SLOVENSKI STANDARD
SIST EN 60870-5-101:1997/A2:2002

01-oktober-2002

Telecontrol equipment and systems - Part 5-101: Transmission protocols - Companion standard for basic telecontrol tasks - Amendment A2 (IEC 60870-5-101:2001)

Telecontrol equipment and systems -- Part 5-101: Transmission protocols - Companion standard for basic telecontrol tasks

Fernwirkeinrichtungen und -systeme -- Teil 5-101: Übertragungsprotokolle - Anwendungsbezogene Norm für grundsätzliche Fernwirkaufgaben

Matériels et systèmes de téléconduite -- Partie 5-101: Protocoles de transmission - Norme d'accompagnement pour les tâches élémentaires de téléconduite

Ta slovenski standard je istoveten z: **EN 60870-5-101:1996/A2:2001**

ICS:

33.200	Daljinsko krmiljenje, daljinske meritve (telemetrija)
	Telecontrol. Telemetering

SIST EN 60870-5-101:1997/A2:2002 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60870-5-101/A2

November 2001

ICS 33.200

English version

Telecontrol equipment and systems
Part 5-101: Transmission protocols - Companion standard for basic telecontrol tasks
(IEC 60870-5-101:1995/A2:2001)

Matériels et systèmes de téléconduite
Partie 5-101: Protocoles de transmission - Norme d'accompagnement pour les tâches élémentaires de téléconduite
(CEI 60870-5-101:1995/A2:2001)

Fernwirkeinrichtungen und -systeme
Teil 5-101: Übertragungsprotokolle - Anwendungsbezogene Norm für grundsätzliche Fernwirkaufgaben
(IEC 60870-5-101:1995/A2:2001)

This amendment A2 modifies the European Standard EN 60870-5-101:1996; it was approved by CENELEC on 2001-11-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC
European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 60870-5-101:1996/A2:2001 E

Foreword

The text of document 57/535/FDIS, future amendment 2 to IEC 60870-5-101:1995, prepared by IEC TC 57, Power system control and associated communications, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 60870-5-101:1996 on 2001-11-01.

The following dates were fixed:

- latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2002-08-01
- latest date by which the national standards conflicting with the amendment have to be withdrawn (dow) 2004-11-01

Endorsement notice

The text of amendment 2:2001 to the International Standard IEC 60870-5-101:1995 was approved by CENELEC as an amendment to the European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

Add:

Publication	Year	Title	EN/HD	Year
IEC 60870-5-103	1997	Telecontrol equipment and systems Part 5-103: Transmission protocols -- Companion standard for the informative interface of protection equipment	EN 60870-5-103	1998
ISO/IEC 8824-1	2000	Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation	-	-

INTERNATIONAL STANDARD

IEC 60870-5-101

1995

AMENDMENT 2
2001-10

Amendment 2

Telecontrol equipment and systems –

Part 5-101: Transmission protocols – Companion standard for basic telecontrol tasks

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PRICE CODE X

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FOREWORD

This amendment has been prepared by IEC technical committee 57: Power system control and associated communications.

The text of this amendment is based on the following documents:

FDIS	Report on voting
57/535/FDIS	57/551/RVD

Full information on the voting for the approval of this amendment can be found in the report on voting indicated in the above table.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until 2003. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

Page 7

1 Scope and object

Add, after the third paragraph, the following new text:

Although this companion standard defines the most important user functions, other than the actual communication functions, it cannot guarantee complete compatibility and interoperability between equipment of different vendors. An additional mutual agreement is normally required between concerned parties regarding the methods of use of the defined communication functions, taking into account the operation of the entire telecontrol equipment.

2 Normative references

Insert, in the list, the titles of the following standards:

IEC 60870-5-103:1997, *Telecontrol equipment and systems – Part 5-103: Transmission protocols – Companion standard for the informative interface of protection equipment*

ISO/IEC 8824-1:2000, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*

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5 Physical layer

5.1 Selections from ISO and ITU-T standards

Add, on page 19, after 5.1.3, the following new subclause:

5.1.4 Other compatible interfaces

Physical interfaces other than those which are recommended in the IEC 60870-5 series may be used, according to agreement between user and vendor. However, if other interfaces are used, it is the responsibility of the user and the vendor to prove their functionality and interoperability.

6 Link layer

6.1 Selections from IEC 60870-5-1: Transmission frame formats

Add, after the notes, the following new text:

Transmission rule R3 states that no idle line intervals are admitted between characters. This may not be possible to achieve in some practical implementations, particularly with high bit rate transmission, because of unavoidable hardware or software delays.

However, annex B demonstrates that a line idle interval between characters that has a duration not longer than one transmitted bit time does not reduce the frame integrity. Therefore, transmission rule R3 may be relaxed to allow line idle intervals of up to one transmitted bit time duration between characters. The line idle intervals between characters extend the transmission time of time critical information (for example, clock synchronization) which may reduce the accuracy of clocks in controlled stations.

There is no requirement for the receiver to measure line idle intervals between characters. For example, the receiver may be implemented using an industry standard UART circuit alone, without any special hardware or software concerned with the duration of gaps between characters in a received frame.

6.2 Selections from IEC 60870-5-2: Link transmission procedures

Add, after the third paragraph, the following new subclause:

6.2.1 State transition diagrams

This subclause adds more detail to the base definitions of link transmission procedures given in IEC 60870-5-2. State transition diagrams are used to define the procedures more exactly so that link layers implemented by different manufacturers can be made fully interoperable. State transition diagrams represent the states (in this case of the link layer defined in IEC 60870-5-2) and the transitions from one state into another. The actions (send Tx and receive Rx) are included. In addition to the states, important internal processes are described.

The state transition diagrams are presented in the format defined by Grady Booch/Harel. The explanation of the particular elements is shown in figure 75.

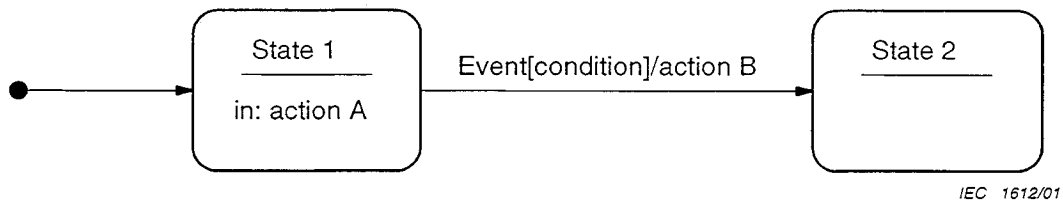

Figure 75 – State transition diagram by Grady Booch/Harel

The word "in" describes an action which is triggered when a transition into a new state occurs. The transition to the next state may be triggered by the termination of the current state, in the case where there is no defined event to cause the transition.

The notation used in the following state transition diagrams is:

FC0 to FC15 = function code number 0 to 15, see tables 1 to 4 of IEC 60870-5-2

FCB = frame count bit

FCV = frame count bit valid

DFC = data flow control

ACD = access demand

PRM = primary message

SC = single character

Replace the heading "UNBALANCED TRANSMISSION" *by:*

6.2.1.1 Unbalanced transmission procedures

Add, after the fourth paragraph of 6.2.1.1, the following new text:

The SEND/NO REPLY service is used when issuing a user data message to all stations (broadcast address).

Add, after the second sentence of the sixth paragraph, the following new text:

The assignment of the causes of transmission to the two classes is defined in 7.4.2.

Add, after the sixth paragraph, the following new text:

Table 10 shows the permissible combinations of the unbalanced link layer procedures.

Table 10 – Permissible combinations of unbalanced link layer services

Function codes and services in the primary direction	Permitted function codes and services in the secondary direction
<0> Reset of remote link	<0> CONFIRM: ACK or <1> CONFIRM: NACK
<1> Reset of user process	<0> CONFIRM: ACK or <1> CONFIRM: NACK
<3> SEND/CONF user data	<0> CONFIRM: ACK or <1> CONFIRM: NACK
<4> SEND/NO REPLY user data	No reply
<8> REQUEST for access demand	<11> RESPOND: status of link
<9> REQUEST/RESP request status of link	<11> RESPOND: status of link
<10> REQUEST/RESP request user data class 1	<8> RESPOND: user data or <9> RESPOND: requested data not available
<11> REQUEST/RESP request user data class 2	<8> RESPOND: user data or <9> RESPOND: requested data not available

Responses <14> Link service not functioning or <15> Link service not implemented are also permitted. The single control character E5 may be used instead of a fixed length CONFIRM ACK (secondary function code <0>) or fixed length RESPOND NACK (secondary function code <9>) except when there is an access demand for class 1 data (ACD = 1) or further messages may cause an overflow (DFC = 1). This is shown in figures 77 and 78. The single character A2 must not be used.

For unbalanced transmission procedures: The primary station contains only a primary link layer and the secondary station contains only a secondary link layer (see figure 76). More than one secondary station may be connected to one primary station. Compatible communication between the primary station and a particular secondary station relies on these two stations alone. The polling procedure for requesting data from multiple secondary stations is a local internal function of the primary station and need not be shown in figures 76 to 78. Consequently, these diagrams only show the primary station and a single secondary station. In the case of more than one secondary station, the primary station has to remember the current state of each secondary station.

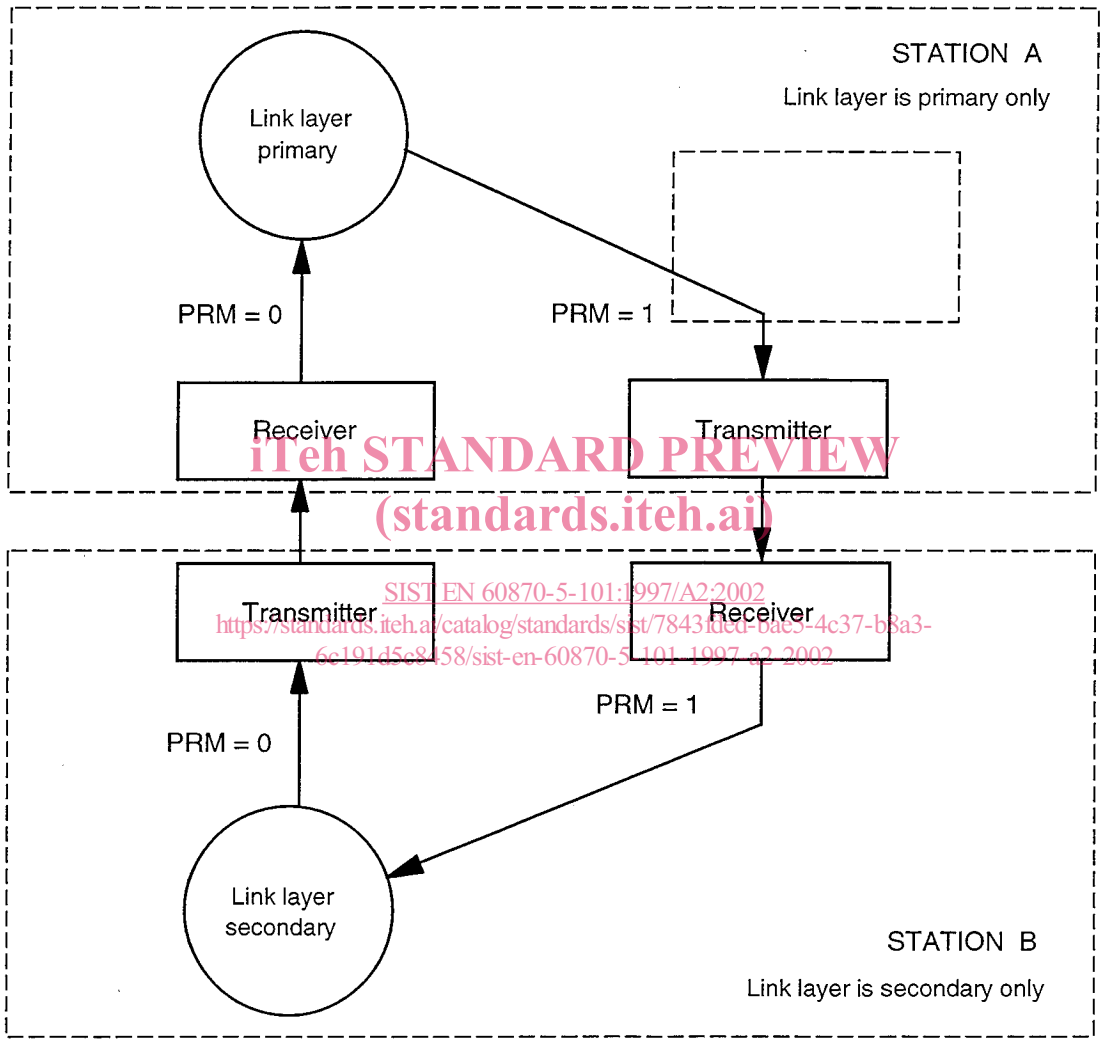

Figure 76 – Unbalanced transmission procedures, primary and secondary stations

Figure 77 shows the state transition diagram of the primary station, figure 78 that of the secondary station.

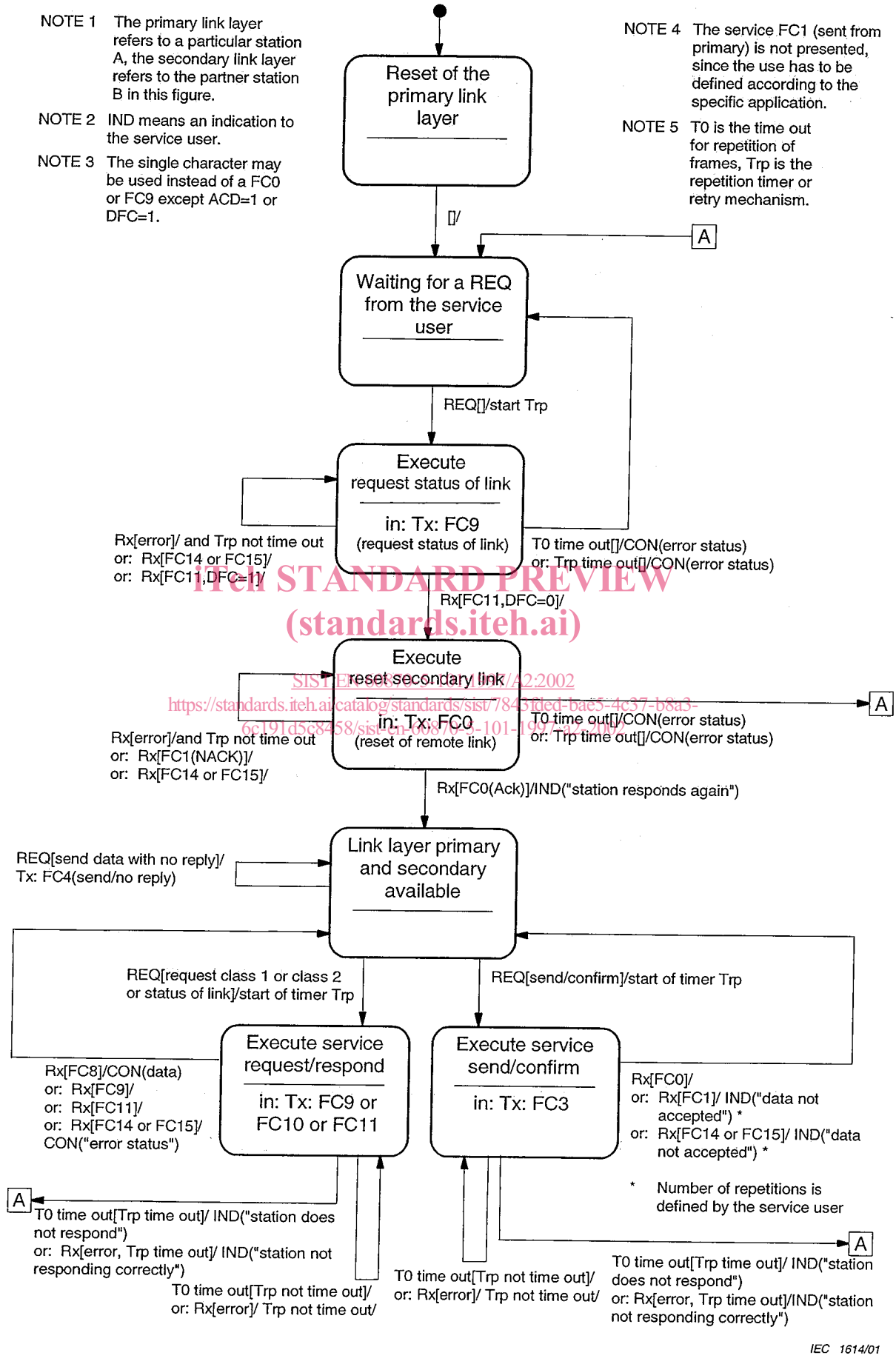

Figure 77 – State transition diagram for unbalanced transmission primary to secondary

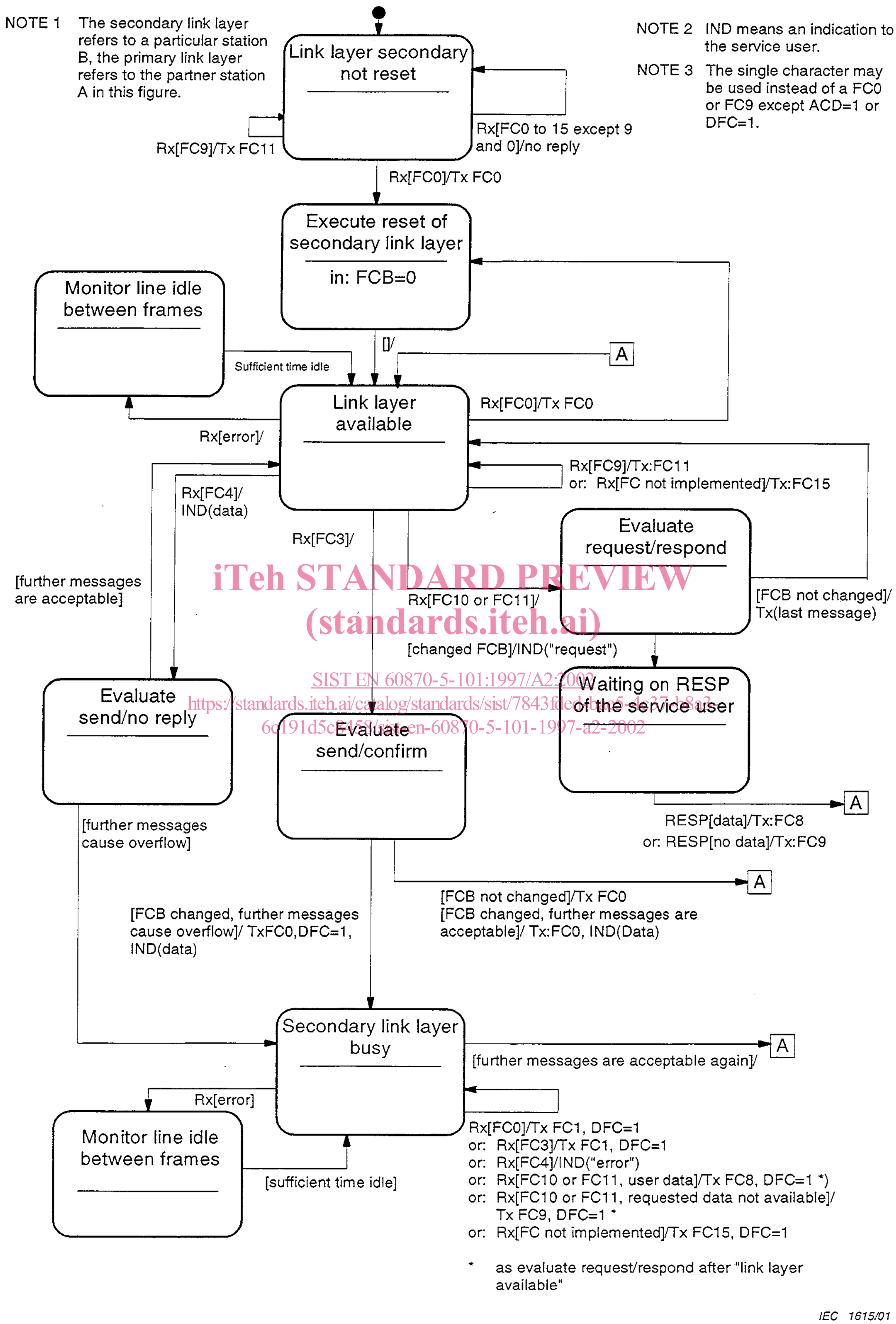
NOTE 1 The secondary link layer refers to a particular station B, the primary link layer refers to the partner station A in this figure.
NOTE 2 IND means an indication to the service user.
NOTE 3 The single character may be used instead of a FC0 or FC9 except ACD=1 or DFC=1.
Link layer secondary not reset
Rx[FC9]/Tx FC11
Rx[FC0 to 15 except 9 and 0]/no reply
Rx[FC0]/Tx FC0
Execute reset of secondary link layer
in: FCB=0
Monitor line idle between frames
Sufficient time idle
[]/
A
Link layer available
Rx[FC0]/Tx FC0
Rx[error]/
Rx[FC9]/Tx:FC11
or: Rx[FC not implemented]/Tx:FC15
Rx[FC4]/
IND(data)
Rx[FC3]/
Evaluate request/respond
[further messages are acceptable]
Rx[FC10 or FC11]/
[FCB not changed]/
Tx(last message)
[changed FCB]/IND("request")
Evaluate send/no reply
Waiting on RESP of the service user
Evaluate send/confirm
RESP[data]/Tx:FC8
or: RESP[no data]/Tx:FC9
[further messages cause overflow]
[FCB not changed]/Tx FC0
[FCB changed, further messages are acceptable]/ Tx:FC0, IND(Data)
[FCB changed, further messages cause overflow]/ TxFC0,DFC=1, IND(data)
Secondary link layer busy
[further messages are acceptable again]/
Rx[error]
Monitor line idle between frames
[sufficient time idle]
Rx[FC0]/Tx FC1, DFC=1
or: Rx[FC3]/Tx FC1, DFC=1
or: Rx[FC4]/IND("error")
or: Rx[FC10 or FC11, user data]/Tx FC8, DFC=1 *)
or: Rx[FC10 or FC11, requested data not available]/ Tx FC9, DFC=1 *
or: Rx[FC not implemented]/Tx FC15, DFC=1
* as evaluate request/respond after "link layer available"
IEC 1615/01

Figure 78 – State transition diagram for unbalanced transmission secondary to primary

Replace the heading "BALANCED TRANSMISSION" *by:*

6.2.1.2 Balanced transmission procedures

Add, after the first paragraph of 6.2.1.2, the following:

The following table shows the permissible combinations of the balanced link layer procedures

Table 11 – Permissible combinations of balanced link layer services

Function codes and services in the primary direction	Permitted function codes and services in the secondary direction
<0> Reset of remote link	<0> CONFIRM: ACK or <1> CONFIRM: NACK
<1> Reset of user process	<0> CONFIRM: ACK or <1> CONFIRM: NACK
<2>SEND/CONF test function for link	<0> CONFIRM: ACK or <1> CONFIRM: NACK
<3> SEND/CONF user data	<0> CONFIRM: ACK or <1> CONFIRM: NACK
<4> SEND/NO REPLY user data	No reply
<9> REQUEST/RESP request status of link	<11> RESPOND: status of link

Responses <14> link service not functioning or <15> link service not implemented are also permitted. The single control character E5 may be used instead of a fixed length CONFIRM ACK (secondary function code <0>) except when further messages may cause an overflow (DFC = 1).

Add, after the second paragraph, the following new text:

The link layers for balanced transmission procedures consist of two decoupled logical processes, one logical process represents station A as the primary station and station B as the secondary station and the other logical process represents station B as the primary station and station A as the secondary station (each station is a combined station). Thus, two independent processes exist in each station to control the link layer in the logical primary and in the secondary direction. Figure 79 shows the typical arrangement of the link layer using balanced transmission procedures.

NOTE The physical transmission direction is fixed defined by the bit DIR. The logical processes primary or secondary may change from station A to B and vice versa. The primary message is defined by the bit PRM = 1, the secondary message by the bit PRM = 0 (see 6.1.2 of IEC 60870-5-2).

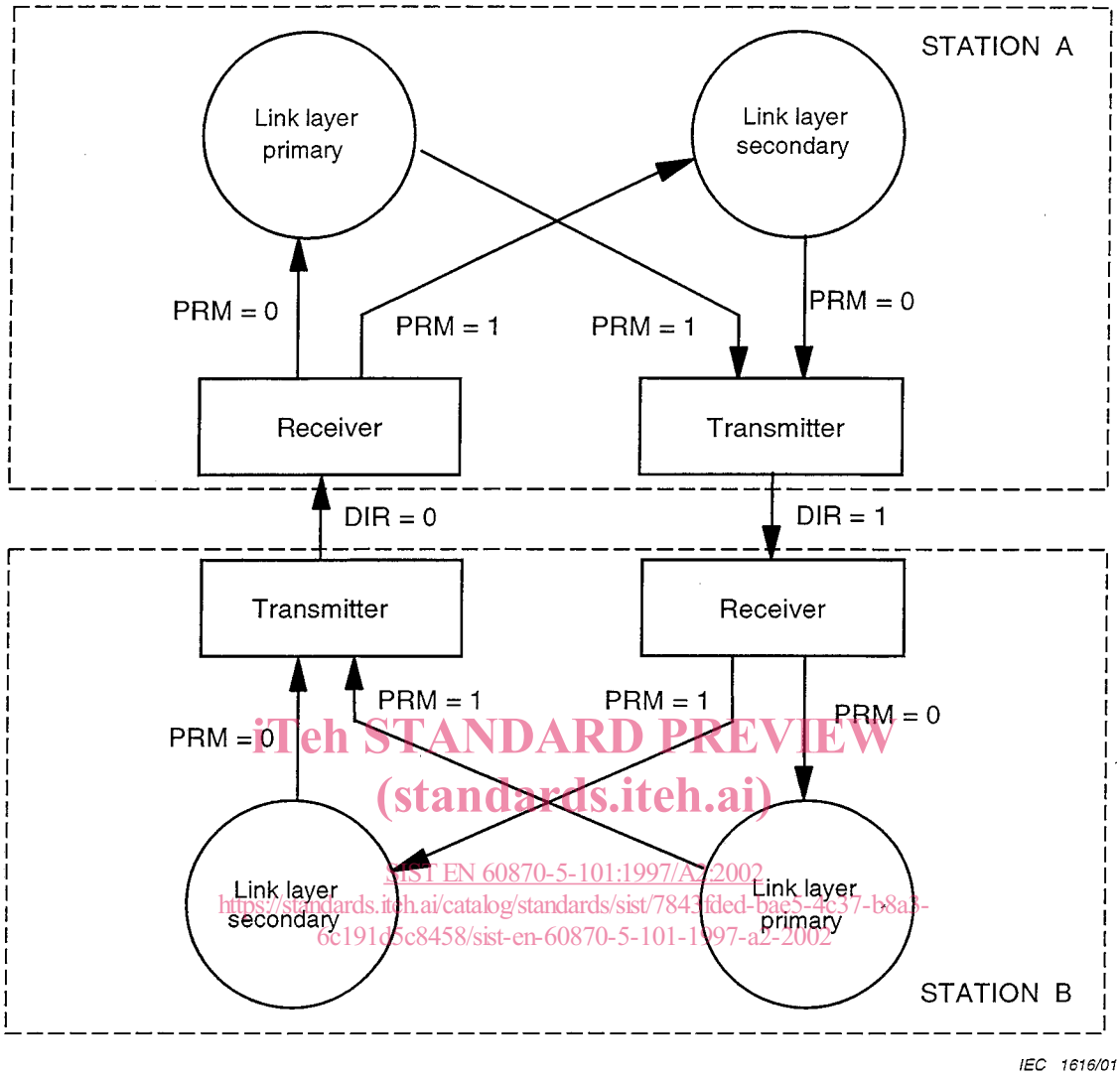

Figure 79 – Balanced transmission procedures, primary and secondary link layers

Figures 80 and 81 do not show the reactions of the link layer in the case of receiving corrupted frames. These frames are already rejected by a process which is not shown in the following. This process is also responsible for the control of the time out interval. Figure 80 shows the state transition diagram of the primary link layer using balanced transmission procedures. Figure 81 shows the secondary link layer.