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Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Classes of procedures

Technologies de l'information — Télécommunications et échange d'informations entre systèmes — Procédures de commande à haut niveau (HDLC) — Classes de procédures

Reference number
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Contents

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 7809 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

This third edition cancels and replaces the second edition (ISO/IEC 7809:1991), and incorporates ISO/IEC 7809 amendments 5, 6 and 7.

Annex A of this International Standard is for information only.

Introduction

High-level data link control (HDLC) classes of procedures describe methods of data link operation which permit synchronous or start/stop, code-transparent data transmission between data stations in a variety of logical and physical configurations. The classes are defined in a consistent manner within the framework of an overall HDLC architecture. One of the purposes of this International Standard is to maintain maximum compatibility between the basic types of procedures, unbalanced, balanced and connectionless, as this is particularly desirable for data stations with configurable capability, which may have the characteristics of a primary, secondary, combined, control, tributary, or peer station, as required for a specific connection.

This International Standard defines five fundamental classes of procedures (two unbalanced, one balanced, and two connectionless). The unbalanced classes apply to both point-to-point and multipoint configurations (as illustrated in figure 1) over either dedicated or switched data transmission facilities. A characteristic of the unbalanced classes is the existence of a single primary station at one end of the data link plus one or more secondary stations at the other end(s) of the data link. The primary station alone is responsible for data link management, hence the designation "unbalanced" classes of procedures.

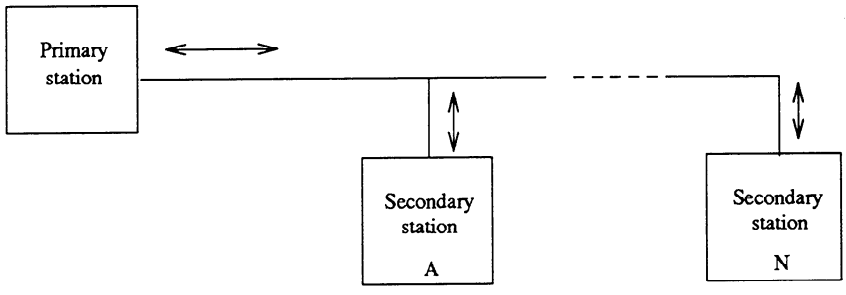

Figure 1 - Unbalanced data link configuration

The balanced class applies to point-to-point configurations (as illustrated in figure 2) over either dedicated or switched data transmission facilities. A characteristic of the balanced class is the existence of two data stations, called combined stations, on a logical data link, that may share equally in the responsibility for data link management, hence the designation "balanced" class of procedures.

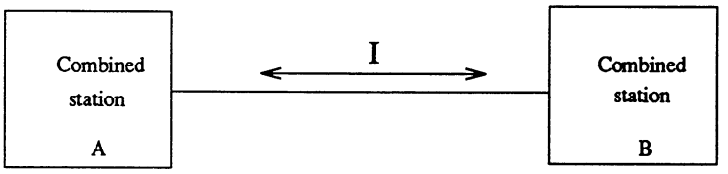

Figure 2 - Balanced data link configuration

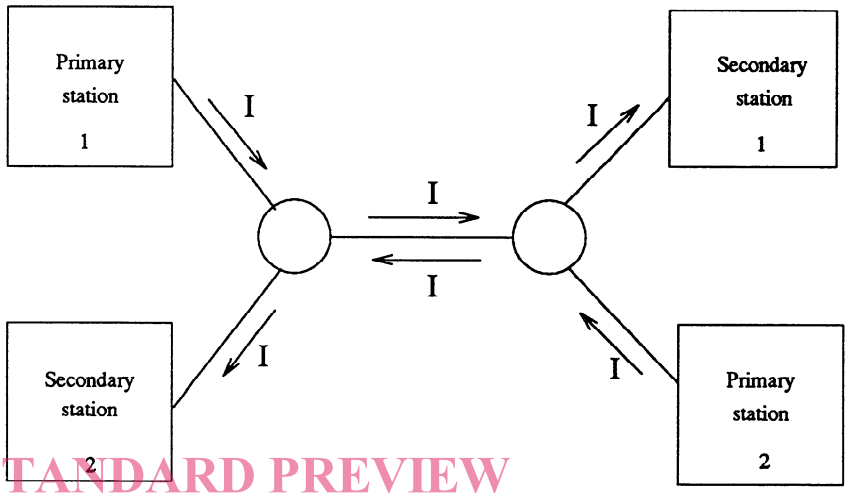

Figure 3 - Symmetrical data link configuration

The unbalanced connectionless class applies to point-to-point configurations over either dedicated or switched data transmission facilities, or to multipoint configurations over dedicated data transmission facilities. A characteristic of the unbalanced connectionless class is the existence of a single control station at one end of the data link plus one or more tributary stations at the other end(s) of the data link. The control station is responsible for determining when a tributary station is permitted to send. Neither the control station nor the tributary station(s) support any form of connection establishment/termination procedures, flow control procedures, data transfer acknowledgement procedures, or error recovery procedures, hence the designation "connectionless" class of procedures.

The balanced connectionless class applies to point-to-point configurations over either dedicated or switched data transmission facilities. A characteristic of the balanced connectionless class is the existence of two data stations, called peer stations, on a data link, that are each independently in control of when they can send. Neither peer station supports any form of connection establishment/termination procedures, flow control procedures, data transfer acknowledgement procedures, or error recovery procedures, hence the designation "connectionless" class of procedures.

For each class of procedures, a method of operation is specified in terms of the capabilities of the basic repertoire of commands and responses that are found in that class. A variety of optional functions are also listed. Procedural descriptions for the use of the optional functions are found in clause 6.

It is recognized that it is possible to construct symmetrical configurations for operation on a single data circuit from the unbalanced classes of procedures which are defined in this International Standard. For example, the combination of two unbalanced procedures (with I frame flow as commands only) in opposite directions would create a symmetrical point-to-point configuration (as illustrated in figure 3).

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Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Classes of procedures

1 Scope

This International Standard describes the HDLC unbalanced classes of procedures, the HDLC balanced class of procedures, and the HDLC connectionless classes of procedures for synchronous or start/stop data transmission.

Balanced operation is intended for use in circumstances which require equal control at either end of the data link. Operational requirements are covered in accordance with the overall HDLC architecture. The procedures use the HDLC frame structure defined in ISO/IEC 3309 and the HDLC elements of procedures described in ISO/IEC 4335.

For the unbalanced classes, the data link consists of a primary station plus one or more secondary stations and operates in either the normal response mode or the asynchronous response mode in a point-to-point or multipoint configuration. For the balanced class, the data link consists of two combined stations and operates in the asynchronous balanced mode in a point-to-point configuration. For the unbalanced connectionless class, the data link consists of a control station plus one or more tributary stations and operates in the unbalanced connectionless-mode in a point-to-point or multipoint configuration. For the balanced connectionless class, the data link consists of two peer stations and operates in the balanced connectionless-mode in a point-to-point configuration. In each class, a basic repertoire of commands and responses is defined, but the capability of the data link may be modified by the use of optional functions.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provision of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 646 : 1991, *Information technology — ISO 7-bit coded character set for information interchange.*

ISO 2382-9 : 1984, *Data processing — Vocabulary - Part 09: Data communication.*

ISO/IEC 3309 : 1993, *Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Frame structure.*

ISO/IEC 4335 : 1993, *Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — Elements of procedures.*

ISO/IEC 8885 : 1993, *Information technology — Telecommunications and information exchange between systems — High-level data link control (HDLC) procedures — General purpose XID frame information field content and format.*

3 General description

3.1 Principles

3.1.1 Types of data station

3.1.1.1 Two types of data station are defined for the unbalanced classes of procedures (see figure 4):

a) primary station, which sends commands, receives responses and is ultimately responsible for data link layer error recovery;

b) secondary stations, which receive commands, send responses and may initiate data link layer error recovery.

3.1.1.2 One type of data station is defined for the balanced class of procedures (see figure 4), i.e. combined stations, which send both commands and responses, receive both commands and responses, and are responsible for data link layer error recovery.

3.1.1.3 Three types of data stations are defined for the connectionless classes of procedures (see figure 4):

a) control station in unbalanced connectionless class of procedure, which sends commands, receives responses, but does not support any form of data link layer connection establishment/termination, flow control, acknowledgement, or error recovery;

b) tributary stations in unbalanced connectionless class of procedure, which receives commands, sends responses, but does not support any form of data link layer connection establishment/termination, flow control, acknowledgement, or error recovery;

c) peer stations in balanced connectionless class of procedures, which send both commands and responses, receive both commands and responses, but are not responsible for any form of data link layer connection establishment/termination, flow control, acknowledgment, or error recovery.

NOTE - The above terms are introduced in order to avoid having to use compound terms such as "connectionless secondary station", etc., throughout the subclauses that deal with connectionless classes of procedures.

3.1.2 Configurations

For the unbalanced classes of procedures, a single primary station plus one or more secondary station(s) shall be connected together over various types of transmission facilities to build point-to-point or multipoint, half-duplex or duplex, switched or non-switched configurations.

For the balanced class of procedures, two combined stations shall be connected together over various types of transmission facilities to build point-to-point, half-duplex or duplex, switched or non-switched configurations.

For the unbalanced connectionless class of procedures, a single control station plus one or more tributary station(s) shall be connected together over various types of transmission facilities to build point-to-point or multipoint, half-duplex or duplex, switched or non-switched configurations.

For the balanced connectionless class of procedures, two peer stations shall be connected together over various types of transmission facilities to build point-to-point, half-duplex or duplex, switched or non-switched configurations.

3.1.3 Operational modes

In an unbalanced class, any coupling of a primary station with secondary station(s) shall be operated in either the normal response mode (NRM) or the asynchronous response mode (ARM), two-way alternate or two-way simultaneous, in accordance with the capability of the configuration being employed. In the balanced class, two combined stations shall be operated in the asynchronous balanced mode (ABM), two-way alternate or two-way simultaneous, in accordance with the capability of the configuration being employed.

In the unbalanced connectionless class, any coupling of a control station with tributary station(s) shall be operated in the unbalanced connectionless mode (UCM), two-way alternate or two-way simultaneous, in accordance with the capability of the configuration being employed.

In the balanced connectionless class, two peer stations shall be operated in the balanced connectionless mode (BCM), two-way alternate or two-way simultaneous, in accordance with the capability of the configuration being employed.

3.1.4 Addressing scheme

In all classes (unbalanced, balanced, and connectionless), commands shall always be sent containing a destination data station address, and responses shall always be sent containing the assigned transmitting data station address.

The "all-station" address or a "group" address may be used to transmit a command frame simultaneously to all the secondary stations on a multipoint configuration or to the defined group of secondary stations. The addressing convention is specified in ISO/IEC 3309, clause 5. The mechanism to avoid overlapping responses to multiple station addressing is system dependent and is not specified in either ISO/IEC 3309 or this International Standard.

3.1.5 Send and receive state variables

For each primary-to-secondary or combined-to-combined pairing, a separate pair of send and receive state variables shall be used for each direction of transmission of information (I) frames. Upon receipt and acceptance of a mode setting command, both the send and receive state variables of the receiving station, shall be set to zero. Upon receipt and acceptance of an acknowledgement response to a mode setting command, both the send and receive state variables of the originating station shall be set to zero.

For each control-to-tributary or peer-to-peer pairing, there are no send and receive state variables used for each direction of transmission of data.

3.2 Fundamental classes of procedures

3.2.1 Designations

Five fundamental classes of procedures are defined. They are designated:

UNC - Unbalanced operation Normal response mode Class;

UAC - Unbalanced operation Asynchronous response

mode Class;

BAC - Balanced operation Asynchronous balanced mode Class;

UCC - Unbalanced operation Connectionless - mode Class; and

BCC - Balanced operation Connectionless - mode Class.

In these designations

— the first letter, U or B, indicates unbalanced or balanced operation;

— the second letter, A, N, or C, indicates asynchronous, normal, or connectionless response mode; and

— the third letter, C, stands for class.

3.2.2 Basic repertoires

The following basic repertoires utilize single octet addressing, unextended control field format, a 16-bit FCS, and synchronous transmission.

3.2.2.1 UNC

The basic repertoire of commands and responses for UNC shall be as follows:

Commands	Responses
I	I
RR	RR
RNR	RNR
SNRM	UA
DISC	DM
	FRMR

3.2.2.2 UAC

The basic repertoire of commands and responses for UAC shall be as follows:

Commands	Responses
I	I
RR	RR
RNR	RNR
SARM	UA
DISC	DM
	FRMR

3.2.2.3 BAC

The basic repertoire of commands and responses for BAC shall be as follows:

Commands	Responses
I	I
RR	RR
RNR	RNR
SABM	UA
DISC	DM
	FRMR

3.2.2.4 UCC

The basic repertoire of commands and responses for UCC shall be as follows:

Commands	Responses
UI	UI

3.2.2.5 BCC

The basic repertoire of commands and responses for BCC shall be as follows:

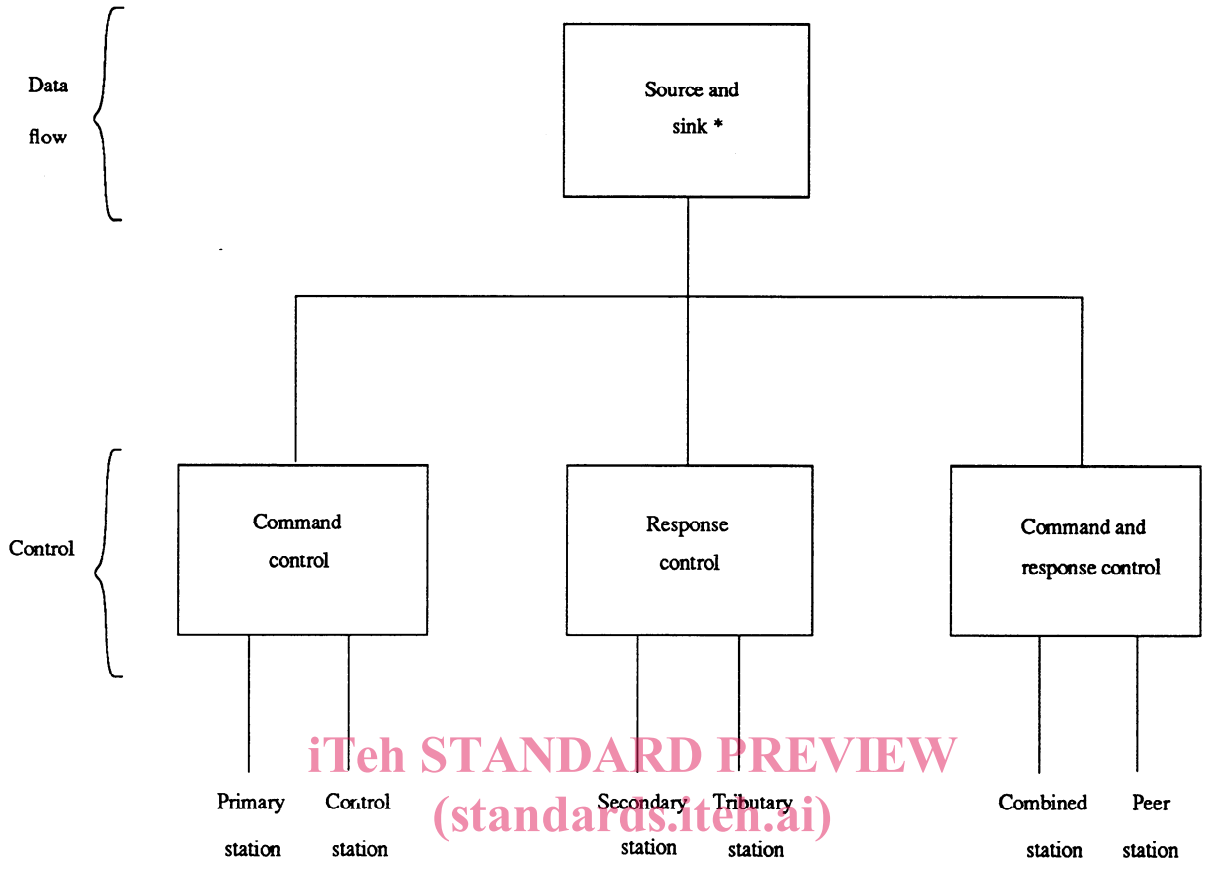
Commands	Responses
UI	

3.3 Optional functions

Sixteen optional functions are available (see table 1) to modify the fundamental classes of procedures defined in 3.2. These optional functions are obtained by the additions or deletions of commands and responses to or from the basic repertoires, or by the use of alternate address or control field formats or alternate frame checking sequences or alternate form of transmission (see figure 5). Option 11 is applicable to the balanced class of procedures only. Options 2, 3, 4, 8, 9, 10, 11 and 13 are not applicable to the connectionless classes of procedures.

3.4 Consistency of classes of procedures

The consistency in the five classes of procedures, obtained through the use of the concepts of modes of operation, basic command/response repertoires, and hierarchical structuring, is shown in figure 5. This consistency in repertoire facilitates the inclusion of multiple versions of the classes of procedures in a data station that is configurable.



* For send-only I frame stations or receive-only I frame stations, remove source or sink capability, as appropriate.

Figure 4 - HDLC stations - Building blocks

Table 1 - Optional functions

Option	Functional description	Required change
1	Provides the ability to exchange identification and/or characteristics of data stations	Add command: XID Add response: XID
2	Provides the ability for more timely reporting of I frame sequence errors (not for UCC or BCC)	Add command: REJ Add response: REJ
3.1	Provides the ability for more efficient recovery from I frame sequence errors by requesting retransmission of a single frame (not for UCC or BCC)	Add command: SREJ Add response: SREJ
3.2	Provides the ability for more efficient recovery from I frame sequence errors by requesting retransmission of one or more individual frames with a single request (not for UCC or BCC)	Add command: SREJ Add response: SREJ Support multi-selective reject option
4	Provides the ability to exchange information fields independent of the mode (operational or non-operational) without impacting the I frame sequence numbers (not for UCC or BCC)	Add command: UI Add response: UI
5	Provides the ability to initialize a remote data station, and the ability to request initialization	Add command: SIM Add response: RIM
6	Provides the ability to perform unnumbered group and all-station polling as well as unnumbered individual polling	Add command: UP
7	Provides for greater than single octet addressing	Use extended addressing format instead of basic addressing format
8	Limits the procedures to allow I frames to be commands only (not for UCC or BCC)	Delete response: I
9	Limits the procedures to allow I frames to be responses only (not for UCC or BCC)	Delete command: I
10	Provides the ability to use extended sequence numbering (modulo 128) (not for UCC or BCC)	Use extended control field format instead of basic control field format; use SXXME instead of SXXM
11	Provides the ability to reset the state variables associated with only one direction of information flow (for BAC only) (not for UCC or BCC)	Add command: RSET
12	Provides the ability to perform a basic data link test	Add command: TEST Add response: TEST
13	Provides the ability to request logical disconnection (not for UCC or BCC)	Add response: RD
14	Provides for 32-bit frame checking sequence (FCS)	Use the 32-bit FCS instead of the 16-bit FCS
15.1	Provides for start/stop transmission with basic transparency	Use start/stop transmission with basic transparency instead of synchronous transmission
15.2	Provides for start/stop transmission with basic transparency and flow-control transparency	Use start/stop transmission with basic transparency and flow-control transparency instead of synchronous transmission
15.3	Provides for start/stop transmission with basic transparency and control-character octet transparency	Use start/stop transmission with basic transparency and control-character octet transparency instead of synchronous transmission
16	Provides for operation in a start/stop transmission environment that only permits transfer of seven data bits per character	Use the seven-bit data path transparency function, in conjunction with one of the Option 15 functions

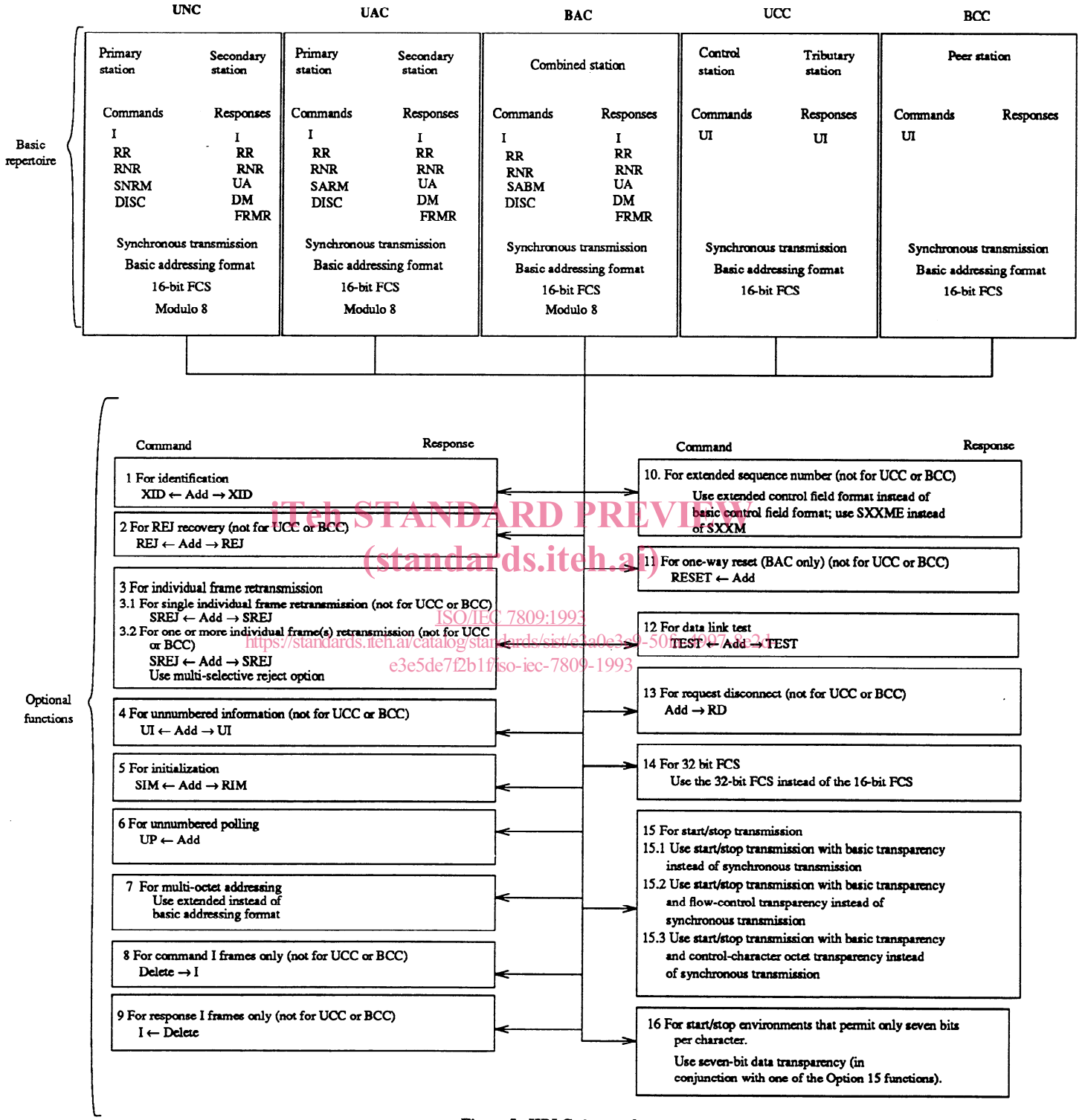


Figure 5 - HDLC classes of procedures