

**Recommendation T/CD 01-08 E (Ostende 1979, revised at Cannes 1983)
concerning the engineering requirements for a parallel data transmission modem for use in the general
switched telephone network**

Recommendation proposed by Working Group T/WG 10 "Data Communications" (CD)

Text of the revised Recommendation adopted by the "Telecommunications" Commission:

"The Conference of European Post and Telecommunications Administrations,

Considering

- that Recommendation T/CD 01-01 contains the text of the Specifications of the general engineering requirements for data circuit terminating equipment for analogue and digital networks;
- that working group CD has studied the harmonization of modems under the auspices of Question CD 1.

Recommends

- that the attached Specification of engineering requirements for a parallel data transmission modem for use in the general switched telephone network as contained in Annex I to this Recommendation should be taken into account by all CEPT Administrations when implementation of such a piece of equipment is being planned by Administrations."

Administrations are free to stipulate additional requirements, and also which of the optional requirements, if any, are to be provided.

Note 1: The Specification is subject of continuous study and possible amendment.

Note 2: The Annex is an integral part of the Recommendation.

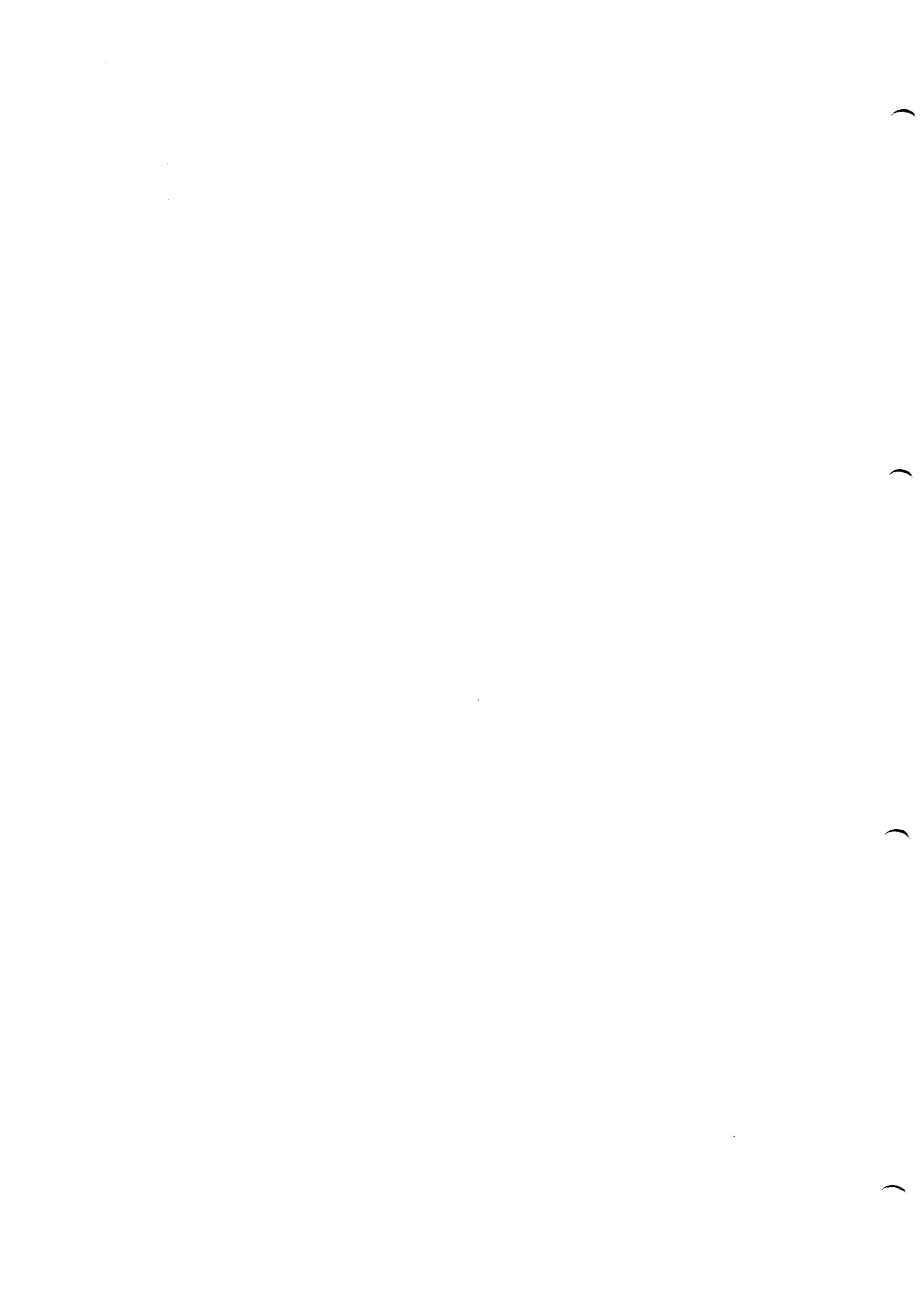
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Section B. *Network dependent requirements*

No specific requirements.

Parts of this specification which are literally copied from CCITT-Recommendations, are marked with a line in the margin of the paper. Sections which need further study, are marked with an asterisk.



Section A. *Common requirements*

1. GENERAL

The modems for parallel data transmission for one-way data transmission, where a large number of low-cost sending stations (outstations) transmit to a central receiving station (instation) are intended for use in the general switched telephone network only.

The modems must meet the requirements given in the Specification of the general engineering requirements (Recommendation T/CD 01-01) and in this specification. They must comply with CCITT Recommendations V.20, V.24/V.28 and V.31.

The main characteristics of these recommended modems (outstation modem/instation modem) for parallel data transmission are as follows:

- (a) transmission of 16-character combinations
 - (b) transmission of 64-character combinations
 - (c) transmission of 256-character combinations
 - (d) transmission of simple acknowledgement signals or analog signals (voice-answering) from the instation to the outstation.
-] from outstation to instation;

The parallel data transmission system uses two or three times one out of four frequencies.

2. DATA SIGNALLING RATES

The modulation rate is up to 40 characters per second. In the 16-character combination system the data signalling rates shall be up to 20 or up to 40 characters per second, in the other combination systems the data signalling rates shall be up to 20 characters per second.

3. INTERFACES

3.1. Instation modem interface

The interchange circuits to be used are given in the list below.

List of interchange circuits:

- 102 Signal ground or common return.
- 104 Received data, 12 or 8 circuits depending on whether group B is used or not. These received data circuits are designated A1, A2...C4, each corresponding to its relevant frequency (see Table 1).
- 105 Request to send (see *Note 2*).
- 107 Data set ready.
- 108/1 Connect data set to line
- 108/2 Data terminal ready] (see *Note 1*).
- 109 Data channel received line signal detector.
- 118 Transmitted backward channel data (see *Note 2*).
- 120 Transmit backward channel line signal (see *Note 2*).
- 121 Backward channel ready (see *Note 2*).
- 125 Calling indicator.
- 130 Transmit backward tone (see *Note 3*).
- 191 Transmitted voice answer (see *Note 4*).
- 110 Data signal quality detector.
- 124 Select frequency groups.
- 131 Received character timing.

Note 1: These circuits shall be capable of being used as circuits 108/1: Connect data set to line or circuit 108/2: Data terminal ready, depending upon its use. For automatic calling it shall be used as 108/2.

Note 2: These circuits are required if the 75 bit/s frequency modulated backward channel is provided in the modem (see also *Note 4*).

Note 3: This circuit is required if the 5 bit/s amplitude modulation backward channel is provided in the modem.

Note 4: The pin allocation on the interface connector is the same for circuits 191A and 121 and 191B and 118, respectively. If both, the speech channel and the 75 bit/s backward channel shall be provided in the modem, means have to be provided to switch between those circuits.

The functions of the above interchange circuits are defined in the Specification of the general engineering requirements (Recommendation T/CD 01-01) and comply with CCITT Recommendation V.24.

3.1.1. *Interchange circuit connector*

The allocation of the interchange circuits to pins of the connector is in conformance with ISO Standard 2110.

It is given in Figure 1.

3.1.2. *Electrical characteristics*

The electrical characteristics of the above interchange circuits are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01) and comply with CCITT Recommendation V.28.

3.1.3. *Electrical characteristics of interchange circuit 191*

The impedance and transmitter requirements must comply with the line requirements for the modem, which are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

3.2. **Outstation modem interface**

The interchange circuits to be used are given in the list below.

List of interchange circuits:

- 102 Signal ground or common return (see *Note 2*).
- 103 Transmitted data (nine or six circuits depending on whether group B is used or not). These circuits are designated A1, A2...C3, each corresponding to its relevant frequency (see Table 1).
- 105 Request to send.
- 107 Data set ready.
- 108/1 Connect data set to line
- 108/2 Data terminal ready] (*Note 1*).
- 119 Received backward channel data (*Note 3*).
- 122 Backward channel received line signal detector (*Note 4*).
- 125 Calling indicator.
- 129 Request to receive.

Note 1: This circuit shall be capable of being used as circuit 108/1 "Connect data set to line" or circuit 108/2 "Data terminal ready". For automatic calling it shall be used as 108/2.

Note 2: The transmitted data circuits (103) will all use the same common return (102). The control circuits may operate each on their own return circuit.

Note 3: The pin allocation on the modem interface connector is the same for circuits 192 and 119. If both, the speech channel and the 75 bit/s backward channel shall be provided in the modem, means have to be provided to switch between those circuits.

Note 4: This circuit carries the data of the 5 bit/s amplitude modulated backward channel, if provided.

Correspondence for each group

At outstation closing of circuit	Number of the channel on line	At instation negative polarity on circuit
1	1	1
2	2	2
3	3	3
None	4	4

Not more than one circuit per group may be closed at a time.

3.2.1. *Interchange circuit connector*

The allocation of the interchange circuits to pins of the connector is in conformance with ISO Standard 2110.

It is given in Figure 2.

3.3. **Electrical characteristics**

The electrical characteristics of the above interchange circuits are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01) and comply with CCITT Recommendation V.31, except circuit 119.

The electrical characteristics for this interchange circuit are for further study.

4. **MODULATION AND CODING**

Data channels

Channel Group	1	2	3	4
A	920 Hz	1,000 Hz	1,080 Hz	1,160 Hz
B	1,320 Hz	1,400 Hz	1,480 Hz	1,560 Hz
C	1,720 Hz	1,800 Hz	1,880 Hz	1,960 Hz

Table 1.

For the 16-character system only groups A and C are used.

During the time no input data circuits are operated rest frequencies are sent to the line; the highest frequency in each group is recommended to be the rest frequency.

5. **SCRAMBLING:** not provided for.

6. **TIMING**

In the 16-character system for the signalling rate up to 40 characters per second the timing channel shall consist of the frequencies $F_{B2} = 1,400$ Hz and $F_{B3} = 1,480$ Hz.

In the 256-character system this timing channel shall be used to identify the two halves of an 8 bit character ($2^8 = 16 \times 16$). The higher frequency is transmitted simultaneously with the first half of the character. No timing channel is provided in the 16-character and the 64-character combination systems for the signalling rate up to 20 characters per second.

7. **BACKWARD CHANNEL**

For the backward channel two non-exclusive options exist.

7.1. **Amplitude modulated 5 bit/s backward channel**

The frequency of the amplitude modulated backward channel for audible and electrical signalling shall be 420 Hz. This tone may be amplitude modulated at rates of up to 5 bit/s.

7.2. **Frequency modulated 75 bit/s backward channel**

The modulation rate and characteristic frequencies for this backward channel are as follows:

F_Z	F_A
(Symbol 1, mark)	(Symbol 0, space)
420 Hz	480 Hz

Modulation rate up to 75 bauds.

In the absence of any signal on the backward channel interface, the condition Z signal is to be transmitted.

The frequency modulated backward channel can be used simultaneously with the forward data frequencies.

8. **LINE SIGNAL CHARACTERISTICS**

The transmit power levels shall be adjustable as indicated in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

8.1. **Data channels**

The frequencies of the groups are transmitted parallel, the line signal consists of one and only one frequency of every group. Depending which combination system is used the line signal consists either of two frequencies (of groups A and C) or of three frequencies (of group A, B and C). In both cases the transmit power level shall be the same.

The tolerances on the data frequencies should be ± 4 Hz.

The tolerance on the level difference of the single frequencies should be less than 1,0 dB.

8.2. Backward channel

Provision shall be made for the following facilities:

- (a) a speech channel non-simultaneous with forward data;
- (b) an amplitude modulated 5 bit/s backward channel for audible signals or/and electrical signalling (see Section A 7.1.);
- (c) a frequency modulated 75 bit/s backward channel for electrical signalling (see Section A 7.2.).

For the speech channel the signal specifications shall be the same as for the telephone channel indicated in the Specification of the general engineering requirements (Recommendations T/CD 01-01). The tolerances on the backward channel frequencies (420 Hz, 480 Hz) should be ± 4 Hz.

8.3. Threshold levels

8.3.1. Threshold levels of the data channel received signal detector

When the level of the received signal in group C exceeds -49 dBm, circuits 109 shall be ON. When the level of this received signal is less than -54 dBm, circuit 109 shall be OFF. The detector circuit which causes circuit 109 to turn ON or OFF shall exhibit hysteresis action such that the level at which the OFF to ON transition occurs shall be at least 2 dB greater than that for the ON to OFF transition.

Group C was chosen for this purpose because it is the most critical from a received level point of view.

8.3.2. Threshold levels of the backward channel

The expected minimum level for the amplitude modulated backward channel is -43 dBm for the 420 Hz.

Level of the received line signal of the frequency modulated backward channel:

greater than -43 dBm circuit 122 ON;
less than -48 dBm circuit 122 OFF.

The condition of circuit 122 for levels between -43 dBm and -48 dBm is not specified except that the signal detectors shall exhibit a hysteresis action such that the function OFF to ON transition occurs is at least 2 dB greater than that for the ON to OFF transition.

9. OUT-OF-BAND INTERFERENCE

The limits of the line signal spectrum shall conform to the requirements indicated in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

10. PERFORMANCE REQUIREMENTS

The performance of the equipment will be evaluated by testing in accordance with the Specification for the general engineering requirements (Recommendation T/CD 01-01). In addition to those requirements the following requirements regarding error rate limits and parallel distortion limits apply.

The character error rate under GSTN test conditions shall be less 10^{-5} .

The parallel distortion, that means the time difference of the demodulation in the single frequency groups shall be less 2 ms.

11. TESTING AND MEASURING REQUIREMENTS

To be able to find the source of errors during a transmission procedure (whether it is in the modem or on the line or in the data terminal equipment), the modem shall offer test possibilities.

11.1. Test of the instation modem

The instation modem shall have a unit which—irrespective of whether the data terminal equipment is connected or not—checks the received data signals. If the received data signal is correct, an audible signal is sent to the transmitted station.

11.2. Test of the outstation modem

The test of the outstation modem shall be performed in cooperation with an instation modem.

Irrespective of whether the data terminal equipment is connected to the modem or not, it shall be possible by means of switches

- (a) to transmit the rest frequencies $F_{A4} = 1,160$ Hz and $F_{C4} = 1,960$ Hz in the 16-character combinations system, or $F_{A4} = 1,160$ Hz, $F_{B4} = 1,560$ Hz and $F_{C4} = 1,960$ Hz in all other combination systems, and
- (b) to switch on the receiver and give a visible signal if a backward signal is recognized correctly.

12. **CONSTRUCTION**

12.1. **Instation modem**

The requirements are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

12.2. **Outstation modem**

The size of the modems must be such that they can be placed beneath telephone sets. The modems shall be capable of being sealed.

All functional units of the modem shall be accommodated on one card.

12.3. **Maintenance requirements**

The requirements are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

13. **SPECIFIC DESIGN REQUIREMENTS**

As all functional units of the outstation modem shall be accommodated on one card no specific fixing arrangement shall prohibit the possibility to put this card directly in a suitable place in a DTE or a telephone box.

14. **POWER SUPPLY**

14.1. **Power supply, instation**

Power consumption shall be less than 25 VA.

The requirements are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

14.2. **Power supply, outstation**

The modem of the outstation shall be fed by the telephone battery. The following values are prescribed for loop current and DC resistance:

$$17 \text{ mA} \leq I_L \leq 60 \text{ A}$$
$$R_{DC} \geq 300 \Omega.$$

15. **ENVIRONMENTAL REQUIREMENTS**

The requirements are given in the Specification of the general engineering requirements (Recommendation T/CD 01-01).

Outstation interchange circuits

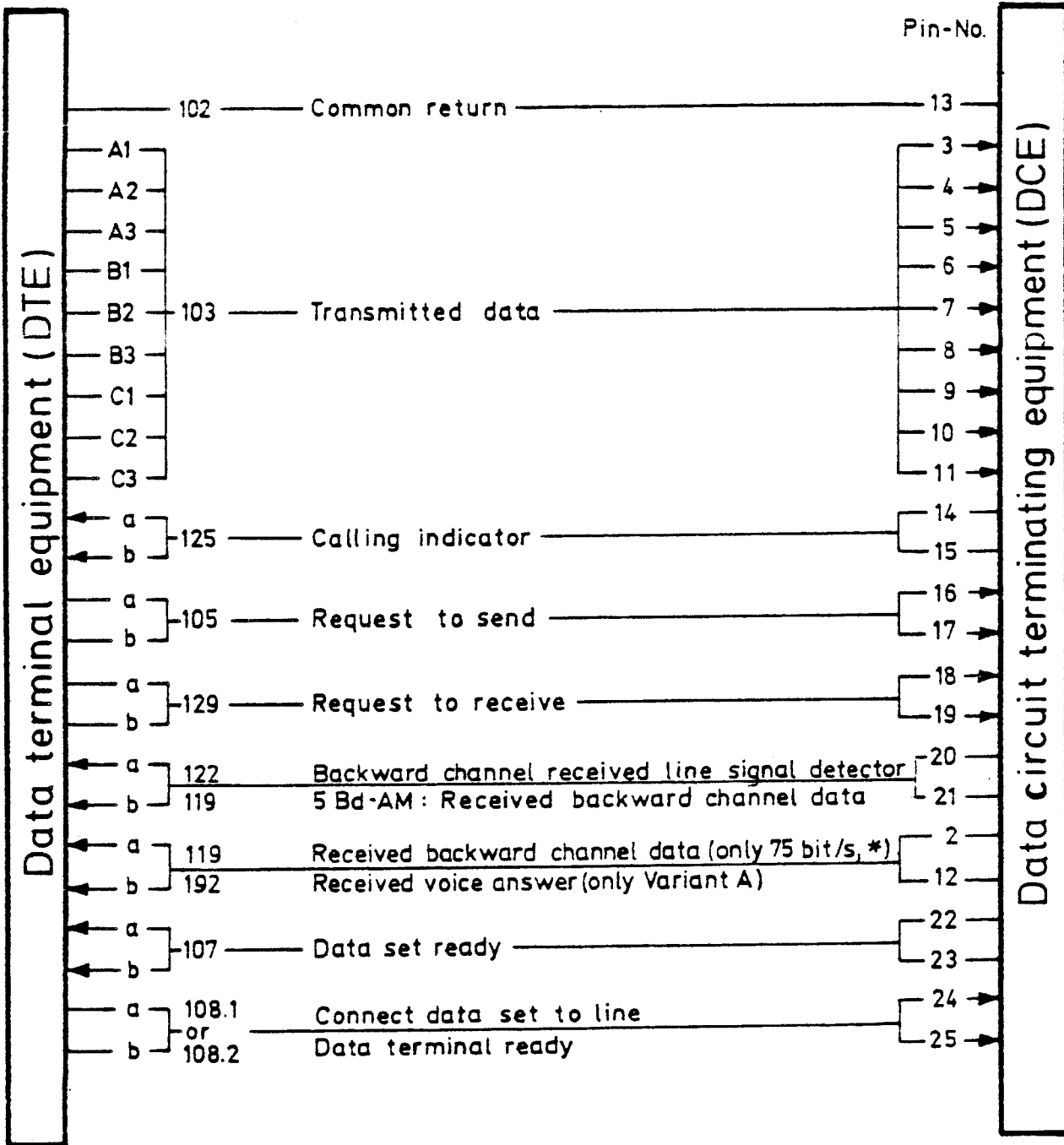


Figure 1.

* Variant B.

Instation interchange circuits

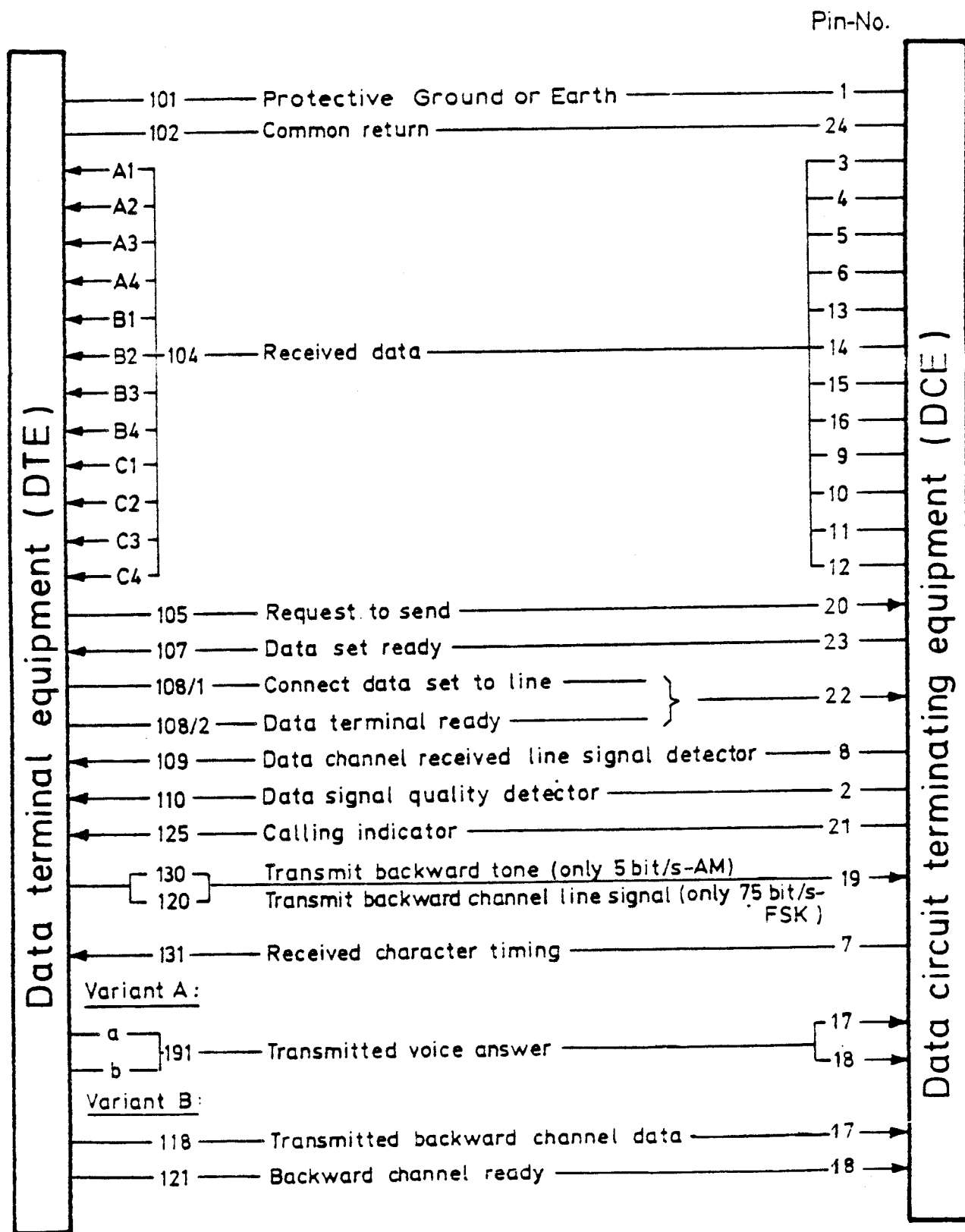


Figure 2.