Connecting External Network on the TANDBERG products family

TANDBERG

Application Note

D12096 Rev. 06

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External Networks – Using the TANDBERG product family interfaces

1. Introduction

The TANDBERG product family hereafter called the TANDBERG CODEC supports multiple interfaces for connection to synchronous digital services. Although the maximum data rate for the different types of interface may vary with the software type loaded, the two areas classified as network types by the TANDBERG CODEC are ISDN and External.

ISDN or T1/E1 support is provided via S/T buses presented by RJ-45 sockets located at the rear panel of the Codec. These interfaces enable the TANDBERG CODEC to operate at data rates up to 2Mbit/s (in 64kbit or 56 kbit increments). Aggregation of data via the ISDN/T1/E1 interfaces is accomplished using Bonding Mode 1 and is further augmented by use of TANDBERG's unique Intelligent Call Management (ICM) system.

For the purposes of this document however, we will concentrate on the support for network types classified as External.

2. Acronyms

BRI	=	**B**asic **R**ate **I**nterface
CSU	=	**C**hannel **S**ignaling **U**nit
DSU	=	**D**ata **S**ignaling **U**nit
DTE	=	**D**ata **T**erminal **E**quipment
DCE	=	**D**ata **C**ircuit terminating **E**quipment
E1	=	2.048 Mbit/s bus (2Mbit/s line)
IMUX	=	**I**nverse **MU**ltiple**X**er
PRI	=	**P**rimary **R**ate **I**nterface (2Mbit/s line)
TA	=	**T**erminal **A**dapter
T1	=	1.544 Mbit/s bus

3. External Network Types

All network types classified by the TANDBERG CODEC as External are presented at the rear panel of the Codec via one High density, Male, 26-pin DSUB connectors. This connector is known as the NET connector and through which the TANDBERG CODEC can provide the following network interfaces:

- **V35**
- **RS-499**
- **X21**

Selection of the required network type is made via a simple on-screen menu using the hand-held remote control. It is possible to switch between network types without re-starting the Codec.

NOTE: Notwithstanding the support for both ISDN and External network types, the detection of an incoming call or the routing of an outgoing call will only be made using the network type currently selected in the on-screen menu.

4. Terminal Adapters (TAs)

Connection to External networks is done via a device known as a Terminal Adapter (TA). The TA provides a standard, physical interface by which the TANDBERG CODEC is able to connect to the actual network used for transporting the data from one Codec to another.

To support the various physical network interfaces the NET connector support signaling on most of the 26 pins. This implementation enables a variety of cables to be used with the TANDBERG CODEC that provide the physical interface required (i.e. those interfaces listed above) for a given terminal adapter. See chapter 9 for details.

NOTE: The maximum data rate via this port is 2Mbit/s and all data rates MUST be multiples of 56kbit/s or 64 kbit/s.

5. Network Clocking

The type of External network selected in the menu is divided into 2 categories. These categories are distinguished by the format of the Network Clock used by the selected network, i.e. V.35 and RS-449 networks are defined to use 2 separate clocks. It is these clocks by which the TANDBERG CODEC synchronizes its transmission and reception of data. These two clocks are usually referred to as the *transmit clock* and the *receive clock.*

NOTE: Both the *transmit* and *receive clock* are network clocks i.e. they are provided by the network. In addition, although both clocks will have the same frequency they will not necessarily be in phase with each other.

In contrast to V.35 & RS-449, the definition for X.21 networks uses only a single clock by which both the transmission and reception of data will be synchronized.
The ability of the TANDBERG CODEC to be so versatile in the area of network clocking allows the Codec to be extremely adaptable to a host of different network situations where although a standard interface may be provided the type of signaling may fall below the specification for that standard.

The following explains the support provided for each given network interface and details the External network configuration recommended by TANDBERG:

5.1 V.35

Support for the V.35 interface is as per a standard V.35 implementation. TANDBERG have produced a cable definition that transforms the 26-pin DSUB of each NET port into a standard 35-pin Winchester connector. See chapter 10.1 for pin layout or cable specification documents for existing cables.

Connection to most switched circuits or leased line synchronous networks will be possible via this type of interface.

NOTE: The provision of signaling provided by the TANDBERG CODEC also enables support for **V.36**.

5.2 RS-449

Support for the RS-449 interface is as per a standard RS-449 implementation. TANDBERG have provided a cable definition that transforms the 26-pin DSUB of each NET port into a connector suitable for connection to most ASCEND IMUX equipment. See chapter 10.2 for pin layout or cable specification documents for existing cables.

5.3 X.21

Support for the X.21 interface is as per a standard X.21 implementation although in-band signaling for call control is not supported. See below for more details on call control.

TANDBERG has provided a cable definition that transforms the 26-pin DSUB of the NET port into a 15 pin DSUB connector suitable for connection to most X.21 interfaces. See chapter 10.4 for pin layout.

6. Call Control

For the purposes of controlling the initiation and detection of a call i.e. Call Control, the TANDBERG CODEC supports 4 modes of operation:

- **RS-366**
- **Leased Line**
- **Data Triggered**
- **Manual mode**

For signaling details for DCE/DTE see chapter 11.
Mixing the network clock types and Call Control options enables the TANDBERG CODEC to cater for multiple permutations of External network interface types.

The following explains the support provided for each given Call Control type and details the configuration recommended by TANDBERG for typical network scenarios.

6.1 RS-366

When switched digital services are provided it is necessary to provide a mechanism by which the Codec can indicate to its TA how the call is to be routed. Essentially this is how the Codec tells the TA what number is to be dialed. The most common interface for providing this call routing information (usually the number to be dialed) is the RS-366 interface.

Support for the RS-366 interface is as per a standard RS-366 implementation. TANDBERG have provided a cable definition that transforms the 26-pin DSUB of the NET port into a connector suitable for connection to most TAs supporting RS-366 type Call Control.

The specific cable definition will be for a *Y* cable i.e. two cables coming from the 26-pin DSUB, one for data transfer the other for call control. The specific cable definition will depend on the TA being used.

NOTE: If a TANDBERG cable definition is not available for your specific TA, please see chapter 10.3 for pin layout to allow a suitable cable to be manufactured.

6.2 Leased Line

Leased line calls do not need to be routed. Generally, calls via leased line services are to fixed destinations, or at the very least, to destinations for which the routing has been determined before data is transmitted.

When communicating via Leased Line services however, the interface used tends to support certain protocols which the TA will use to inform the Codec of certain events e.g. incoming call, and that similarly the Codec can use to inform the TA of certain events e.g. initiating call.

If a leased line service is employed and the interface provided by the TA being used supports the type of signaling associated with V.35/V.36 or RS-449 or T1/E1 then TANDBERG recommends that the Leased Line option is selected.

6.3 Data Triggered

The Data Triggered option can typically be employed in any situation where a leased line service is employed.

Unlike the Leased Line option, Data Triggered does not use a signaling protocol between the Codec and TA, instead the Codec simply monitors the data signals. When the Codec identifies data on its data lines it assumes an incoming call and responds accordingly. When initiating a call using this mode the Codec simply starts to transmit data on its data lines.

When a leased line service is employed and the TA being used supports one of the standard interface types but does not support the signaling normally associated with

this interface (or this signaling is not compatible with the Codec) TANDBERG recommends that the Data Triggered option is selected.

6.4 Manual mode

'Manual' should be used when no handshake signals are available, and the external equipment requires a fixed connected line or T1/E1 leased line.

7. How to Interface with different Network Services

So far this document has only dealt with which interfaces that are available to connect to synchronous data services. This chapter will now cover how to connect to specific network types. The types covered below, although by no means exhaustive, caters for the most widely available services:

- **Switched & Leased Line 56/64**
- **X.21**
- **Leased Line (dedicated) T1/E1/PRI**
- **Circuit Switched (dial up) T1/E1/PRI**
- **E1**
- **T1 Supported on TANDBERG CODEC**

Each one of these network services are listed below along with a brief explanation of the type(s) of TA required to enable the Codec to use this service.

7.1 Switched & Leased Line 56/64

Both the switched and leased line 56 & 64 services provide single physical lines with (as their name suggests) 56kbit/s and 64 kbit/s data transmission capabilities. The difference between switched and leased line services, as explained earlier, is that switched services require information from the Codec to route outgoing calls. From the Codec's perspective this translates to the need for selecting the RS-366 Call Control option.

The TA(s) used for switched and leased line 56 & 64 services are typically known as CSU/DSUs. Such TAs can provide an RS-366 Call Control option (if required) and will typically provide a V.35 interface with the standard set of signaling.

Typically 56kbit/s and 64kbit/s services will be provided as a pair of physical lines allowing 112kbit/s or 128kbit/s connections. The Codec can support these data rates through the use of its NET port and a suitably configured CSU/DSU.

Each manufacturer's CSU/DSU will need to be configured to suit both the network service and the Codec itself. TANDBERG may cooperate with manufacturers to give out configuration details. TANDBERG has to be contacted when needed.

The type of device which enables aggregation of multiple lower bandwidth lines into a single higher bandwidth stream is known as an IMUX.

One manufacturer of an IMUX that can be used with switched 64/56 services is Ascend. This IMUX will aggregate the individual channels to provide a 768/672Kbit/s data stream to the Codec. In fact this device supports up to twelve switched 56 lines. The Ascend IMUX presents a physical interface very similar to that of NET.
See chapter 9 for cable specification/pin layout.

7.2 X.21

Support for the X.21 network is similar to that for switched and leased line 56 & 64 services in as much as some form of CSU/DSU is required. Normally however, an X.21 service will be presented physically via a 26-pin DSUB connector to which the TANDBERG CODEC Codec can connect directly (provided the appropriate cable is used).

NOTE: The TANDBERG CODEC Codec does not support the X.21 protocol that enables in-band dialling. Typically therefore, unless some form of RS-366 call control interface is available a leased line X.21 service should be used.

A typical configuration for the TANDBERG CODEC Codec to connect to an X.21 service would be to set Leased Line for Call Control and obviously X.21 for Network Type.

7.3 Leased Line (dedicated) T1/E1/PRI

A leased line T1/PRI service provides a total bandwidth of 1.54MB or 2Mb via multiple switched 56kbit/s (T1) or 64kbit/s (PRI) channels. The TANDBERG CODEC supports up to maximum bandwidth of 2Mbit/s.
See chapter 10.5 for pin layout and details.

As with the leased line 56 and 64 services a CSU/DSU can be used to split off the required bandwidth i.e. 768Kbit/s or 672Kbit/s from the full T1 or PRI. If the remaining bandwidth is required elsewhere then the CSU/DSU must support a feature known as *Drop and Insert*. This feature allows the bandwidth not reserved for the Codec to be passed through the CSU/DSU and on to a subsequent device that may use this bandwidth e.g. a PBX.

It is possible to obtain fractional T1 or E1 services, in this case only the amount of bandwidth required is supplied e.g. a *quarter T or E* is as its name suggests one quarter of a full T1/E1 or 336/512kbits.

Most CSU/DSU's will provide a V.35 interface and as such a suitable setting for the TANDBERG CODEC would be for Call Control to be set to Leased Line and Network type to be set to V.35.

7.4 Circuit Switched (dial up) T1/E1/PRI

A circuit switched T1/E1/PRI service, just like its leased line cousin, provides a total bandwidth of 1.54/2MB via multiple switched 56kbit/s or 64kbit/s (T1/E1/PRI) channels. Again the TANDBERG CODEC maximum bandwidth support of 2Mbit/s

allows full bandwidth of this service to be used. See chapter 10.5 for pin layout and details.

For dial up services each separate 56kbit/s or 64kbit/s channel can be dialed separately, therefore some form of call control is required. Again however a device must be used that can split off the required bandwidth i.e. 768 kbit/s from the full T1/E1/PRI. The *Drop and Insert* feature is described earlier in chapter 7.3.
Again a fractional T1/E1 service such as a *quarter T/E* would provide a limited number of channels for the Codec's.

A typical TA that will allow the TANDBERG CODEC to connect to a full or fractional circuit switched T1/E1 service and provides the *Drop and Insert* feature is the Ascend VSX T1/E1. To connect to this device the Codec should be configured to use a Network Type of RS-449 and RS-366 for Call Control.

For connection to a PRI another Ascend product, the Ascend MAX can be used. The MAX will allow any remaining bandwidth to be used by other devices. Again the recommended configuration for the Codec is to set a Network Type of RS-449 and RS-366 for Call Control.

7.5 E1

An E1 service provides 2MB of bandwidth made up of separate 64 kbit/s channels. The TANDBERG CODEC maximum capability of 2Mbit/s means that all of the bandwidth is used.

It is now possible for an E1 service to be provided solely for use by a videoconferencing system. Usually an E1 will terminate at a PABX within a facility. You will now have the possibility to connect more than one TANDBERG CODEC in the front of the PABX and use the *Drop and Insert* feature.

7.6 H331

The H331 standard makes it possible to handle communication via satellite or other networks in a simplex mode.
This means that the Transmitter broadcasts data without doing any handshake with the receiver.
The Transmitter must be configured with audio- video- standards (in the Advanced Call Quality menu, ex: H261 and G722) and maximum bandwidth that the Receiver supports.
The H331 communication can be run in both direction when using an ISDN or other duplex network, this due to the fact that the Codec can both send and receive data in simplex mode at the same time.

8. Comments

The key to enabling the TANDBERG CODEC Codec to use an External network is the Terminal Adapter. Choosing a suitable Terminal Adapter must take into consideration the provision of a suitable interface to the TANDBERG CODEC Codec. The most common interface found on Terminal Adapters is the V.35 interface and the TANDBERG CODEC Codec comprehensively supports this.

Once a suitable interface is available it is only necessary to configure the TA and select the relevant Network Type and Call Control options for the Codec. TANDBERG may be able to provide appropriate information to enable the TA to be configured and will suggest the most suitable settings for the Codec.

9. Electrical Connections and Connectivity

9.1. Description

This section describes the use and interfacing requirements when using the Net interface and the T1/E1 PRI Interface.
The section also describes the identification and pin configuration of signals on the Net interfaces and T1/E1 interface.

9.2. Location

To identify the connector and the location, see the drawings below:

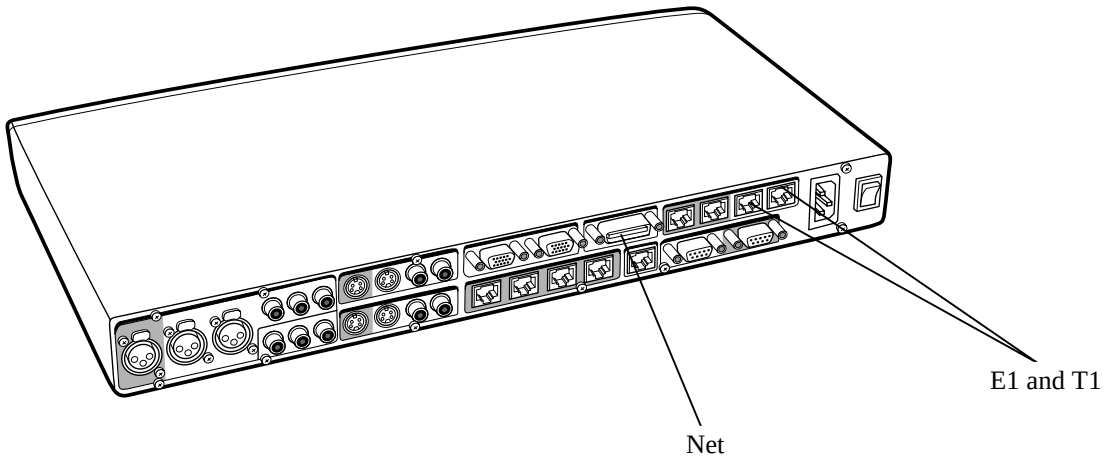


Figure 1 TANDBERG CODEC Connectors

The Codec for TANDBERG CODEC has:

- 1 Network Interfaces named NET
- The speed on this port is 56Kb – 2Mb/s
- T1/E1/PRI Interface

9.2. Definitions

9.2.1 Definition of DTE/DCE

- The **Network** is seen as the **DTE** when connecting to a Network.
- The **Terminal Adapter** is seen as the **DCE**.

Note*: The clock signals must be provided by the DCE*

The arrows used indicate the signals directions:

← → means that the signal is bidirectional (i.e ground).

← means that a signal is an input

→ means that a signal is an output

All signals marked with * means that it has to be connected and used

9.2.2 Definition of Signalling protocols between DTE/DCE

V35 CD (*1) is the same signal for these interfaces:
V35 CD/RLSD, X21 I, RS449 RR

V35 DTR (*2) is the same signal for these interfaces:
V35 DTR, X21 C, RS449 TR

V35 RI (Ring Indicator) (*3) is the same signal as:
RS449 IC.

***1 refer to chapter 11**

***2 refer to chapter 11**

***3 refer to chapter 11**

10. Interfaces

Net and the T1/E1/PRI can support the following:

10.1 V35 Interface:

Connection diagram 1 : V35 Interface

DTE → DCE

Pin	Signal Name	Direction	Description
1	FGND	←→	Frame ground on equipment
11	SD(A)	→	Send data/Transmit
12	SD(B)	→	Send data/Transmit
13	RD(A)	←	Receive Data
14	RD(B)	←	Receive Data
15	SCR(A)	←	Signal Clock Receive
16	SCR(B)	←	Signal Clock Receive
17	SCT(A)	←	Signal Clock Transmit
18	SCT(B)	←	Signal Clock Transmit
19	GND *	←→	Signal ground
22	RLSD(CD)	←	Received Line Signal Detector / Carrier Detect
23	RLSD/GND*	←	Signal ground
24	RI	←	Ring Indicator
25	LOS	→	Loss Of Signal (KG194)
26	DTR	→	Data Terminal Ready

(*= This pin is connected to ground for correct operations)

Note: Frame ground is connected to pin 1 on DTE and DCE

All balanced inputs and outputs (A and B) use balanced line signals according to V.11 (RS422) and single ended signals in accordance with V.10 (RS423).
For balanced signals a “0”=low voltage is defined as terminal A positive with respect to terminal B.
For unbalanced signals a “0”= low voltage is defined as terminal positive with respect to GND.

Cable length max: Leased Line Control = 20 Meter
Cable length max: Data Trigged = 50 meter

10.2 RS530 Interface:

Connection diagram 2 : RS530 Interface

Pin	Signal Name	Direction	Description
1	FGND	←→	Frame ground
11	BA(A)	→	Transmit data
12	BA(B)	→	Transmit data
13	BB(A)	←	Receive Data
14	BB(B)	←	Receive Data
15	DD(A)	←	Signal Clock Receive
16	DD(B)	←	Signal Clock Receive
17	DB(A)	←	Signal Clock Transmit
18	DB(B)	←	Signal Clock Transmit
19	GND *	←→	Ground
20	CD(A)	→	DTE Ready
21	CD(B)	→	DTE Ready
22	CF(A)	←	Received Line Signal Detector
23	CF(B)	←	Received Line Signal Detector

Note: Frame ground is connected to pin 1 on DTE
(*= This pin is connected to ground for correct operations)

All balanced inputs and outputs (A and B) use balanced line signals according to V.11 (RS422) and single ended signals in accordance with V.10 (RS423).

Cable lenght max: Leased Line Control = 20 Meter
Cable lenght max: Data Trigged = 50 meter

10.3 RS449 Interface:

Connection diagram 3 : RS449 Interface

DTE → DCE

Pin	Signal Name	Direction	Description
1	FGND	←→	Frame ground
11	SD(A)	→	Send data
12	SD(B)	→	Send data
13	RD(A)	←	Receive Data
14	RD(B)	←	Receive Data
15	RT(A)	←	Receive Timing
16	RT(B)	←	Receive Timing
17	ST(A)	←	Send Timing
18	ST(B)	←	Send Timing
19	GND *	←→	Ground
20	TR(A)	→	Terminal Ready
21	TR(B)	→	Terminal Ready
22	RR(A)	←	Carrier Detect / Receiver Ready
23	RR(B)	←	Carrier Detect / Receiver Ready
24	IC	←	Incoming Call
25	LOS	→	Loss Of Signal (KG194)

NOTE: Frame ground is connected to pin 1 on DTE
(*= This pin is connected to ground for correct operations)

All balanced inputs and outputs (A and B) use balanced line signals according to V.11 (RS422) and single ended signals in accordance with V.10 (RS423).
For balanced signals a “0”=low voltage is defined as terminal A positive with respect to terminal B.
For unbalanced signals a “0”= low voltage is defined as terminal positive with respect to GND.

Cable length max: Leased Line Control = 20 Meter
Cable length max: Data Trigged = 50 meter

10.4 RS366 Interface:

Connection diagram 4 : RS366 Interface

DTE → DCE

Pin	Signal Name	Direction	Description
1	FGND	←→	Frame ground
2	DPR	→	Digit Present
3	ACR	←	Abandon Call & Retry
4	CRQ	→	Call Request
5	PND	←	Present Next Digit
6	DLO	←	Data Line Occupied
7	NB1	→	Digit Bit 1
8	NB2	→	Digit Bit 2
9	NB4	→	Digit Bit 4
10	NB8	→	Digit Bit 8

Note: Frame ground is connected to pin 1 on DTE

All signals are electrically according to RS232.

Cable length max: 5 meter

10.5 X21 Interface:

Connection diagram 5 : X21 Interface

DTE → DCE

Pin	Signal Name	Direction	Description
1	FGND	←→	Frame ground
11	T(A)	→	Send data/Transmit
12	T(B)	→	Send data/Transmit
13	R(A)	←	Received Data/ Receive
14	R(B)	←	Received Data/ Receive
15	S(A)	←	Signal Element Timing
16	S(B)	←	Signal Element Timing
20	C(A)	→	Terminal Ready/Control
21	C(B)	→	Terminal Ready/Control
22	I(A)	←	Carrier detect
23	I(B)	←	Carrier detect

Note: 1. Frame ground is connected to pin 1 on DTE
2. Byte Element Timing is not implemented.

All balanced inputs and outputs (A and B) use balanced line signals according to V.11 (RS422) and single ended signals in accordance with V.10 (RS423).
For balanced signals a “0”=low voltage is defined as terminal A positive with respect to terminal B.
For unbalanced signals a “0”= low voltage is defined as terminal positive with respect to GND.

Cable length max: 50 meter

10.6 T1/E1/PRI Interface :

Connection diagram 6 : T1/E1/PRI Interface RJ48C specifications.

DTE → DCE

Pin	Signal Name	Direction	Description
1	Ring (R1)	←	Multiband Plus- T1/E1/PRI Receive (input) pair
2	Tip (T1)	←	Multiband Plus- T1/E1/PRI Receive (input) pair
4	Ring (R)	→	Multiband Plus- T1/E1/PRI Transmit (output) pair
5	Tip (T)	→	Multiband Plus- T1/E1/PRI Transmit (output) pair

If you are using the PRI/T1 interface, the PRI/T1 cable should be connected to a CSU unit. You will need a CSU between your TANDBERG Codec and the line from your network provider.

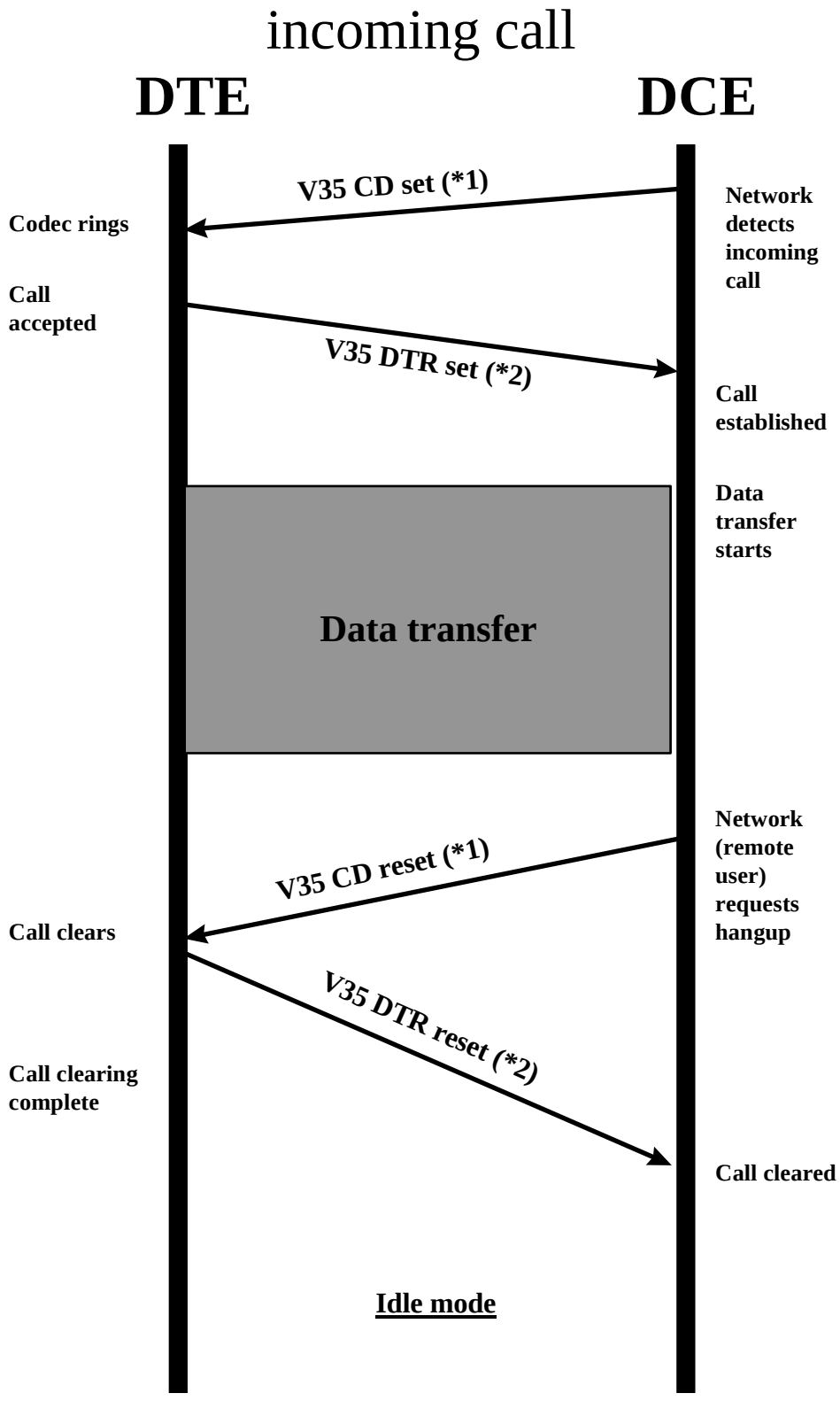
Type	**Manufacturer**	**PRI Switch Type setting**
ATT 4 ESS	AT&T	AT&T ISDN
ATT 5 ESS	AT&T/Lucent	AT&T ISDN or National ISDN*****
DMS 100	Northern Telecom	National ISDN
DMS 250	Northern Telecom	National ISDN

- Settings will depend on configuration of the switch. PRI Switch Type is not changed when Restoring Defaults.

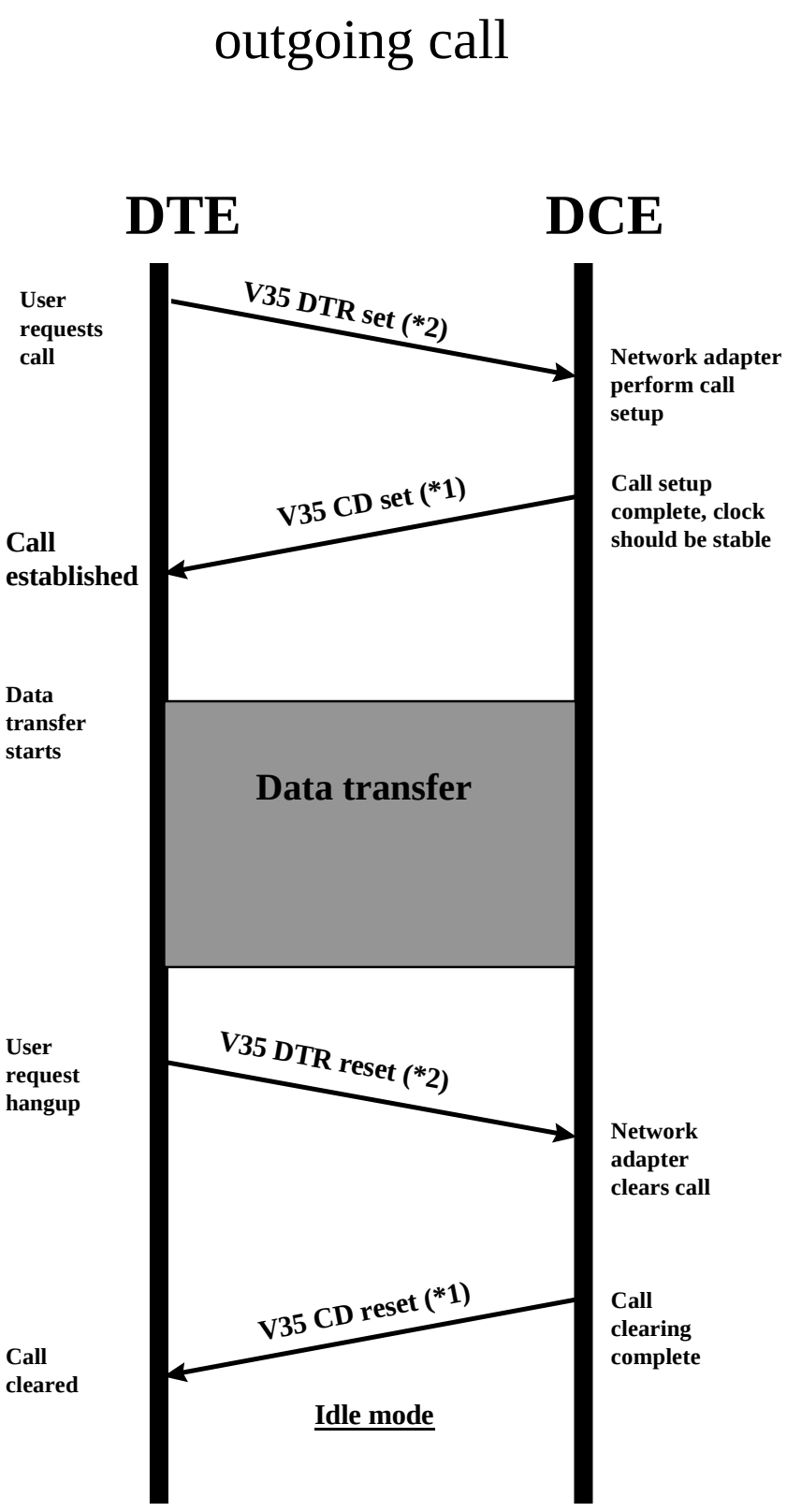
Note that the T1 format is predefined to ESF and the line code is B8ZS.
This is not configurable.

11. Signaling protocol between DTE and DCE

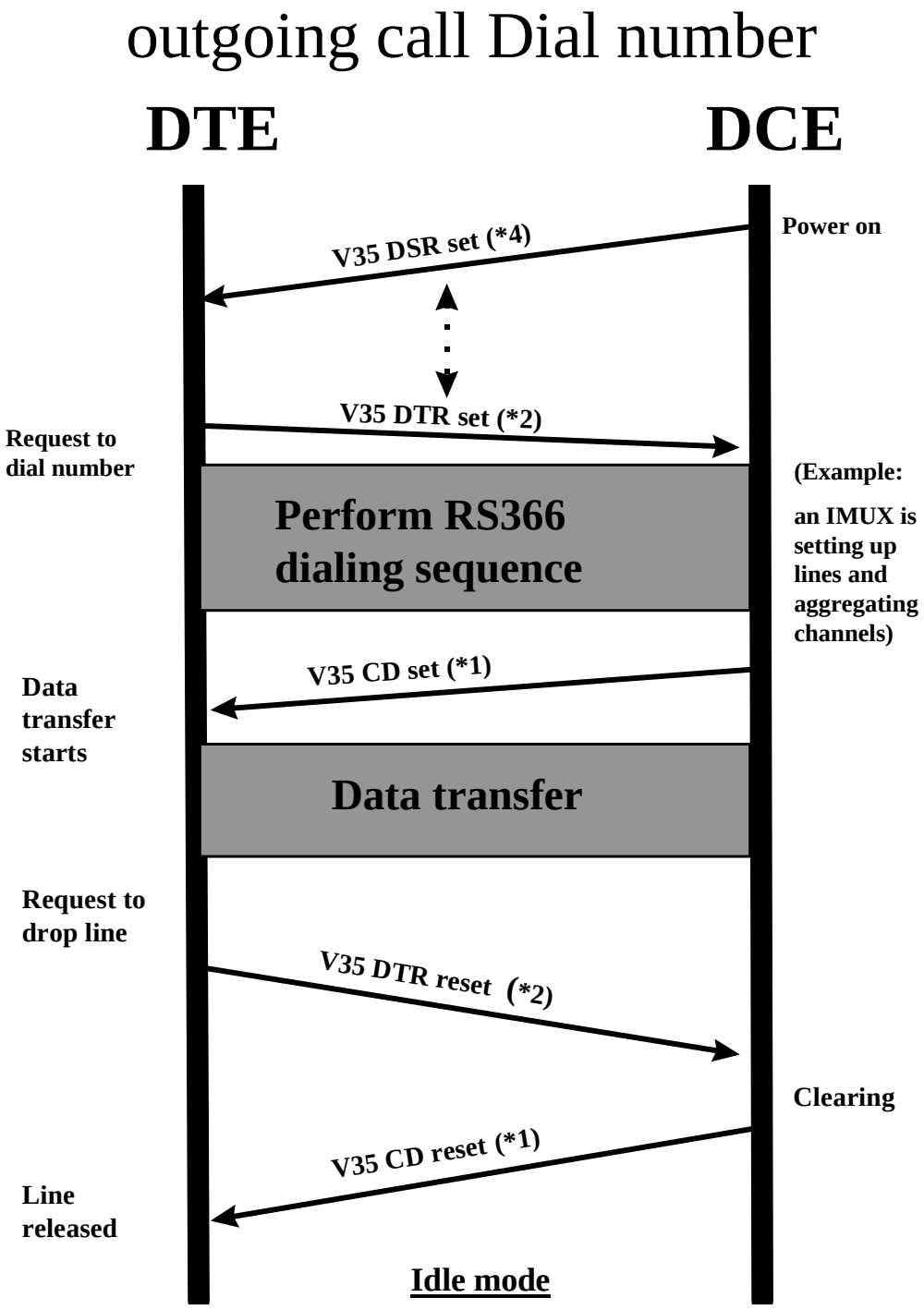
11.1 Leased line incoming call protocol



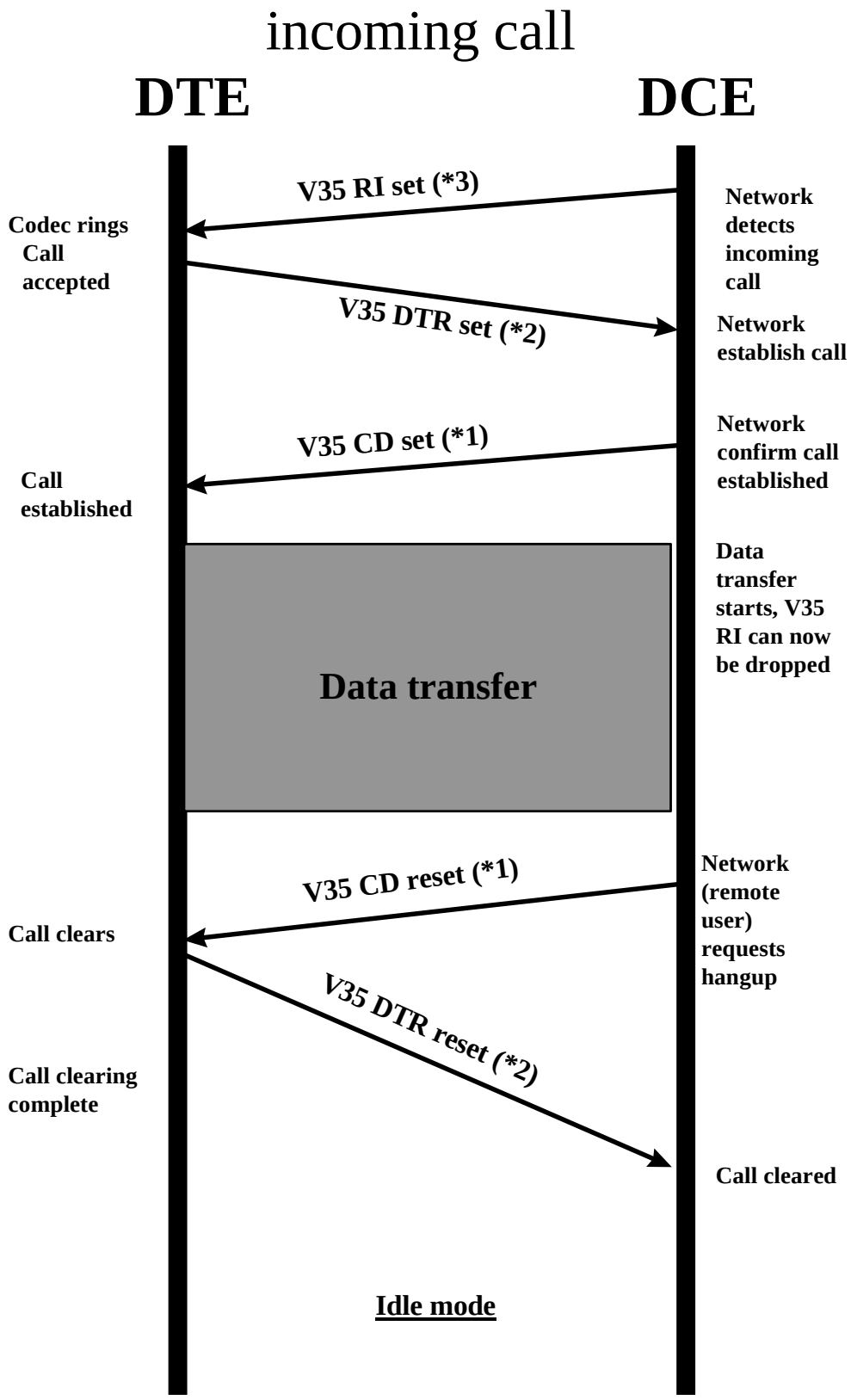
11.2 Leased Line outgoing Call protocol



11.3 RS366 Dialling protocol



11.4 Incoming call using Ring Indicator, Available when RS366 dialling protocol is selected.



12. Plugs and connectors, ordering information

- Net plug on Codec end is a male 26 pin High Density D-Sub
- **Net plug at Cable side is a female 26 pin High Density D-Sub**
- Cable type: Shielded (Shield Ground can be connected to both ends or only one end as our equipment is connected to common ground inside. The number of pairs in the cable can vary depending on your connectivity and use of signals. Refer to the manual for external equipment for proper pin assignment and connections.

12.1 Ordering information:

12.1.1 ELFA Skandinavia AS

Order phone: +46 8 580 941 00 (in scandinavia: 800 10 135)
Ord
er fax: +46 8 580 943 00 (in scandinavia: 800 10 136)
Internett: http://www.elfa.se/ (E-mail: order @ elfa.se)
Part No: 44-071-36 female 26 pin High Density D-Sub