d) for execute E command

0-1 - reserved for future use

2 - formatted communication coding method execute (optional, see Annex C)

3-9 - reserved for future use.

e) for exit B command

0 - complete sign-off

1 - complete sign-off for battery operated devices using the fast wake-up method

2-9 - reserved for future use.

20) Data set

This provides the address and data for the message (see 6.5).

The following applies to command messages:

a) The password command

The address and unit fields are empty (devoid of any characters).

b) The write command

Where the value represents a data string, the address is the start location to which the data is to be written. The unit field is left empty.

c) The read command

Where a data string is to be read, the address is the start location from which data is read.

The value represents the number of locations to be read including the start location. The unit field is left empty.

d) The execute command

It requests that a device executes a predefined function.

e) The exit command

No data set is required when the command type identifier is 0.

21) Error message

This consists of 32 printable characters maximum with exception of (,), *, / and !. It is bounded by front and rear boundary characters, as in the data set structure. This is manufacturer-specific and should be chosen so that it cannot be confused with data, for example starting all error messages with ER.

22) Device address, optional field, manufacturer-specific, 32 characters maximum. The characters can be digits (0...9), upper-case letters (A...Z), or lower case letters (a...z), or a space ( ). Upper and lower case letters, and the space character are unique*. Leading zeros shall not be evaluated. This means that all leading zeros in the transmitted address are ignored and all leading zeros in the tariff device address are ignored (i.e. 10203 = 010203 = 000010203). When both the transmitted address and the tariff device address contain only zeros, regardless of their respective lengths, the addresses are considered equivalent. As a missing address field is considered as a general address (/ ? ! CR LF), the tariff device shall respond. The tariff device shall be able to evaluate the complete address as sent by an external device, even if the internal programmed address is shorter or longer in length.

NOTE 1 * Upper and lower case letters, and the space character must match and their combination may be used only once.

NOTE 2 The device identification number can be used as an address to avoid reading of, or writing to, wrong devices.

23) Sequence delimiter (backslash code 5CH), optional field. This character is always followed by a one character field 24). This field is part of the maximum 16 character wide identification field 14). Multiple pairs 23)/24) are allowed.

24) Enhanced baud rate and mode identification character (optional field). This field is part of the 16 character wide identification field 14). W must be registered with the administrator: The DLMS User Association (see the foreword). For details see 6.4.5.1.

6.4 Communication modes

6.4.1 Protocol mode A

Protocol mode A supports bidirectional data exchange at 300 baud without baud rate switching. This protocol mode permits data readout and programming with optional password protection.

6.4.1.1 Overview

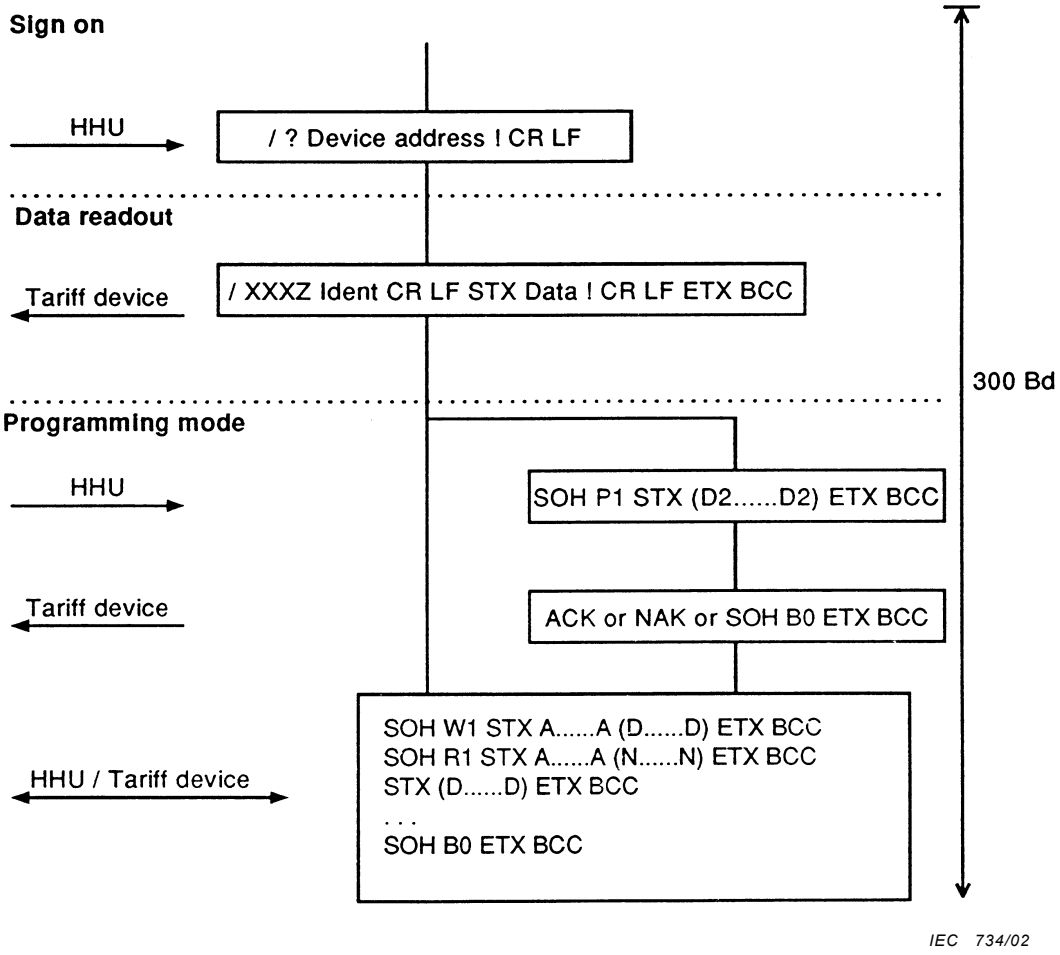

Figure 8 – Diagram protocol mode A

6.4.1.2 Data readout

The tariff device transmits the data message immediately following the identification message.

6.4.1.3 Switch to programming mode

Programming mode can be entered immediately following completion of the data readout by sending any command message, including a password command message.

6.4.1.4 Data readout with optional switch to programming mode

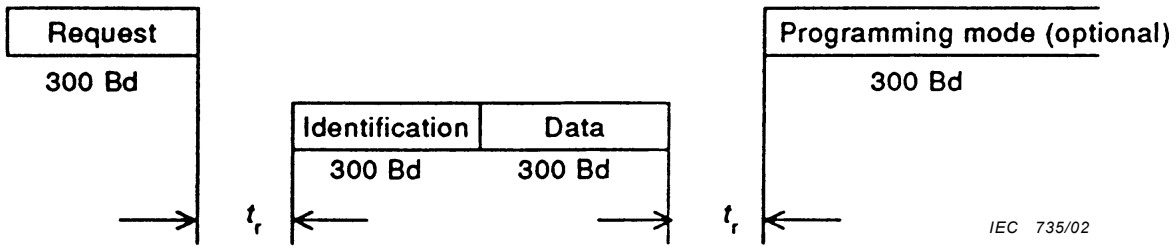

Figure 9 – Transmission protocol for protocol mode A

6.4.1.5 Reaction and monitoring times

The time between the reception of a message and the transmission of an answer is:

(20 ms) 200 ms ≤ t_r ≤ 1 500 ms (see item 12) of 6.3.14).

The time between two characters in a character sequence is:

t_a < 1 500 ms

6.4.1.6 End of data readout transmission

The data transmission is complete after the data message has been transmitted by the tariff device. An acknowledge signal is not provided for.

The HHU can retransmit a request if the transmission was faulty.

6.4.2 Protocol mode B

Protocol mode B supports bidirectional data exchange with baud rate switching. This protocol mode permits data readout and programming with optional password protection.

6.4.2.1 Overview

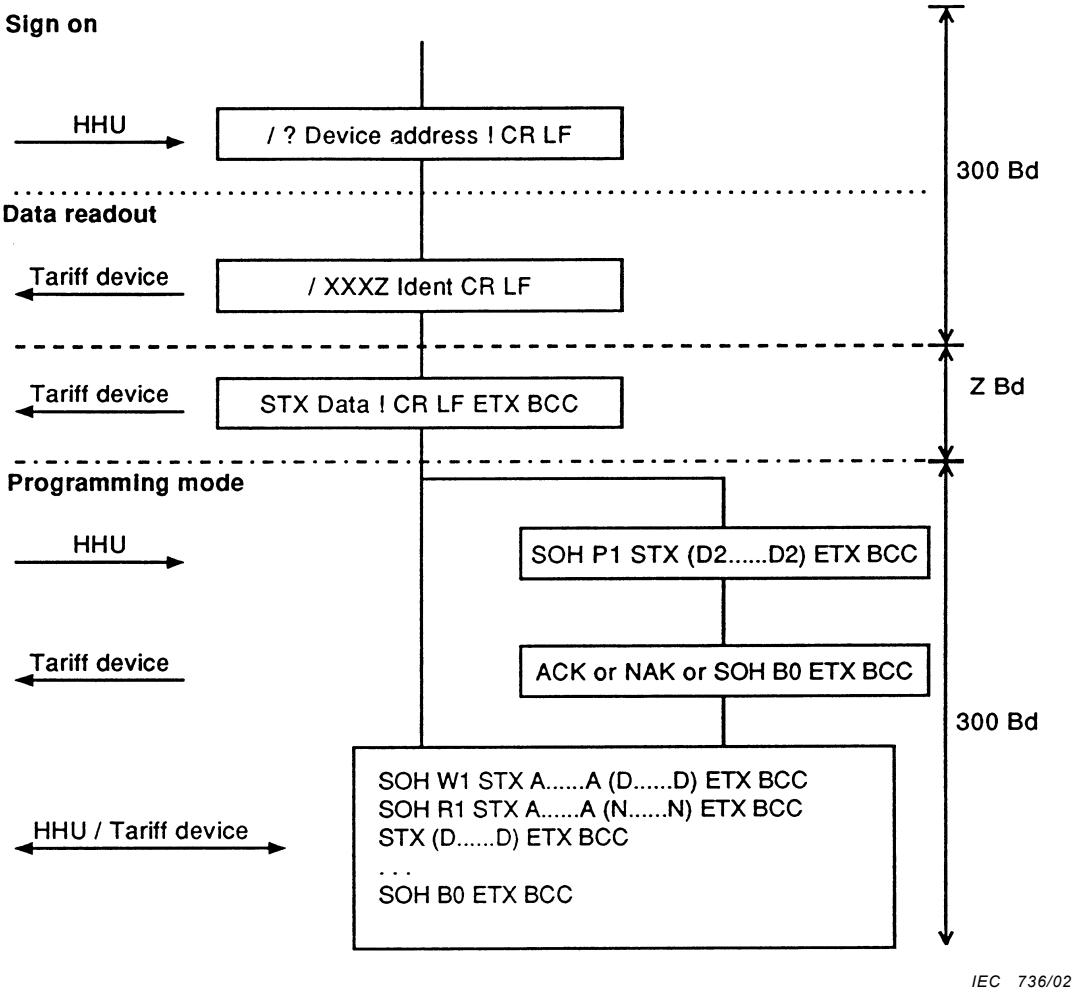

Figure 10 – Diagram protocol mode B

6.4.2.2 Data readout

After transmitting the identification message, the tariff device briefly interrupts the transmission. During the interval the tariff device and the HHU switch over to the baud rate prescribed in the identification message. Following this the tariff device transmits the data message at the new baud rate.

6.4.2.3 Switch to programming mode

Programming mode can be entered immediately following completion of the data readout by sending any command message by the HHU at 300 baud, including a password command message.

6.4.2.4 Data readout with optional switch to programming mode

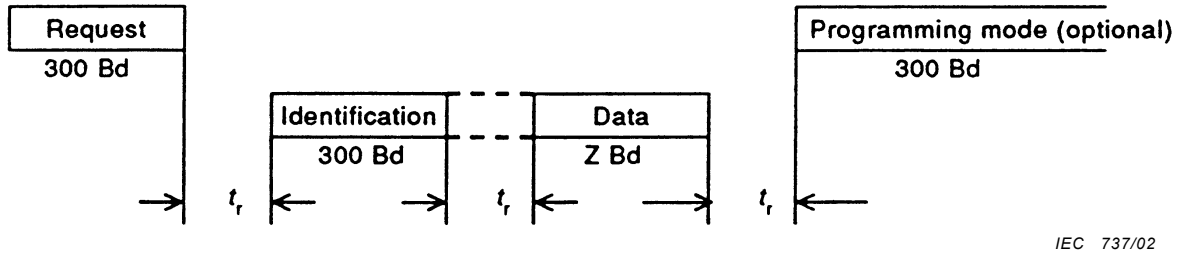

Figure 11 – Transmission protocol for protocol mode B

6.4.2.5 Reaction and monitoring times

The time between the reception of a message and the transmission of an answer is:

(20 ms) 200 ms ≤ t_r ≤ 1 500 ms (see item 12) of 6.3.14.

The time between two characters in a character sequence is:

t_a < 1 500 ms

6.4.2.6 End of data readout transmission

The data transmission is complete after the data message has been transmitted by the tariff device. An acknowledge signal is not provided for.

The HHU can retransmit a request if the transmission was faulty.

6.4.3 Protocol mode C

Protocol mode C supports bidirectional data exchange with baud rate switching and permits data readout, programming with enhanced security and manufacturer-specific modes.

6.4.3.1 Overview

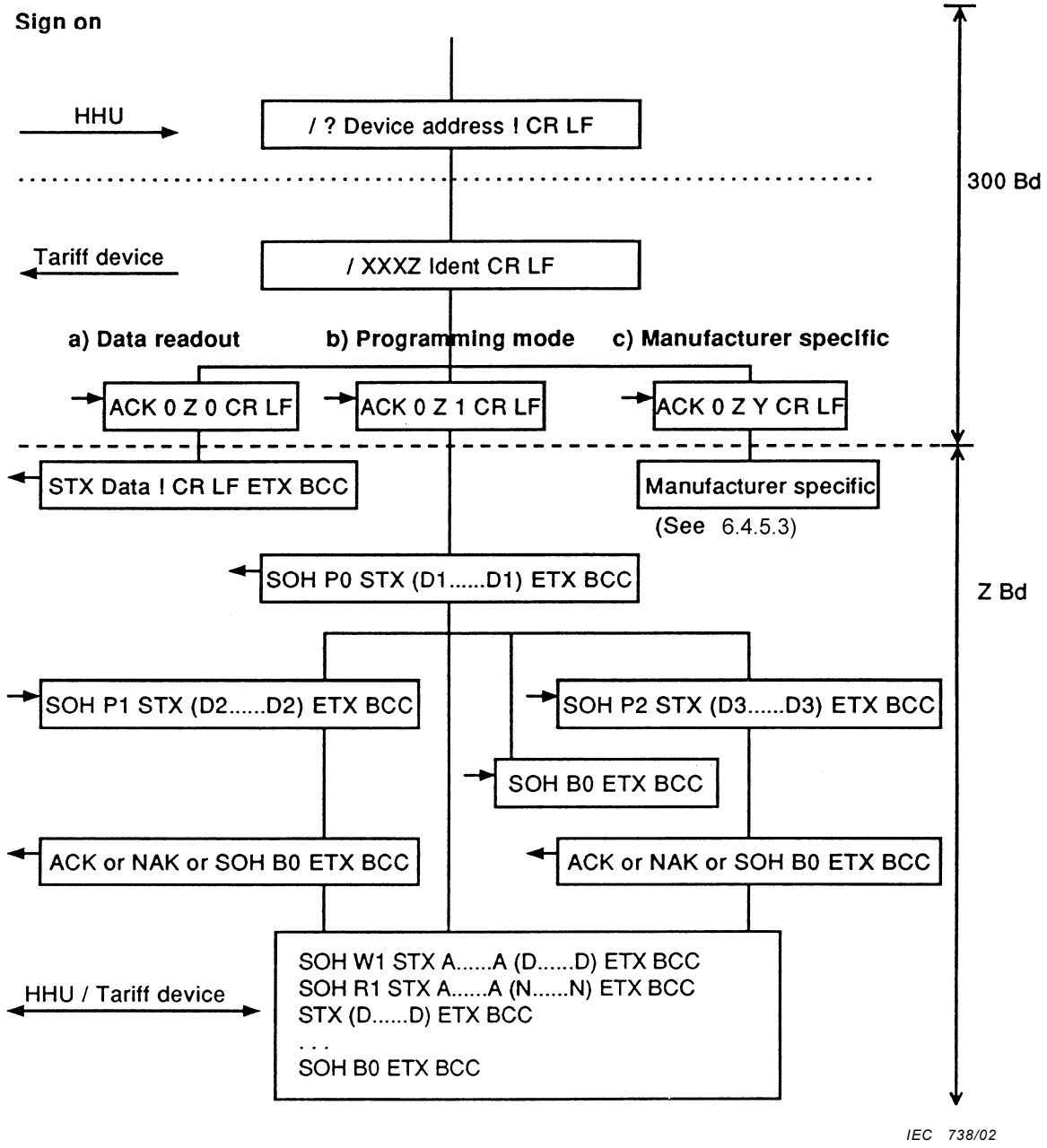

Figure 12 – Diagram protocol mode C

W (Write) will be followed by ACK or NAK or an error message.

R (Read) will be followed by a data message or NAK or an error message as reply.

Termination occurs following SOH B0 ETX BCC (without NAK response), or by timeout (see Annex A, note 1).

See also Annex A.

After the identification message has been transmitted, the tariff device waits for the acknowledge/option select message from the HHU. This may be a request for data readout, a switch to programming mode, or a switch to manufacturer-specific operation.

6.4.3.2 Data readout mode

In the case of ACK 0 Z 0 CR LF the tariff device will respond with a predefined data set in the format defined in 6.5 ("Syntax diagrams - Readout mode - Data message"). The data set may be empty for those tariff devices not designed to read data in this manner.

The communication will proceed at 300 Bd (initial baud rate) if:

– the "Z" character in the acknowledgement/option select message is 0; or

– an incorrect or unsupported acknowledgement/option select message is sent or received; or

– no acknowledgement/option select message is sent or received.

The communication will only switch to Z baud if the Z characters in the identification response and the acknowledgement/option select message are identical.

6.4.3.3 Switch to programming mode

In the case of ACK 0 Z 1 CR LF the tariff device will switch to programming mode. Further communication will proceed at 300 Bd (the initial baud rate) if:

– the Z character in the acknowledgement/option select message is 0.

The communication will switch to Z baud if the Z character in the identification response and the acknowledgement/option select message are identical. If the acknowledgement/option select message is inconsistent or determined to be in error by the tariff device, then communication will proceed at 300 Bd in the data readout mode. Programming will not be entered.

6.4.3.4 Switch to manufacturer-specific operation

Manufacturer's own options may be obtained by selecting Y to take values between 6 and 9 in the sequence ACK 0 Z Y CR LF.

Data readout mode (fallback mode, corresponds to protocol mode A, data readout)

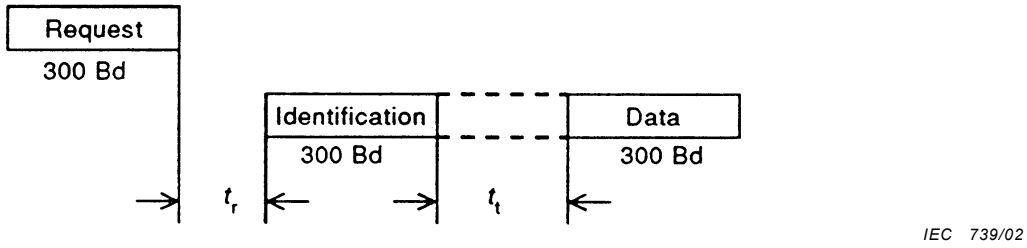

Figure 13 – Transmission protocol for protocol mode C giving data readout without acknowledgement from the HHU

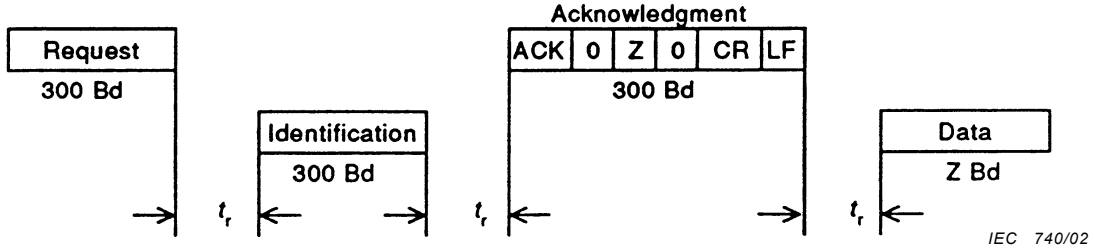

Figure 14 – Transmission protocol for protocol mode C giving data readout with confirmation of the suggested baud rate

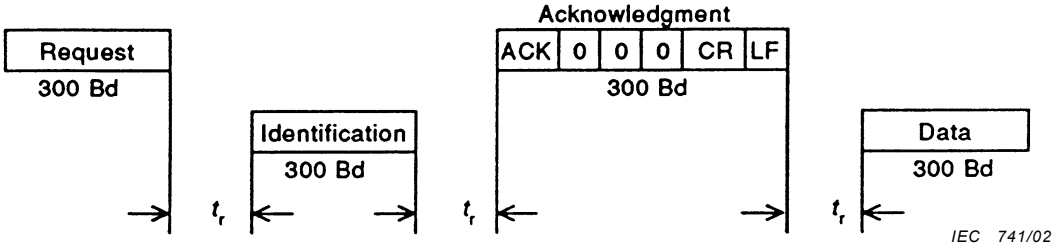

Figure 15 – Transmission protocol for protocol mode C giving data readout with rejection of the suggested baud rate

6.4.3.5 End of data readout transmission

The data transmission is complete after the data message has been transmitted by the tariff device. An acknowledge signal is not provided for. The HHU can transmit a repeat request if the transmission was faulty.

6.4.3.6 Reaction and monitoring times

The time between the reception of a message and the transmission of an answer is:

(20 ms) 200 ms ≤ t_r ≤ 1 500 ms (see item 12) of 6.3.14).

If a response has not been received, the waiting time of the transmitting equipment after transmission of the identification message, before it continues with the transmission, is:

1 500 ms < t_t ≤ 2 200 ms

The time between two characters in a character sequence is:

t_a < 1 500 ms

6.4.3.7 Programming mode

This mode is entered as prescribed. In order to permit access, certain security measures may have to be undertaken.

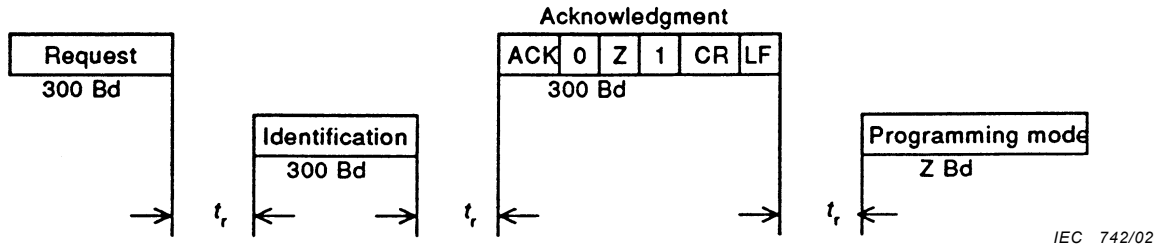

Figure 16 – Transmission protocol for protocol mode C. Switching to programming mode with acceptance of the suggested baud rate

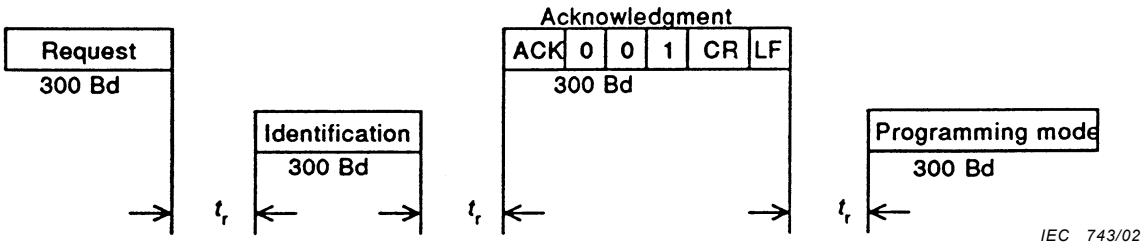

Figure 17 – Transmission protocol for protocol mode C. Switching to programming mode with rejection of the suggested baud rate

6.4.3.8 Levels of access - system security

See Annex D.

6.4.4 Protocol mode D

Protocol mode D supports unidirectional data exchange at a fixed baud rate of 2400 baud and permits data readout only.

6.4.4.1 Overview

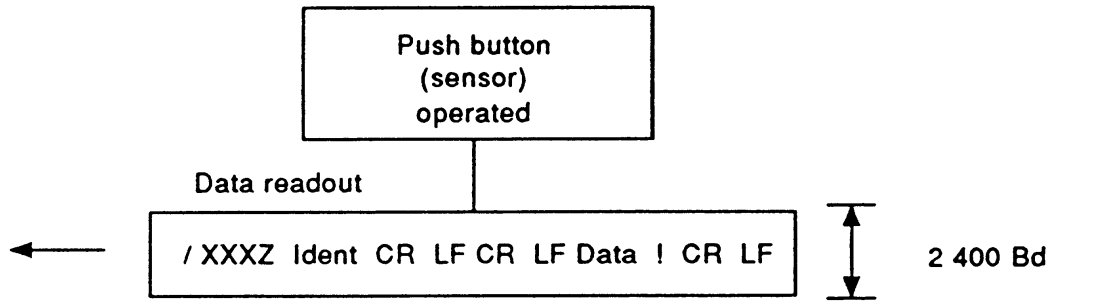

Figure 18 – Diagram protocol mode D

6.4.4.2 Data readout

The tariff device transmits the data message at 2 400 Bd immediately following the activation of a push button or other sensor on the tariff device.

/	X	X	X	3	Identification	CR	LF	CR	LF	Data	!	CR	LF

2 400 Bd

IEC 745/02

Figure 19 – Transmission protocol for protocol mode D

The time between two characters in a character sequence is:

t_a < 1 500 ms

6.4.4.3 End of transmission

The data transmission is complete after the data message has been transmitted by the tariff device. An acknowledgement signal is not provided for.

6.4.5 Protocol mode E (other protocols)

The identification message (server's response to the initial request message of a client) includes an identification field, which may be up to 16 characters long. Within this identification string, one or more escape sequences, consisting of an escape character "\" and one following identifying character (see 6.4.5.1), advise the client that enhanced capabilities are available. The protocol control characters define details to enter protocol modes C or E.

6.4.5.1 Usage of escape character "W" in protocol mode E (item 24 in 6.3.2)

Enhanced baud rate and mode identification character (optional field, defining protocol mode E)

0-1 - reserved for future applications.

2 - binary mode (HDLC), see Annex E.

3-9 - reserved for future applications.

Other printable characters with exception of /, \ and !: manufacturer-specific use.

6.4.5.2 Usage of protocol control character "V" in protocol mode C and E (item 10 in 6.3.3)

0 - normal protocol procedure.

1 - secondary protocol procedure.

2 - HDLC protocol procedure, see Annex E.

3-9 - reserved for future applications.

6.4.5.3 Usage of mode control character "Y" in protocol modes C and E (item 11 in 6.3.3)

0 - data readout.

1 - programming mode.

2 - binary mode (HDLC), see Annex E.

3-5 and A-Z - reserved for future applications.

6-9 - manufacturer-specific use.

6.4.6 Entering programming mode (unknown tariff device)

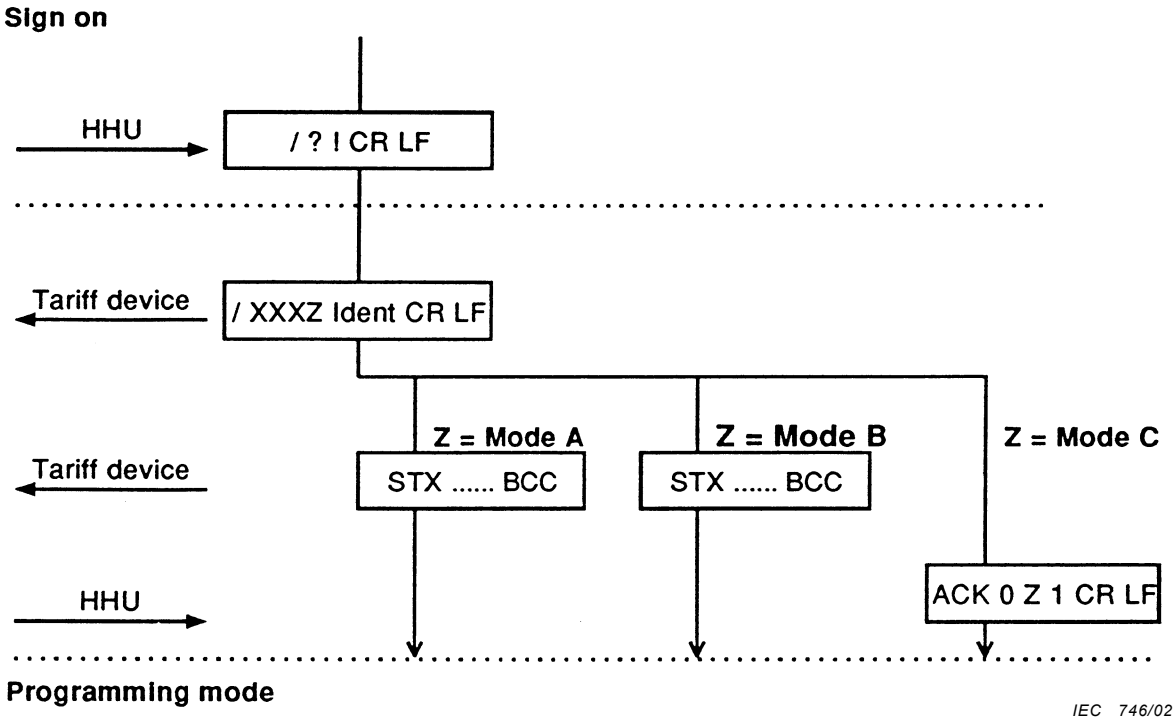

Figure 20 – Diagram for entering programming mode

NOTE 1 For full details, see relevant subclauses.

NOTE 2 The request message is sent without address as this is for an unknown tariff device.

NOTE 3 The value returned by the tariff device in the Z character of the identification message determines which protocol mode the tariff device operates in (see item 13) in 6.3.14).

NOTE 4 This method should not be used if more than one device is connected to the communication channel.

NOTE 5 Protocol mode E (for other protocols, see Annex E) may need to handle programming in its own context

6.4.7 Partial block communication (optional, only in protocol mode C)

Partial blocks are identified using the command type identifier issued from the HHU set to 3 or 4, corresponding to "unformatted" and "formatted" coding respectively; for example R3 means "partial block read, unformatted", and R4 means "partial block read, formatted". Partial block communication can be used for read and write commands.

All partial block data messages are tagged with the EOT character, except for the last partial block data message which is tagged with ETX to indicate to the receiving unit that the current message completes the partial block data transfer. The length of partial block data messages is not defined and can be variable.

When writing using partial block data messages, whether unformatted or formatted, the address field within the data set is sent only in the first command message. This indicates the start of a partial block transfer. The addresses for the subsequent command messages will not be sent, as the data within the command messages are considered to be one continuous block.

When using partial blocks, ACK is sent from the receiving unit to indicate that the last partial block data message was received correctly and the next partial block data message can be sent. NAK is sent from the receiving unit to indicate that the last partial block data message was not correctly received and should be repeated.

The master device (for example HHU) can decide to abort a partial block transfer by issuing a new command message. This can be used to discontinue the communication when the tariff device has difficulty receiving telegrams and continues to respond with NAKs or when the master device has difficulty receiving the data messages from the tariff device.

Table 2 – Read, Write and Execute commands

	Normal	With partial blocks
Unformatted	W1/R1	W3/R3
Formatted	E2/W2/R2	W4/R4

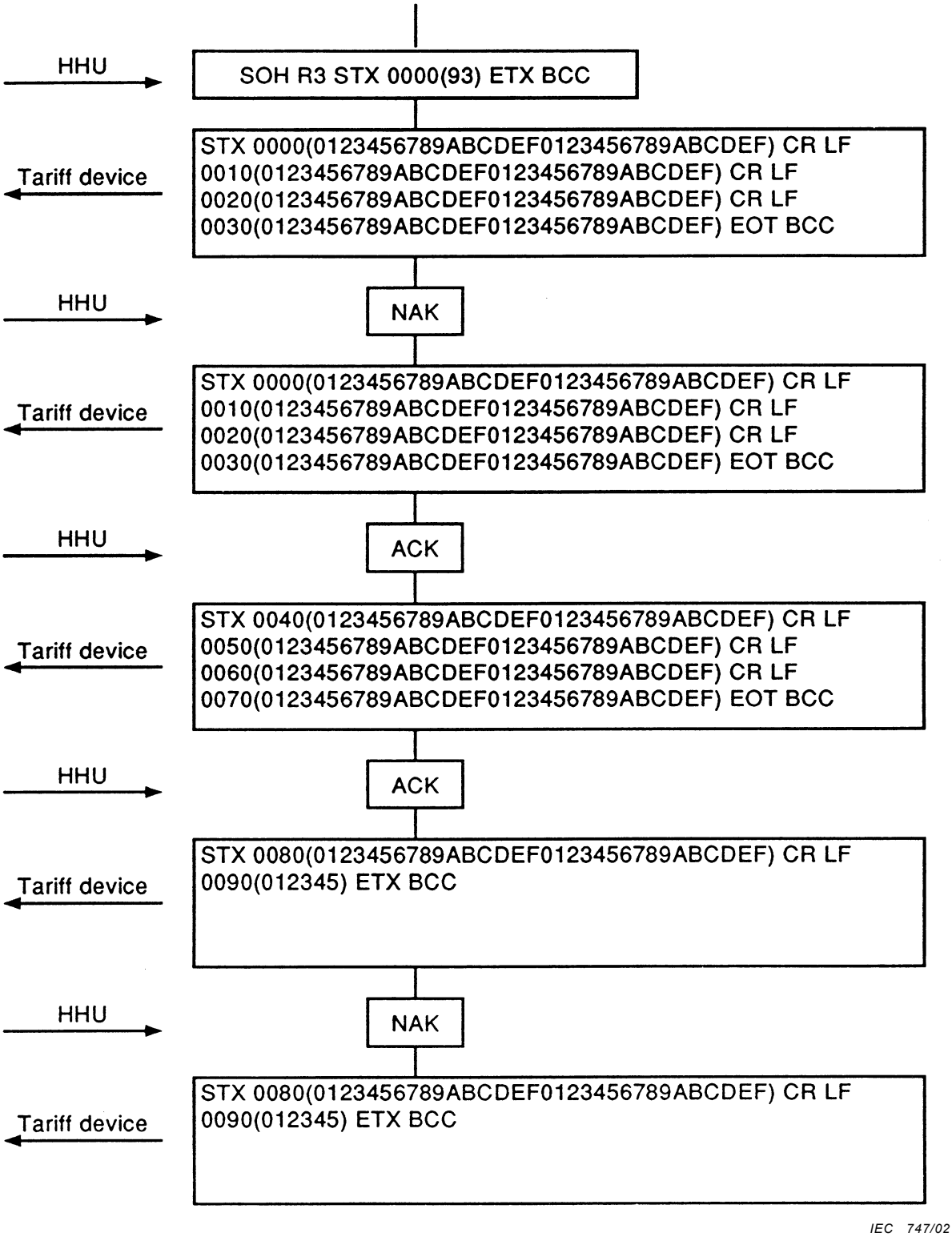

Figure 21 – Example of a partial block unformatted read

Example of a partial block unformatted read. In this case, the tariff device is creating partial block data messages with 48 bytes each (16 bytes per data line) except for the last data message. The first and last data messages had to be repeated.