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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

# ISO RECOMMENDATION R 1745

**BASIC MODE CONTROL PROCEDURES  
FOR DATA COMMUNICATION SYSTEMS**

**1st EDITION**

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## BRIEF HISTORY

The ISO Recommendation R 1745, *Basic mode control procedures for data communication systems*, was drawn up by Technical Committee ISO/TC 97, *Computers and information processing*, the Secretariat of which is held by the American National Standards Institute (ANSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1745, which was circulated to all the ISO Member Bodies for enquiry in December 1968. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

|                |             |                |
|----------------|-------------|----------------|
| Australia      | Israel      | Sweden         |
| Brazil         | Italy       | Switzerland    |
| Canada         | Japan       | Thailand       |
| Czechoslovakia | New Zealand | Turkey         |
| Denmark        | Peru        | United Kingdom |
| France         | Poland      | U.S.S.R.       |
| Germany        | Romania     |                |
| Greece         | Spain       |                |

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

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## BASIC MODE CONTROL PROCEDURES FOR DATA COMMUNICATION SYSTEMS

### INTRODUCTION

#### General

A data communication system may be considered as the ensemble of the terminal installations and the interconnecting network that permits information to be exchanged.

A data link concept is identifiable when considering terminal installations connected to the same network, operating at the same speed, in the same code. Whenever actions on the respective transmission control characters take place, a separation of data links is constituted. Typical examples where this applies are : store and forward switching centres, concentrators, intermediate reformatting and speed-change devices.

The information transfer in a data link is monitored by data link control procedures where some characters, selected within a code set, are given particular meanings according to the transmission phase and are used for various purposes such as to delineate information, to reverse the direction of transmission, to ask questions, to answer, etc.

The data link control procedures are categorized in classes which are referred to as modes of operation. The present considerations relate to one class called "basic mode", which is defined as follows :

In the basic mode all the necessary transmission control information (for example, message framing and supervisory instructions) passing from one station to another is carried over the link by discrete control characters selected from the ten transmission control characters which are defined in the ISO/CCITT 7 bit code (ISO Recommendation R 646). The information exchanges are carried out in the alternate mode on standard communication facilities. The control of the data link is not affected by any characters other than the ten transmission control characters. Other codes than the ISO/CCITT code may therefore be transmitted provided that they do not contain any of the ten transmission control characters in either heading or text. Sequences of transmission control character combinations such as DLE.XXX are not permitted, with the one exception DLE.EOT which is defined as "Disconnect".

Extension of the principles used in the basic mode will lead to the definition of other modes which are presently referred to as

- Extended mode,
- Transparent mode.

The following considerations have been taken into account in developing the rules for the basic mode :

The rules are based on the assumption that one of the stations in each connection would be either a computer or a device capable of handling automatically an exchange of information. The rules are designed to allow the complexity of operation to be increased from a basic level by adding options. These options are designed so that any number of stations can still communicate even though they normally operate at different levels of complexity.

It is desirable to reduce optional features in the ISO Recommendation to a minimum, but still retain a balance between an economic solution for the "low cost systems" and extendability for encompassing more complex systems. The rules may be difficult to implement in very simple systems involving low cost devices and human control. On the other hand, in complex high speed computer links, the rules may seriously restrict the through-put of information. These two cases are regarded as the upper and lower fringes of the present ISO Recommendation and may be the subject of future Recommendations.

With the above considerations, typical limitations of basic mode control procedures are :

- restriction of efficiency by the time delay which is due to the alternate mode of operation;
- single link operation only.

### Communication phases

The following Table shows the various possible phases and sub-phases of a data communication.

Phases 1 and 5, which relate to the establishment and clearing of connections over the general switched network, are under the responsibility of the CCITT and are therefore not covered by this ISO Recommendation.

In each phase, one of the stations directs the operation and is responsible for the continuity of the communication. The other station or stations only react to the actions of the responsible station.

The transmission control characters which are shown alongside the various sub-phases are those which are involved in the basic mode of operation.

EOT is shown in parentheses in Phases 2 and 3 because its use within the phases initiates a changeover to Phase 4.

Table of phases

| Phase                                               |                               | Function              |             | Station's name |            | Transmission control characters<br>used in basic mode |                 | Notes                  |
|-----------------------------------------------------|-------------------------------|-----------------------|-------------|----------------|------------|-------------------------------------------------------|-----------------|------------------------|
|                                                     |                               | Action                | Reaction    | Responsible    | Responsive | Forward                                               | Backward        |                        |
| 1. Establishment of connection over general network | (a) Switching                 |                       |             |                |            |                                                       |                 | CCITT Responsibility   |
|                                                     | (b) Identification            |                       |             |                |            |                                                       |                 |                        |
| 2. Establishment of data link                       | (a) Switching                 | Call                  | Answer      | Calling        | Called     |                                                       |                 | Not covered at present |
|                                                     | (b) Polling                   | Poll                  | Reply       | Control        | Tributary  | (EOT), ENQ                                            | (EOT)           |                        |
|                                                     | (c) Selecting                 | Select                | Reply       | Master         | Slave      | (EOT), ENQ                                            | ACK, NAK, (EOT) |                        |
| 3. Information transfer                             |                               | Transfer              | Supervision | Master         | Slave      | SOH, STX<br>ETB, ETX, (EOT)                           | ACK, NAK, (EOT) |                        |
| 4. Termination                                      | (a) Return to neutral state   | Terminate Interrupt   |             | Master         | Slave      | EOT                                                   | EOT             |                        |
|                                                     | (b) Return to control station | Terminate Interrupt   |             | Master         | Slave      | EOT                                                   | EOT             |                        |
|                                                     | (c) Disconnect                | Disconnect Disconnect |             | Master         | Slave      | DLE, EOT                                              | DLE, EOT        |                        |
| 5. Clearing of connection                           |                               |                       |             |                |            |                                                       |                 | CCITT Responsibility   |



## 1. SCOPE

### 1.1 General

This ISO Recommendation describes the implementation of the ISO/CCITT 7 bit coded character set\* for information interchange on data transmission channels. It also defines the formats of the transmitted messages and the supervisory sequences which are part of the transmission control procedures. It covers the majority of existing data transmission systems and data link configurations used in conjunction with data processing systems.

These control procedures deal with transmission over one link at a time and do not describe the operation of data links in "tandem". They relate to the class of control procedures which is known as the basic mode and apply at the interface between data communication equipment and data terminal equipment.

It is accepted that, in their present form, the control procedures are a framework upon which a system can be built and that, before the successful interconnection of equipment from different supplies can be ensured, it will be necessary to define additional details, such as :

- structure of prefixes or addresses when used;
- "time-out" procedures and the recovery procedures which follow the various time-out conditions.

This ISO Recommendation must be considered in conjunction with the following ISO Recommendations :

- (1) ISO/R 1177, *Character structure for start/stop and synchronous transmission*;
- (2) ISO/R 1155, *The use of longitudinal parity to detect errors in information messages*.

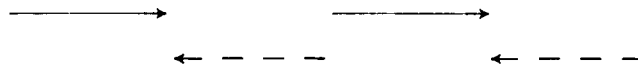
### 1.2 Assumptions

- (1) The information to be transmitted will normally be coded in accordance with the 7 bit ISO/CCITT code.
- (2) All transmission control functions will be performed by the use of ten specific transmission control characters which are defined in this code as TC 1 to TC 10.
- (3) No recommendation is made regarding
  - the technique used (hardware or software);
  - the part of the terminal installation where the information messages and supervisory sequences are generated and recognized.
- (4) Transmission may be at any data transfer rate, either serial or parallel and either start/stop or synchronous.
- (5) Responses to an information message or a supervisory sequence may be either by turn around of the channel or by using another channel.
- (6) The basic mode control procedures are applicable to systems of varied complexity based on either-way transmission using :

- (a) One-way transfer of information with alternate supervision on the same channel



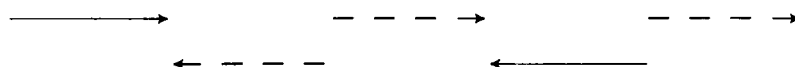
- (b) One-way transfer of information with alternate supervision on a separate channel



- (c) Alternate two-way transfer of information with alternate supervision on the same channel



- (d) Alternate two-way transfer of information with alternate supervision on separate channels



\* See ISO Recommendation R 646, 6 and 7 bit coded character sets for information processing interchange.  
CCITT : Alphabet No. 5.

- (7) The following cases will be the subject of further study :
- (a) One-way transfer of information with simultaneous supervision.
  - (b) Alternate two-way transfer of information with simultaneous supervision.
  - (c) Two-way simultaneous transfer of information with alternate supervision.
  - (d) Two-way simultaneous transfer of information with simultaneous supervision.

## 2. DEFINITIONS OF THE TRANSMISSION CONTROL CHARACTERS

The basic definitions of the ten transmission control characters, as taken from ISO Recommendation R 646, are listed below (see section 5 for description of use).

(TC1) **SOH Start of heading**

A transmission control character used as the first character of a heading of an information message.

(TC2) **STX Start of text**

A transmission control character which precedes a text and which is used to terminate a heading.

(TC3) **ETX End of text**

A transmission control character which terminates a text.

(TC4) **EOT End of transmission**

A transmission control character used to indicate the conclusion of the transmission of one or more texts.

(TC5) **ENQ Inquiry**

A transmission control character used as a request for a response from a remote station – the response may include station identification and/or station status. When a “Who are you” function is required on the general switched transmission network, the first use of ENQ after the connection is established shall have the meaning “Who are you” (station identification). Subsequent use of ENQ may, or may not, include the function “Who are you”, as determined by agreement.

(TC6) **ACK Acknowledge**

A transmission control character transmitted by a receiver as an affirmative response to the sender.

(TC7) **DLE Data link escape**

A transmission control character which will change the meaning of a limited number of contiguously following characters. It is used exclusively to provide supplementary data transmission control functions. Only graphics and transmission control characters can be used in DLE sequences.

(TC8) **NAK Negative acknowledge**

A transmission control character transmitted by a receiver as a negative response to the sender.

(TC9) **SYN Synchronous idle**

A transmission control character used by a synchronous transmission system in the absence of any other character (idle condition) to provide a signal from which synchronism may be achieved or retained between terminal equipments.

(TC10) **ETB End of transmission block**

A transmission control character used to indicate the end of a transmission block of data where data is divided into such blocks for transmission purposes.

### 3. MESSAGE FORMATS

The various possible messages are categorized as follows :

- information messages;
- forward supervisory sequences;
- backward supervisory sequences.

#### 3.1 General rules

Every transferred sequence of characters contains at least one transmission control character. These are used either to define the nature of the information contained in a sequence of data or to convey supervisory functions.

- They must not be considered information. Therefore, they must not be transmitted as part of the text or heading of an information message with the exception of SYN which may be inserted as required but which must not be regarded as information.
- When used singly or at the end of a message or sequence, they invite the station receiving them to take action.

##### (a) *Information messages*

Information messages consist of a text which can be preceded by a heading; the heading is delivered with the text. Routing indication, for intermediate points in particular, must be in the heading. Other auxiliary information may be either in the heading or in the text.

SOH, STX, ETB and ETX are used as information framing characters. They cannot be sent singly.

Information messages, or information blocks, may be accompanied by a block checking character in accordance with ISO Recommendation R 1155. The use of this block checking character, shown in parentheses, is optional and therefore subject to prior agreement.

##### (b) *Supervisory sequences*

All supervisory sequences except DLE.EOT are composed of either a single transmission control character or a single transmission control character preceded by one or several graphics.

In some of the following supervisory sequences the meaning of the character or characters which precede the transmission control character is defined (for example Polling address). In others, it is simply shown as a prefix which may include one or more of the following :

- identity information;
- address information;
- status information;
- any other qualifier as necessary (for example response number).

The use of these prefixes and their description is subject to prior agreement. They may be standardized at a later date.

EOT, ENQ, ACK and NAK are used for supervision. They can never appear contiguously.

The prefix must not contain more than 15 characters.