Recommendation X.24

LIST OF DEFINITIONS FOR INTERCHANGE CIRCUITS BETWEEN DATA TERMINAL EQUIPMENT (DTE) AND DATA CIRCUIT–TERMINATING EQUIPMENT (DCE) ON PUBLIC DATA NETWORKS

(Geneva, 1976; amended at Geneva, 1980, Malaga–Torremolinos, 1984, and Melbourne, 1988)

The CCITT,

considering that

(a) the interface between DTE and DCE on public data neworks requires, in addition to the electrical and functional characteristics of the interchange circuits, the definition of procedural characteristics for call control functions and selection of the facilities according to Recommendation X.2;

(b) the functions of the circuits defined in Recommendation V.24 are based on the requirements of data transmission over the general telephone network and are not appropriate for use at DTE/DCE interfaces in public data networks;

unanimously declares

a Recommendation to include the list of definitions of interchange circuits for use in public data networks is required.

1 Scope

1.1 This Recommendation applies to the functions of the interchange circuits provided at the interface between DTE and DCE of data networks for the transfer of binary data, call control signals and timing signals.

For any type of practical equipment, a selection will be made from the range of interchange circuits defined in this Recommendation, as appropriate. The actual interchange circuits to be used in a particular DCE for a user class of service according to Recommendation X.1 and defined user facilities according to Recommendation X.2, are those indicated in the relevant Recommendation for the procedural characteristics of the interface, e.g., Recommendation X.20 or X.21.

To enable a standard DTE to be developed, the use and termination by the DTE of certain circuits even when implemented in the DCE are not mandatory. This is covered by the individual interface Recommendations.

The interchange circuits defined for the transfer of binary data are also used for the exchange of call control signals.

The electrical characteristics of the interchange circuits are detailed in the appropriate Recommendation for electrical characteristics of interchange circuits. The application of those characteristics for a particular DCE is specified in the Recommendation for the procedural characteristics of the interface.

1.2 The range of interchange circuits defined in this Recommendation is applicable to the range of services which could be offered on a public data network, e.g., circuit switching services (synchronous and start/stop), telex service, packet switching services, message registration and retransmission service and facsimile service.

2 Line of demarcation

The interface between DTE and DCE is located at a connector which is the interchange point between these two classes of equipment shown in Figure 1/X.24.

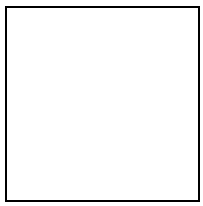

FIGURE 1/X.24 CCITT-38470

2.1 The connector will not necessarily be physically attached to the DCE and may be mounted in a fixed position near the DTE. The female part of the connector belongs to the DCE.

2.2 An interconnecting cable will normally be provided together with the DTE. The cable length is limited by electrical parameters specified in the appropriate Recommendations for the electrical characteristics of the interchange circuits.

3 Definition of interchange circuits

A list of the data network series interchange circuits is presented in tabular form in Table 1/X.24.

TABLE 1/X.24

Data network interchange circuits

Interchange circuit designation	Interchange circuit name	Data		Control		Timing	
		From DCE	To DCE	From DCE	To DCE	From DCE	To DCE
G	Signal ground or common return						
Ga	DTE common return			X			
Gb	DCE common return		X				
T	Transmit		X		X		
R	Receive	X		X			
C	Control				X		
I	Indication			X			
S	Signal element timing					X	
B	Byte timing					X	
F	Frame start identification					X	
X	DTE signal element timing						X

3.1 *Circuit G – Signal ground or common return*

This conductor establishes the signal common reference potential for unbalanced double–current interchange circuits with electrical characteristics according to Recommendation V.28. In the case of interchange circuits according to Recommendations V.10 and V.11, it interconnects the zero volt reference points of a generator and a receiver to reduce environmental signal interference, if required.

Within the DCE, this conductor shall be brought to one point, protective ground or earth, by means of a metallic strap within the equipment. This metallic strap can be connected or removed at installation, as may be required, to minimize the introduction of noise into electronic circuitry or to meet applicable regulations.

Note – Where a shielded interconnecting cable is used at the interface, the shield may be connected either to circuit G, or to protective ground in accordance with national regulations. Protective ground may be further connected to external grounds as required by applicable electrical safety regulations.

For unbalanced interchange circuits with electrical characteristics in accordance with Recommendation V.10, two common–return conductors are required, one for each direction of signalling, each conductor being connected to ground only on the generator side of the interface. Where used, these shall be designated circuits Ga and Gb, and they are defined as follows:

Circuit Ga – DTE common return

This conductor is connected to the DTE circuit common and is used as the reference potential for the unbalanced X.26 type interchange circuit receivers within the DCE.

Circuit Gb – DCE common return

This conductor is connected to the DCE circuit common and is used as the reference potential for the unbalanced X.26 type interchange circuit receivers within the DTE.

3.2 *Circuit T – Transmit*

Direction: To DCE

The binary signals originated by the DTE to be transmitted during the data transfer phase via the data circuit to one or more remote DTEs are transferred on this circuit to the DCE.

This circuit also transfers the call control signals originated by the DTE, to be transmitted to the DCE in the call establishment and other call control phases as specified by the relevant Recommendations for the procedural characteristic of the interface.

The DCE monitors this circuit for detection of electrical circuit fault conditions, according to the specifications of the electrical characteristics of the interface. A circuit fault is to be interpreted by the DCE as defined in the Recommendation for the procedural characteristics of the interface.

3.3 *Circuit R – Receive*

Direction: From DCE

The binary signals sent by the DCE as received during the data transfer phase from a remote DTE, are transferred on this circuit to the DTE.

This circuit also transfers the call control signals sent by the DCE as received during the call establishment and other call control phases as specified by the relevant Recommendations for the procedural characteristics of the interface.

The DTE monitors this circuit for detection of electrical circuit fault conditions, according to the specifications of the electrical characteristics of the interface. A circuit fault is to be interpreted by the DTE as defined in the Recommendation for the procedural characteristics of the interface.

3.4 *Circuit C – Control*

Direction: To DCE

Signals on this circuit control the DCE for a particular signalling process.

Representation of a control signal requires additional coding of circuit T–*Transmit* as specified in the relevant Recommendation for the procedural characteristics of the interface. During the data phase, this circuit shall

remain ON. During the call control phases, the condition of this circuit shall be as specified in the relevant Recommendation for the procedural characteristics of the interface.

Note – After appropriate selection of special user facilities (not yet defined), it might be required to change the ON condition after entering the data phase in accordance with the regulations for the use of these facilities. This subject is for further study.

The DCE monitors this circuit for detection of electrical circuit fault conditions, according to the specifications of the electrical characteristics of the interface. A circuit fault is to be interpreted by the DCE as defined in the Recommendation for the procedural characteristics of the interface.

3.5 *Circuit I – Indication*

Direction: From DCE

Signals on this circuit indicate to the DTE the state of the call control process.

Representation of a control signal requires additional coding of circuit R–*Receive*, as specified in the relevant Recommendation for the procedural characteristics of the interface. The ON condition of this circuit signifies that signals on circuit R contain information from the distant DTE. The OFF condition signifies a control signalling condition which is defined by the bit sequence on circuit R as specified by the procedural characteristics of the interface.

The DTE monitors this circuit for detection of electrical circuit fault conditions, according to the specifications of the electrical characteristics of the interface. A circuit fault is to be interpreted by the DTE as defined in the Recommendation for the procedural characteristics of the interface.

Note – For use with special user facilities (not yet defined) it might be required to use the OFF condition after entering the data transfer phase in accordance with the regulations for the use of these facilities. This subject is for further study.

3.6 *Circuit S – Signal element timing*

Direction: From DCE

Signals on this circuit provide the DTE with signal element timing information. The condition of this circuit shall be ON and OFF for nominally equal periods of time. However, for burst isochronous operations, longer periods of OFF condition may be permitted equal to an integer odd number of the nominal period of the ON condition as specified by the relevant procedural characteristics of the interface.

The DTE shall present a binary signal on circuit T–*Transmit* and a condition on circuit C–*Control*, in which the transitions nominally occur at the time of the transitions from OFF to ON condition of this circuit.

The DCE presents a binary signal on circuit R–*Receive* and a condition on circuit I–*Indication* in which the transitions nominally occur at the time of the transitions from OFF to ON condition of this circuit.

The transition from ON to OFF condition shall nominally indicate the centre of each signal element on circuit R.

The DCE shall transfer signal element timing information on this circuit across the interface at all times that the timing source is capable of generating this information.

3.7 *Circuit B – Byte timing (see Note 2)*

Direction: From DCE

Signals on this circuit provide the DTE with 8–bit byte timing information. The condition of this circuit shall be OFF for nominally the period of the ON condition of circuit S–*Signal element timing* which indicates the last bit of an 8–bit byte and shall be ON at all other times within the period of the 8–bit byte.

During the call control phases, the call control characters and steady state conditions used for all information transfers between the DCE and the DTE, in either direction, shall be correctly aligned to the signals of circuit B.

The DTE shall present the beginning of the first bit of each call control character on circuit T–*Transmit* nominally at the time of the OFF to ON transition of circuit S which follows the OFF to ON transition of circuit B.

A change of condition of circuit C–*Control* may occur at any OFF to ON transition of circuit S, but it will be sampled in the DCE at the time of the OFF to ON transition of circuit B, i.e., for evaluation of the following call control character on circuit T.

The centre of the last bit of each call control character will be presented by the DCE on circuit R–*Receive* nominally at the time of the OFF to ON transition of circuit B.

A change of condition of circuit I–*Indication* will occur nominally at the OFF to ON transition of circuit S which follows the OFF to ON transition of circuit B.

The DCE shall transfer byte timing information on this circuit across the interface at all times that the timing source is capable of generating this information.

Note 1 – During the data transfer phase, DTEs communicating by means of an 8–bit code may utilize the byte timing information for mutual character alignment.

It is a prerequisite for the provision of this feature that character alignment is preserved after the call has entered the data transfer phase and that the alignment obtained at one interface is synchronized to the alignment at the other interface. (This is only possible on some connections.)

Furthermore, where this feature is available, a change of condition on circuit C as defined above may result in an equivalent change in the relative alignment on circuit I at the distant interface.

Note 2 – In some Recommendations for the procedural characteristics of the interface (e.g., X.21), the use and termination of this circuit by the DTE is not mandatory even when implemented in the DCE.

3.8 *Circuit F – Frame start identification*

Direction: From DCE

Signals on this circuit continuously provide the DTE with a multiplex frame start indication when connected to a multiplexed DTE/DCE interface.

The condition on this circuit shall be OFF for the nominal period of one bit, indicating the last bit of the multiplex frame. At other times the circuit shall remain ON.

The first data bit on subscriber channel 1 shall be transmitted or received beginning nominally at the OFF to ON transition of circuit F.

3.9 *Circuit X – DTE transmit signal element timing (see Note)*

Direction: To DCE

Signals on this circuit provide signal element timing information for the transmit direction in cases where circuit S only provides signal element timing for the receive direction. The condition of this circuit shall be ON and OFF for nominally equal periods of time. However, for burst isochronous operations, longer periods of OFF condition may be permitted equal to an integer odd number of the nominal period of the ON condition as specified by the relevant procedural characteristics of the interface.

The DTE shall present a binary signal on the circuit T–*Transmit* and a condition on circuit C–*Control*, in which the transitions nominally occur at the time of the transitions from OFF to ON condition of this circuit.

The transition from ON to OFF condition shall nominally indicate the centre of each signal element on circuit T.

Note – The use and termination of this circuit by the DCE is a national matter.