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This standard was revised in 8, 1991

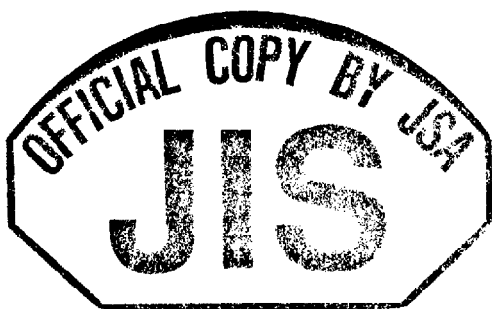
JAPANESE INDUSTRIAL STANDARD

High Level Data Link Control Procedures, Elements of Procedures

JIS C 6364—1978

The code number of this standard
JIS C 6364 changed to the follow-
ing on 1 March 1987.

JIS X 5105-1978



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Translated and Published

by

Japanese Standards Association

Printed in Japan

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JAPANESE INDUSTRIAL STANDARD

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High Level Data Link Control Procedures,
Elements of ProceduresX 5105-1978
(Reaffirmed: 1984)**1. Scope**

This Japanese Industrial Standard specifies elements of procedures for high level data link control carried out by means of the frame structure specified in JIS C 6363.

General rules for the provisions of this standard are as follows:

- (1) This standard generally specifies the procedure in the view point of the action which must be performed by the station who received commands.
- (2) This standard specifies elements of procedures common to high level data link control procedures of every types, and not intend to specify elements of procedures for high level data link control carried out by means of a specific frame structure.
- (3) This standard applies to all of one-way transmission two-way alternate transmission and two-way simultaneous transmission.

2. Definitions

For the purpose of this standard, in addition to the definitions specified in JIS C 6230 and JIS C 6363, the following principal definitions shall apply:

- (1) link level The conceptual level of control or processing logic existing the hierarchical structure of a data station that is responsible to maintaining control of data link. The function of link level is to supply the interface between the higher level logic which the station performs and the data link.
- (2) ready condition Such condition of a data station that the station is able to receive information.
- (3) busy condition Such condition of a data station that the station is temporarily unable to receive information due to capacity of memory or the like.
- (4) exception condition Such condition of a data station that translation of or response to a received command is unable, or that expected response cannot be received, due to transmission error or malfunction of the station itself or partner station.

Applicable Standards:

JIS C 6230-Glossary of Terms Used in Information Processing

JIS C 6363-High Level Data Link Control Procedures-Frame Structure

Reference Standard:

JIS C 6365-High Level Data Link Control Procedures Classes of Procedures

- (5) FCS error The error in received frames found out at inspection by frame check sequence.

3. Modes

3.1 Operation Modes A secondary station or a combined station on which a data link has been set shall act in normal response mode, asynchronous response mode, or asynchronous balanced mode, for sending response frame or receiving command frame, and each mode is defined as follows:

- (1) Normal Response Mode (NRM) This mode is defined for secondary stations. A secondary station in this mode shall be able to transmit the response frame only when it receives permission from a primary station by a command with the P bit set to "1".

The secondary station which has received permission from the primary station shall initiate transmission of one or more contiguous response frames. When the secondary station transmits the last frame (¹), the purport (last frame) shall be clearly indicated by setting the F bit set to "1". After that, the secondary station shall not transmit the following frames until permission is again received from the primary station.

This mode is set by acceptance of the SNRM command or SNRME command specified in 5.4.3, and finished by acceptance of the command to set other modes.

Note (¹) This last frame means either of the case (a), (b) or (c).

- (a) There is no following information frame.
 - (b) The number of information (I) frames which are transmitted but not acknowledged becomes equal to the number previously agreed in the system.
 - (c) The next frame cannot be transmitted within the set value of timer at the primary station.
- (2) Asynchronous Response Mode (ARM) This mode is defined for secondary stations. The secondary station in this mode may, without permission from the primary station, transmit one or more response frames, when the idle data channel state specified in JIS C 6363 is detected in two-way alternate transmission, or always in two-way simultaneous transmission.
- This mode is set by acceptance of the SARM command or SARME command specified in 5.4.3 and finished by acceptance of the command to set other modes.
- (3) Asynchronous Balanced Mode (ABM) This mode is defined for combined stations. The combined station in this mode may transmit, without permission of the partner combined station, one or more command or response frames.
- This mode is set by acceptance of the SABM or SABME command specified in 5.4.3 or by receiving of the UA response specified in 5.4.6 to the SABM or SABME command transmitted by the station itself, and finished by acceptance of the command to set other modes.

3.2 Disconnected Modes Disconnected modes of two link levels, i.e. normal disconnected mode and asynchronous disconnected mode are defined for the action of secondary or combined stations for which no data link has been set.

The function of secondary or combined station is limited to accept the mode setting commands specified in 5.4.3 and XID command specified in 5.4.4, and to transmit each response to the DM and RIM specified in 5.4.6 and to the XID specified in 5.4.7.

The secondary or combined station in disconnected mode is unable to establish command and response frame rejection conditions. To which of the two disconnected mode the secondary station transfers is as determined in the system. The conditions by which the secondary or combined station transfers to the disconnected mode may, in addition to compliance with this standard, be determined in the particular system.

Each disconnected mode is specified as follows:

- (1) **Normal Disconnected Mode (NDM)** The secondary station in this mode is able to transmit the response frame only when it receives the command frame with the P bit set to "1" or the UP command with the P bit set to "0", and its action shall be as follows:
 - (a) The station carries out the action in accordance with the provision of 5.4.3 or 5.4.4 when it receives and accepts the mode setting command or XID command, respectively.
 - (b) The station responds with the DM response specified in 5.4.6 when it receives the mode setting command or XID command but it can not accept such command and still stays in disconnected mode, or when it receives other commands than the said commands with the P bit set to "1".

In the above case, if the secondary station perceives that continuation of functional action is unable, the station transmits the RIM response specified in 5.4.6.
 - (c) When a station receives other commands than the mode setting command, XID command and UP command with the P bit set to "0", the station always ignore such commands.
- (2) **Asynchronous Disconnected Mode (ADM)** The secondary or combined station in this mode is, without permission from the primary station or partner combined station, able to transmit the response frame when the idle data channel state is detected in two-way alternate transmission, or always in two-way simultaneous transmission, and its action shall be as follows:
 - (a) The station carries out the action in accordance with the provisions of 5.4.3 or 5.4.4, when it receives and accepts the mode setting command or XID command.
 - (b) The station responds with the DM response when it receives the mode setting command or XID command but it cannot accept such command and still stays in disconnected mode, or when it receives other commands than the said command with the P bit set to "1".

In the above case, if the secondary or combined station perceives that continuation of functional action is unable, the station transmits the RIM response.

Further, the secondary or combined station may transmit the DM or RIM response without receiving a command, in this mode.

- (c) When a station receives other commands than the mode setting command, XID command and UP command with the P bit set to "0", the station always ignore such commands.

3.3 Initialization Mode (IM) This mode is defined for a secondary or combined station to initialize or regenerate control program for link level of the secondary or combined station or to exchange other parameters, from the primary station or partner combined station.

This mode is initialized by transmission of UA response in reply to receipt of the SIM command specified in 5.4.3, at a respond opportunity previously determined in the system, and finished by receipt of other mode setting commands.

The secondary or combined station may request the primary or partner combined station, setting to this mode by transmitting the RIM response specified in 5.4.6.

Further, in this mode the primary and secondary stations may exchange information in accordance with a method previously determined for the secondary station. Such exchange of information may similarly be made between combined stations each other.

4. Methods for Using Parameters and Poll/Final (P/F) Bits

4.1 Method for Using Parameters The method for using parameters is, in addition to that given in JIS C 6363, specified as given below.

- (1) Send Sequence Number The send sequence number $N(S)$ shall show the sequence number of the information (I) to be sent. Prior to transmission of information (I) frame, the value of $N(S)$ shall be set equal to the value of the send state variable $V(S)$ specified in (2).
- (2) Send State Variable The send state variable is a variable which is possessed by a station to transmit information frames, and denoted as $V(S)$ hereinafter. The value of $V(S)$ denotes the send sequence number of the information frame to be sent next, and shall take a value of 0 to "modulus-1" ⁽²⁾.
The value of $V(S)$ shall be incremented by one with each successive information transmission. However, it shall not exceed the value equal to $N(R)$ of the last received frame from the partner station plus "modulus-1" ⁽³⁾.

Notes ⁽²⁾ The modulus of sequence number is 8 when the control field is not extended, and 128 when the field is extended.

- ⁽³⁾ The addition referred here is so called modulo addition. That is the sequence number returns to zero every time when it becomes equal to the modulus, and circulates in the range of zero to "modulus-1".

- (3) Receive Sequence Number The receive sequence number $N(R)$ denotes the sequence number of the next information (I) frame expected to be received and also denotes that the information (I) frames of the sequence number upto and including " $N(R)-1$ " and all received correctly. The value of $N(R)$ shall, prior to transmission of the information (I) frame or supervisory (S) frame, be renewed so that it becomes equal to the value of the receive state variable $V(R)$ specified in (4).
- (4) Receive State Variable The receive state variable is a variable which is possessed by a station to receive information (I) frames, and denoted as $V(R)$ hereinafter. The value of $V(R)$ denotes the receive sequence number of the information (I) frame expected to be received next in normal state, and shall take a value of 0 to "modulus-1".
- The value of the receive state variable shall be incremented by 1 on receipt of an error-free information (I) frame whose $N(S)$ equals $V(R)$.

4.2 Method for Using Poll/Final (P/F) Bit The method for using poll/final (P/F) bit is, in addition to that given in JIS C 6263, specified as given below.

- (1) Poll (P) Bit When a primary or combined station once transmit a command frame with the P bit set to "1", the station shall not be able to send such command frame until the station receives a response frame with the F bit set to "1" from the secondary or partner combined station. However, if the primary station could not receive a correct response frame within a period previously determined in the system, the command frame with the P bit set to "1" is sometimes send again for recovery of error. The error recovery due to time-out is specified in 6.2 (5).
- The function of P bit in each operational mode shall be as follows:
- (a) P Bit in Normal Response Mode (NRM) In NRM, the P bit shall be set to "1" to solicit a response frame from the secondary station.

The secondary station in this mode is unable to transmit the response frame until it receives the command frame with the P bit set to "1". However, if the station receives the UP command with the P bit set to "0" that is specified in 5.4.4, the above requirement need not be fulfilled.

The primary station may solicit the secondary station to transmit information frame(s) by transmitting an information (I) frame or the supervisory (S) frame specified in 5.3 except RNR, by setting the P bit of such frame to "1".

The primary station may suppress the secondary station to transmit information (I) frames by transmitting RNR frame with the P bit set to "1".

- (b) P Bit in Asynchronous Response Mode (ARM) and Asynchronous Balanced Mode (ABM) In ARM and ABM, the P bit shall be set to "1", when a primary or combined station solicits the secondary or partner combined station to transmit the earliest response frame with the F bit set to "1".

The secondary or combined station in this mode is forced to transmit the response frame with the F bit set to "1" by receipt of the command frame the P bit set to "1".

- (2) Final (F) Bit Transmission of only one response frame with the F bit set to "1" is allowed to respond a command frame with the P bit set to "1".

The function of F bit in each operational mode is specified as given below.

- (a) F Bit in Normal Response Mode (NRM) In NRM, a secondary station shall set the F bit of the last frame to "1" when transmitting a series of response frames.

After transmission of a frame with the F bit set to "1", the secondary station shall stop transmission of the following frames until receipt of a command frame with the P bit set to "1".

- (b) F Bit in Asynchronous Response Mode (ARM) and Asynchronous Balanced Mode (ABM) In these modes, a secondary or combined station shall initiate transmission of the response frame with the F bit set to "1", at receipt of a command with the P bit set to "1".

In such case of two-way simultaneous transmission that a secondary or combined station receives a command frame with the P bit set to "1" during its transmission, the secondary or combined station shall set the F bit of the earliest frame to be sent in succession to "1". However, in these modes, the F bit set to "1" does not mean the end of response frame transmission, and the secondary or combined station may transmit the following response frames in succession.

4.3 Method for Using P/F Bit to Check Error The checking of error in the sequence of information (I) frames carried out by using the receive sequence numbers N(R) possessed by the frames with the P or F of "1", is called as checkpointing. The checkpointing in each mode is specified as given below. The error recovery by the checkpointing is specified in 6.2.

- (1) Checkpointing in Normal Response Mode (NRM) In NRM, if the N(R) of a received frame with the P/F bit set to "1" does not confirm all the information (I) frames, at least having the last frame with the P/F bit set to "1" that were previously transmitted, the station which received this N(R) shall initiate error recovery action.
- (2) Checkpointing in Asynchronous Response Mode (ARM) In ARM, if the N(R) of a received frame with the P/F bit set to "1" does not confirm all the information (I) frames, at least having the last frame with the P/F bit set to "1" that were previously transmitted, the station which received this N(R) shall initiate error recovery action.

- (3) Checkpointing in Asynchronous Balanced Mode (ABM) The method of using checkpointing in ABM is the same as that in ARM, except the exceptions specified below.

That is, in ABM, the retransmission by checkpointing is not carried out in the case of receiving each command frame of I, RR and RNR with the P bit set to "1", and the above provision for checkpointing applies only to such case that each response frame of I, RR and RNR with the F bit set to "1" is received.

5. Commands and Responses

5.1 Classification of Commands and Responses The commands and responses are classified as given in Table 1.

Table 1

Kind of control field		Classification	
Command	Information (I) transfer format	I	Information
	Supervisory (S) format	RR	Receive Ready
		RNR	Receive Not Ready
		REJ	Reject
		SREJ	Selective Reject
	Unnumbered (U) format	SNRM	Set Normal Response Mode
		SARM	Set Asynchronous Response Mode
		SABM	Set Asynchronous Balanced Mode
		SNRME	Set Normal Response Mode Extended
		SARME	Set Asynchronous Response Mode Extended
		SABME	Set Asynchronous Balanced Mode Extended
		SIM	Set Initialization Mode
		DISC	Disconnect
		UI	Unnumbered Information
		UP	Unnumbered Poll
		FRMR	Frame Reject
		XID	Exchange Identification
		RSET	Reset