



# **T**ELENOR

# **S**PECIFICATION

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## **Access to 64kbit/s and Nx64kbit/s digital leased circuits. Specification of the network side of the user-network interface.**

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**Abstract** : Specification describing the network side of the user-network interface of 64 kbit/s and Nx64 kbit/s digital leased circuits.

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## 1 Scope

This specification summarises technical requirements for the interface between data terminal equipment (DTE) and data communication equipment (DCE) to be used on 64 and Nx64kbit/s digital leased circuits with V-type, X-type and G.703 interface. This interface is shown in figure 1.1

User                      Interface to telecommunication network

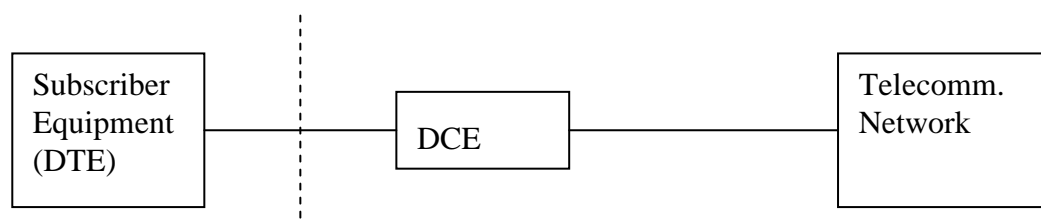


Figure 1.1 Interface between subscriber and network

This specification shall ensure that the equipment neither interfere with other telecommunication services nor damages the telecommunication network. The specification also gives electrical and mechanical requirements for the interface.

Telenor does not require the verification of compliance of a given DTE with the technical requirements contained herein as a prerequisite for attachment to their network(s).

This specification does not place any obligation on Telenor to automatically provide any particular type of DCE.

## 2 References

- [1] ITU-T V.10 - Electrical characteristics for unbalanced double current interchange circuits for general use with integrated circuit equipment in the field of data communications.
- [2] ITU-T V.11 - Electrical characteristics for balanced double current interchange circuits for general use with integrated circuit equipment in the field of data communications.

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- [3] ITU-T V.24 - List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)
  - [4] ITU-T V.28 Electrical characteristics for unbalanced double current interchange circuits.
  - [5] ITU-T V.35 Data transmission at 48 kilobits per second using 60 – 108 kHz group band circuits.
  - [6] ITU-T V.36 Modems for synchronous data transmission using 60 – 108 kHz group band circuits.
  - [7] ITU-T V.54 Loop test devices for modems.
  - [8] ITU-T X.24 List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) on public data networks.
  - [9] ITU-T G.702 Digital hierarchy bit rates.
  - [10] ITU-T G.703 Physical/electrical characteristics of hierarchical digital interfaces.
  - [11] ITU-T G.706 Frame alignment and cyclic redundancy check (CRC) procedures relating to basic frame structures defined in recommendation G.704.
  - [12] ITU-T G.821 Error performance of an international digital connection
  - [13] ITU-T G.823 The control of jitters and wander within digital networks which are based on the 2048 kbit/s hierarchy.
  - [14] ITU-T K31: "Bonding configurations and earthing of telecommunication installations inside a subscriber's building" (1993-03)
  - [15] ITU-T K20: "Resistibility of telecommunication switching equipment to overvoltages and overcurrents" (1996-10)
  - [16] ITU-T K15: "Protection of remote-feeding systems and line repeaters against lightning and interference from neighbouring electricity lines" (1988-11)
  - [17] ITU-T K21: Resistibility of subscribers' terminal to overvoltages and overcurrents" (1996-10)
- EN60950: "Safety of information technology equipment including electrical business equipment" (1992)
- EN 41003: "Particular safety requirements for equipment to be connected to telecommunication networks" (1991-05)
- NEK-EN 60 950: Safety of information technology equipment, including electrical business equipment

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NEK-EN 41 003: Particular electrical safety requirements for equipment to be connected to telecommunications networks.

1.431 Primary rate user-network interfaces – layer 1 specification.

ISO-standards:

2110 Data communication – 25-pin DTE/DCE interface connector and pin assignment.

4902 Data communication – 37 pin DTE/DCE interface connector and pin assignments.

4903 Data communication – 15 pin DTE/DCE interface connector and pin assignments.

2593 Data communication – 34 pin DTE/DCE interface connector and pin assignments.

ETSI ETR 055 – Draft ETSI technical requirements for data terminal equipment for connection to high-speed digital fixed-connection services.

### 3 Definitions.

In this specification a 64 and Nx64kbit/s circuit is defined as a circuit with a digital interface and not normally connected to a public switched network. N will be an integer from 1 to 31, The transfer speed will be from 64kbit/s to 1984kbit/s.

The abbreviation DCE (Data Circuit Equipment) is used synonymous with the abbreviation NTE (Network Terminating Equipment).

- AIS, “Alarm indicating signal”. Alarm signal sent downstream to indicate faulty 2048 kbit/s signal (all bits set to “1”).
- UI, Unit interval, (488 ns for a 2048 kbit/s signal)

### 4 General requirements

A 64 or Nx64kbit/s digital leased (Digital 64K or Nx64K)

- is only used as a full duplex point to point circuit
- can be supplied with two different V-type interfaces: V.35 or V.36 (V.11)
- can be supplied with X-type interfaces, ITU-T Rec. X.21 Electrical
- can be supplied with G-type interfaces, ITU-T Rec. G.703
- as an exception 64 kbit/s can be supplied with V-type interface V.24

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- V.35 can be found in ITU-T Red Book (1985)
- the V.35 interface is supplied with UNC 6-32 double threads and 1.57 mm castings
- Equipment according to Rec. V.35 is often furnished with more interchange circuits than specified in V.35 or this specification
- as an exception V.35 can be supplied with 25 pin D-type (ISO210) female connector when multiplexer is installed in customers premises
- Signalling using circuit 105 – 109 is possible with V-type interface, for X-type the circuits C and I are used.
- Only timing and data circuits are mandatory, control circuits may be supplied optionally
- Local loop and remote loop can be activated from the DCE or via interface circuits, see ITU-T Rec. V.54, but loop settings can only be set from the DCE if X.21 interface is used
- loop setting in Rec. V.36 differs from Rec. V.11 Electrical specifications are according to V.28, not V.10,
- timing signals are normally generated by the DCE (circuit 114)

## **5 The V.35 interface**

### **5.1 General**

This interface is described in CCITT Rec. V.35 which gives the electrical requirements and which interchange circuits to be supplied according to Rec. V.35 in a partly balanced interface for data rates above 20 kbit/s. The data and timing circuits are balanced according to Rec. V.35, but the control circuits are unbalanced according to Rec. V-24/V.28. One pair of lines is used for each of the data and timing circuits, the control circuits are referred to signal ground.

Note: ITU-T's opinion is that V.35 is obsolete. The interface is not recommended for new designs.

### **5.2 Connection requirements**

The interface connector is described in ISO 2593 (1973). A 34 pin female connector, which is also specified in MIL spec. MIL-C-28748, Connector, 34 pins, is used in the DCE.

The pin diameter in the connector shall be 1.57 mm. Double threaded UNC 6-32 locking screws are used. The figure below shows the V.35 connector.

### **5.3 Signal levels and impedance's**

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ITU-T Rec. V.35, Appendix II, gives signal levels and impedance's. A summary is included here:

The input impedance for the equipment connected to the interface shall be  $100 \Omega \pm 10 \Omega$ . The source impedance shall be in range  $50 \Omega$  to  $150 \Omega$ . The resistance between short-circuited terminals and circuit 102 shall be  $150 \Omega \pm 15 \Omega$ .

A short-circuit between any circuit shall damage neither the DCE nor the DTE.

The following apply to the data circuits:

“1” if  $A < B$                       A and B refer to the voltages  
“0” if  $A > B$                       on the pair on the wires.

The voltage between the two wires shall be  $0.55 \text{ V} \pm 20 \%$ . The arithmetic mean of the offset voltage with respect to circuit 102 should not exceed  $0.6 \text{ V}$ .

Signalling on the control circuits is done by positive and negative voltage levels referred to circuit 102. The following apply to control circuits with levels according to V.28:

“OFF” in the voltage level range from  $-25$  to  $-3 \text{ V}$ .  
“ON” in the voltage level range from  $+25$  to  $+3$ .

At normal load resistance the voltage shall be less than  $15 \text{ V}$  in magnitude.

The interface cable should have characteristic impedance between  $80$  and  $120 \Omega$ .

#### 5.4 Interchange circuits

The table below lists the circuits which can be used in the Telenors DCE. The table contains more circuits than described in ITU-T Rec. V.35.

Terminal (DTE)	Signal Direct.	Modem (DCE)	ITU-T Circuit no.
*	→	P	103 A Transmit Data
*	→	S	103 B
-----			
*	←	R	104 A Receive Data
*	←	T	104 B
-----			
£	→	C	105 A Request to send
-----			
£	←	D	106 A Clear to send

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£	←	E	107 A	Data set ready
£	→	H	108 A	Connect data set to line
£	←	F	109 A	Data carrier detect
\$	→	U	113 A	Transmitter signal element
\$	→	W	113 B	timing to DCE
\$	←	Y	114 A	Transmitter signal element
\$	←	AA	114 B	timing to DTE
*	←	V	115 A	Receiver signal element
*	←	X	115 B	timing to DTE
£	→	N	140 A	Loopback/maintenance test
£	→	L	141 A	Local loopback
£	←	NN	142 A	Test indicator
£	—	A		Protective ground
*	—	B	102	Signal ground or common return



Pin allocation in the DCE interface connector

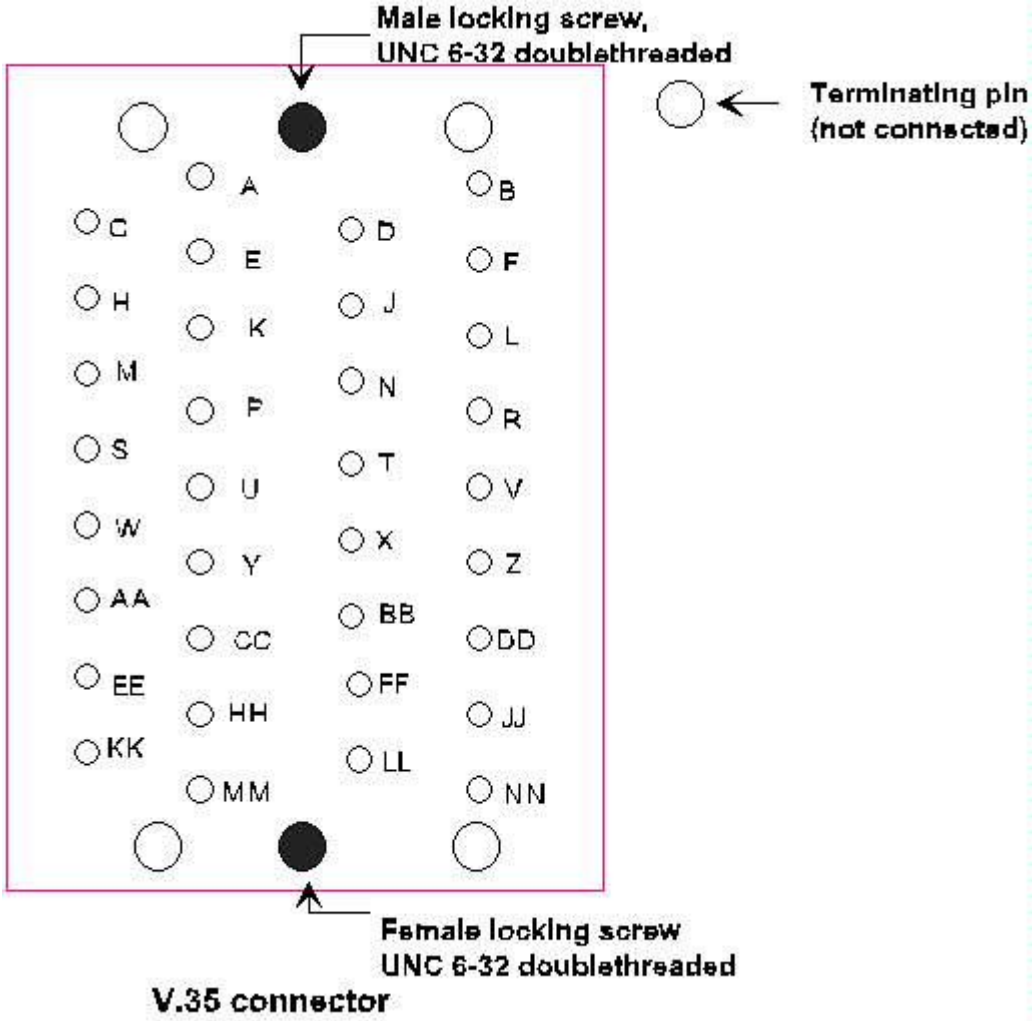
\* = Mandatory circuit

£ = Optional circuit, dependent of type of DCE or connection

\$ = Both circuit 113 and 114 may be used dependent of type of connection. Circuit 114 should normally be used. If circuit 113 is used, it should be derived from circuit 115 in the DTE.



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As an

**6 The V. 36 Interface**

**6.1 General**

ITU-T Rec. V.36 describes a balanced interface for data rates above 48 kbit/s. One pair of wires are used for each of the data and timing circuits, and for all the control circuits except the loop setting circuits. The electrical requirements are according to V.11, however for test loop activation V.10 apply. Please note that Telenors differs from V.36 by using V.28 instead of V.10. Loop settings in the NTE are according to Rec. V.54.

**6.2 Connections requirements**

The interface connector is describes in ISO 4902. A 37 pin female connector is used in the DCE.

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### 6.3 Signals levels and impedance's, V.11

ITU-T rec. V.11 gives signal levels and impedance's used at the V.36 interface. V.11 deals with the electrical characteristics of the generator, receiver and interconnecting leads of a differential signalling (balanced) interchange circuit with data signalling rates up to 10Mbit/s. A summary is included here:

The magnitude of the open circuit voltage from the generator shall not be more than 6V. The source impedance shall be in range 50  $\Omega$  to 100  $\Omega$ . The input impedance for the equipment connected to the interface shall be > 100  $\Omega$ .

A short-circuit between any circuit shall damage neither the DCE nor the DTE.

### 6.4 Interchange circuits

Interchange circuits to be provided mandatory or optionally are listed below.

The table contains more circuits than described in ITU-T Rec. V.36.

Terminal (DTE)	Signal Direct.	Modem (DCE)	ITU-T Circuit no.
*	→	4	103 A Transmit Data
*	→	22	103 B
-----			
*	←	6	104 A Receive Data
*	←	24	104 B
-----			
£	→	7	105 A Request to send
£	→	25	105 B
-----			
£	←	9	106 A Clear to send
£	←	27	106 B
-----			
£	←	11	107 A Data set ready
£	←	29	107 B
-----			
£	←	13	109 A Data carrier detect
£	←	31	109 B
-----			
\$	→	17	113 A Transmitter signal element
\$	→	35	113 B timing to DCE

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\$	←	5	114 A Transmitter signal element
\$	←	23	114 B timing to DTE
-----			
*	←	8	115 A Receiver signal element
*	←	26	115 B timing to DTE
-----			
£	→	14	140 A Loopback/maintenance test
£	→	32	140 B
-----			
£	→	10	141 A Local loopback
£	→	28	141 B
-----			
£	←	18	142 A Test indicator
£	←	36	142 B
-----			
*		19	102 Signal ground or common return
-----			
		↑	
Pin allocation in the DCE interface connector			

\* = Mandatory circuit

£ = Optional circuit, dependent of type of DCE or connection

\$ = Both circuit 113 and 114 may be used dependent of type of connection. Circuit 114 should normally be used. If circuit 113 is used, it should be diverted from circuit 115 in the DTE.

All circuits in ITU-T rec. V.36 are implemented in Telenors DCE.

## 7 The X.21 Interface.

### 7.1 General

ITU-T rec. X.21 describes a balanced interface between data terminal equipment (DTE) and data terminal equipment (DCE) for synchronous operation on public data networks based on line switching. X.21 is a very long and complicated document. From the complete X.21 documentation, only the parts regarding the physical interface are needed for digital fixed point to point communication. One pair of wires is used for each of the data and timing circuits, and for the control circuits.

The electrical requirements are according to V.11.

ITU-T Rec. X. 24 defines the different interface circuits and the use between NTE and DTE.

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## 7.2 Connection requirements

The interface connector is described in ISO 4903. A 15 pin female connector is used in the DTE.

## 7.3 Signal levels and impedance's, V.11.

ITU-T Rec. V.11 gives signal levels and impedance's used at the X.21 interface. V.11 deals with the electrical characteristics of the generator, receiver and interconnecting leads of a differential signalling (balanced) interchange circuit with data signalling rates up to 10Mbit/s.

The magnitude of the open circuit voltage from the generator shall not be more than 6 V. The source impedance shall be in the range 50  $\Omega$  to 100  $\Omega$ . The input impedance for the equipment connected to the interface shall be > 100  $\Omega$ .

A short-circuit between any circuit shall damage neither the DCE nor the DTE.

## 7.4 Interchange circuits

Interchange circuits to be provided mandatory or optionally are listed below.

Terminal (DTE)	Signal Direct.	NTE (DCE)	ITU-T Circuit no.
*	→	2	T (A) Transmit Data
*	→	9	T (B)
*	←	4	R (A) Receive Data
*	←	11	R (B)
£	→	3	C (A) C = Control
£	→	10	C (B) (Request to send)
£	←	5	I (A) I = Indication
£	←	12	I (B) (Data carrier detect)
*	←	6	S (A) S = Signal element timing
*	←	13	S (B)
*		8	G G = Signal ground



Pin allocation in the DCE interface connector

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\* = Mandatory circuits

£ = Optional circuit, dependent of type or DCE or connection.

All circuits in ITU-T Rec. X.21 mentioned above are implemented in Telenors DCE. Signal levels on T and R indicates “0” and “1”, on C and I “ON” and “OFF”.

Functionally there are agreement between X.24 circuits C and I with corresponding V.24 circuits 105 and 109.

## **8 The G.703 64/2048 KBIT/S interface**

### **8.1 General description**

ITU-T Rec. G.703 clause 2 describes a balanced interface for data rate 64 kbit/s and clause 6 for 2048 kbit/s. The user interface will normally be 120Ω with nominal peak voltage 3 V, but can as an exception be delivered as 75Ω.

### **8.2 Connection requirements**

The 120Ω interface is delivered on an external terminal block with screw/knife terminals or on an external RJ45 connector.

Pin allocation for RJ45 external connector

Pin number.	Function
1	Send. Signal from Telenor equipment
2	Send. Signal from Telenor equipment
3	Not in use
4	Receive. Signal from DTE
5	Receive. Signal from DTE
6	Not in use
7	Not in use
8	Not in use

External RJ45 connector

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### 8.3 75 ohm connectors

This interface is delivered on a IEC 169-13 connector (Siemens connector).

### 8.4 Functional characteristics

The delivery of n\*64 kbit/s structured is according to ITU-T G.703 and ITU-T G.704.

## 9 Electrical environmental requirements

### 9.1 General

Below requirements are given for the equipment's safety, resistibility against high voltages and currents from the signal line and from the mains, for the emission of electromagnetic fields and for the immunity against electromagnetic fields.

### 9.2 Safety requirements

The equipment shall satisfy the safety requirements given in Norwegian Norm NEK-EN 60 950: "Safety of information technology equipment, including electrical business equipment", and NEK-EN 41 003: "Particular electrical safety requirements for equipment to be connected to telecommunications networks".

The requirements given in NEK-EN 60 950 and NEK-EN 41 003 are authorised by law, and shall be satisfied for all relevant equipment.

### 9.3 Resistibility and overvoltage protection

Equipment connected to the interface shall be in accordance with [7] ITU-T K20 and [8] ITU-T K15.

### 9.4 Electromagnetic Compatibility (EMC)

The EMC requirement for the equipment ports is given in [2] EN 300 386-2, subclass 5.2.3: "Other than telecommunication centres, ports for indoor signal lines"



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## **ANNEX 1: Table ITU-T V-type V.24 versus Bell RS232**

ITU-T Rec. V.24 describes the individual interface circuits and the use of them between the DCE and DTE. Some of these interchange circuits are listed below and compared with US standard RS232.

Table: V.24 – RS 232

<u>ITU-T V.24</u>	<u>EIA RS-232C</u>	<u>Signal name</u>
(101)*	AA	Protective ground
102	AB	Signal ground
103	BA	Transmitted data
104	BB	Received data
105	CA	RTS – request to send
106	CB	CTS – Clear to send
107	CC	DSR – Data set ready
108/1		CDS – Connect dataset to line
108/2	CD	DTR – Data terminal ready
109	CF	DCD – Data carrier ready
110	CG	SQD – Signal quality detector
111	CH	DRS – Data signalling rate selector
113	DA	Transmit clock (DTE source)
114	DB	Transmit clock (DCE source)
115	DD	Receive clock
118		Transmitted backward channel data
119		Received backward channel data
120		Transmit backward channel line signal
121		Backward channel ready
125	CE	RI – Calling indicator

\* Deleted from Rec. V.24

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**ANNEX 2: V.35 IEC interface with 25 pin D-type connector**

**V.35 IEC connector pin assignment**

Pin number	CCITT V.35 circuit number	Signal level
1	---	
7	102	
2	103A	V.35
14	103B	
3	104A	V.35
16	104B	
4	105	V.28
5	106	V.28
6	107	V.28
8	109	V.28
20	108	V.28
24	113A	V.35
11	113B	
15	114A	V.35
12	114B	
17	115A	
9	115B	V.35
21	140	V.28
18	141	V.28
25	152	V.28