B-channel Equalizer performs the reverse operation by combining the received B-channels to restore the original Layer II data signal after having equalized possible delay inequalities of up to 0.5 s between the established B-channels. This feature is used to feed an RE 661 Decoder with received data in order to form a bi-directional link.

If the 384 kbit/s option is not installed, the Layer II encoder board splits the two B-channels into a parallel data stream thus yielding a maximum transmission capacity of 128 kbit/s.

The Layer II Encoder board is equivalent to the one used in the RE 660 Layer II Encoder. The board accepts up to two audio input signals, compressed according to the ISO/IEC 11172-3 Layer II standard to a bit-rate matching the capacity of the established B-channels. A digital input option is mounted directly on the Layer II encoder board.

An RE 663 ISDN Layer II Decoder also comprises two to four circuit boards; a Layer II decoder board, the same Triple ISDN Basic Rate Interface and, if the 384 kbit/s option is installed, the same B-channel Equalizer board as used in the RE 662 ISDN Layer II Encoder. Furthermore, a small digital output option board can be installed.

Like the Layer II Encoder board, the Layer II Decoder board is equivalent to the one used in the RE 661 Layer II Decoder. The board accepts a restored serial data-signal conveying audio data in a format according to the ISO/IEC 11172-3 Layer II standard. The decoder decodes the Layer II audio frames and restores the audio signals. A digital output option is mounted directly on the Layer II decoder board.

Figs. 5.1 and 5.2 show block diagrams of the RE 662 ISDN Layer II Encoder and the RE 663 ISDN Layer II Decoder.

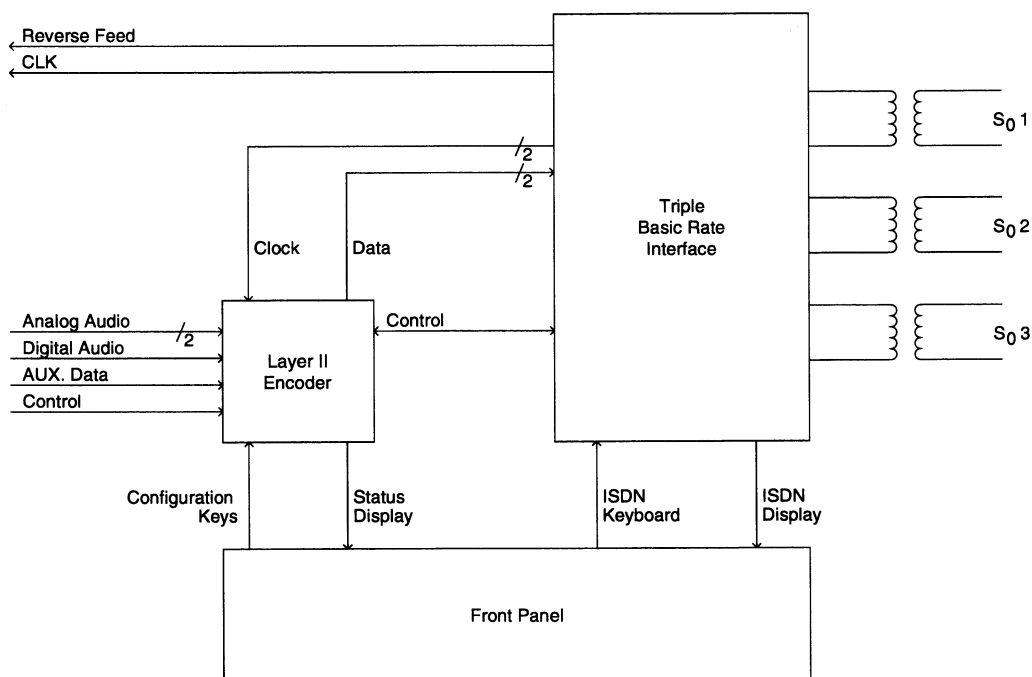


Fig. 5.1 The RE 662 ISDN Layer II Encoder

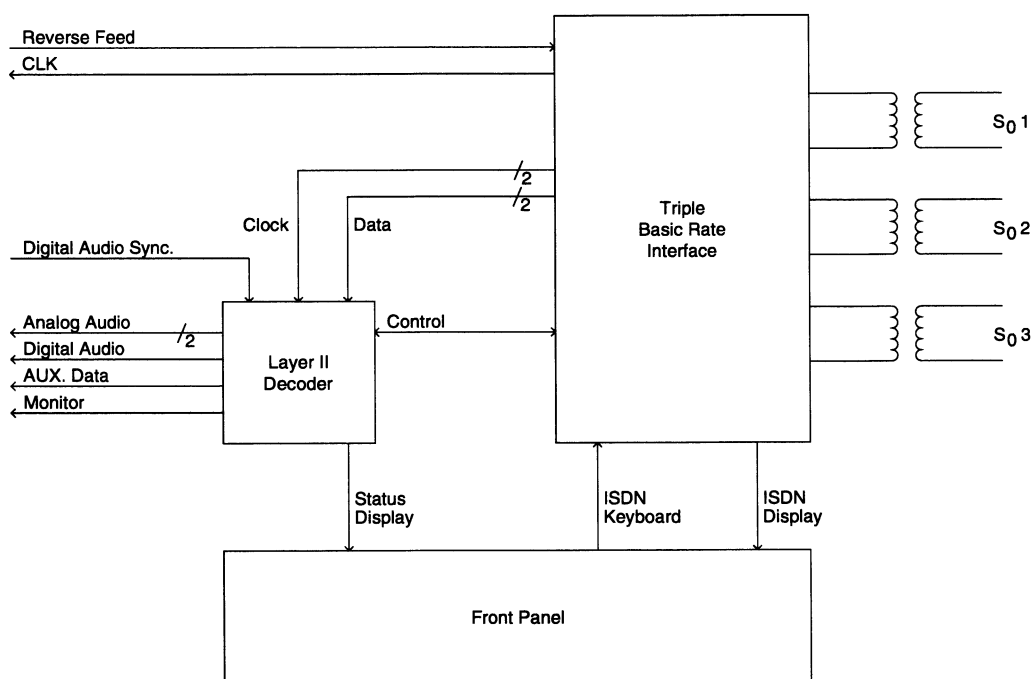


Fig. 5.2 The RE 663 ISDN Layer II Decoder

## **6. General Operation**

### **6.1 Power-up and Down**

When power is applied, the Status display and the ISDN display light up. Both displays show the software versions of the respective parts of the codec. Error messages may be displayed if the codec fails to complete its power-up procedure.

If the encoder loses power during operation, the last entered configuration is automatically recalled on resumption of power to the encoder.

ISDN connections active at the time of power-down are not re-dialed on power-up.

### **6.2 Layer II and G.722 Operation**

#### **6.2.1 Settings**

You can change the following settings:

##### **Input Setting**

If you have the digital audio option installed, you can set the Input to analog or digital audio, as shown in Table 6.1.

##### **Fs (Sampling Frequency) Setting**

With Layer II coding, you can set Fs to any one of the frequencies shown in Table 6.4 (though certain combinations are not valid; see Chapter 6.2.2 for further details).

With G.722 coding, the sampling frequency is fixed at 16 kHz. If you select G.722, Fs automatically changes to 16 kHz. The last used Fs is restored, if you change back to Layer II coding.

Input	Explanation
AN	Analog audio input
DI	Digital input

Table 6.1 Input - Audio Input

Mode	Explanation
ST	Stereo
JST	Joint stereo
2CH	Dual Mono
1CH	Single channel
722	G.722

Table 6.2 Mode - Coding Mode

Aux	Explanation
00	None
03	300 baud
06	600 baud
12	1200 baud
24	2400 baud
48	4800 baud
96	9600 baud
AS	ADR/DAB mode

Table 6.3 Aux - Auxiliary Data Channel; Layer II Coding

Fs	Explanation
16	16 kHz sampling
22	22.05 kHz sampling
24	24 kHz sampling
32	32 kHz sampling
44	44.1 kHz sampling
48	48 kHz sampling

Table 6.4 Fs - Sampling Frequency

Aux	Explanation
1	Aux. Data is off
2	Aux. Data is on

Table 6.5 Aux - Auxiliary Data Channel<sup>a)</sup>; G.722 Coding

a. Only for 64 kbit/s

## Mode Setting

You can select Layer II coding by entering any one of the first four mode settings listed in Table 6.2. Alternatively, you can select G.722 coding as the mode, with transmission bit rates of 56 or 64 kbit/s (one B-channel); for 64 kbit/s, you can select Mode 1 or Mode 2.

## Rate (Transmission Bit Rate) Setting

The rate is automatically selected by the codec. It depends on the number of ISDN connections. For each ISDN B-channel connection you make, you get 64 kbit/s transmission bit rate. The connections are combined to give a higher virtual bit rate.

You can only get 56 or 112 kbit/s if you have a connection to a Switched-56 Network.

The following applies if you *have* the 384 kbit/s option installed:

- If you have one ISDN connection, and thus 56 kbit/s or 64 kbit/s, you can select between G.722 coding and Layer II coding.
- If you have 56 kbit/s and select G.722 coding, the codec automatically selects G.722 Mode 2S.
- If you have 64 kbit/s and select G.722 coding, you can select between G.722 Mode 1 and G.722 Mode 2.
- If you have more than one ISDN connection, you can only select Layer II coding.

**NOTE** If G.722 is selected and more than one B-channel is connected, the coding automatically changes to Layer II. If the number of B-channels changes back to one again, G.722 coding is automatically re-selected.

The following applies if you *do not have* the 384 kbit/s option installed:

- If you have one or two 56 kbit/s ISDN connections and select G.722 coding, the codec automatically selects G.722 Mode 2S.
- If you have one or two 64 kbit/s ISDN connections and select G.722 coding, you can select between G.722 Mode 1 and G.722 Mode 2.
- If you have two ISDN connections and have selected a Layer II coding mode, the bit rate is indicated as X56 or X64.
- If you have two ISDN connections and have selected G.722 coding mode, the bit rate is indicated as D56 or D64, and both the left and the right audio channels are used for transmission. Left-channel audio is always transmitted from the encoder on the ISDN B-channel a, and right-channel audio is always transmitted on the ISDN B-channel b. This is called Dual G.722 operation.
- If you have one ISDN connection and select G.722 coding, only the left audio channel is used for transmission.

### **Aux (Auxiliary Data Channel) Setting**

With Layer II coding, you can set the baud rate for the auxiliary data channel to any one of the settings shown in Table 6.3.

In ADR (ASTRA Digital Radio) mode the codec is able to insert and extract a block of ancillary data into the Layer II frame, as specified in the ASTRA Standard, version 1.3. This standard also includes Scale Factor Protection (SCF-CRC) as specified in the standard ETS 300 401 Digital Audio Broadcast.

Furthermore, the codec is able to insert and extract ancillary data into the Layer II frame, as specified in the standard ETS 300 401 Digital Audio Broadcast. See Chapter 10.3 for further information.

With G.722 coding, you can set the auxiliary data channel to on or off as shown in Table 6.5. At the same time, this determines which G.722 format the encoder uses. If you select 2, the auxiliary data channel is on and G.722 Mode 2 is selected. If you select 1, the auxiliary data channel is off and either Mode 1 or Mode 2S is used, depending on the transmission bit rate.

The baud rate for auxiliary data is fixed at 9600 baud, though the auxiliary data is carried with an effective bit rate of 4.8 kbit/s.

**NOTE** Hardware handshaking is used by the encoder when G.722 is selected and the PC (or other data source) must, therefore, support this.

## 6.2.2 Combining Settings

### Rate, Mode, and Sampling Frequency

Table 6.6 shows valid combinations of transmission bit rate, coding mode, and sampling frequency in the RE 662 Encoder. Check-marked areas indicate valid combinations.

		Transmission Bit Rate (kbit/s)													
Mode	Fs (kHz)	Without 384 kbit/s option						With 384 kbit/s option							
		56	D56	64	D64	X56	X64	56	64	112	128	192	256	320	384
ST	16			✓		✓	✓		✓	✓	✓				
JST	16			✓		✓	✓		✓	✓	✓				
2CH	16			✓		✓	✓		✓	✓	✓				
1CH	16	✓		✓		✓	✓	✓	✓	✓	✓				
G.722 <sup>a)</sup>	16	✓	✓	✓	✓			✓	✓						
ST	22			✓		✓	✓		✓	✓	✓				
JST	22			✓		✓	✓		✓	✓	✓				
2CH	22			✓		✓	✓		✓	✓	✓				
1CH	22	✓		✓		✓	✓	✓	✓	✓	✓				
ST	24			✓		✓	✓		✓	✓	✓				
JST	24			✓		✓	✓		✓	✓	✓				
2CH	24			✓		✓	✓		✓	✓	✓				
1CH	24	✓		✓		✓	✓	✓	✓	✓	✓				
ST	32/44/48			✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
JST	32/44/48			✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
2CH	32/44/48			✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
1CH	32/44/48	✓		✓		✓	✓	✓	✓	✓	✓	✓			

*Table 6.6 Valid Combinations of Rate, Mode and Sampling Frequency*

a. G.722 can only use a sampling frequency of 16 kHz.

If you try to enter a value which would result in an invalid combination, the value is rejected. The “INVALID ENTRY” LED lights for about 5 seconds.

If the bit rate itself changes to a value which would result in an invalid combination, the mode and/or sampling frequency is forced to a valid setting. The user setting is saved and restored whenever the bit rate reverts to a value where the original setting is valid, even after a power interruption.

## Sampling Frequency

Table 6.7 shows the valid combinations of sampling frequency and bit rate in the Layer II coding modes. Check-marked areas indicate valid combinations.

Fs (kHz)		Transmission Bit Rate (kbit/s)											
		Without 384 kbit/s option				With 384 kbit/s option							
		56	64	X56	X64	56	64	112	128	192	256	320	384
“Lower”	16	✓	✓	✓	✓	✓	✓	✓	✓				
	22	✓	✓	✓	✓	✓	✓	✓	✓				
	24	✓	✓	✓	✓	✓	✓	✓	✓				
“Normal”	32	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	44	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	48	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

*Table 6.7 Valid Combinations of Rate and Sampling Frequency for Layer II*

If the selected sampling frequency becomes invalid due to a change of bit rate, a “lower” Fs is changed to a “normal” sampling frequency as follows:

- 16 kHz is changed to 32 kHz.
- 22 kHz is changed to 44 kHz.
- 24 kHz is changed to 48 kHz.

In G.722 mode, the only valid sampling frequency is 16 kHz. If you change the coding mode from one of the Layer II modes to G.722, the sampling frequency is forced down to 16 kHz. In this case, the sampling frequency used for Layer II is restored the next time one of the Layer II modes is selected.

## Mode

Table 6.8 shows the valid combinations of coding mode and bit rate. Check-marked areas indicate valid combinations

	Transmission Bit Rate (kbit/s)											
	Without 384 kbit/s option				With 384 kbit/s option							
Mode	56	64	X56 D56	X64 D64	56	64	112	128	192	256	320	384
G.722	✓	✓	✓	✓	✓	✓						
ST		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
JST		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
2CH		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
1CH	✓	✓	✓	✓	✓	✓	✓	✓	✓			

*Table 6.8 Valid Combinations of Rate and Coding Mode*

If the selected mode becomes invalid due to a change of bit rate, it changes to a valid one as follows:

- If 1CH becomes invalid, the mode changes to the preferred stereo mode. Preferred stereo mode means the stereo mode (ST, JST or 2CH) last selected by the user.
- If JST, ST or 2CH becomes invalid, the mode changes to 1CH.
- If G.722 becomes invalid, the mode changes to the last selected Layer II mode.

If DI has been selected as input, the received digital audio specifies the mode in the channel status. The channel status of digital audio can be received in two formats: AES/EBU (professional use) or S/PDIF (consumer use).

Selection of coding mode in the encoder is independent of the mode signaled in the digital audio, i.e. you can change the coding mode at any time. However, if the encoder detects a change in the mode signaled in the digital audio, or if input changes to DI (Digital Input), the encoder changes coding mode as shown in the table below.

<b>AES/EBU Channel Mode Change to</b>	<b>Comment</b>	<b>Encoder changes to Mode</b>
0000	Mode not indicated. Power-up setting	No change
0001	Two-channel mode	2CH
0010	Single-channel mode	1CH
0011	Primary/secondary mode	2CH
0100	Stereo mode	Preferred stereo <sup>a)</sup>
All other		No change

*Table 6.9 AES/EBU Channel Mode Change and Encoder Coding Mode Change*

a. Preferred stereo is the stereo mode last selected (ST, JST or 2CH).

If the mode signaled changes to AN (analog) input, the encoder changes back to the coding mode last selected.

Note, that if the coding mode signaled in the channel status changes to an invalid mode, the encoder does not react to this change. Even if the coding mode changes to a valid mode at a later time, the encoder still takes no action.

## Aux Rate

If the mode is set to one of the Layer II modes, you can select any of the Aux rates 00, 03, 06, 12, 24, 48 or 96.

If G.722 is selected, the baud rate is always set to 96.

For further information, see Chapter 10.2, “TA Control” and Chapter 10.3, “ASTRA Digital Radio and Digital Audio Broadcast”.

## G.722 Modes

With a bit rate of 64 kbit/s, the Aux data channel may be enabled by selecting G.722 Mode 2. This is not possible for 56 kbit/s. If the bit rate changes from 56 to 64 kbit/s, the Mode changes to the last G.722 Mode used with 64 kbit/s.


## 6.3 ISDN Operation

### 6.3.1 General

When you want to transmit an audio signal from Point A to Point B with the RE 662 and RE 663 ISDN Layer II Codec you can make calls from both the encoder and the decoder. If you want a higher bit rate than 64 kbit/s, you can even make some of the calls from Point A and the rest from Point B.

You can start with one connection and add extra connections when you need a better sound quality.

If you need a temporary voice connection and all B-channels are used for audio calls, you can disconnect one of the Layer II connections, go to a lower bit rate and make your voice call. When you finish your telephone call, you can change to the higher bit rate again.

The RE 662 and RE 663 allows you to use ISDN numbers up to 20 digits, \* and #. If one of the numbers you use is longer than 13 digits, only the first or last part of the number is shown in the display. You can scroll to the other part of the number with the  keys.

In the display, in front of the number, the channel used for a connection is shown.

If your codec makes the call, the display shows the number called. If your codec receives the call, the display shows the number of the calling device if this number is transferred by the ISDN network. This is not usually the case if your codec receives a voice call from an analog telephone.

### 6.3.2 Audio and Voice Calls

ISDN calls carrying Layer II data are audio calls. The ISDN network does not allow you to make an audio call connection to an ordinary analog telephone.

You can also make voice calls from the RE 662 and RE 663 Codec. Voice calls can be routed to an ordinary analog telephone. If you establish a voice call and you press any of the number keys on the front panel, a DTMF tone is generated. This feature can be used to dial into local switchboards. The digits are also shown on the front panel.

The display shows one of the following letters in front of the channel letter: Note, however, that if you do not have the 384 kbit/s option installed, only the V for Voice Call can be shown.

Display	Connection type
V	Voice call
A	Audio call, the codec receives and synchronizes to the incoming Layer II data
-	The codec receives no audio call, G 722 data or data that can be synchronized
Ln	Audio call in multiple audio links mode. n is the link designation

*Table 6.10 Indication of Connection Types on the Display*

### 6.3.3 Number Groups

In the codec, you can save up to 100 number groups. If you have the 384 kbit/s option installed, each group can contain up to 6 phone numbers. If no 384 kbit/s option is installed, each number group can contain up to 3 phone numbers.

You can store both audio calls and a single voice call in a number group. You cannot store pauses, DTMF signaling or other telephone specialities.

All the number groups can be recalled from the front panel, and the first 10 groups can be recalled from the remote interface.

The numbers in the number groups can be stored and deleted from the front panel or via the serial interface. If you store the number groups by means of the serial interface, you can give each number group a name.

When you store a number in a number group, it is given a channel letter. This channel is the preferred B-channel when you activate the group, but there is no guarantee that the preferred B-channel is used.

The number groups can be locked, so that the content cannot be changed from the front panel. For control of the number group lock, see “Setup Menu” on page 38.

You cannot change the content of a number group from the front panel while the codec is in remote state.

### 6.3.4 Disturbing Calls

Note, that this feature only applies to codecs in which the 384 kbit/s option is installed.

Since the ISDN network is a public network you may get disturbing calls caused by wrongly dialed numbers and wrong connections. The RE 662/RE 663 tries to reject as many of the disturbing calls as possible.

Incoming voice calls do not disturb audio transmission.

Calls from other RE 662 and RE 663 Codecs do not disturb your audio transmission if the new call is received on the same channel as one of the calls you have already connected. For example, if the codec at point X is connected to the a- and b-channels of a codec at point Y and it receives a call from channel a of the codec at point Z, this new call is rejected.

Incoming audio calls to a codec that receives Layer II data do not disturb existing Layer II transmission.

An incoming audio call to a codec which is not receiving but is transmitting Layer II data causes the codec to split the transmitted data to the new connection too and thus disturb the transmission. However, if the new call carries Layer II data and none of the existing calls do, the new call is disconnected after a short time with no disturbance. For further information, see Chapter 6.3.11, “Verify”.

### 6.3.5 Re-dial

When you make a call, the network may not let your call through the first time.

In this case, the network always sends a cause code back to the RE 662 and RE 663 Codec explaining why the call did not come through. In some cases, this causes the codec to re-dial the call. See Appendix A for a list of cause codes and their descriptions.

The codec re-dials the call up to 8 times with 20 seconds between each attempt. Only audio calls are re-dialled.

You can turn the re-dial feature on or off from the front panel (Chapter 6.3.14, “Setup Menu”) or from the serial interface.

Apart from the automatic re-dial function, you can always force the codec to re-dial connections that do not come through manually. To do this, press the [CALL] key on the front panel. Alternatively, you can send the code LLLL via the remote interface. See Chapters 9.2.1 and 9.2.2 for further details.

### 6.3.6 Multiple Audio Links

If you have the 384 kbit/s option installed, you can use the RE 662 Encoder to distribute your audio signal to 6 destinations with 64 kbit/s each or 3 destinations with 128 kbit/s each. This can be useful in backup systems.

You can also use an RE 663 Decoder with an RE 660 Encoder connected to the reverse feed for multiple audio links.

You select the number of audio links in the setup menu. Chapter 6.3.14, “Setup Menu”.

When you use 6 audio links, only the return information in the A-channel is used, and when you use 3 audio links, only the return information in the A- and B-channels is used. Thus, only the return data in these channels influences the treatment of any disturbing calls.

If you use 3 audio links, you must make your connections in pairs on the a-b, c-d and e-f channels. If you have 64 kbit/s (one B-channel) on all 3 pairs, the codec automatically changes the transmission to 64 kbit/s. If one of the pairs has 128 kbit/s (two B-channels), the transmission is 128 kbit/s and the pairs that do not have 128 kbit/s only receive half of the frames. The decoder(s) that only receive half of the frames show a RATE INDEX ERROR.

### 6.3.7 Sequential Calls

If you do not have the 384 kbit/s option installed, and you connect an RE 662/RE 663 to a terminal adapter with an RE 660/RE 661, wanting to use G.722 coding with two B-channels (Dual G.722 operation), you must make sure that the two channels are connected to the terminal adapter in the right order. If they are not, the left and right audio channels are switched. The call from the A-channel must arrive before the call from the B-channel.

If you make the calls manually, you need to wait for a moment before you make the next call.

If you use number groups, the codec must ensure that the first call is put through before the second call is made. Generally, when you make a number group call, the codec waits for a call to be confirmed before the next one is made.

You must disconnect the calls individually. If you disconnect a call in the middle of a sequence of calls using a number group, no further calls are made.

### 6.3.8 Origin (Calling Party Number)

If you use the RE 662/RE 663 in connection with a local switchboard, it is sometimes necessary that the call setup has a Calling Party Number to identify its origin on the S-bus. This is typically a number from 0 to 8, depending on the local switch configuration.

In some cases you can also use the Calling Party Number to identify the origin of your codec on the S-bus to a public switch.

You can turn the Origin feature on and off, and the origin numbers can be stored and deleted from the front panel (see “Setup Menu” on page 38) or from the serial interface. If you store the origin numbers from the serial interface you can give the installation site a name as well.

### 6.3.9 Multiple Codecs on the Same S-bus

If more than one codec is connected on the same S-bus, each codec on the S-bus must have a unique address so that only one pre-determined codec accepts an incoming call. Addressing takes place by means of the MSN feature (Multiple Subscriber Number) which gives you more than one number for each S-bus installation. Thus, different numbers are accepted by the same S-bus. The address of each codec on the S-bus is determined by the last digit in the number. This address can be defined in the Origin sub-menu (see “Setup Menu” on page 38).

This feature can be illustrated by the following example:

Two codecs (A and B) are connected on the same S-bus; the S-bus includes the MSN feature and accepts calls to the numbers 39 16 10 41, 39 16 10 42 and 39 16 10 43. In codec A, the Origin feature for channels a and b is set to 1, and in codec B, the Origin feature for channels a and b is set to 2.

A call to number 39 16 10 41 is accepted by codec A.

A call to number 39 16 10 42 is accepted by codec B.

A call to number 39 16 10 43 is not accepted by any of the codecs because no codec is set up for this number.

### 6.3.10 Service Profile Identifier (SPID)

If you want to use your RE 662/RE 663 in North America, you need to enter a so-called Service Profile Identifier (SPID). This is a number you get from the telephone company. You get an SPID number for each of your B-channels. The SPID number is specific for each installation and must be changed if you move the codec to any other installation.

The SPID numbers can be stored and deleted in the Setup menu on the front panel (see below) or from the serial interface (See “Serial Interface” on page 61). If you store the SPID numbers from the serial interface you can give the installation site a name as well.

### 6.3.11 Verify

You can set the codec to verify all incoming calls against the phone numbers stored in the number groups. In this way, you ensure that only a specific amount of remote units are able to connect to the codec. That is, you can establish a “closed group of codecs” on the ISDN network. Thus, you increase the protection against disturbing calls. You can change the Verify setting via the Setup menu.

### 6.3.12 Bit Rate $\leq$ 128 k

This message is shown in the Setup menu. It indicates that the codec does not have the 384 kbit/s option installed, meaning that only 1 terminal adapter can be accessed via the codec, and thus a transmission bit rate of up to 128 kbit/s can be established.

### 6.3.13 Bit Rate $\leq$ 384 k

This message is shown in the Setup menu. It indicates that the codec has the 384 kbit/s option installed. You can access the full Triple Basic Rate Interface via the codec, meaning that you can establish a transmission bit rate of up to 384 kbit/s.


### 6.3.14 Setup Menu


Using the Setup menu, you can control the following settings from the front panel:

- Group lock (0=unlocked, 1=locked)
- Number of audio links (1, 3 or 6)
- Re-dial on/off
- Manual or automatic answer of voice calls
- ISDN standard (EURO, ITR6, USNI1 or AUSTRAL)
- SPID numbers if the ISDN standard is US NI1
- Origin on/off
- Origin numbers if Origin is on
- Verify on/off

All settings controlled from the Setup menu are stored in non-volatile memory and are recalled on power-up. You can also control all of these settings from the serial interface, see Chapter 10.2.

## Opening the Setup Menu

To enter the Setup menu, you must press the up and down arrow keys  at the same time. The Setup menu is shown for a short period, after which the first menu item of the Setup menu is shown. In the menu, you can select a menu item to be changed or you can select a sub-menu. Table 10.1 shows the settings and their parameters.

With the Setup menu open, you can scroll through the Setup menu items using .

Use [STO] to open sub-menus. If you want to leave a sub-menu, press [RCL].


The function of some keys changes while the Setup menu is open. Refer to the following look-up table:

Key Name	Key Function in Setup Menu
CALL	ENTER
DIS	CANCEL
RCL	←
STO	→

*Table 6.11 Alternative Key Functions in the Setup Menu*

## Changing Parameters


Press [STO](→) to move the cursor to the value field and select the item to be changed.

When you select a text parameter to be changed, a cursor is shown under the parameter. You can change the parameter by means of the  keys. The parameter starts blinking when a non-selected value is shown. When you have made your changes, you must press [CALL] (ENTER) to accept the changes. Pressing [DIS] (CANCEL) or [RCL](←) cancels the changes.

When you use [STO] to select a number entry to be changed, an empty field is shown. You can also just use the number keys and [DEL] to select the number field and start editing from the end. The cursor is moved to the end point of the number. When you have edited the number, press [CALL] to accept the new number or [DIS] or [RCL] to cancel the changes.

You only see the SPID sub-menu if you select USNI1, and you only see the Origin sub-menu if you set Origin to ON.

## Closing the Menu

To leave the Setup menu, press  at the same time. Note, however, that this cancels any change of parameters that you have not confirmed, so be sure to accept all new settings you want by pressing [CALL] before you close the Setup menu.

## 7. Local Operation

### 7.1 RE 662 ISDN Layer II Encoder

The status display on the front panel of the encoder shows the mode of operation. The Layer II setup keys and the function keys are used to configure the codec.

The ISDN number keys and ISDN setup keys are used in connection with ISDN calls.

To configure the codec locally, do as follows:

#### 7.1.1 Layer II and G.722 Local Operation

To set up the codec for Layer II or G.722 transmission, use the function keys on the front panel of the RE 662 Encoder.

The status display on the front panel of the encoder shows the current configuration for the encoder operation. The setup keys and the function keys are used to configure the codec. To configure the codec manually, do as follows:

1. Press a function key. A cursor is shown under the field selected.
2. Press [Arrow Up] or [Arrow Down] to choose a new value. The field in question flashes, indicating that a new value has been selected.
3. Press [Enter] to accept the change. The field in question stops flashing, and the cursor disappears, indicating that the new setup has been accepted.

Pressing [Cancel] cancels all changes not yet accepted by [Enter].

If you try to enter a value which is not valid, the “INVALID ENTRY” LED lights for approximately 5 seconds. See Chapter 6.2.2 “Combining Settings” for further details.

#### 7.1.2 ISDN Local Operation

##### Checking the Connection to the NT

After power-up, the display shows “NO CONNECTIONS”, and you can scroll to the Lines menu by pressing [Arrow Up] or [Arrow Down]. The Lines menu shows whether the codec is connected to and has established communication with the NT. The ISDN B-channels for which communication has been established with the NT are indicated by lowercase letters. A “-” indicates that no connection is established. If you are using your RE 662 and RE 663 Codec in North America, a capital letter indicates an ISDN B-channel for which the SPID has been approved. That means that the line:

“LINES : ab -- EF”

indicates that the ISDN B-channels a and b (connector S<sub>0</sub>1) and e and f (connector S<sub>0</sub>3) are communicating with the NT. On channels e and f SPID is approved. The ISDN B-channels c and d (connector S<sub>0</sub>2) are not communicating with the NT, or they are not connected.

### **Making a Direct ISDN Call**

1. Enter the ISDN number using the number keys. (Pressing [DEL] deletes one digit at a time from the right to the left.)
2. Press [CALL].
3. Repeat steps 1 and 2 if additional channels are needed to give a higher network transmission rate. It is possible to connect up to two B-channels, each of 64 kbit/s, yielding a virtual bit rate of 128 kbit/s. If you have the 384 kbit/s option installed, you can connect up to six B-channels, yielding a virtual bit rate of 384 kbit/s.
4. You can scroll through the status for all the connections by pressing [Arrow Up] or [Arrow Down].
5. In the case of a non-connected number, you can press [CALL] to re-dial the non-connected number.

*OR* You can clear the error situation by pressing [DIS].

### **Terminating an ISDN Call**

1. Press [DIS] to disconnect the number displayed on the ISDN display.
2. Repeat step 1 until you have disconnected the numbers you wish to terminate.

### **Receiving an ISDN Audio Call**

Do nothing. The codec will autoanswer all audio calls.

### **Re-using a Number**


1. Press [RCL] to re-use one of the numbers you have already entered.
2. Press [\*] to recall the number of an active call that was last shown in the display.  
*OR* Press [#] to recall the number of the last audio call you made.  
*OR* Press [VOICE] to recall the number of the last voice call you made.  
*OR* Press [STO] to recall the last number you stored in a number group.

3. You can now edit the recalled number with [DEL] and the number keys, or you can use the number for new calls or store the number in a number group.

### **Making a Call using a Number Group**

1. Press [RCL].

Now you can select the number group. Key in a number from 00 to 99 to select directly. Then press [CALL].

*OR* Press  to scroll through the pre-programmed number groups.

If a name has been defined for the number group, this is displayed. Select the wanted number group by pressing [RCL] and then [CALL], or just press [CALL].

2. When you have pressed [CALL], all the numbers in the group are called automatically and sequentially.
3. In the case of non-connected numbers, you can press [CALL] to re-dial **all** non-connected numbers.

*OR* Clear the error situation by pressing [DIS] for each of the non-connected numbers.

### **Storing Numbers in a Number Group**


1. Enter the ISDN number using the number keys. (Pressing [DEL] deletes one digit at a time from the right to the left).
2. Press [STO] and key in one of the numbers from 00 to 99 to select the number group into which you wish to store the new number.

If you want to store the number as a voice call, press [VOICE] before you enter the number of the group.


If additional channels are needed to give a higher transmission bit rate, repeat steps one and two. It is possible to connect up to two B-channels, each of 64 kbit/s, yielding a virtual bit rate of 128 kbit/s. If you have the 384 kbit/s option installed, you can connect up to six B-channels, yielding a virtual bit rate of 384 kbit/s.

### **Checking the Contents of a Number Group**


1. Press [RCL].
2. Now you can select the number group. Key in a number from 00 to 99 to select the number group directly.

*OR* Press  to scroll through the pre-programmed number groups. If a name has been defined for the number group, this is displayed.

Then select the wanted number group by pressing [RCL].

3. Press  to scroll through the numbers in the number group.
4. Press [RCL] again to exit the number group.

### Deleting Numbers from a Number Group

1. Press [RCL].
2. Key in one of the numbers from 00 to 99 to select the number group.
3. Press  to select the number to delete.
4. Press [DEL] to delete the number displayed on the ISDN display.
5. Repeat steps 3 and 4 until you have deleted all the numbers you wish to delete.
6. Press [RCL] to exit the number group.

### Making a Voice Call

1. Connect the handset to the front panel handset jack.
2. Enter the telephone number using the number keys.  
*OR* recall the last voice call number by pressing [RCL] and [VOICE].  
*OR* recall the number group in which the voice call is stored, see “Making a Call using a Number Group” on page 43.
3. Press the [VOICE] key.
4. In the case of a non-connected number, you can press [CALL] to re-dial the non-connected number  
*OR* Clear the error situation by pressing [DIS].

When you have finished using the telephone function, press [VOICE] again to disconnect the Voice call.

### Receiving a Voice Call

In the case of an incoming voice call, the VOICE LED flashes, and the buzzer sounds:

1. Connect the handset to the front panel handset jack.  
If you have set voice answer to AUTO (See “Setup Menu” on page 38), the call is automatically connected and the buzzer sounds once only.
2. If you have set voice answer to MAN, you must press [VOICE] to connect the call or [DIS] to reject the call.

## **Terminating a Voice Call**

Press [VOICE] to disconnect the Voice call when the number is displayed on the ISDN display.

### **7.2 RE 663 ISDN Layer II Decoder**

The status display on the front panel of the decoder shows the mode of operation. All Layer II configuration takes place from the encoder.

The ISDN number keys and ISDN setup keys are used as described for the RE 662 ISDN Layer II Encoder.



## 8. Remote Operation

### 8.1 RE 662 ISDN Layer II Encoder

The encoder can be configured via the rear panel Alarm-Remote connector. You can use either relays or TTL-signals to control the remote input. The alarm output is a relay with both normally-open and normally-closed contacts available. For pin allocations, See “Remote Control of the RE 662 ISDN Layer II Encoder (Inputs)” on page 54.

You can connect and disconnect ISDN group calls from the remote interface on both the RE 662 Encoder and the RE 663 Decoder. Only groups 0 to 9 can be used. You can still use the front panel to inspect number groups while the unit is in remote, but you cannot alter the settings.

You can disconnect audio calls, voice calls or all calls. You can answer incoming voice calls and you can force a re-dial of the connections you asked for but did not get.

To enable remote control, connect pin 3 in the Alarm-Remote connector to ground. Remote operation is indicated by the yellow LED “REMOTE” on the front panel.

The remote control allows almost the same selections as the front panel keys; the exception is that you can set the auxiliary data to on/off, but you cannot select the baud rate for the RS-232 interface. The baud rate must be selected on the front panel.

An INVALID ENTRY signal is available at the remote control interface. This TTL output is active (HIGH) if you set up an illegal remote entry, and the red front panel LED INVALID ENTRY also lights.

While G.722 coding is selected, pins 5, 6, 7, 8 and 17, which determine Layer II coding mode and sampling frequency, are ignored.

The alarm relay is activated in the following situations:

- An ISDN fault is active.
- The digital audio input is selected (only if the digital audio option is installed), but no digital audio input signal is present (DIG. AUDIO LOSS).

Furthermore, the relay is active during power-down.

## **8.2 RE 663 ISDN Layer II Decoder**

You can connect and disconnect ISDN group calls from the remote interface in the same way as for the RE 662 Encoder.

To enable remote control, connect pin 3 in the Alarm-Remote connector to ground.

The current setting of each of the front panel status display functions of the decoder can be monitored via the rear panel Alarm-Remote connector, with the exception of the baud rate of the Auxiliary data RS-232 interface; an Auxiliary data channel on/off status output is provided, while the baud rate is only shown on the front panel.

The alarm output is a relay with both normally-open and normally-closed contacts available. The alarm relay is activated if no ISDN connection is established, or the decoder is not able to synchronize to the received digital signal (FRAME LOSS). Frame loss occurs only if neither Layer II frames nor G.722 is received. Furthermore, the relay is active during power-down.

For pin allocations, see “Remote Control of the RE 663 ISDN Layer II Decoder (Inputs)” on page 57 and “Remote Monitoring of the RE 663 ISDN Layer II Decoder (Outputs)” on page 58.

9. Connectors and Pin Allocations

9.1 Connectors

9.1.1 Hand-set Jack

Fig. 9.1 shows the four-position jack for the front panel hand-set.

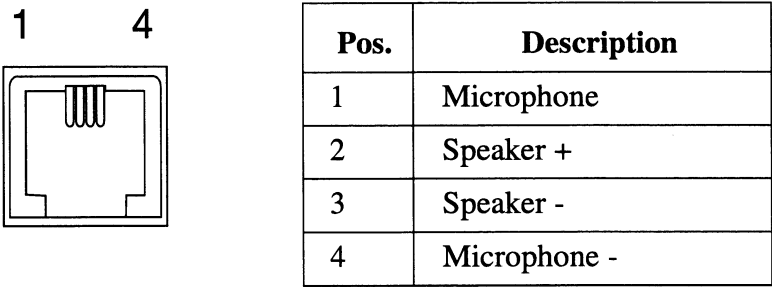


Table 9.1 Hand-set Jack

Fig. 9.1 Front Panel Hand-set Jack

9.1.2 Analog Audio Connectors

Fig. 9.2 shows the pin allocation for the analog audio connectors:

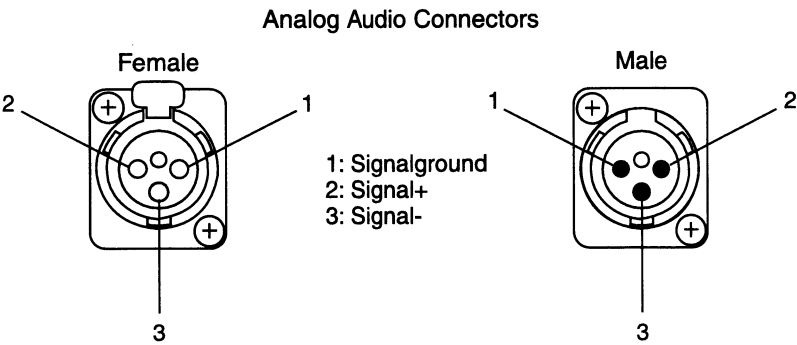


Fig. 9.2 Analog Audio Connectors

**NOTE** The cable shield must be connected to the connector housing.

9.1.3 Digital Audio and SYNC Connectors

Fig. 9.3 shows the pin allocation for the digital audio connector: Note, that these connectors are only operational when the Digital Audio Option is installed.

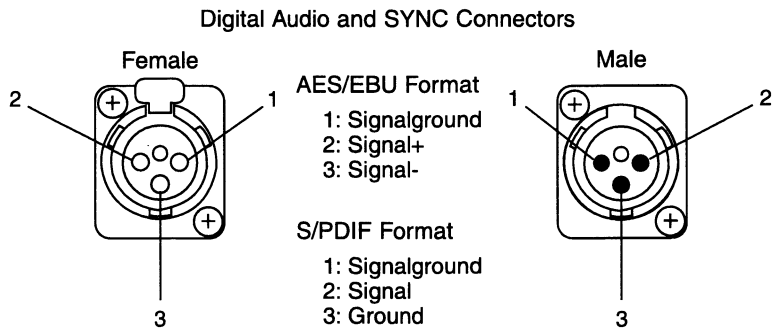


Fig. 9.3 Digital Audio Connector

**NOTE** The cable shield must be connected to the connector housing.

9.1.4 ISDN Interfaces Connector

Fig. 9.4 shows one of the three eight-position jacks for the ISDN Basic Access Interfaces.

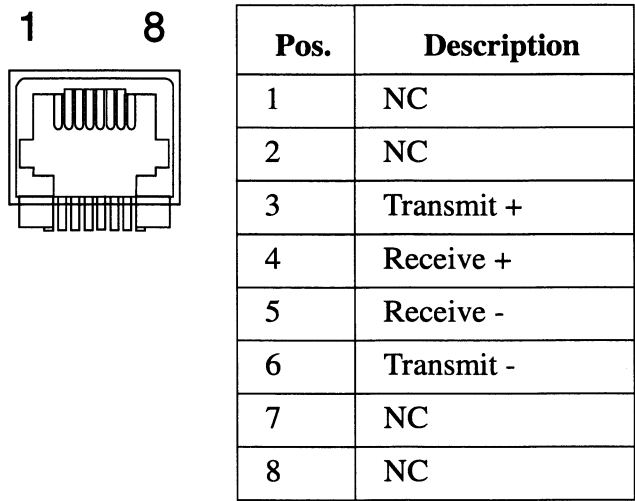


Table 9.2 ISDN Basic Access Interface Jack

Fig. 9.4 ISDN Basic Access Interface Jack

### 9.1.5 Reverse Transmission Connector

Fig. 9.5 shows the 15-pin female connector for the Reverse Transmission interface:

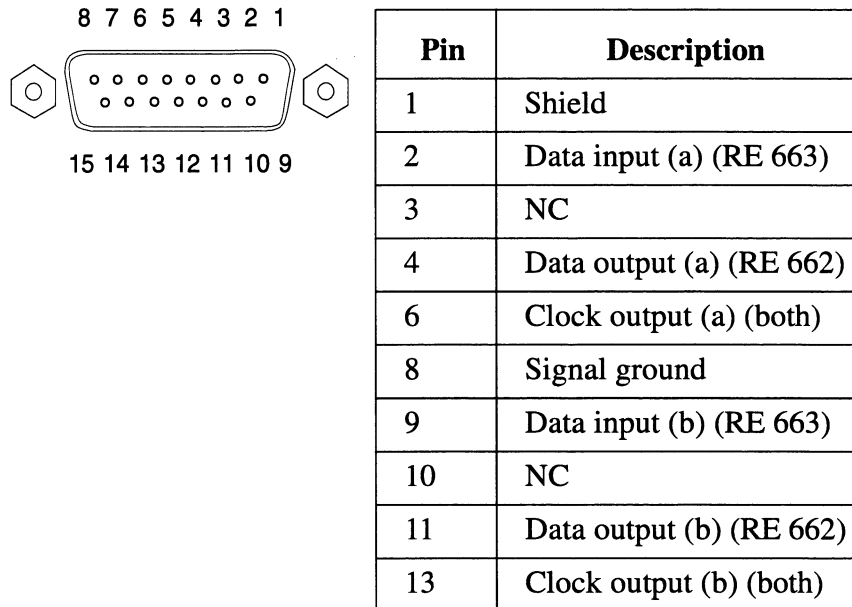


Table 9.3 X.21/RS-422 Connectors

Fig. 9.5 Reverse Transmission Connector

For a description of the reverse transmission cable, see “Reverse Transmission Cable” on page 60.

The remaining pins are not connected.



9.1.7 Alarm-Remote Connector

Fig. 9.7 shows the Sub-D female connector for the alarm and remote control interface for both the encoder and decoder.

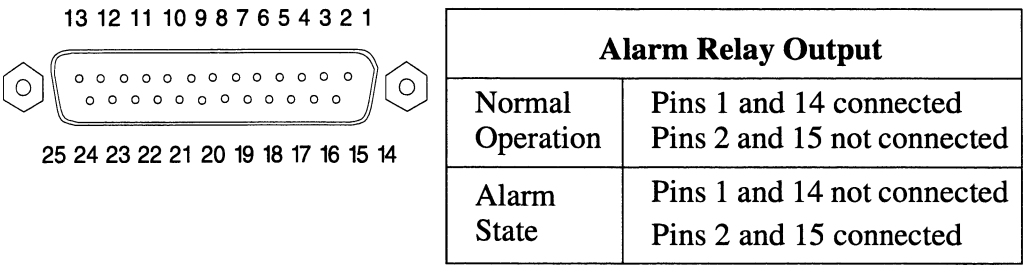


Table 9.5 Alarm Relay Output

Ground and +5V	
Ground	Pins 16 and 25
+5 V (Z <sub>out</sub> = 4.7 k)	Pin 13

Table 9.6 Ground and +5 V

Fig. 9.7 Alarm-Remote Connector

## 9.2 Remote Control of the Codec Inputs

### 9.2.1 Remote Control of the RE 662 ISDN Layer II Encoder (Inputs)

Sampling Frequency	Pin 17	Pin 6	Pin 5
16 kHz	L	L	H
22.05 kHz	L	L	L
24 kHz	L	H	H
32 kHz	H	L	H
44.1 kHz	H	L	L
48 kHz	H	H	H

*Table 9.7 Sampling Frequency*

Remote Control	Pin 3
Enable	L
Disable	H

*Table 9.8 Remote Control*

Audio Input	Pin 4
Analog	H
Digital	L

*Table 9.9 Audio Inputs*

Coding Mode	Pin 18
G.722	L
Layer II	H

*Table 9.10 Coding Mode*

<b>G.722 Coding Mode</b>	<b>Pin 4</b>
Mode 1 (Aux off)	L
Mode 2 (Aux on)	H

*Table 9.11 G.722 Coding Mode*

<b>Layer II Coding Mode</b>	<b>Pin 8</b>	<b>Pin 7</b>
Stereo	L	H
Joint Stereo	H	H
Dual	L	L
Mono	H	L

*Table 9.12 Layer II Coding Mode*

<b>Aux. Data channel</b>	<b>Pin 19</b>
Off	L
On <sup>a)</sup>	H

*Table 9.13 Auxiliary Data Channel (Layer II Coding)*

- a. Position “On” provides the baud rate shown on the front panel display.

<b>Invalid Entry Output</b>	<b>Pin 20</b>
Invalid Entry	High (+5 V)
No Invalid Entry	Low (0 V)

*Table 9.14 Invalid Entry Output*

**NOTE** “H” means open or connected to +5 V. “L” means connected to Ground.

ISDN Group Calls	Pin 24	Pin 23	Pin 22	Pin 21
Group 00	L	H	L	H
Group 01	H	H	H	L
Group 02	H	H	L	H
Group 03	H	H	L	L
Group 04	H	L	H	H
Group 05	H	L	H	L
Group 06	H	L	L	H
Group 07	H	L	L	L
Group 08	L	H	H	H
Group 09	L	H	H	L
Disconnect, or no calls	H	H	H	H
Redial calls	L	L	L	L
Connect pending voice call	L	L	H	H
Disconnect voice calls	L	L	H	L
Disconnect audio calls	L	L	L	H

*Table 9.15 ISDN Group Calls*

**NOTE** “H” means open or connected to +5 V. “L” means connected to Ground.

### 9.2.2 Remote Control of the RE 663 ISDN Layer II Decoder (Inputs)

Remote Control	Pin 3
Enable	L
Disable	H

*Table 9.16 Remote Control*

ISDN Group Calls	Pin 24	Pin 23	Pin 22	Pin 21
Group 00	L	H	L	H
Group 01	H	H	H	L
Group 02	H	H	L	H
Group 03	H	H	L	L
Group 04	H	L	H	H
Group 05	H	L	H	L
Group 06	H	L	L	H
Group 07	H	L	L	L
Group 08	L	H	H	H
Group 09	L	H	H	L
Disconnect, or no calls	H	H	H	H
Redial calls	L	L	L	L
Connect pending voice call	L	L	H	H
Disconnect voice calls	L	L	H	L
Disconnect audio calls	L	L	L	H

*Table 9.17 ISDN Group Calls*

**NOTE** “H” means open or connected to +5 V. “L” means connected to Ground.

### 9.3 Remote Monitoring of the RE 663 ISDN Layer II Decoder (Outputs)

Sampling Frequency	Pin 17	Pin 6	Pin 5
16 kHz	L	L	H
22.05 kHz	L	L	L
24 kHz	L	H	H
32 kHz	H	L	H
44.1 kHz	H	L	L
48 kHz	H	H	H

*Table 9.18 Sampling Frequency*

Coding Mode	Pin 18
G.722	L
Layer II	H

*Table 9.19 Coding Mode*

G.722 Coding Mode	Pin 19
Mode 1 (Aux off)	L
Mode 2 (Aux on)	H

*Table 9.20 G.722 Coding Mode*

Layer II Coding Mode	Pin 8	Pin 7
Stereo	L	H
Joint Stereo	H	H
Dual	L	L
Mono	H	L

*Table 9.21 Layer II Coding Mode*

**NOTE** “H” means open or connected to +5 V. “L” means connected to Ground

Aux Data Channel	Pin 19
Off	L
On <sup>a)</sup>	H

*Table 9.22 Auxiliary Data Channel*

- a. Position “On” provides the baud rate shown on the front panel display.

Transmission Bit Rate	Pin 12	Pin 11	Pin 10	Pin 9
56 kbit/s	L	L	L	L
64 kbit/s	L	L	L	H
112 kbit/s	L	L	H	H
128 kbit/s	L	H	L	L
192 kbit/s	L	H	L	H
256 kbit/s	L	H	H	L
320 kbit/s	L	H	H	H
384 kbit/s	H	L	L	L
none	H	L	H	H

*Table 9.23 Transmission Bit Rate*

**NOTE** “H” means a logical 1 (+5 V). “L” means a logical 0 (0 V).

9.4 Reverse Transmission Cable

The following multi-purpose cable can be used for reverse transmission of Layer II data between an ISDN Layer II encoder/decoder and a Layer II encoder/decoder.

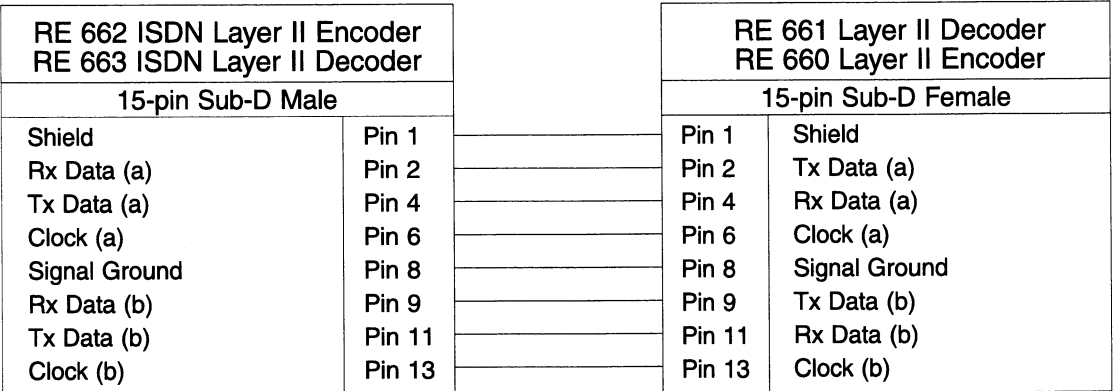


Fig. 9.8 Reverse Transmission Cable

The remaining pins are not connected.

The following figure shows a typical environment where the reverse transmission cable can be used.

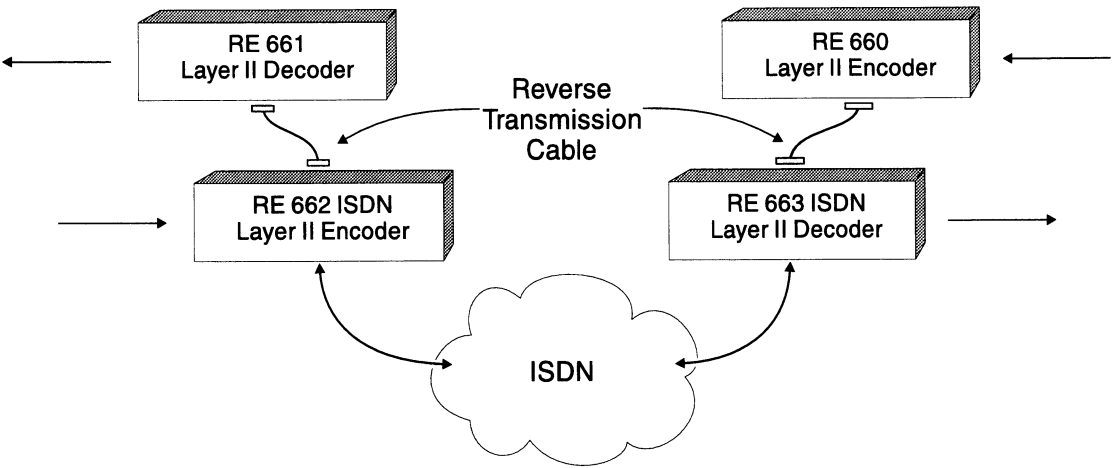


Fig. 9.9 Typical Environment for Reverse Transmission Cable

## 10. Serial Interface

You can use the Auxiliary serial RS-232 interface in several cases.

- To transmit data (in transparent mode)
- To inspect and control the triple basic rate interface (ISDN interface)
- To download new software to the codec

### 10.1 Transparent Mode

You can use the serial RS-232 interface to transmit from the RE 662 Encoder to the RE 663 Decoder.

You can control the baud rate on the RE 662 Encoder from the front panel or from the remote interface. The baud rate on the RE 663 automatically changes to the baud rate of the connected RE 662. For G.722 coding, this is, however, always 9600.

The character length is always 8 bits, and the parity is always none.

### 10.2 TA Control

From the serial interface you can inspect and control the settings of the ISDN interface and set up or disconnect calls.

You must use the baud rate shown on the front panel. If the RE 662 is set to no auxiliary data, it is default set to 9600 baud. If the RE 663 does not have any active connections, the default baud rate is 9600 baud.

First you must escape from the Transparent mode and enter the TA Control mode:

Send no characters for one second, send \*\*\* and then wait one more second.

The status display shows TA (Terminal Adapter) in the Aux field, and the AUX key is disabled.

Issue the wanted commands. All commands must be terminated by <CR> and/or <LF>. The codec answers ">" in response to a <CR> or <LF>.

To escape from TA control mode and revert to transparent mode, wait one second, send \*\*\*, and then wait one more second.

With TA control active you have access to the following commands:

Command	Parameters	Comment
CAUDIO	“{Phone Number}” <sup>a)</sup>	Establishes an audio connection to the number given in the parameter.
CG	0...99	Calls the number group selected.
CVOICE	“{Phone Number}” <sup>a)</sup>	Establishes a voice connection to the number given in the parameter.
DIS	{ALL AUDIO VOICE}	Disconnects calls.
GL	{0 1}	Group Lock. Locks or unlocks the number groups' contents for changes from the front panel. 0 = unlocked 1 = locked
GR	n="name" a="dddd" b="dddd" c="dddddd" ..... f="dddddd" v="dddddd"	Defines a number group. One of the channels can be a voice channel, marked with the letter "V". Without the 384 kbit/s option, only channels a and b can be used for audio calls. The channels are preferred, but not guaranteed. The name can be used as a name for the destination.
ISDN	{EURO 1TR6 USNI1 AUSTRAL}	Selects the ISDN standard. This must be done before a call is made.
LINESTATUS		Sends the status of lines a-f.
LINKS	{1 3 6}	Sets the number of audio links. This is only possible if the 384 kbit/s option is installed. 1 = normal 3 = 3*128 kbit/s 6 = 6*64 kbit/s

Table 10.1 Codec TA Control Commands

Command	Parameters	Comment
ORIGIN	{ON OFF} n="name" a="dddd" b="dddd" c="dddddd" ..... f="dddddd"	Sets the Origin feature on or off. If on, the ISDN call set-up message contains the number as the Calling Party Number. This can/must be used in connection with some local switchboards. The name can be used as a name for your installation site.
Q	No parameters	Soft restart of the ISDN board.
REDIAL	{ON OFF}	Turns automatic re-dial on or off.
SPID	n="name" a="dddd" b="dddd" c="dddddd" ..... f="dddddd"	Sets the Service Profile Identifier for use with the US-NI1 ISDN standard. The name can be used as a name for your installation site. The numbers are given to you by your telephone company on request.
VERIFY	{ON OFF}	Turns verification on or off. If on, incoming calls are verified against the phone numbers stored in the number groups.
VOICE	AUTO MAN ANSWER	Selects voice answer mode. In AUTO mode, voice calls are automatically answered. In MAN mode, you must confirm the connection. In ANSWER mode, a pending voice call is answered.
?		Sends the codec identity and software settings.

*Table 10.1 Codec TA Control Commands (Continued)*

- a. The phone number must be enclosed in quote marks.

### 10.3 ASTRA Digital Radio and Digital Audio Broadcast

When delivered from RE TECHNOLOGY AS, the ADR (ASTRA Digital Radio) mode interface and the DAB (Digital Audio Broadcast) mode interface on the RE 662 and RE 663 Codec are disabled.

In the RE 662 Encoder, only the ADR mode can be enabled, as the ADR mode in the encoder covers both the ADR mode and the DAB mode.

The RE 663 Decoder, however, needs to be set up to receive ancillary data in the Layer II frame formatted as specified in the ASTRA standard or the Digital Audio Broadcast standard.

In order to enable the ADR or the DAB interface, connect a PC to the RE 662 and RE 663 ISDN Layer II Codec using the RS-232 Sub-D connector, and open a terminal program. Any standard terminal program can be used for communication with the codec.

Note, that the communication parameters are set to 8N1, 9600 baud. The PC must support hardware handshaking. On the RE 662, the Aux field in the status display must show "00" or "96".

To enable the interface, do the following:

1. Enter the command `!!!` to bring the codec into SERVICE mode. The Status Display on the codec now shows SERVICE MODE.
2. If you are setting up an RE 662 Encoder, type the command `AS, 1`, and press [ENTER] to enable the ADR/DAB mode for the encoder.

or

If you are setting up an RE 663 Decoder, type the command `AS, 1` and press [ENTER] to enable the ADR mode, or type the command `AS, 2` and press [ENTER] to enable the DAB mode.

3. Type the command `rr`, and press [ENTER] to bring the codec back to the normal operation mode again.

If the RE 663 is forced into ADR. mode, ancillary data in the Layer II frame is always decoded as ASTRA auxiliary data, and the status display on the RE 663 always shows AS.

If the RE 663 is forced into DAB mode, ancillary data in the Layer II frame is always decoded as DAB auxiliary data, and the status display on the RE 663 always shows DA.

To disable the interface, do the following:

1. Enter the command `!!!` to bring the codec into SERVICE mode. The Status Display on the codec now shows SERVICE MODE.
2. Type the command `AS, 0`, and press [ENTER].
3. Type the command `rr`, and press [ENTER] to bring the codec back to the normal operation mode again.

This procedure must be carried out on both the RE 662 ISDN Layer II Encoder and the RE 663 ISDN Layer II Decoder.

## 10.4 Software Upgrades

### Equipment Requirements

A computer equipped with a free COM port and a 3 1/2" disk drive, which is able to read a DOS formatted disk. A standard RS-232 cable (one-to-one).

### How to Update

1. Insert the software update disk from RE TECHNOLOGY AS in the computer's disk drive.
2. Read the **README.TXT** ASCII file on the disk.
3. Follow the instructions in the file.



## 11. ISDN Messages

### 11.1 ISDN Messages

The following messages may be shown in the ISDN display:

Message	Explanation
"DEL NAME ? 1/[0]"	Do you really want to delete the name of the number group. Press [1] if you want to delete the name, or press any other key if you do not want to delete the name.
"DEL NUMB ? 1/[0]"	Do you really want to delete the number from the number group. Press [1] if you want to delete the number or any other key if you do not want to delete the number.
"DISCONNECT FIRST"	You attempted to make a group call or enter the Setup menu while you have active audio calls.
"DSP BOOT ERR. xx"	This message is shown if something fails during power-up. The boot error code xx is the software version code returned from the DSP. Please contact your RE representative.
"EEPROM LOST "	This message is shown during power-up if the codec has lost one or more of its settings. Open the Setup menu and restore all settings.
"GROUP EMPTY "	You attempted to make a group call with an empty group.
"GROUP FULL "	You have attempted to store a number in a group where 2 numbers are already stored (6 if the 384 kbit/s option is installed).
"GROUPS LOCKED "	The number group contents are locked so you are not allowed to store or delete numbers in the number groups.
"INVALID ENTRY "	You have pressed a key that (at the moment) has no meaning.
"LINES: ab cd ef"	This is the line status message. A lowercase letter indicates that communication to the NT is established on the channel. "--" indicates that there is no connection on the channel.

*Table 11.1 ISDN Error Messages*


Message	Explanation
“LOAD V x.y “	This message is shown if the software power-up fails or during software updates.
“MAX 1 VOICE CALL”	You have attempted to store more than one voice call in a number group.
“NAME DELETED”	The name was successfully deleted.
“NO CONNECTIONS “	This is the idle state display.
“NO GROUPS FOUND “	You tried to scroll trough the groups and all groups are empty.
“NUMBER DELETED “	The number was successfully deleted.
“RATE INDEX ERROR”	This message is shown if the received Layer II frames indicate a higher bit rate that the one the codec actually receives. The reason could be that the codec transmitting has connected a call to another codec than yours.
“RECALL GROUP #??”	You have pressed [RCL]. Key in the two digits of the number group you want, OR press  to scroll trough the non-empty number groups, OR press [#] to recall the last called number, OR press [*] to recall the last shown number, OR press [VOICE] to recall the last called voice call, OR press [STO] to recall the last stored number, OR press [DEL] or [RCL] if do not want to recall anything.
“SETUP MENU “	This message is shown when you enter the Setup menu.
“STO NUMB IN #??”	You are storing a number in a number group. Press [VOICE] to store the number as a voice call, and then key in the two digits of the number group. OR just key in the two digits of the number group.
“UNIT IN REMOTE “	While the codec is remote you cannot make audio calls or change the content of the number groups.
“VOICE PENDING “	A voice call is waiting for you. Press [VOICE] to accept the call OR [DIS] to reject the call.

Table 11.1 ISDN Error Messages (Continued)

Message	Explanation
<i>In the following messages, x is the channel letter, from a to f</i>	
"x BEARER NOT IMP."	The destination called did not connect your call. If the destination is an RE 662/RE 663, the reason could be that it does not have the 384 kbit/s option installed, and that it has received your call on an ISDN B-channel other than a or b.
"x CALL REJECTED "	The destination of the call did not want to connect your call. If the destination is an RE 662/RE 663, the reason could be that the channel identification procedure identified your call as a disturbing call, or that your call could not be verified (see "Verify" on page 38) by the RE 662/RE 663 you called.
"x CONNECTED "	The call is now connected.
"x CONNECTING "	The connect procedure is in progress.
"x DISCONNECTED "	The call is now disconnected.
"x DISCONNECTING "	The disconnect procedure is in progress.
"x NETWORK ERR xx"	If the call is rejected for any other reason than the above, this error message is shown. xx is the cause code in hexadecimal. For a list of cause codes and their meaning, see Appendix A in this manual.
"x NO ANSWER "	The destination of the call did not answer the call. RE 662/RE 663 codecs automatically answer all incoming audio calls, so the destination is another device or the call is a voice call.
"x NO CHNL AVAIL "	The codec or the public switch does not have a channel available to connect the call.
"x NO RESPONSE "	This message is shown if the number you dialed was not connected or powered up.
"x NO ROUTE "	The switch could not route the call to the destination. The reason could be that you tried to make an audio call to an analog telephone.
"x NOT READY "	The connection to the NT is not correctly established.
"x READY "	Connection and communication with the NT has been established.
"x READY SPID "	The SPID has been approved.

Table 11.1 ISDN Error Messages (Continued)

Message	Explanation
"x REDIAL TRY fsd"	This message is shown during re-dial of a connection. d is the re-dial count up to 8.
"x REMOTE BUSY "	The destination of the call was busy with another call.
"x S-BUS ERROR "	This message is shown if the codec does not communicate properly with your network termination or with the public switch. Check that the codec is connected correctly. This messages causes a re-dial.
"x WAITING "	This channel waits for another channel to be connected, before the connect procedure starts. This message is shown when groups with at least 2 numbers are activated.

*Table 11.1 ISDN Error Messages (Continued)*

## 12. Equipment and Accessories

This section contains a list of the accessories supplied with the RE 662 and RE 663 ISDN Layer II Codec and a list of optional equipment and accessories.

### 12.1 Standard Equipment and Accessories

The following equipment and accessories should be found when unpacking the RE 662 ISDN Layer II Encoder or the RE 663 ISDN Layer II Decoder.

Order number	Description
395-028	RE 662 ISDN Layer II Encoder, <b>or</b>
395-029	RE 663 ISDN Layer II Decoder
983-483	Operator Manual

*Table 12.1 Standard Equipment and Accessories*

### 12.2 Optional Equipment and Accessories

Optional equipment and accessories to be used with the RE 662 & RE 663 ISDN Layer II Codec.

Order number	Description
910-314	Handset
906-797	384 kbit/s Option
902-416	Digital Audio Input Option
902-417	Digital Audio Output Option
618-276	S <sub>0</sub> Cable
983-486	Service Manual

*Table 12.2 Optional Equipment and Accessories*



## 13. Specifications

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### Analog Audio Specifications

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Type of connector	3-pin XLR, female for inputs and male for outputs
Companding	ISO/MPEG Layer II or G.722
A/D and D/A converter resolution	16 bits sigma-delta, 64/128 times oversampling
Sampling frequency	Selectable: 16, 22.05, 24, 32, 44.1 or 48 kHz
Input impedance	600 $\Omega$ or $> 25 \text{ k}\Omega$ , balanced
Output impedance	600 $\Omega$ or $< 60 \text{ }\Omega$ , balanced
Input clipping level	21, 18, 15, 12, 9, 6, 3, 0, -3 dBu
Output level	
Low output impedance	24, 21, 18, 15, 12, 9, 1, -2, -5 dBu
600 output impedance into 600 $\Omega$ load	18, 15, 12, 9, 6, 3, -5, -8, -11 dBu
Insertion gain	0 dB $\pm 0.2$ dB

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### Layer II coding<sup>1)</sup>

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Frequency response <sup>2)</sup>	$\pm 0.3$ dB relative to 1 kHz
Fs = 16 kHz	20 to 7,500 Hz
Fs = 22.05 kHz	20 to 10,300 Hz
Fs = 24 kHz	20 to 11,250 Hz
Frequency response	$\pm 0.15$ dB relative to 1 kHz
Fs = 32 kHz	20 to 14,500 Hz
Fs = 44.1 kHz	20 to 20,000 Hz
Fs = 48 kHz	20 to 20,000 Hz

---

1) The analog audio specifications are given for a codec pair coupled back-to-back at 384 kbit/s stereo transmission rate unless otherwise indicated

2) This specification is given for a codec pair coupled back-to-back at 128 kbit/s stereo transmission rate.

Total harmonic distortion

3 dB below clipping, 1 kHz

< -80 dB at 1 kHz

SINAD

3 dB below clipping, 1 kHz

< -60 dB at 1 kHz

Idle channel noise, +15 dBm0 clipping

Quasipeak, unweighted

< -67 dBq0

Quasipeak, weighted

< -60 dBq0ps

RMS, unweighted

< -71 dBm0

Signal-to-Noise ratio

> 86 dB

Crosstalk

< -85 dB

Phase difference between channels

< 3°

Maximum Bandwidth vs. Bit Rates and Audio Modes											
Bit Rate (kbit/s)	Audio Mode				Bandwidth (kHz) vs. Sampling Frequency						
	Mono	Dual	Stereo	Joint Stereo		16 kHz	22.05 kHz	24 kHz	32 kHz	44.1 kHz	48 kHz
56	✓				1 ch.	7.5	10.3	11.2	6.8	9.4	10.2
64	✓				1 ch.	7.5	10.3	11.2	6.8	9.4	10.2
		✓	✓	✓	2 ch.	7.5	10.3	11.2	6.0	5.5	6.0
112 <sup>a)</sup>	✓				1 ch.	7.5	10.3	11.2	15.0	20.6	20.2
		✓	✓	✓	2 ch.	7.5	10.3	11.2	6.8	9.4	10.2
128 <sup>a)</sup>	✓				1 ch.	7.5	10.3	11.2	15.0	20.6	20.2
		✓	✓	✓	2 ch.	7.5	10.3	11.2	6.8	9.4	10.2
192	✓				1 ch.	-	-	-	15.0	20.6	20.2
		✓	✓	✓	2 ch.	-	-	-	15.0	20.6	20.2
256	-	✓	✓	✓	2 ch.	-	-	-	15.0	20.6	20.2
320	-	✓	✓	✓	2 ch.	-	-	-	15.0	20.6	20.2
384	-	✓	✓	✓	2 ch.	-	-	-	15.0	20.6	20.2

*Table 13.1 Maximum Bandwidth vs. Bit Rates and Audio Modes*

- a. In the joint stereo mode the bandwidth is:
- |                        |          |
|------------------------|----------|
| 32 kHz sampling rate   | 13.5 kHz |
| 44.1 kHz sampling rate | 18.6 kHz |
| 48 kHz sampling rate   | 20.2 kHz |

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**G.722 Coding**


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Frequency Response	
Relative to 1 kHz	$\pm 0.3$ dB, 20 to 6400 Hz +0.3/-3.0 dB, 20 to 7000 Hz
Total Harmonic Distortion	
3 dB below clipping, 1 kHz	< -50 dB
SINAD	
3 dB below clipping, 1 kHz	< -46 dB, 64 kbit/s Mode 1 < -40 dB, 64 kbit/s Mode 2, 56 kbit/s
Idle Channel Noise, +15 dBm0 clipping	
Quasipeak, unweighted	< -55 dBq0
Quasipeak, weighted	< -44 dBq0ps
RMS, unweighted	< -60 dBm0
Signal-to-Noise ratio	> 75 dB
Group Delay Variation	< 0.05 ms

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**Auxiliary Data Channel Specifications**


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Type of connector	25-pin Sub-D, female
Baud rate	
Layer II	300, 600, 1200, 2400, 4800 or 9600 baud
G.722 <sup>3)</sup>	9600 baud
Mode	8 data bits, no parity bit, and 1 stop bit (8N1)
Data flow control	Hardware handshake

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3) The effective bit rate, when using G.722 is limited to 4.8 kbit/s

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**Data Interface Specifications**


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**Network Interface**

Type	ISDN S <sub>0</sub> (2B+D)
With 384 kbit/s option	
Number of BRI	From 1 to 3 in parallel (up to 6 B-channels)
Bit rates	56, 64, 112, 128, 192, 256, 320, or 384 kbit/s
Without 384 kbit/s option	
Number of BRI	1 (2 B-channels) for audio calls, and 1 B-channel for voice calls
Bit rates	56, 64, 112 or 128 kbit/s

**ISDN Protocols**

Euro ISDN  
 ITR6  
 US-NI1  
 Australian

**X.21/RE 660/RE 661 Interface**

Type of connector	15-pin, Sub-D, female
Number of channels	Up to two
Clock/Data signals	V.11/RS-422-A with pin-out according to X.21

**Alarm/Remote Interface**

Type of connector	25-pin, Sub-D, female
Functions	RE 662: Remote control, alarms, RE 663: Remote group call, monitoring, alarms

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**Digital Audio Specifications**


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Type of connector	3-pin XLR, female for inputs and male for outputs
Data format	AES/EBU or S/PDIF
Impedance	110 $\Omega$ , balanced or 75 $\Omega$ , single ended
Lock range	$\pm 400$ ppm

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**General**

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**Environmental Conditions**

Storage temperature	-40 to 70 °C (-40 to 158 °F)
Operating temperature	5 to 45 °C (41 to 113 °F)
Relative humidity	20 to 80 %, non-condensing
EMC	<sup>4)</sup> EN 55022:1986, EN 50082-1:1992

**Power Supply**

Input voltage	90 to 250 V AC
Frequency	47 to 65 Hz
Power consumption	Approximately 30 VA per terminal
Type of connector	IEC standard, single-fused with filter
Fuse	Slow Blow, 500 mA

**Dimensions and Weight**

Height	2U or 89 mm (3.5")
Width	482 mm (19")
Depth	310 mm (12.2")
Net Weight	Approximately 4.5 kg (10 lbs)
Shipping weight	Approximately 8.9 kg (19.6 lbs)

Data subject to change

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4) Shielded cables must be used.



## 14. Appendix A: Cause Codes

When you make a call on the ISDN network, the call may not come through or it may be disconnected. In both cases, the ISDN network sends a so-called release cause to the devices participating in the call. In the RE 662 and RE 663 ISDN Layer II codec, these release causes are used for generating user information and determining the action of the codec.

In this Appendix, the release causes and their special meaning in the RE 662 and RE 663 are described. The explanations in this Appendix are based on the descriptions in the ITU-T Q.931 recommendation Annex G. The description from the ITU-T document is given together with special comments for the RE 662 and RE 663.

Some release causes have a special display message in the codec. For other release causes, the message "**c NETWORK ERR xx**" is shown, where **c** is the channel letter, and **xx** is the release cause in hexadecimal. The release cause number is, therefore, shown both in decimal (as in Q.931) and in hexadecimal notation.

Furthermore, this Appendix shows if the release cause makes the codec re-dial the number - if the codec is the caller and the re-dial feature is turned on.

**G.1 Normal Class**

<b>Hex Code</b>	<b>Description as in ITU-T Q.931 recommendation Annex G</b>	<b>Codec displays (c = channel)</b>
01	<p><i>G.1.1 Cause No. 1: unallocated (unassigned) number</i></p> <p>This cause indicates that the destination requested by the calling user cannot be reached because, although the number is in a valid format, it is not currently assigned (allocated).</p>	c NETWORK ERR 0x01
02	<p><i>G.1.2 Cause No. 2: no route to specified transit network</i></p> <p>This cause indicates that the equipment sending this cause has received a request to route the call through a particular transit network which it does not recognize. The equipment sending this cause does not recognize the transit network either because the transit network does not exist or because that particular network, while it does exist, does not serve the equipment which is sending this cause.</p> <p>This cause is supported on a network-dependent basis.</p>	c NETWORK ERR 0x02
03	<p><i>G.1.3 Cause No. 3: no route to destination</i></p> <p>This cause indicates that the called user cannot be reached because the network through which the call has been routed does not serve the destination desired.</p> <p>This cause is supported on a network-dependent basis.</p>	c NO ROUTE
06	<p><i>G.1.4 Cause No. 6: channel unacceptable</i></p> <p>This cause indicates the channel most recently identified is not acceptable to the sending entity for use in this call.</p>	c NETWORK ERR 0x06
07	<p><i>G.1.5 Cause No. 7: call awarded and being delivered in an established channel</i></p> <p>This cause indicates that the user has been awarded the incoming call, and that the incoming call is being connected to a channel already established to that user for similar calls (e.g., packet-mode X.25 virtual calls).</p>	c NETWORK ERR 0x07
10	<p><i>G.1.6 Cause No. 16: normal call clearing</i></p> <p>This cause indicates that the call is being cleared because one of the users involved in the call has requested that the call be cleared.</p> <p>Under normal situations, the source of this cause is not the network.</p>	(This is the normal termination cause, so it is not shown on the display)
11	<p><i>G.1.7 Cause No. 17: user busy</i></p> <p>This cause is used when the called user has indicated the inability to accept another call. It is noted that the user equipment is compatible with the call.</p>	c REMOTE BUSY

*Table A.1 Cause Codes, Normal Class*

Hex Code	Description as in ITU-T Q.931 recommendation Annex G	Codec displays (c = channel)
12	<p><i>G.1.8 Cause No. 18: no user responding</i></p> <p>This cause is used when a user does not respond to a call establishment message with either an alerting or connect indication within the prescribed period of time allocated (defined in Recommendation 4.931 by the expiry of either timer T303 or TJ310).</p>	c NO RESPONSE
13	<p><i>G.1.9 Cause No. 19: no answer from user (user alerted)</i></p> <p>This cause is used when a user has provided an alerting indication but has not provided a connect indication within a prescribed period of time.</p> <p>Note - This cause is not necessarily generated by Q.931 procedures but may be generated by internal network timers.</p>	c NO ANSWER
15	<p><i>G.1.10 Cause No. 21: call rejected</i></p> <p>This cause indicates that the equipment sending this cause does not wish to accept this call, although it could have accepted the call because the equipment sending this cause is neither busy nor incompatible.</p>	c CALL REJECTED <sup>a)</sup>
16	<p><i>G.1.11 Cause No. 22: number changed</i></p> <p>This cause is returned to a calling user when the called party number indicated by the calling user is no longer assigned. The new called party number may optionally be included in the diagnostic field. If a network does not support this capability, cause No. 1, <i>unassigned (unallocated) number</i> shall be used.</p>	c NETWORK ERR 0x16
1A	<p><i>G.1.12 Cause No. 26: non-selected user clearing</i></p> <p>This cause indicates that the user has not been awarded the incoming call.</p>	c NETWORK ERR 0x1A
1B	<p><i>G.1.13 Cause No. 27: destination out of order</i></p> <p>This cause indicates that the destination indicated by the user cannot be reached because the interface to the destination is not functioning correctly. The term “not functioning correctly” indicates that a signalling message was unable to be delivered to the remote user; e.g., a physical layer or data link layer failure at the remote user, user equipment off-line, etc.</p>	c NETWORK ERR 0x1B <sup>b)</sup>
1C	<p><i>G.1.14 Cause No. 28: invalid number format (address incomplete)</i></p> <p>This cause indicates that the called user cannot be reached because the called party number is not a valid format or is not complete.</p>	c NETWORK ERR 0x1C
1D	<p><i>G.1.15 Cause No. 29: facility rejected</i></p> <p>This cause is returned when a facility requested by the user can not be provided by the network.</p>	c NETWORK ERR 0x1D

Table A.1 Cause Codes, Normal Class (Continued)

Hex Code	Description as in ITU-T Q.931 recommendation Annex G	Codec displays (c = channel)
1E	G.1.16 Cause No. 30: response to STATUS ENQUIRY This cause is included in the STATUS message when the reason for generating the STATUS message was the prior receipt of a STATUS ENQUIRY message.	c NETWORK ERR 0x1E
1F	G.1.17 Cause No. 31: normal, unspecified This cause is used to report a normal event only when no other cause in the normal class applies.	(In some cases, this releases cause is used instead of the normal call termination cause number 16 (0x10 Normal Call clearing) so the codec display will not show the release cause.)

Table A.1 Cause Codes, Normal Class (Continued)

- a. This release cause comes from the RE 662 and RE 663 codec if the Layer II data or channel identification procedure indicates that the call should not be connected. The reason could be that the call disturbs an existing transmission, or that there is no match between the rate indication in the Layer II headers and the number of connections established. Another possible reason is that your number could not be verified by the RE 662 or RE 663 you have called. (See "Verify" on page 38)
- b. This could indicate that the destination of the call was not powered up or the S-bus was not connected to the codec.

## G.2 Resource Unavailable Class

Hex Code	Description as in ITU-T Q.931 recommendation Annex G	Codec displays (c = channel)
22	<p><i>G.2.1 Cause No. 34: no circuit/channel available</i></p> <p>This cause indicates that there is no appropriate circuit/channel presently available to handle the call.</p>	c NO CHNL AVAIL <sup>a)</sup>
26	<p><i>G.2.2 Cause No. 38: network out of order</i></p> <p>This cause indicates that the network is not functioning correctly and that the condition is likely to last a relatively long period of time; e.g., immediately re-attempting the call is not likely to be successful.</p>	c NETWORK ERR 0x26
29	<p><i>G.2.3 Cause No. 41: temporary/failure</i></p> <p>This cause indicates that the network is not functioning correctly and that the condition is not likely to last a long period of time; e.g., the user may wish to try another call attempt almost immediately.</p>	c NETWORK ERR 0x29 <sup>a)</sup>
2A	<p><i>G.2.4 Cause No. 42: switching equipment congestion</i></p> <p>This cause indicates that the switching equipment generating this cause is experiencing a period of high traffic.</p>	c NETWORK ERR 0x2A <sup>a)</sup>
2B	<p><i>G.2.5 Cause No. 43: access information discarded</i></p> <p>This cause indicates that the network could not deliver access information to the remote user as requested: i.e. a user-to-user information, low layer compatibility, high layer compatibility, or sub-address as indicated in the diagnostic.</p> <p>It is noted that the particular type of access information discarded is optionally included in the diagnostic.</p>	c NETWORK ERR 0x2B
2C	<p><i>G.2.6 Cause No. 44: requested circuit/channel not available</i></p> <p>This cause is returned when the circuit or channel indicated by the requesting entity can not be provided by the other side of the interface.</p>	c NETWORK ERR 0x2C <sup>a)</sup>
2F	<p><i>G.2.7 Cause No. 47: resource unavailable, unspecified</i></p> <p>This cause is used to report a resource unavailable event only when no other cause in the resource unavailable class applies.</p>	c NETWORK ERR 0x2F <sup>a)</sup>

Table A.2 Cause Codes, Resource Unavailable Class

a. This release cause makes the codec re-dial the number.

### G.3 Service or Option Not Available Class

Hex Code	Description as in ITU-T Q.931 recommendation Annex G	Codec displays (c = channel)
31	<p><b>G.3.1 Cause No. 49: Quality of service not available</b></p> <p>This cause is used to report that the requested Quality of Service, as defined in Recommendation X.213, cannot be provided (e.g., throughput or transit delay cannot be supported).</p>	c NETWORK ERR 0x31 <sup>a)</sup>
32	<p><b>G.3.2 Cause No. 50: requested facility not subscribed</b></p> <p>This cause indicates that the requested supplementary service could not be provided by the network because the user has not completed the necessary administrative arrangements with its supporting networks.</p>	c NETWORK ERR 0x32
39	<p><b>G.3.3 Cause No. 57: bearer capability not authorised</b></p> <p>This cause indicates that the user has requested a bearer capability which is implemented by the equipment which generated this cause but the user is not authorised to use.</p>	c NETWORK ERR 0x39
3A	<p><b>G.3.4 Cause No. 58: bearer capability not presently available</b></p> <p>This cause indicates that the user has requested a bearer capability which is implemented by the equipment which generated this cause but which is not available at this time.</p>	c NETWORK ERR 0x3A <sup>a)</sup>
3F	<p><b>G.3.5 Cause No. 63: service or option not available, unspecified</b></p> <p>This cause is used to report a service or option not available event only when no other cause in the service or option not available class applies.</p>	c NETWORK ERR 0x3F <sup>a)</sup>

Table A.3 Cause Codes, Service or Option Not Available Class

a. This release cause makes the codec re-dial the number.

**G.4 Service or option not implemented class**

<b>Hex Code</b>	<b>Description as in ITU-T Q.931 recommendation Annex G</b>	<b>Codec displays (c = channel)</b>
41	G.4.1 Cause No. 65: <i>bearer capability not implemented</i> This cause indicates that the equipment sending this cause does not support the bearer capability requested.	c BEARER NOT IMP <sup>a)</sup>
42	G.4.2 Cause No. 66: <i>channel type not implemented</i> This cause indicates that the equipment sending this cause does not support the channel type requested.	c NETWORK ERR 0x42
45	G.4.3 Cause No. 69: <i>requested facility not implemented</i> This cause indicates that the equipment sending this cause does not support the requested supplementary service.	c NETWORK ERR 0x45
46	G.4.4 Cause No. 70: <i>only restricted digital information bearer capability is available</i> This cause indicates that one equipment has requested an unrestricted bearer service but that the equipment sending this cause only supports the restricted version of the requested bearer capability.	c NETWORK ERR 0x46
4F	G.4.5 Cause No. 79: <i>service or option not implemented, unspecified</i> This cause is used to report a service or option not implemented event only when no other cause in the service or option not implemented class applies.	c NETWORK ERR 0x4F

*Table A.4 Cause Codes, Service or Option Not Implemented Class*

- a. This release cause comes from the RE 662 and RE 663 codec if it receives an audio call on an ISDN B-channel other than a or b, and the 384 kbit/s option is not installed.

**G.5 Invalid Message (e.g. Parameter out of Range) Class**

<b>Hex Code</b>	<b>Description as in ITU-T Q.931 recommendation Annex G</b>	<b>Codec displays (c = channel)</b>
51	<i>G.5.1 Cause No. 81: invalid call reference value</i> This cause indicates that the equipment sending this cause has received a message with a call reference which is not currently in use on the user-network interface.	c NETWORK ERR 0x51
52	<i>G.5.2 Cause No. 82: identified channel does not exist</i> This cause indicates that the equipment sending this cause has received a request to use a channel not activated on the interface for a call. For example, if a user has subscribed to those channels on a primary rate interface numbered from 1 to 2 and the user equipment or the network attempts to use channels 13 through 23, this cause is generated.	c NETWORK ERR 0x52
53	<i>G.5.3 Cause No. 83: a suspended call exists, but this call identity does not</i> This cause indicates that a call resume has been attempted with a call identity which differs from that in use for any presently suspended call(s).	c NETWORK ERR 0x53
54	<i>G.5.4 Cause No. 84: call identity in use</i> This cause indicates that the network has received a call suspended request. The call suspend request contained a call identity (including the null call identity) which is already in use for a suspended call within the domain of interfaces over which the call might be resumed.	c NETWORK ERR 0x54
55	<i>G.5.5 Cause No. 85 no call suspended</i> This cause indicates that the network has received a call resume request. The call resume request contained a Call identity information element which presently does not indicate any suspended call within the domain of interfaces over which calls may be resumed.	c NETWORK ERR 0x55
56	<i>G.5.6 Cause No. 86: call having the requested call identity has been cleared</i> This cause indicates that the network has received a call resume request. The call resume request contained a Call identity information element which once indicated a suspended call; however, that suspended call was cleared while suspended (either by network timeout or by remote user).	c NETWORK ERR 0x56
58	<i>G.5.7 Cause No. 88: incompatible destination</i> This cause indicates that the equipment sending this cause has received a request to establish a call which has low layer compatibility, high layer compatibility, or other compatibility attributes (e.g., data rate) which cannot be accommodated.	c NETWORK ERR 0x58

*Table A.5 Cause Codes, Invalid Message (e.g. Parameter out of Range) Class*

Hex Code	Description as in ITU-T Q.931 recommendation Annex G	Codec displays (c = channel)
5B	<i>G.5.8 Cause No. 91: invalid transit network selection</i> This cause indicates that a transit network identification was received which is of an incorrect Format as defined in Annex C/Q.931.	c NETWORK ERR 0x5B
5F	<i>G.5.9 Cause No. 95: invalid message, unspecified</i> This cause is used to report an invalid message event only when no other cause in the invalid message class applies.	c NETWORK ERR 0x5F

*Table A.5 Cause Codes, Invalid Message (e.g. Parameter out of Range) Class (Continued)*

**G.6 Protocol Error (e.g. Unknown Message) Class**

Hex Code	Description as in ITU-T Q.931 recommendation Annex G	Codec displays (c = channel)
60	<p><i>G.6.1 Cause No. 96: mandatory information element is missing</i></p> <p>This cause indicates that the equipment sending this cause has received a message which is missing an information element which must be present in the message before that message can be processed.</p>	c NETWORK ERR 0x60
61	<p><i>G.6.2 Cause No. 97: message type non-existent or not implemented</i></p> <p>This cause indicates that the equipment sending this cause has received a message with a message type it does not recognize either because this is a message not defined or defined but not implemented by the equipment sending this cause.</p>	c NETWORK ERR 0x61
62	<p><i>G.6.3 Cause No. 98: message not compatible with call state or message type non-existent or not implemented</i></p> <p>This cause indicates that the equipment sending this cause has received a message such that the procedures do not indicate that this is a permissible message to receive while in the call state, or a STATUS message was received indicating an incompatible call state.</p>	c NETWORK ERR 0x62
63	<p><i>G.6.4 Cause No. 99: information element non-existent or not implemented</i></p> <p>This cause indicates that the equipment sending this cause has received a message which includes information elements not recognised because the information element identifier is not defined or it is defined but not implemented by the equipment sending the cause. However, the information element is not required to be present in the message in order for the equipment sending the cause to process the message.</p>	c NETWORK ERR 0x63
64	<p><i>G.6.5 Cause No. 100: invalid information element contents</i></p> <p>This cause indicates that the equipment sending this cause has received an information element which it has implemented: however, one or more of the fields in the information element are coded in such a way which has not been implemented by the equipment sending this cause.</p>	c NETWORK ERR 0x64
65	<p><i>G.6.6 Cause No. 101: message not compatible with call state</i></p> <p>This cause indicates that a message has been received which is incompatible with the call state.</p>	c NETWORK ERR 0x65
66	<p><i>G.6.7 Cause No. 102: recovery on timer expiry</i></p> <p>This cause indicates that a procedure has been initiated by the expiry of a timer in association with Q.931 error handling procedures.</p>	c NETWORK ERR 0x66

Table A.6 Cause Codes, Protocol Error (e.g. Unknown Message) Class

Hex Code	Description as in ITU-T Q.931 recommendation Annex G	Codec displays (c = channel)
6F	G.6.8 Cause No. 111: protocol error, unspecified This cause is used to report a protocol error event only when no other cause in the protocol error class applies.	c NETWORK ERR 0x6F

Table A.6 Cause Codes, Protocol Error (e.g. Unknown Message) Class (Continued)

## G.7 Interworking Class

Hex Code	Description as in ITU-T Q.931 recommendation Annex G	Codec displays (c = channel)
7F	G.7.1 Cause No. 127: interworking, unspecified This cause indicates that there has been interworking with a network which does not provide causes for actions it takes, thus, the precise cause for a message which is being sent cannot be ascertained.	c NETWORK ERR 0x7F

Table A.7 Cause Codes, Interworking Class

## List of RE 662 and RE 663 Special Display of Release Causes

"c S-BUS ERROR "	This message has no special release cause. It indicates that the codec does not communicate with the NT (Network Termination).
"c NO ROUTE "	Release cause 3 (0x03)
"c REMOTE BUSY "	Release cause 17 (0x11)
"c NO RESPONSE "	Release cause 18 (0x12)
"c NO ANSWER "	Release cause 19 (0x13)
"c CALL REJECTED "	Release cause 21 (0x15)
"c NO CHNL AVAIL "	Release cause 34 (0x22)
"c BEARER NOT IMP:"	Release cause 65 (0x41)
"c NETWORK ERR xx"	This is the general release cause message



## 15. Glossary

The following is a list of the abbreviations used in this Operator Manual:

A/D	Analog-to-Digital
AC	Alternating Current
ADC	Analog to Digital Converter
ADR	ASTRA Digital Radio
AES	Audio Engineering Society
CRC	Cyclic Redundancy Check
D/A	Digital-to-Analog
DAB	Digital Audio Broadcast
DAC	Digital to Analog Converter
DI	Digital Input
DTMF	Dual Tone Multi-Frequency
EBU	European Broadcasting Union
EPROM	Erasable and Programmable Read Only Memory
ICR	Inter City Relay
IEC	International Electrotechnical Commission
ISDN	Integrated Services Digital Network
ISO	The International Organization for Standardization
ITU-T	International Telecommunications Union - Telecommunication Sector
LED	Light Emitting Diode
MPEG	Moving Pictures Experts Group
MSN	Multiple Subscriber Number
SCF	Scale Factor protection
S/PDIF	Sony/Philips Digital Interface
STL	Studio-to-Transmitter Link
SPID	Service Profile Identifier
TA	Terminal Adapter
TBRI	Triple Basic Rate Interface
TTL	Transistor-Transistor Logic



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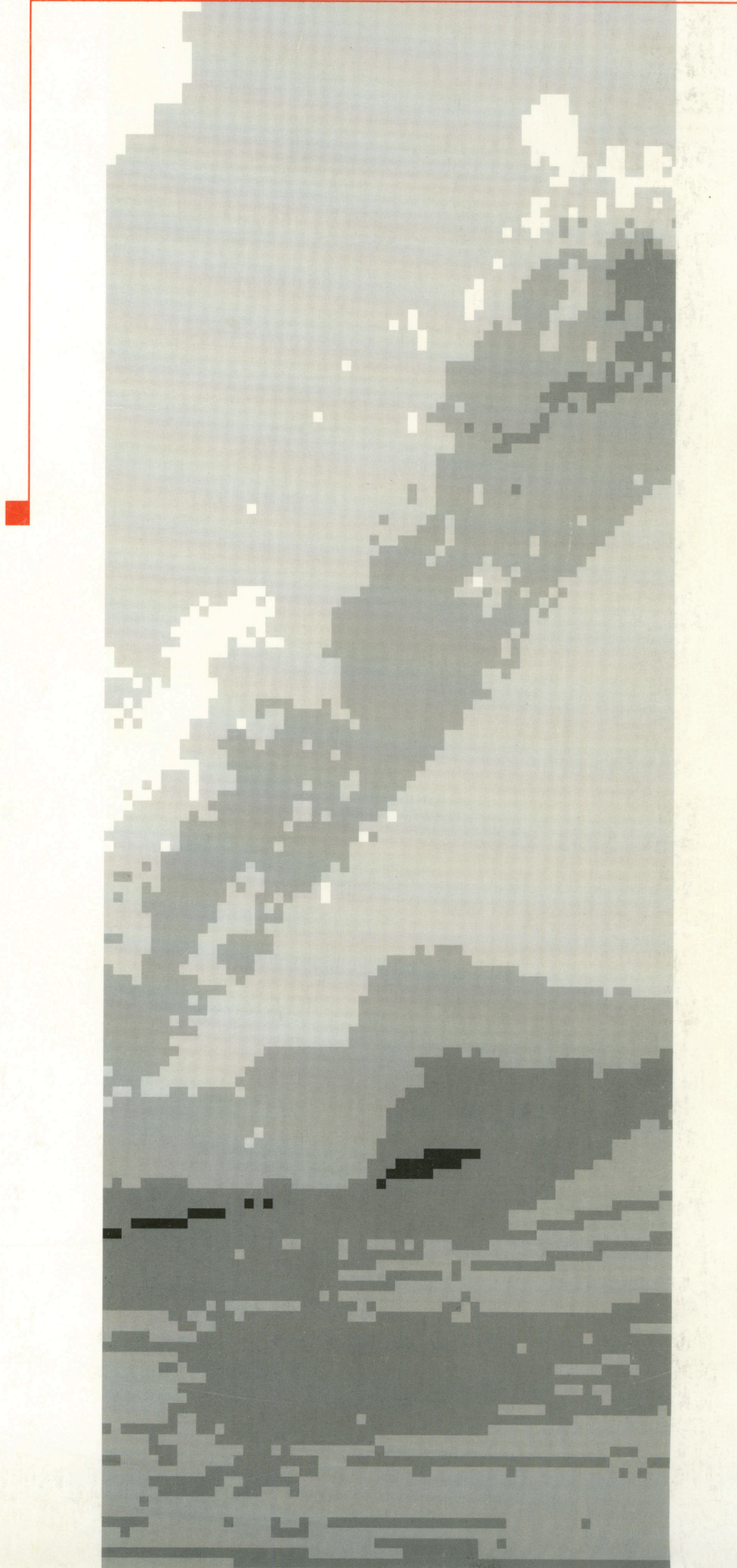
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