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## DATA COMMUNICATION OVER THE TELEPHONE NETWORK

# TRANSMISSION OF START-STOP CHARACTERS OVER SYNCHRONOUS BEARER CHANNELS

## ITU-T Recommendation V.14

(Previously “CCITT Recommendation”)

## FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation V.14 was revised by the ITU-T Study Group XVII (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

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NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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# TRANSMISSION OF START-STOP CHARACTERS OVER SYNCHRONOUS BEARER CHANNELS

*(Melbourne, 1988; revised Helsinki, 1993)*

## 1 Scope

**1.1** This Recommendation describes a method of conveying start-stop characters over synchronous bearer channels using an async-to-sync converter in the data signalling rate range of up to 19 200 bit/s. Start-stop characters at signalling rates below or equal to 300 bit/s can be conveyed over synchronous bearer channels by oversampling at a signalling rate of at least 1200 bit/s.

NOTE – The conversion method provided here replaces the conversion method applied earlier to Recommendations V.22, V.22 *bis*, V.26 *ter* and V.32.

**1.2** This converter may be an intermediate device inserted into the data lines of both circuit 103 in the transmitter and circuit 104 in the receiver inside a synchronous DCE (see Figure A.1), or a stand-alone unit in certain applications.

### 1.3 Operation of DTE-DCE interface after failure to establish error-correcting (Recommendation V.42) operation

DCEs may be designed to employ primarily the asynchronous-to-synchronous conversion associated with the error-correcting function specified in Recommendation V.42. Such DCEs are normally also capable of interworking, in a fallback mode, with DCEs employing the asynchronous-to-synchronous conversion in conformance with this Recommendation, but retaining the buffering of data and the flow control across the DTE-DCE interface. Further details may be found in 7.9/V.42.

## 2 Data signalling rates

The conversion method shall be limited to signalling rates of up to 19 200 bit/s preferring the standard signalling rates of Recommendation V.5.

The nominal signalling rates for both the start-stop characters and the synchronous DCE shall be the same. The tolerance of the signalling rate of the synchronous transmission shall be ± 0.01%.

## 3 Signalling rate ranges of the start-stop characters at the converter input

The conversion method is capable of tolerating the signalling rates of the DTE in two ranges:

a) basic range: +1% to –2.5%;

b) extended range: +2.3% to –2.5%.

The use of the basic signalling rate range is preferred since it results in lower distortion. The choice of range shall be made at the time of installation, and shall be the same for both transmitter and receiver. It is not intended to be under customer control.

## 4 Start-stop character format

It shall be possible to condition the converter to accept the following formats; viz:

a) a one-unit start element, followed by seven data units, and a stop element of the unit in length (9-bit characters);

b) a one-unit start element, followed by eight data units, and a stop element of one unit in length (10-bit characters);

c) a one-unit start element, followed by nine data units, and a stop element of one unit in length (11-bit characters);

the converter may also accept characters consisting of:

d) a one-unit start element, followed by six data units, and a stop element of one unit in length (8-bit characters).

Note that character formats c) and d) do not conform to International Alphabet No. 5.

The character format selected shall be the same for both transmitter and receiver. The characters shall be in accordance with Recommendation V.4 regardless of whether they conform to International Alphabet No. 5. It shall be possible to transmit characters continuously or with any additional continuous stop element of arbitrary length between characters.

NOTE – In each of the four formats, data units can be replaced by additional stop units. For example, format c) will allow 11-bit characters consisting of a one-unit start element, followed by eight data units and a stop element of two units to be handled.

## 5 Margin of the converter input

The effective net margin of the converter for transmitting of start-stop characters applied to the input of the converter shall be at least 40%. This figure is a subject for further study.

## 6 Selection of synchronous or asynchronous modes of operation

Selection for synchronous or asynchronous modes of operation shall be provided by switch (or similar means) enabling the user to perform normal transmission and testing in each mode of operation, respectively.

In synchronous mode of operation the converter is totally bypassed in both directions.

## 7 Async-to-sync conversion method

The general method to handle the speed differences between the intracharacter signalling rate of the start-stop characters and the data signalling rate of the synchronous bearer channel will be the insertion/deletion of stop elements at the transmitter and reinsertion of deleted stop elements at the receiver. Means are provided to transfer continuous start polarity (break signals) as well.

### 7.1 Transmitter

In the transmit direction the start-stop characters shall be adapted to the signalling rate of the synchronous bearer channel by:

– deleting stop elements in case of overspeed of the start-stop characters;

– insertion of additional stop elements in case of underspeed of the start-stop characters.

#### 7.1.1 Basic signalling rate range

No more than one stop element shall be deleted for any eight consecutive characters.

#### 7.1.2 Extended signalling rate range

No more than one stop element shall be deleted for any four consecutive characters.

### 7.2 Receiver

The intracharacter signalling rate provided by the converter shall be in the range of the nominal data rate to the limit of the specified overspeed tolerance, i.e. +1% in the basic and +2.3% in the extended data signalling range. The length of the stop element shall not be reduced by more than 12.5% for the basic signalling rate range (or 25% for the optional extended signalling rate range) to allow for overspeed in the transmitting terminal. The nominal length of the start and data elements for all characters shall be the same.

NOTE – Equipments exists in the field which delete stop elements more frequently than specified in 7.1.1 and 7.1.2. However, in these equipments there will always be at least one additional inserted stop element between deleted stop elements.

## 7.3 Break signal

### 7.3.1 Transmitter

If the converter detects M to 2M + 3 bits all of "start" polarity, where M is the number of bits per character in the selected format, the converter shall transmit 2M + 3 bits of "stop" polarity. If the converter detects more than 2M + 3 bits all of "start" polarity the converter shall transmit all these bits as "start" polarity.

NOTE – The converter must receive at least 2M bits of "stop" polarity after the "start" polarity break signal in order to ensure that it regains the character synchronism.

### 7.3.2 Receiver

The 2M + 3 or more bits of "start" polarity received from the transmitting modem shall be transferred to the output of the converter, and the character synchronism shall be regained from the following "stop" to "start" transition.

NOTE – In some earlier implementations an uninitiated NUL character may precede the break signal at the output of the converter when no measures have been taken to prevent this.

## 7.4 Tandem operation

Tandem operation between two ends comprising async-to-sync conversions can be established only by using cascaded synchronous bearer channels.

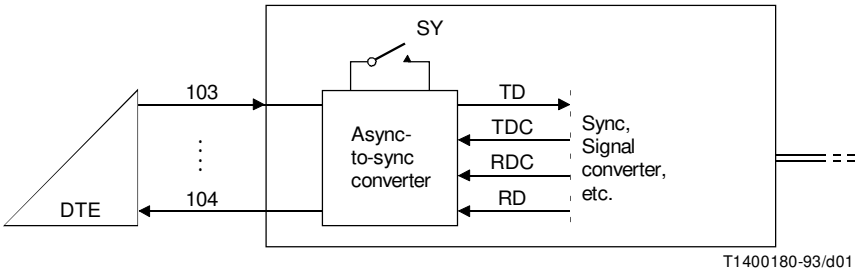
## 7.5 Testing facilities

All the tests recommended in the relevant Recommendations can be performed in asynchronous operation as well, where this converter is used, with the exception of self test end-to-end.

# Annex A

## Inclusion of an async-to-sync converter into a synchronous DCE

(This annex forms an integral part of this Recommendation)




| | |
|---|---|
| 103 | Transmitted data; data input to the DCE |
| TD | Transmitted data; the synchronous output of the converter following the async-to-sync conversion of start-stop characters to be transmitted |
| TDC | Transmitter signal element timing; internal timing information for the generation of synchronous transmitted data |
| RDC | Receiver signal element timing; internal timing information associated with synchronous received data |
| RD | Received data; the input of the converter for the restoration of start-stop characters |
| 104 | Received data; data output from the DCE |
| SY | Synchronous mode; selection of the required mode of operation (asynchronous or synchronous) |

FIGURE A.1/V.14

NOTE – Other interchange circuits which are provided are not involved in the operation of the async-to-sync converter but must comply with the requirements of the relevant DCE Recommendations including the conditions of the timing circuits (i.e. 113, 114 and 115) during both the asynchronous modes of operation.