INTERNATIONAL STANDARD

ISO/IEC 10192-1

First edition
2002-08

Information technology – Home electronic system (HES) interfaces

Part 1: Universal Interface (UI) Class 1



Reference number
ISO/IEC 10192-1:2002(E)

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Part 1: Universal Interface (UI) Class 1

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INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) INTERFACES –

Part 1: Universal Interface (UI) Class 1

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This publication has been drafted in accordance with the ISO/IEC directives, part 2.

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INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) INTERFACES –

Part 1: Universal Interface (UI) Class 1

1 Scope and application

1.1 Scope

This part of ISO/IEC 10192 is one of a set of standards describing the characteristics of a specific home control system called the Home Electronic System, HES.

This standard specifies the characteristics of the Universal Interface Class 1 that connects devices to the home network in an HES for control applications.

This standard informs as to the usefulness of the principles of a UI and forms a basis for new work in this field.

NOTE This standard draws upon text from IEC 60870-5-1:1990 and IEC 60870-5-2:1992.

1.2 Application

This standard specifies a generic interface for a device to connect to a home control network via a Network Adaptor Unit. The home control network signals may be carried on the cabling system being specified in ISO/IEC 15018[1].

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60227-2, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V – Part 2: Test methods*

IEC 60364-1, *Electrical installations of buildings - Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60603-7, *Connectors for frequencies below 3 MHz for use with printed boards – Part 7: Detail specification for connectors, 8-way, including fixed and free connectors with common mating features, with assessed quality*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60870-5-1:1990, *Telecontrol equipment and systems – Part 5: Transmission protocols – Section 1: Transmission frame formats*

ISO/IEC 11801, *Information technology – Generic cabling for customer premises*

[1] Information technology - Integrated cabling for residential and SOHO (Small Office, Home Office) environments (under development).

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ISO/IEC TR 14543-1, *Information technology – Home Electronic System (HES) Architecture – Part 1: Introduction*

ISO/IEC TR 15044, *Information technology – Terminology for the Home Elecronic System (HES)*

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this document the following definitions apply.

3.1.1
network powered device, NPD
device that derives its power from the network

[ISO/IEC TR 15044, definition 2.38]

3.1.2
self-powered device, SPD
device which derives its power from other sources than the network

[ISO/IEC TR 15044, definition 2.50]

3.1.3
UI adaptation
process of adapting a device or an NAU to the UI

[ISO/IEC TR 15044, definition 2.68]

3.1.4
UI cable
cable connecting with an UI device to a UI NAU. The UI connector on the NAU is normally mounted in the wall

[ISO/IEC TR 15044, definition 2.69]

3.1.5
UI cable connector
standardized connector on a UI cable for connecting a UI device to a UI NAU

NOTE The device end of the cable may have a connector or be permanently attached to the device.

[ISO/IEC TR 15044, definition 2.70]

3.1.6
UI cable plug housing, UI CPH
connector housing for the NAU end of the UI cable

[ISO/IEC TR 15044, definition 2.71]

3.1.7
UI connector, UIC
connector on a UI NAU for connecting a UI device to a UI NAU

NOTE The UI connector is normally mounted in the wall.

[ISO/IEC TR 15044, definition 2.72]

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3.1.8
UI device, UID
device supporting and offering a UI

NOTE If the context makes it clear that a device is a UI device, UI will normally be omitted from the term.

[ISO/IEC TR 15044, definition 2.73]

3.1.9
UI device connector
optional connector on a UI device for connection of a UI cable. The cable may instead be permanently attached to the device

[ISO/IEC TR 15044, definition 2.74]

3.1.10
UI network access unit, UI NAU
NAU supporting and offering the universal interface

NOTE If the context makes it clear that the NAU is a UI NAU, UI is normally omitted.

[ISO/IEC TR 15044, definition 2.75]

3.1.11
universal interface, UI
standardized interface, placed on top of the network layer, between a home network and the devices to be connected to it. The specification of the UI includes the necessary mechanical, electrical, functional and procedural characteristics of the interface. Three classes of UIs are defined corresponding to the three classes of home control systems

[ISO/IEC TR 15044, definition 2.76]

3.2 Abbreviations

The following abbreviations are used in this document.

EP UI NAU	externally powered UI NAU
HES	Home Electronic System
NAU	network access unit
NP	network powered
NPD	network powered device
OSI	Open Systems Interconnection
OSI/RM	Open Systems Interconnection Reference Model
SP	self-powered
SPD	self-powered device
UI	Universal Interface
UIC	UI connector
UID	UI device

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4 Principles of the UI

In principle the UI is placed above layer 3 (network layer) in the OSI/RM stack. It provides a standardized interface between the home network on one side and the devices on the other side. The UI is connected to a home network via the UI Network Access Unit (NAU). The mechanical, electrical, functional and procedural characteristics of the UI itself are standardized in this document, but the NAU is not standardized. This makes it possible to provide specific NAUs that fit specific home networks on the market. The NAU, however, shall supply the HES Network Service standardized in ISO/IEC 14543-1 to the device connected to it. In an HES the UI will also pass transparently the HES Application Protocol standardized in ISO/IEC 14543-1. The NAU shall also contain implementations of layers 1 and 2 for the local network. The UI connected to a network based on wired (metallic) media always provides a limited amount of electrical power from the home network system to the connected device.

NOTE For completeness, Annex A defines an NAU for those home control networks that do not provide electrical power (e.g. Infra-red, Radio-frequency etc.).

Specifications of the UI adaptation are under some aspects different in the case in which the UI device does or does not use the power feed provided by the UI NAU. Consequently, two different types of connection between an UI NAU and an UI device are defined. The block diagrams of the two connection types are shown in Figure 1.

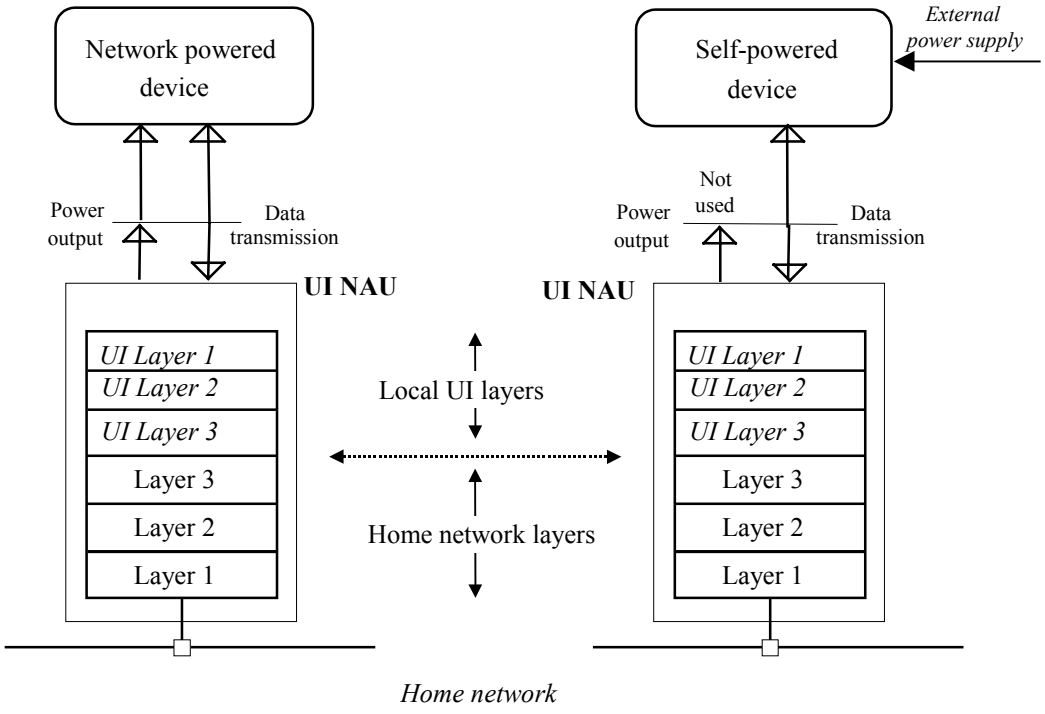


Figure 1 – UI connections in a home network providing a power-feed service

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5 Connectors and cabling

5.1 Mechanical characteristics

5.1.1 UI NAU connector housing and connector

5.1.1.1 UI NAU connector housing

The UI NAU connector housing is a mechanical adapter that can be fitted into an electrical box or be surface mounted. It contains a socket that should meet IEC 60603-7.

5.1.1.2 UI NAU connector

The electrical and mechanical characteristics of the UI NAU connector shall conform to IEC 60603-7.

The UI NAU jack connector shall accept both the connection to a UI cable connector and to a UI cable connector housing, as shown in figure 4.

5.1.2 UI cabling

The UI cable connects a UI device (NP device or SP device) to a UI NAU. Different UI cables are specified for the two types of connection, see Figure 2.

The maximum cable lengths defined for the NP and SP connection are:

NP Device connection: maximum cable length, L = 2 m

SP Device connection: maximum cable length, L = 10 m

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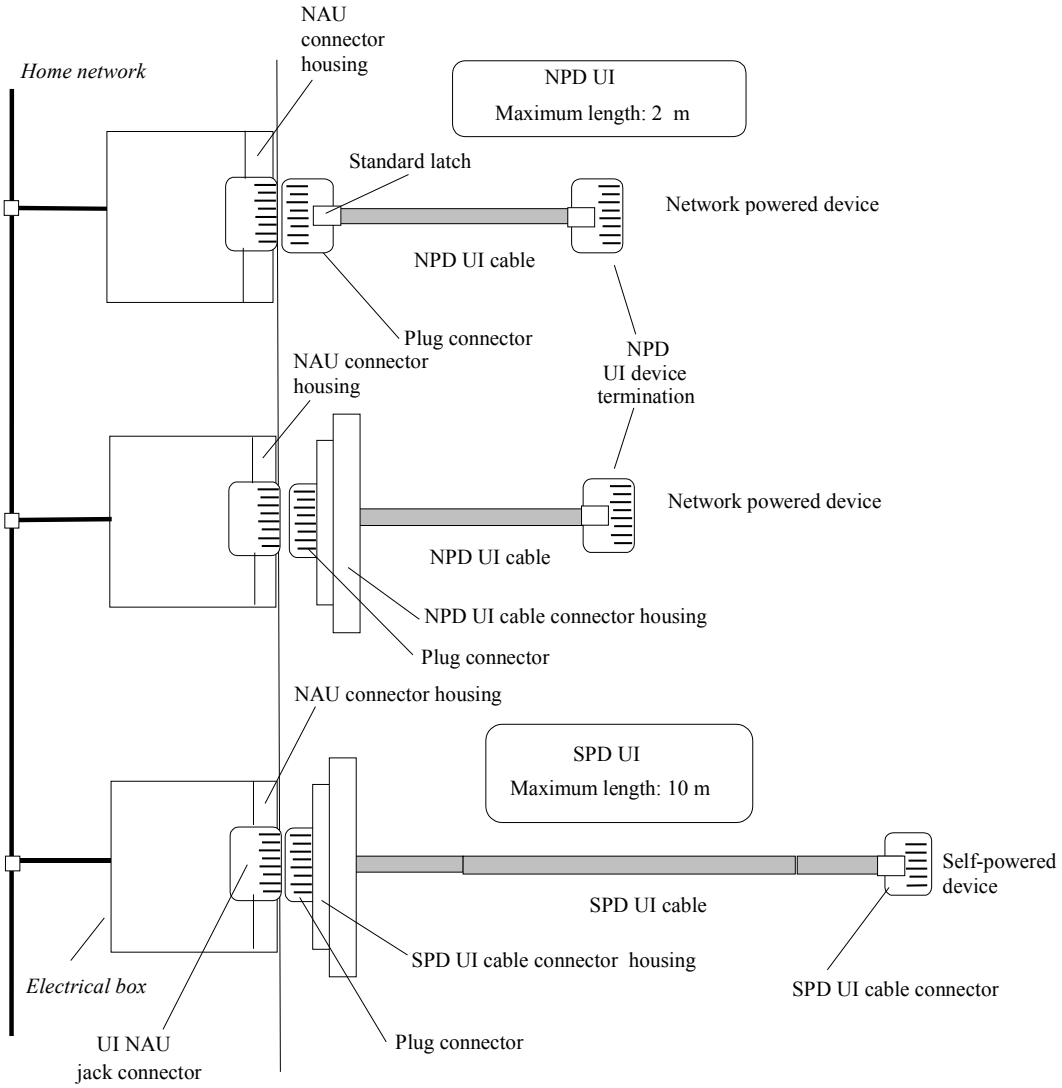


Figure 2 – UI cables

The UI cable (see Figure 2) will be mechanically retained in the NAU connector housing by

– the standard plug connector latch in the case in which no UI cable connector housing is used,

– a latch built into the UI cable connector housing when this is used.

In this second case the standard plug connector latch no longer operates.

5.1.2.1 UI cable connectors

The terminations of the UI cables for UI NAU and UI device ends are specified below for both types of connection.

NP device connection: the NP UI cable could terminate at the UI NAU end with a plug connector to mate the UI NAU socket specified in 5.1.1, or with a UI cable connector housing. The connector housing shall provide the mechanical characteristics and the plug connector to mate the outlet specified in 5.1.1. The UI cable can terminate at the UI device end with a connector or be permanently attached to the UI device.

SP device connection: the SP UI cable terminates at the UI NAU end with a UI cable connector housing that shall provide the mechanical characteristics and the plug connector to mate the outlet specified in 5.1.1.

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The UI cable can terminate at the UI device end with a connector or be permanently attached to the UI device.

The electrical characteristics and the mechanical characteristics shall conform to IEC 60603-7.

The mechanical and electrical characteristics of the UI connector shall conform to the specifications given in IEC 60603-7.

5.1.2.2 UI cable

The recommended characteristics for the UI cable are specified below.

NP UI cable: 2 pairs unshielded twisted pairs

SP UI cable: 3 pairs unshielded twisted pairs

Characteristics:

Conductor wire	0,65 mm diameter
Conductor material	Copper
Insulation material	Polyethylene
Jacket material	Flame Retardant Polyvinyl Chloride
Rip Cord material	Polyamide

For electrical characteristics, see ISO/IEC 11801.

NOTE Different colours shall be used to identify the cable conductors.

For the UI cable an additional High-Voltage insulation test between all cores connected together and the outer surface shall be considered, as specified in IEC 60227-2.

5.2 Electrical characteristics

5.2.1 UI NAU interface

5.2.1.1 NP device connection

SELV or PELV requirements, as specified in IEC 60364-1, shall be fulfilled both at the UI NAU outlet and at the UI device connection. (See Figure 1.)

No electrical isolation between UI NAU and the UI network powered device is required.

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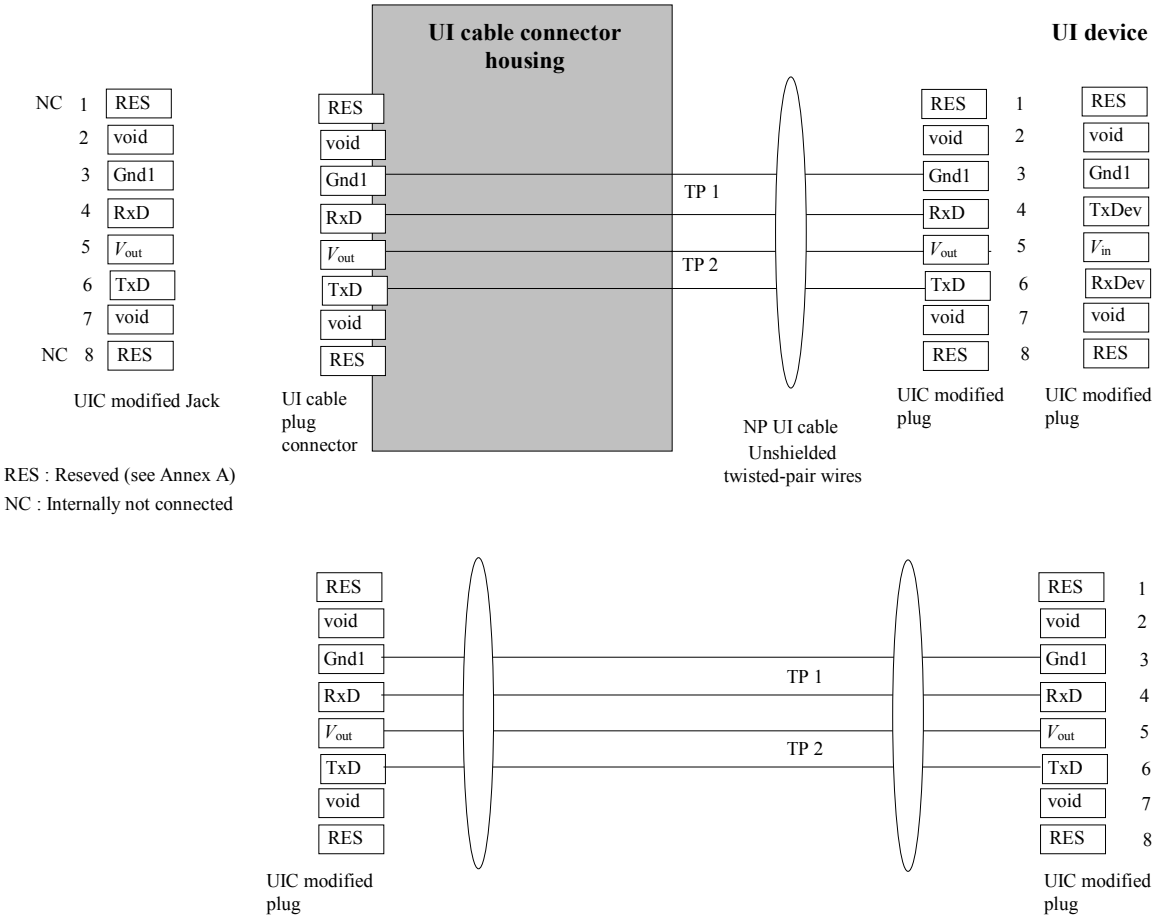


Figure 3 – NP UI cable

NOTE The void positions in the connectors should provide the necessary electrical isolation when an EP UI NAU is used in a home control network that does not provide power-feed service (see Annex A). Optionally twisted pairs (TP3) could be connected to the RES pins.

5.2.1.2 SP device connection

The UI Self-Powered Device shall provide a SELV interface, as specified in IEC 60364-1, to offer a safety electrical connection to a SP UI cable connector housing, see Figure 4 and Figure 5. An isolating transceiver shall be provided between UI NAU and the UI Self-Powered Device in order to protect the HES from fault conditions.

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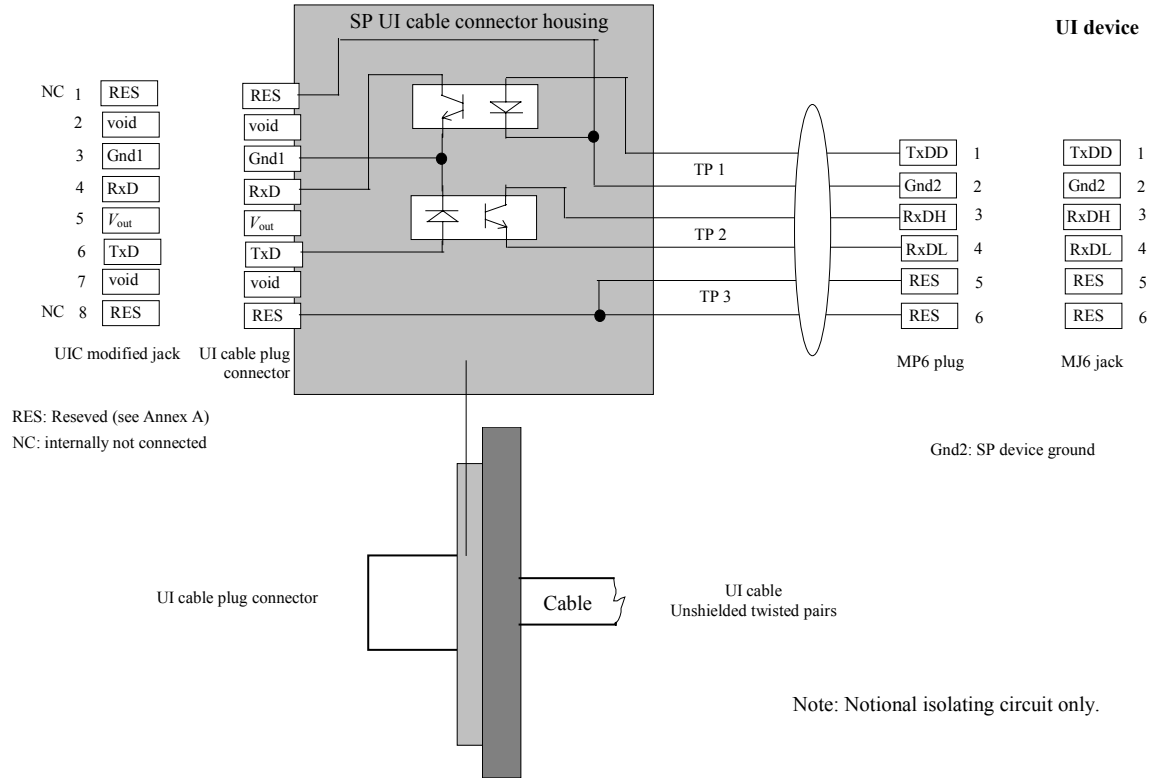


Figure 4 – SP UI cable

NOTE The TP3 pair allows the connection of a SP Device to an home control network that does not provide power using the same SP UI cable as described in Annex A. The void positions in the UI socket should provide the necessary electrical isolation, as given in IEC 60664-1, when this type of connection is used.

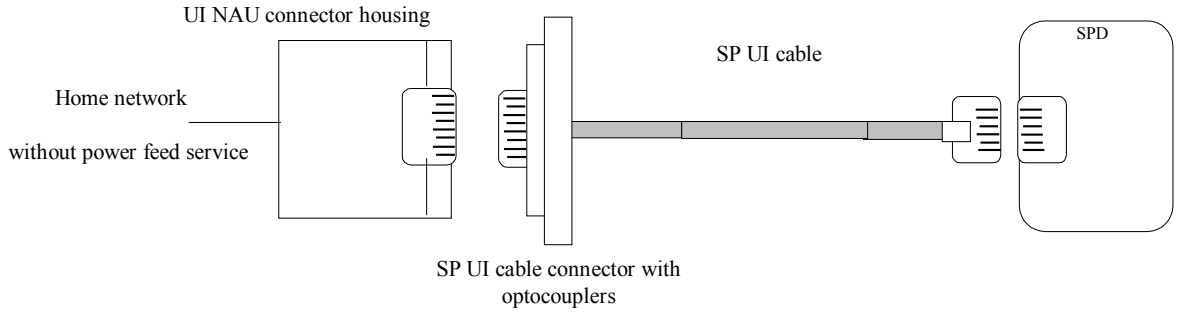


Figure 5 – Connection of an SPD to a home control network that does not provide power

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5.2.2 Electrical signal

The UI NAU shall provide sufficient driving capability in order to generate the appropriate signal level for the NP and SP connections.

The general relation between logic and voltage levels is:

Logic level	Voltage level
0 (False)	≤1,5 V
1 (True)	≥3,5 V

Driver specifications (CMOS compatible V_{DD} = 5 V):

V_{OL} ≤ +0,2 V

V_{OH} ≥ +4,6 V

Receiver specifications (CMOS compatible ≤V_{DD} = 5 V):

V_{IL} ≤ +1,5 V

V_{IH} ≥ +3,5 V

In the SP connection, the drivers of the optocouplers shall translate the input logic to a current signal suitable for driving a light emitting diode (LED). The general relation between output logic levels and LED forward current is:

Logic level	Current level
0 (False/Busy)	≥3 mA
1 (True/Idle)	0 mA

The SP device receivers provide the reverse function of an optocoupler's driver where the output of the phototransistor is detected and restored to a logic level.

5.2.2.1 Response time

The switching time of the optocoupler is a function of

a) the forward current,
b) the load resistor of the phototransistor,
c) and the load capacitance.

The typical timing characteristics of the optocouplers are generally specified in graphical form as a function of:

turn on time t_{on} (µs) = f(I_F,R_L)

turn off time t_{off} (µs) = f(I_F,R_L)

rise time t_{rise} (µs) = f(I_F,R_L)

fall time t_{fall} (µs) = f(I_F,R_L)

where I_F is the LED input forward current and R_L is the phototransistor load.

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5.2.2.2 Switching times

The specified typical timing characteristics of the optocouplers are measured with the test circuit as given in Figure 6.

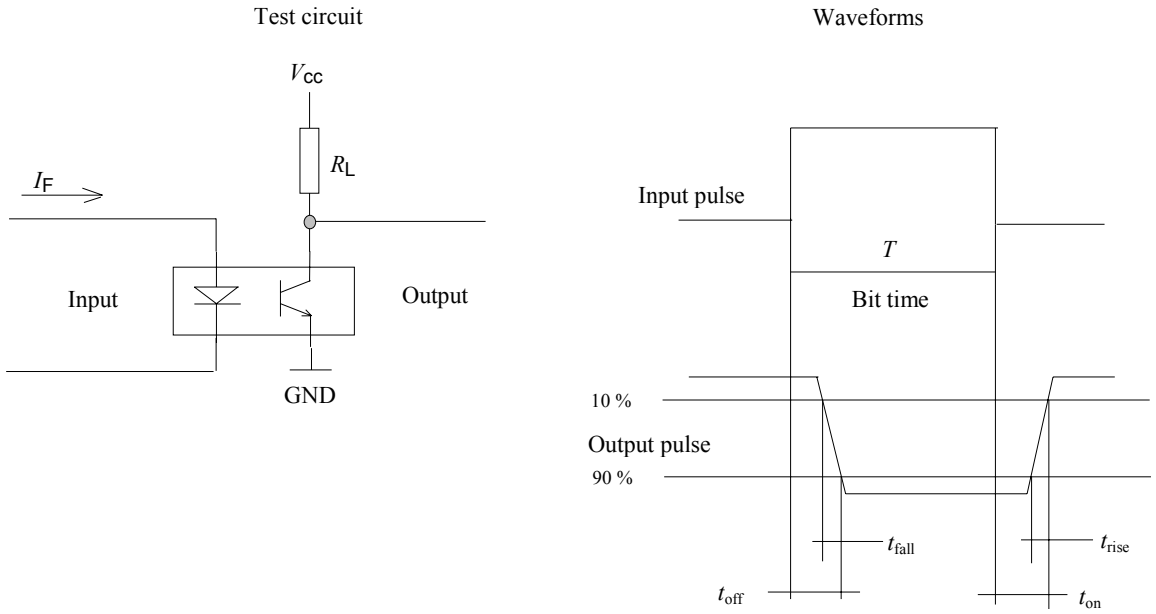


Figure 6 – Test circuit for timing characteristics of optocouplers

The required switching times shall be adequate for the chosen maximum allowed transmission speed. Suggested maximum values for rise time (t_{rise}) and fall time (t_{fall}) are 0,2 % of the bit time T. Allowed clock tolerance shall be ±1 %.

5.2.3 Power output

The power output requirements through the UI NAU, when an NP connection is used to connect a UI NPD, shall be:

- V_{out} = 5 V d.c. + 10 %
- $I_{out} \geq$ 10 mA
- Ripple and noise voltage ≤ 100 mV

6 Procedural requirements

The UI NAU and UI device shall support full duplex and half duplex communication. During the normal operation mode the UI NAU and the UI device shall use the same protocol based on IEC 60870-5-1:1990 and IEC 60870-5-2:1992. This standard has been designed for a “point-to-point” communications protocol. The UI NAU and the UI device may act as a primary station (initiating a message transfer) or as a secondary station (receiving a message). The point-to-point communication between the UI NAU and the UI device support only the FT 1.2 frame format without address field as described in IEC 60870-5-2. (See Figure 7.)

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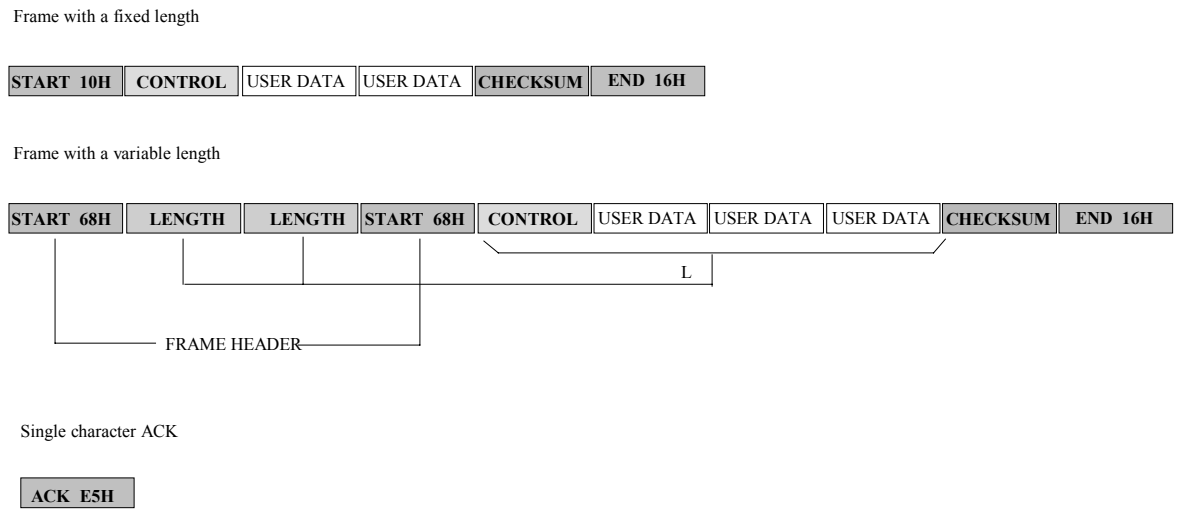


Figure 7 – FT 1.2 frame format

The frame with fixed length consists of a START character, a CONTROL character, two USER DATA bytes, a frame CHECKSUM character and an END character. The frame with variable length consists of a START character, two equal LENGTH characters which specify the number L of USER DATA bytes plus a CONTROL character, a second START character, a CONTROL character, a number L of USER DATA bytes, a frame CHECKSUM character and an END character. The single character ACK is used for a positive acknowledgement.

6.1 FT 1.2 Control field

The control field contains information that characterizes

- the direction of the communication link (UI NAU to UI device or UI device to UI NAU),
- the type of service requested,
- the control functions for suppressing losses or duplications of frames.

6.1.1 Control field from primary station

MSB LSB

RES	PRM	FCB	FCV	FUNCTION			
	1			2^3	2^2	2^1	2^0

Function used:

Function code	Frame type	Frame function	FCV
0	Send/Confirm	Reset of the communication link	0
3	Send/Confirm	User data	1
4	Send – No – reply	User data	0
9	Request/Respond	Status of the communication link	0

RES: Reserved

PRM (Primary message): 1 = message from a primary station (Request)

FCB (Frame count bit): 0, 1 = alternating bit for successive transmissions

FCV (Frame count bit valid): 0 = invalid FCB alternating control function

1 = valid FCB alternating control function

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6.1.2 Control field from secondary station

MSB							LSB
RES	PRM	ACD	DFC	FUNCTION			
	0	0		2^3	2^2	2^1	2^0

Function used:

Function code	Frame type	Frame function
11	RESPOND	Status of link

RES: Reserved

PRM (Primary message): 0 = message from a primary station (Request)

DFC (Data flow control): 1 = further message from a primary station may cause a buffer overflow

0 = the secondary station can accept further message

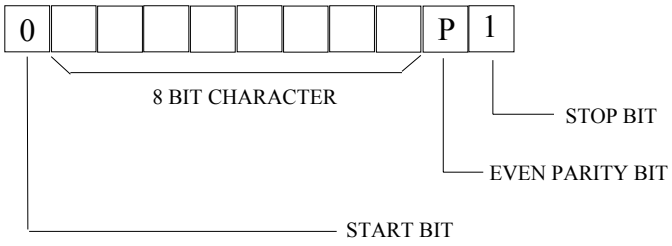
ACD (Access demand): 0 = always

6.2 FT 1.2 Checksum field

The CHECKSUM field shall be used in order to verify the integrity of the received frame. The CHECKSUM value is calculated as an eight bit arithmetic sum of the USER DATA bytes disregarding overflows (sum modulo 256).

6.3 FT 1.2 Field codification

The transmission of each field of the frame is performed as specified below:



6.4 FT 1.2 transmission rules

6.4.1 Frame with fixed length

Table 1 – Frame with fixed length

R1	The line idle is logic level 1 (See 5.1.1).
R2	Each character is sent with: one START bit (logic level 0), eight bits of information, one even parity bit P and one STOP bit (logical level 1).
R3	The maximum line idle interval between characters is 33 line idle bits.
R4	A minimum interval of 33 line idle bits is required between frames when an error is detected according to rule R6.
R5	The sequence of USER DATA characters is terminated by an 8 bit CHECKSUM.
R6	The receiver (secondary station) checks: for each frame character: the START bit, the parity bit P, the STOP bit, for the frame: the specified START character, the frame CHECKSUM and the END character.
NOTE After 33 idle bits as stated in the rules R3 and R4 the receiver should resynchronise.	

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6.4.2 Frame with variable length

Transmission Rules R1, R2, R3, R4, R5 are identical to the Rules specified for the Frame with Fixed Length.

Table 2 – Frame with variable length

R6	The receiver (Secondary Station) checks: for each frame character: the START bit, the parity bit P, the STOP bit, for the frame: the specified START character at the beginning and at the end of the frame header, the identity of the two length values L, the total number of the received characters (L + 6), the frame CHECKSUM and the END character.

6.4.3 Single character frame

Transmission rules R1, R2, R3, R4 are identical to the rules specified for the frame with fixed length.

Table 3 – Single character frame

R5	The receiver (secondary station) checks: for the single character: the START bit, the parity bit P, the STOP bit.

6.5 Transmission procedure

When a secondary station receives a correct send/confirm frame a positive single character is transmitted to the primary station. A secondary station receiving a disturbed frame does not reply. This error condition is detected by the primary station by means of a time-out mechanism. The primary station sends each new send/confirm function with alternated FCB bit. A primary station receiving a disturbed confirm or respond frame repeats the frame again with unchanged FCB bit. If the frame message implies a mandatory response, send, no-reply function, this is interpreted as positive acknowledgement.

6.6 Transmission errors

Transmission errors are detected locally by the UI NAU or by the UI device, based on transmission rule R6 for frame with fixed or variable length and transmission rule R5 for single character frame. In the event of error detection the frame is rejected and the type of error detected is signalled in the status register. When an error is detected a minimum interval of 33 line idle bits is required between frames.

6.6.1 Error management

The error management mechanism specifies the numbers of retransmissions that have to occur when the primary station detects a transmission error.

Maximum number of transmission retries is 3.

The error management based on a time out mechanism indicates that a specified time out is elapsed and the response frame or single character confirm is not yet received.

The time out is specified as 508 idle bits.

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7 UI NAU resources for the UI

7.1 General

The following clause defines the resources the UI NAU shall provide and the registers that control the UI NAU configuration.

7.2 Local and destination addresses

The UI NAU shall contain the facility for storing its own physical address (local network address) and the physical destination address of one UI device message if required. The local network address is assigned to the UI NAU during the set up phase. During start up, immediately after transmission speed negotiation, the UI device shall declare itself to UI devices involved in the same application, thus establishing physical routing. The UI device can read or write these addresses using the appropriate commands among those specified in Clause 8.

The maximum UI NAU local and destination address dimension shall be 6 bytes.

7.3 Transmit and receive buffers

A message can be sent to the HES network when the UI device writes in the UI transmit buffer, see figure 8. The UI device can write the UI transmit buffer using the appropriate command specified in Clause 8. In order to prevent possible buffer overflow the UI transmit buffer dimension shall be accessible to the UI device by using the appropriate command specified in Clause 8. Received data from the HES network are temporarily buffered in the UI receive buffer. The UI receive buffer can be read by the UI device (using the appropriate command as specified in Clause 8) or can be sent automatically to the UI device when a message from HES network is properly received (function mode register).

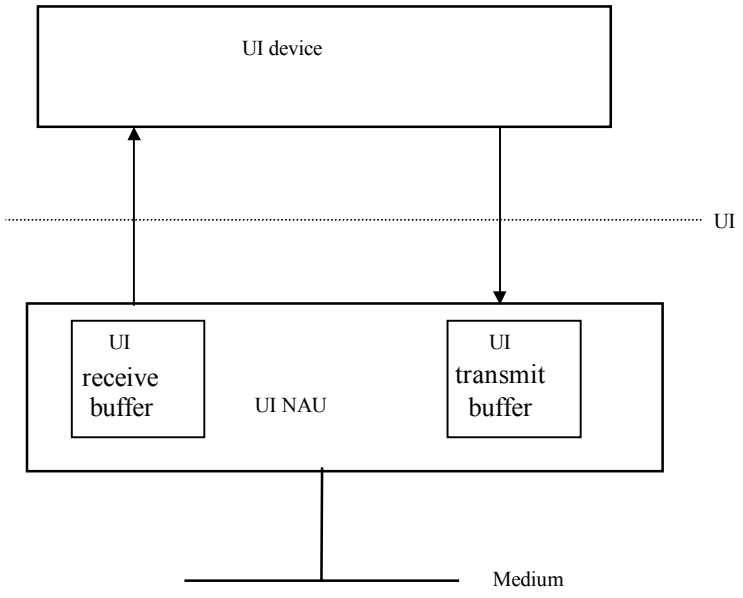


Figure 8 – Transmit and receive buffers

The two buffers are physically integral with the UI NAU. The buffer dimensions should be designed to conform to the specific home network with which they communicate.

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7.3.1 UI NAU registers

The UI NAU shall provide two read/write registers that control the HES transmission and the point-to-point communication with the UI device. The UI device can read or write these registers using the appropriate commands as specified in Clause 8.

7.3.2 Status register (S_R)

See Figure 9 below.

Read only register

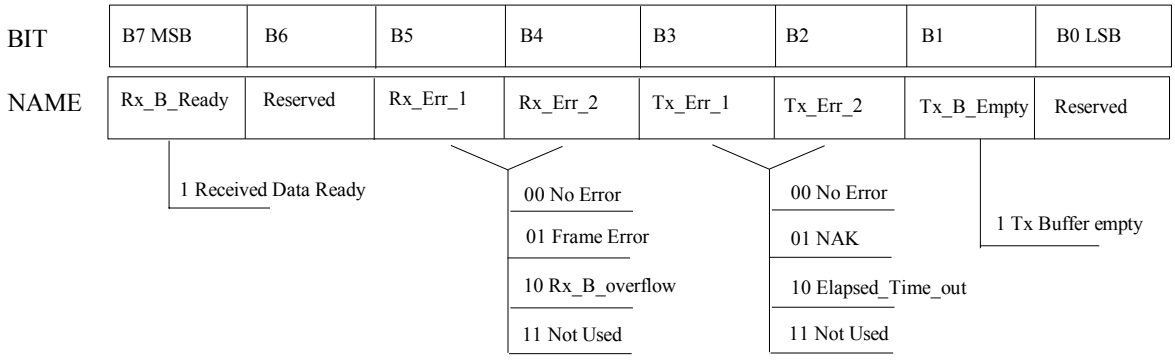


Figure 9 – Status register

Of the eight bits available only six are used (B0 and B6 reserved):

- Rx_B_Ready (active high):

  Indicates that a valid message has been received from HES network.

- Rx_Err_1, Rx_Err_2:

  No_Error indicates that a message from HES network has been properly received. Frame Error indicates that a message from HES network has been improperly received. Rx_B overflow indicates that a message from HES network is sent to a full receiving buffer (the frame causing the overflow is lost).

- Tx_Err_1 and Tx_Err_2:
- No_Error indicates that a message to HES network has been transmitted. NAK indicates that a not acknowledges from HES network has been received. Elapsed_Time_out indicates that a transmission time out is elapsed.

- Tx_B_Empty (active high):

  Indicates that the transmission buffer is empty and can accept new message to be transmitted.

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7.3.3 Function mode register (FM_R)

See Figure 10 below.

Read/write register

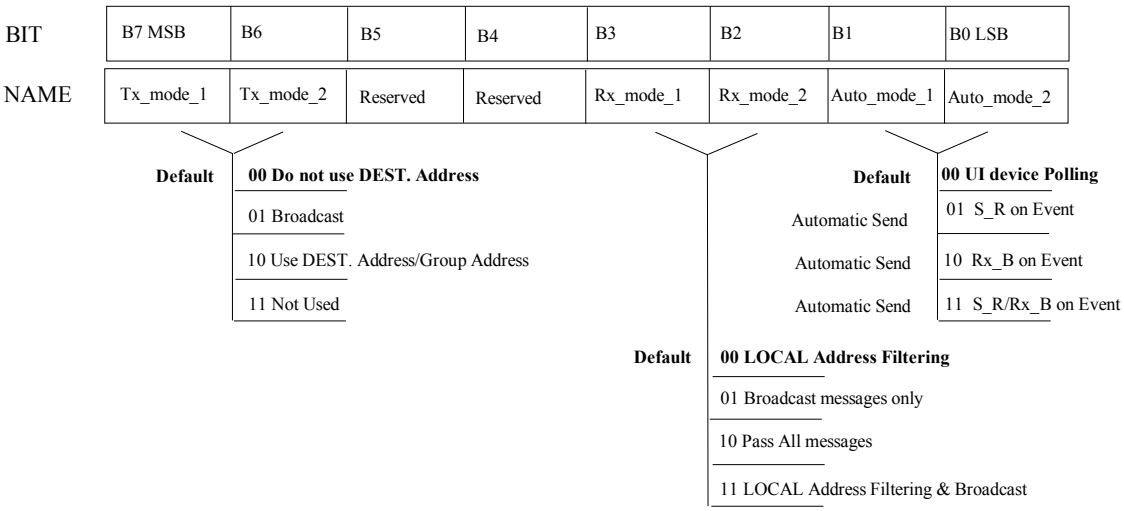


Figure 10 – Function mode register

Of the eight bits available only six are used (B4 and B5 reserved):

- Tx_mode_1, Tx_mode_2:

  By default a logical communication addressing to HES network is enabled (B7=0 and B6=0).
  If required, a message to HES network can be transmitted using the physical destination address (B7=1 and B6=0) or a group address.
  The broadcast mode supports the transmission of a message to all HES network devices.

- Rx_mode_1, Rx_mode_2:

  The Rx_mode bits (B3 and B2) select four types of filter for HES network messages. By default Rx_mode is set to Local Addressing Filtering B1=0 and B0=0.

- Auto_mode_1, Auto_mode_2:

- The Auto_mode bits (B1 and B0) select the data transfer mode to the UI Device.
  By default data transfer mode is set to UI device Polling (B1=0 and B0=0).
  In the Automatic send mode the Status Register (B1=0 and B1=1), the receiving buffer (B1=1 and B0=0) or both (B1=1 and B0=1) can be sent to the UI Device when the Status Register changes.

8 Command structure

Processes in the UI NAU and in the UI device communicate by using commands to control the transfer of information messages. In order to provide uniform communication with different UI device application processes the following commands are specified.

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8.1 Frame format FT 1.2 language structure

8.1.1 Management commands using fixed length

Command/Response: General structure.

START 10H	CONTROL	USER DATA	USER DATA	CHECKSUM	END 16H
		Identifier	Value		

Command: Read UI NAU Receiver Buffer.

RD_Rx_B	00H

Command: Read UI NAU Local Address.

RD_UI_NAU_L_AD	00H

Command: Read UI NAU Function Mode Register.

RD_UI_NAU_FM_R	00H

Command: Read UI NAU Function Mode Register.
Response: UI NAU Function Mode Register.

UI_NAU_FM_R	Value	as defined in 8.3

Command: Set UI NAU Function Mode Register.

SET_UI_NAU_FM_R	Value	as defined in 8.3

Command: Read UI NAU Status Register.

RD_UI_NAU_S_R	00H

Command: Read UI NAU Status Register.
Response: UI NAU Status Register.

UI_NAU_S_R	Value	as defined in 8.3

Command: Bit Rate Negotiation.

BIT_RATE_N	Capability	as specified in 9.2.1

Command: UI Device Polling Message.

POLLING	00H

Command: UI Device Polling Message.

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Response: UI NAU Polling Response.

POLLING	Link_Status	as specified in 9.3

Command: Read UI NAU Transmission Buffer Dimension.

RD_Tx_B_DIM	00H

Command: Read UI NAU Transmission Buffer Dimension.
Response: UI NAU Transmission Buffer Dimension.

Tx_B_DIM	Value	as described in 8.2

Command: Reset Message.

RESET	00H

8.1.2 Frame with variable length

Command/Response: General structure.

START 68H	LENGTH	LENGTH	START 68H	CONTROL	USER DATA	USER DATA	USER DATA	USER DATA	CHECK-SUM	END 16H
					Identifier	D1	.....	Dn		

Command: Write UI NAU Transmission Buffer.

WR_Tx_B	Tx_D1	.....	Tx_Dn

Command: Read UI NAU Receiver Buffer (Fixed Length Frame).
Response: UI NAU Receiver Buffer.

Rx_B	Rx_D1	.....	Rx_Dn

Command: Read UI NAU Local Address (Fixed Length Frame).
Response: UI NAU Local Address.

UI_NAU_L_AD	AD1	.....	AD6	as specified in 8.1

Command: Set UI NAU Local Address.

SET_ UI_NAU L_AD	AD1	.....	AD6	as specified in 8.3

Command: Set Destination Address.

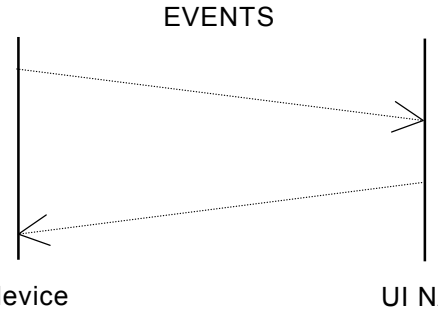
SET_D_AD	AD1	.....	AD6	as specified in 8.3

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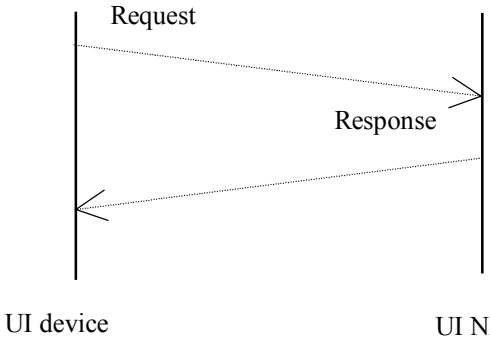
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8.1.3 Control sequences specification

The commands specified in 8.1.1 and 8.1.2 shall be used to control the processes in the UI NAU and in the UI Device. These controls can be specified using the general model described below.

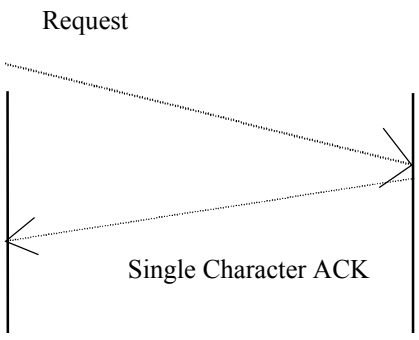


The Request/Response Model defines the control commands specified below:



Request: *Read UI NAU Receiver Buffer*	Response: *UI NAU Receiver Buffer*
Request: *Read UI NAU Local Buffer*	Response: *UI NAU Local Address*
Request: *Read UI NAU Function Mode Register*	Response: *UI NAU Function Mode Register*
Request: *Read UI NAU Status Register*	Response: *UI NAU Status Register*
Request: *Read UI NAU Transmission Buffer dimension*	Response: *UI NAU Transmission Buffer dimension*
Request: *UI Device Bit Rate Capability*	Response: *UI NAU Bit Rate Capability*
Request: *UI Device Polling*	Response: *Link Status*

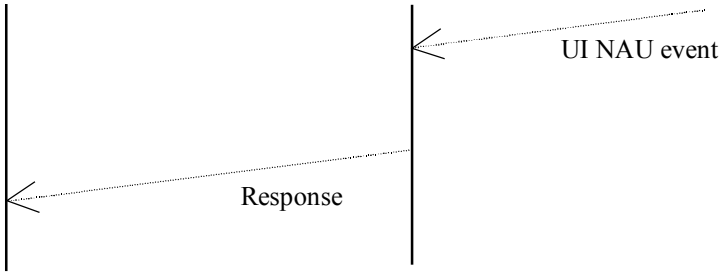
The Request only Model defines the control commands specified below:



Request: *Write UI NAU Transmission Buffer*
Request: *Set UI NAU Function Mode Register*
Request: *Set UI NAU Local Address*
Request: *Set Destination Address*
Request: *Reset*

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The Response only Model defines the control commands specified bellow when the Function Mode Register Auto_Mode bits are set to automatic send:



Response:	*Receiving Buffer*	UI NAU event:	*HES message received*
Response:	*Status Register*	UI NAU event:	*Status Register update*
Response:	*Receiving Buffer and Status Register*	UI NAU event:	*HES message received or Status Register update*

8.2 Command specifications

Identifier:	WR_Tx_B
Frame Type:	Variable Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	3
Function Type:	SEND/CONFIRM
Confirm:	Single Character ACK

Identifier:	RD_Rx_B
Frame Type:	Fixed Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	Rx_B Response

Identifier:	Rx_B
Frame Type:	Variable Length
Primary Station:	UI NAU
Secondary Station:	UI Device
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	–

Identifier:	RD_L_AD
Frame Type:	Fixed Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	UI_NAU_L_AD Response

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Identifier:	UI_NAU_L_AD
Frame Type:	Variable Length
Primary Station:	UI NAU
Secondary Station:	UI Device
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	–

Identifier:	SET_L_AD
Frame Type:	Variable Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	3
Function Type:	SEND/CONFIRM
Confirm:	Single Character ACK

Identifier:	SET_D_AD
Frame Type:	Variable Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	3
Function Type:	SEND/CONFIRM
Confirm:	Single Character ACK

Identifier:	RD_UI_NAU_S_R
Frame Type:	Fixed Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	UI_NAU_S_R Response

Identifier:	UI_NAU_S_R
Frame Type:	Fixed Length
Primary Station:	UI NAU
Secondary Station:	UI Device
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	–

Identifier:	RD_UI_NAU_FM_R
Frame Type:	Fixed Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	UI_NAU_FM_R Response

Identifier:	UI_NAU_FM_R
Frame Type:	Fixed Length
Primary Station:	UI NAU
Secondary Station:	UI Device
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	–

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Identifier:	SET_UI_NAU_FM_R
Frame Type:	Fixed Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	3
Function Type:	SEND/CONFIRM
Confirm:	Single Character ACK

Identifier:	RD_Tx_B_DIM
Frame Type:	Fixed Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	Tx_B_DIM Response

Identifier:	Tx_B_DIM
Frame Type:	Fixed Length
Primary Station:	UI NAU
Secondary Station:	UI Device
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	–

Identifier:	BIT_RATE_N
Frame Type:	Fixed Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	BIT_RATE_N from UI NAU

Identifier:	BIT_RATE_N
Frame Type:	Fixed Length
Primary Station:	UI NAU
Secondary Station:	UI Device
Function Code Nr:	4
Function Type:	SEND NO REPLY
Confirm:	–

Identifier:	POLLING
Frame Type:	Fixed Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	9
Function Type:	REQUEST/RESPOND
Confirm:	Link Status

Identifier:	POLLING
Frame Type:	Fixed Length
Primary Station:	UI NAU
Secondary Station:	UI Device
Function Code Nr:	11
Function Type:	RESPOND
Confirm:	–

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Identifier:	RESET
Frame Type:	Fixed Length
Primary Station:	UI Device
Secondary Station:	UI NAU
Function Code Nr:	0
Function Type:	SEND/CONFIRM
Confirm:	Single Character ACK

8.3 Command identifiers coding

Identifier	Coding
WR_Tx_B	01H
RD_Rx_B	02H
Rx_B	03H
SET_D_AD	04H
SET_UI_NAU_L_AD	05H
RD_UI_NAU_L_AD	06H
UI_NAU_L_AD	07H
RD_UI_NAU_FM_R	08H
UI_NAU_FM_R	09H
SET_UI_NAU_FM_R	0AH
RD_UI_NAU_S_R	0BH
UI_NAU_S_R	0CH
RD_Tx_B_DIM	0DH
Tx_B_DIM	0EH
BIT_RATE_N	0FH
POLLING	10H
RESET	11H

9 UI operational procedure

9.1 Point-to-point communication link initialisation

The UI NAU and the UI device shall set the initial bit rate of the point-to-point communication link to 1,200 bit/s (default value). The UI device (primary station) shall send a reset frame to UI NAU (secondary station) until a single character positive acknowledgement is received. This reset procedure initialises the UI NAU resources and the UI device to a known initial state. The reset procedure shall not affect the UI NAU physical address. After the initialisation process the UI device can start normal operation or can initiate the negotiation procedure described in 9.2.

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9.2 Negotiation capabilities

The UI NAU and the UI device can agree on the default communication speed or negotiate a higher speed according to the procedure defined in 9.2.2. In order to perform a negotiation the UI device and the UI NAU shall enumerate their own capabilities and use only those capabilities common to both sides. In the negotiation phase the communication shall take place with the UI device working as master unit and the UI NAU working as slave unit.

9.2.1 Communication speed negotiation

The UI NAU and the UI device shall perform the following procedure to negotiate the bit rate of the point-to-point communication link.

The additional bit rates are the following:

Higher rate	57 600 bit/s	38 400 bit/s	28 800 bit/s	19 200 bit/s	9 600 bit/s	4 800 bit/s	2 400 bit/s

MSB LSB

Figure 11 – Communication speed parameter

The UI NAU and the UI device will set a logic 1 in the positions corresponding to each supported communication speed.

9.2.2 Negotiation procedure

See Figure 11 below.

- The UI device (master unit) shall establish a communication at the default bit rate allowed on the communication link: 1 200 bit/s.
- The UI device shall send to the UI NAU its own bit rate capability in a single frame.
- When the UI NAU receives the UI device bit rate capability, it shall respond with its own bit rate capability.
- The UI NAU and UI device shall use the highest bit rate capability common to both ends. In order to define the common bit rate capability the UI NAU and the UI devices shall mask the received packet with their own bit rate capability.

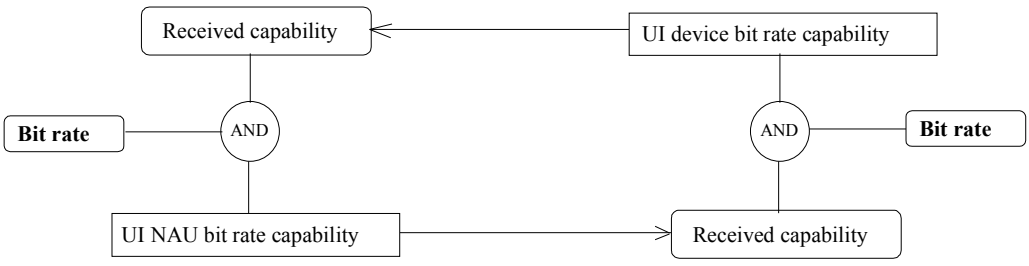


Figure 12 – Negotiation procedure

NOTE If the UI NAU or the UI device support only the lowest bit rate the capability packet shall be 00 Hex.

- The UI NAU and UI device shall adjust their bit rate according to the step.

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9.3 Polling message

A polling frame shall be exchanged periodically between the UI Device and UI NAU to check the integrity of the physical connection, see Figure 13.

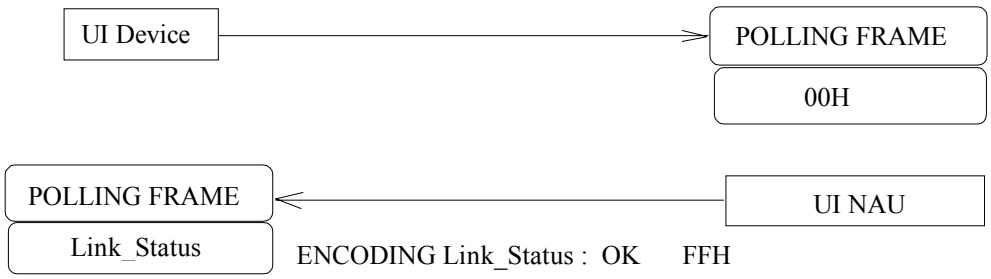


Figure 13 – Polling message

If an error is detected by means of a time out mechanism the UI NAU and the UI Device shall return to their initial default state. This reset procedure initialises the UI NAU and the UI Device to a known initial state; this includes the bit rate of the point-to-point communication link (see 9.1), which is set to the 1 200 bit/s default value. The reset procedure shall not affect the UI NAU physical address.

The Polling message time out is specified as 508 idle bits.

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Annex A
(informative)

Home control systems that do not provide power from the network

This annex describes home control systems based on media that do not normally provide power, such as infrared or radio frequency.

For this type of externally powered NAU only connection with an UI SP device will be allowable. A SELV or PELV power output, as specified in IEC 60364-1, should be provided by the UI SP device to the EP UI NAU.

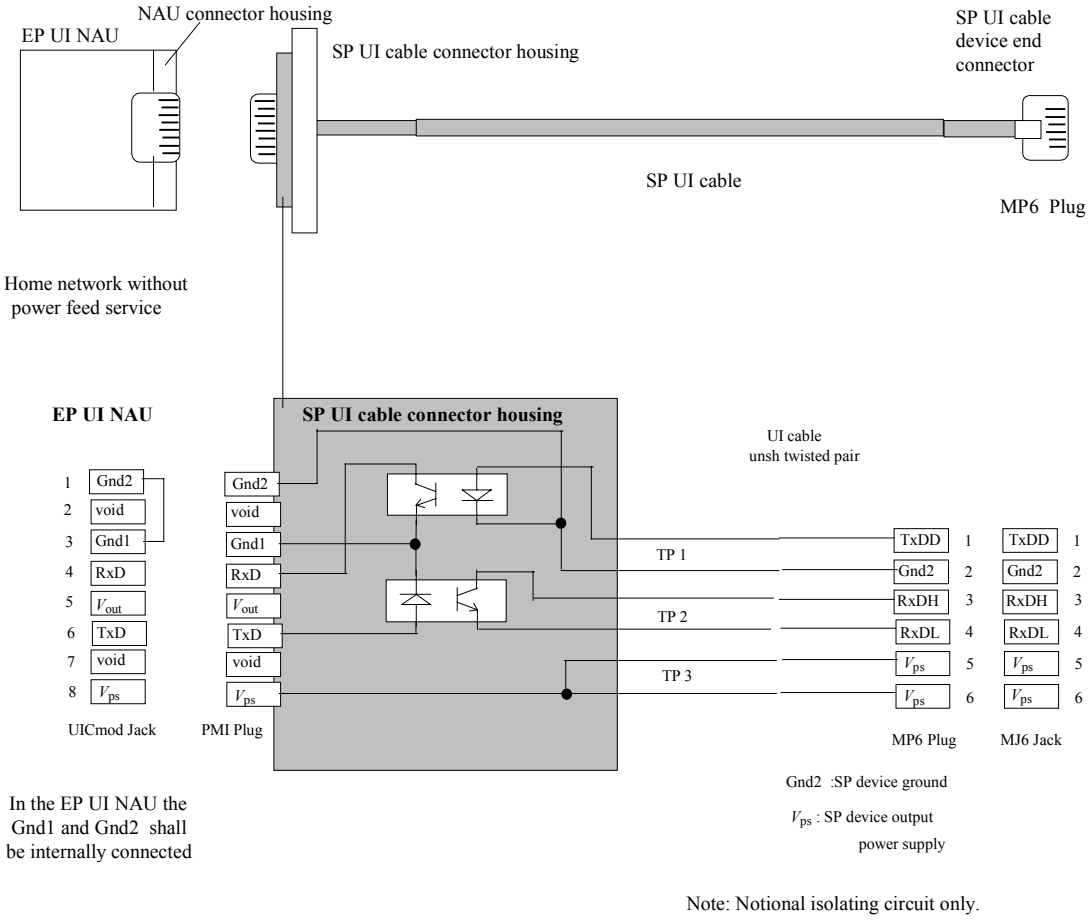


Figure A.1 – Function mode register

The UI interface used as shown in Figure A.1 should comply with this International Standard. An additional standard might contain a more detailed specification.

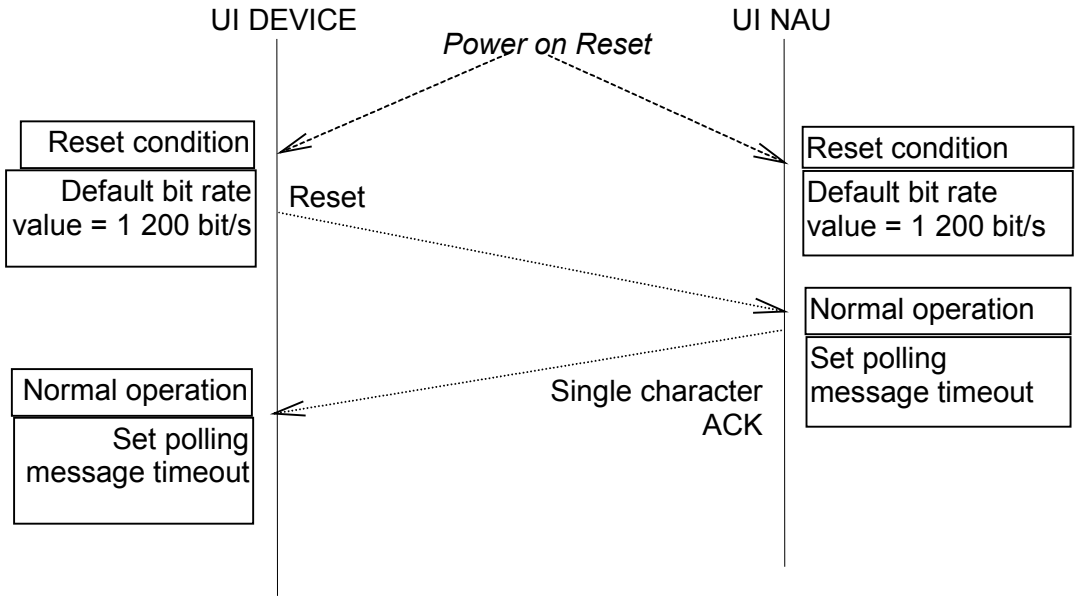
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Annex B
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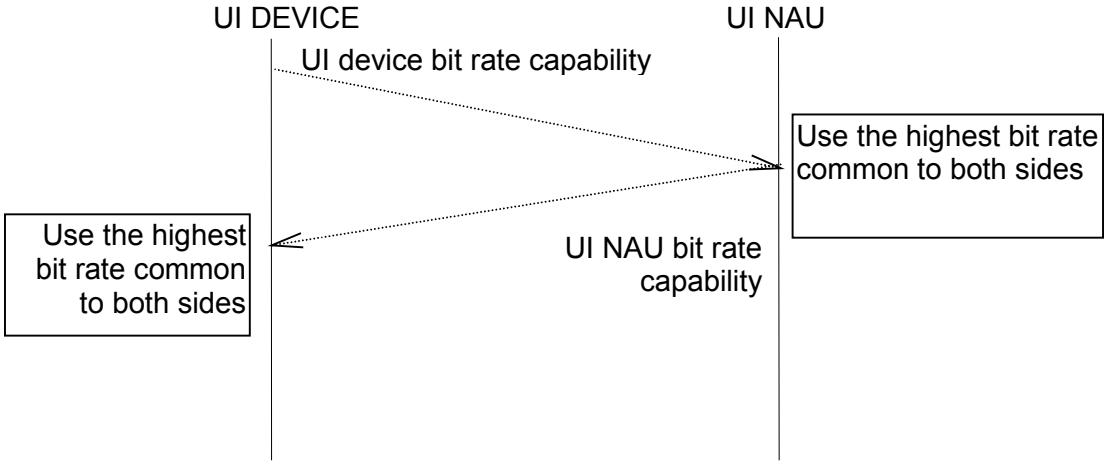
Illustration of UI operational procedure

This Annex contains graphical presentations of the UI operational procedure defined in clause 9.

Point-to-point communication link initialisation

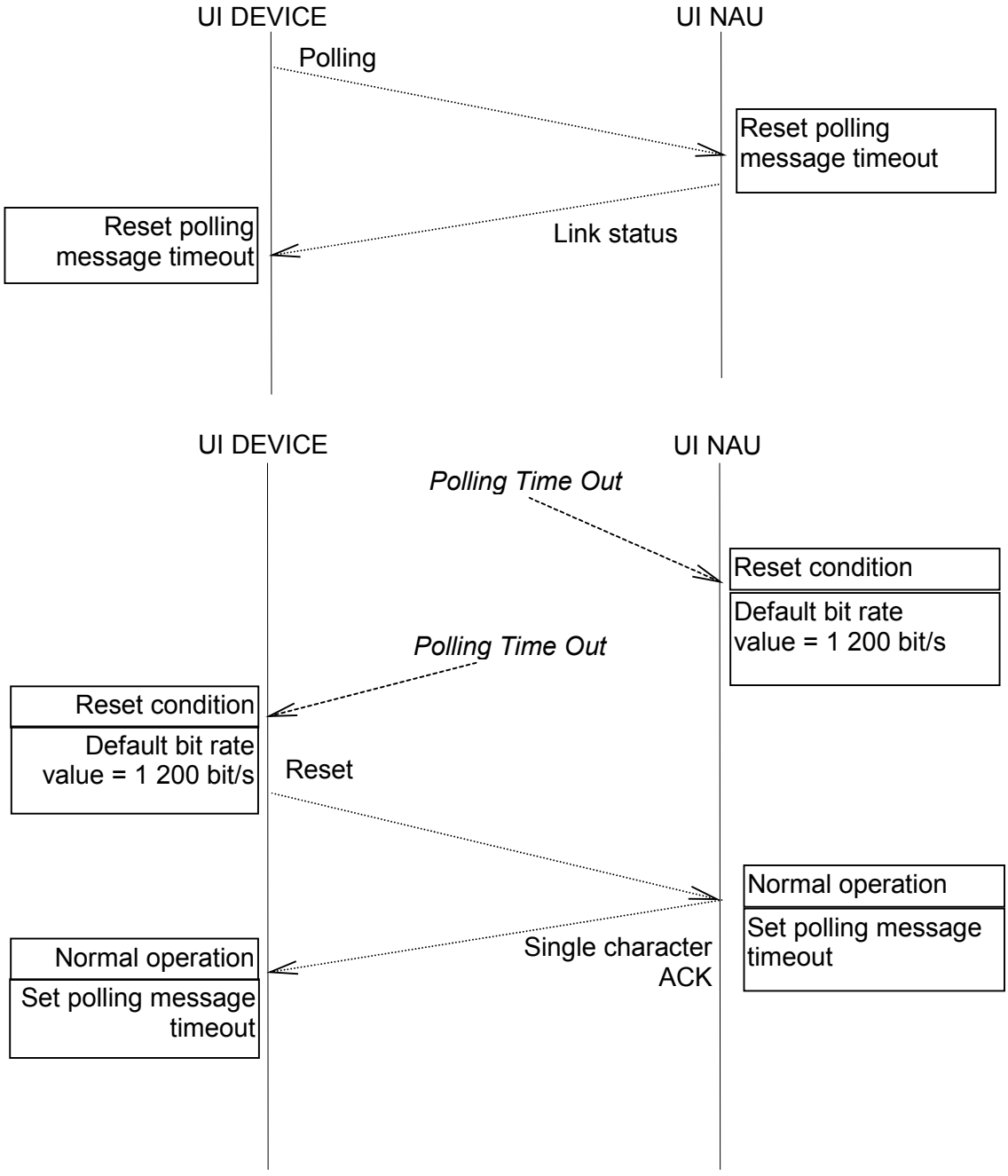


UI device and UI NAU negotiation



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Polling mechanism



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