SPECIFICATION

Item	Communication Specification
Model No.	ID-003

The 5th edition

Approved by:	Checked by:	Prepared by:

Contents

ID-003 COMMUNICATION SPECIFICATION

1. General

The specifications regarding and limited to the data for the interface between ACCEPTOR and CONTROLLER are described in this document. Refer to the specification of each machine model for model-by-model specifications of the electrical connection and operation.
ID-003 interface is a bi-directional serial interface, which enables CONTROLLER to control the status and action of ACCEPTOR and confirm the function settings by sending the polling ([STATUS REQUEST]) and the commands ([OPERATION COMMAND] and [SETTING COMMAND]).

2. Transmission Specification

(1) Transmission method — Full-duplex transmission

(2) Transmission speed — 9600 bps/19200 bps
(Selectable with dipswitch, depending on the machine model)

(3) Synchronous system — Asynchronous method

(4) Connection control method — Polling method

(5) Data format

Start bit	1
Data bit	8
Parity bit	EVEN
Stop bit	1
X parameter	Not used

(6) Message format

SYNC	LNG	CMD	DATA	CRC

SYNC 1 byte : Start code of sending message [FCH] fixed
LNG 1 byte : Data length (total number of bytes from SYNC through CRC)
CMD 1 byte : Command, status
DATA 0-250 byte : Data required for a command (may be omitted, depending on the CMD)
CRC 2 byte : Check code of CRC method
The object is the interval from SYNC through the end of DATA.

CRC *(L)*	CRC *(H)*

(Default value = 0)

(7) Error control system — Error detection — CRC method

(CRC-CCITT
$P_{(X)} = X^{16}+X^{12}+X^{5}+1$)

3. Sending/Receiving Message Format

Formats of sending/receiving messages are classified into five types as shown below.

(1) Polling format (CONTROLLER → ACCEPTOR)

SYNC	LNG	CMD	CRC *(L)*	CRC *(H)*

SYNC : [FCH]
LNG : [05H]
CMD : [11H] (STATUS REQUEST)
CRC *(L)* : [27H]
CRC *(H)* : [56H]

(2) ACK format (CONTROLLER → ACCEPTOR / ACCEPTOR → CONTROLLER)

SYNC	LNG	ACK	CRC *(L)*	CRC *(H)*

SYNC : [FCH]
LNG : [05H]
ACK : [50H]
CRC *(L)* : [AAH]
CRC *(H)* : [05H]

(3) Command format (CONTROLLER → ACCEPTOR)

SYNC	LNG	CMD	DATA	CRC *(L)*	CRC *(H)*

SYNC : [FCH]
LNG : Data length
CMD : Command
DATA : Data required for a command (may be omitted, depending on the CMD)
CRC : Check code of CRC method (2 byte)

(4) Response format I (ACCEPTOR → CONTROLLER)

SYNC	LNG	SST	DATA	CRC *(L)*	CRC *(H)*

SYNC : [FCH]
LNG : Data length
SST : Status code
DATA : Data required for a status (may be omitted, depending on the status)
CRC : Check code of CRC method (2 byte)

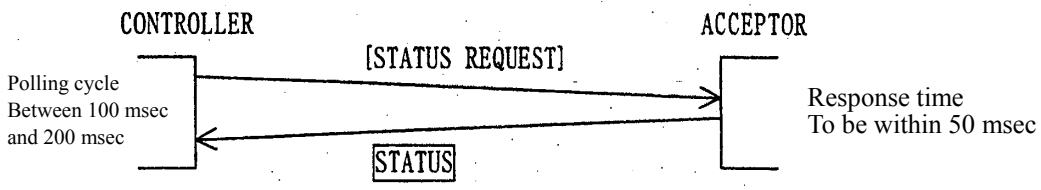
(5) Response format Ⅱ (ACCEPTOR → CONTROLLER)

SYNC	LNG	CMD	DATA	CRC *(L)*	CRC *(H)*

SYNC : [FCH]
LNG : Data length
CMD : Response
DATA : Data required for a command (may be omitted, depending on the CMD)
CRC : Check code of CRC method (2 byte)

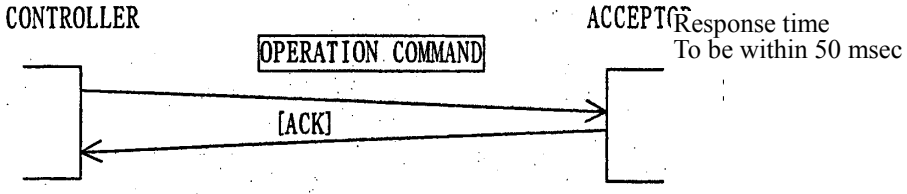
4. Communication Flow

(1) Sending STATUS REQUEST



When sending STATUS REQUEST after sending command to ACCEPTOR, transmission interval should be left for polling cycle interval.

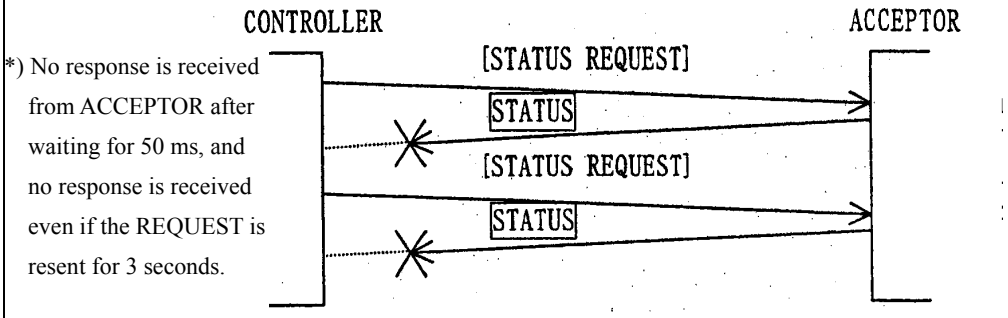
(2) Sending a command to ACCEPTOR



Command transmission must not overlap with a response to polling.

(3) Communication error ①

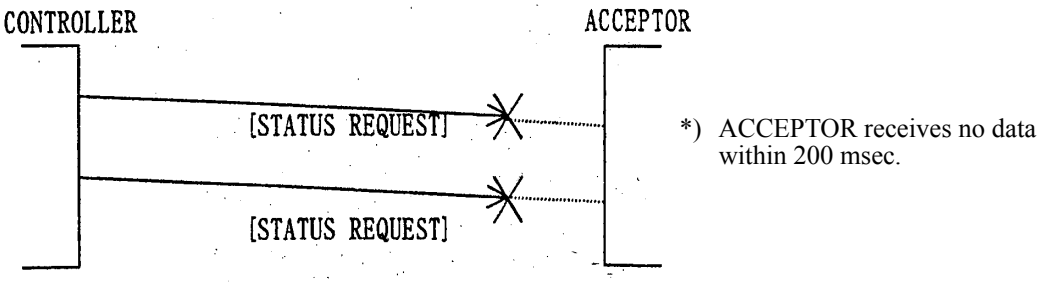
(A malfunction in the communication system, power-off and/or a malfunction of ACCEPTOR, etc.)



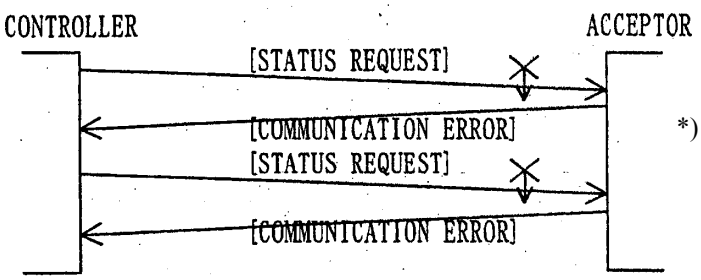
If RESET occurs in ACCEPTOR, recovery of communication may take a few seconds. Therefore, STATUS REQUEST must be sent continuously and status of ACCEPTOR must be monitored even if a communication error is detected.

(4) Communication error ②

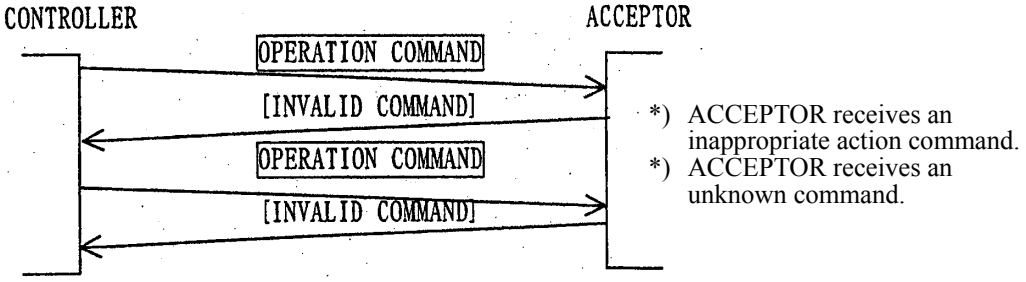
(A malfunction in the communication system or such)



(5) Communication error ③

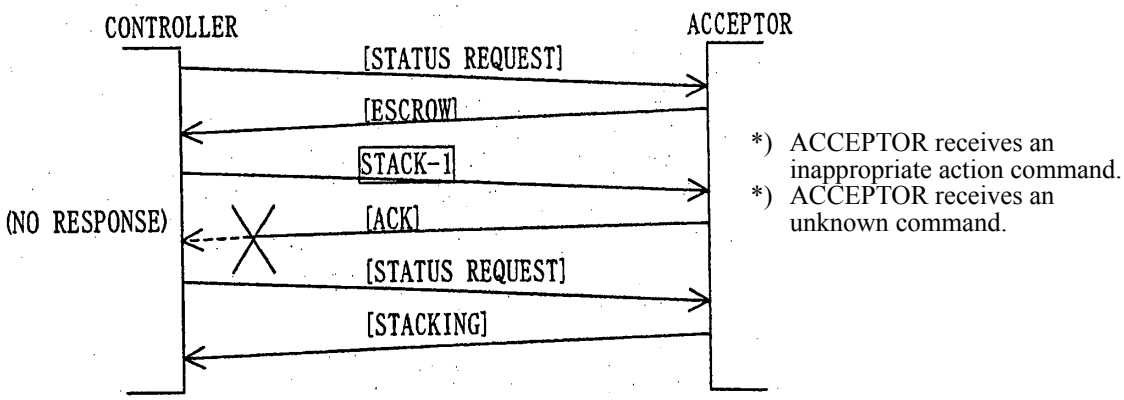


(6) Communication error ④



Except for the case where an unknown command is received, CONTROLLER must send STATUS REQUEST to check current status of ACCEPTOR because the status of ACCEPTOR may have changed.

(7) Communication error ⑤



*) ACCEPTOR comes into [STACKING] status upon sending [ACK] response.
A response of [INVALID COMMAND] status is sent back when receiving a [STACK-1] command (OPERATION COMMAND) resent from CONTROLLER. The response of [INVALID COMMAND] status against [STACK-1] command shows that ACCEPTOR has normally received the [STACK-1] command and also been in a status other than [ESCROW] status.
Therefore, in this case, the current status of ACCEPTOR is to be verified by sending [STATUS REQUEST] to ACCEPTOR from CONTROLLER.

5. Command and Response Table

CONTROLLER → ACCEPTOR		*ACCEPTOR → CONTROLLER*	
STATUS		**STATUS**	
STATUS REQUEST	11H	ENABLE (IDLING)	11H
		ACCEPTING	12H
		ESCROW	13H+DATA
		STACKING	14H
		VEND VALID	15H
		STACKED	16H
		REJECTING	17H+DATA
		RETURNING	18H
		HOLDING	19H
		DISABLE (INHIBIT)	1AH
		INITIALIZE	1BH
		POWER UP STATUS	
		POWER UP	40H
		POWER UP WITH BILL IN ACCEPTOR	41H
		POWER UP WITH BILL IN STACKER	42H
		ERROR STATUS	
		STACKER FULL	43H
		STACKER OPEN	44H
		JAM IN ACCEPTOR	45H
		JAM IN STACKER	46H
		PAUSE	47H
		CHEATED	48H
		FAILURE	49H+DATA
		COMMUNICATION ERROR	4AH
RESPONSE TO [VEND VALID]		**POLL REQUEST**	
ACK	50H	ENQ	05H
OPERATION COMMAND		**RESPONSE TO OPERATION COMMAND**	
RESET	40H	ACK	50H
STACK-1	41H	INVALID COMMAND	48H
STACK-2	42H		
RETURN	43H		
HOLD	44H		
WAIT	45H		
SETTING COMMAND		**RESPONSE TO SETTING COMMAND**	
ENABLE/DISABLE (DENOMI)	C0H+DATA	ENABLE/DISABLE (DENOMI)	C0H+DATA
SECURITY (DENOMI)	C1H+DATA	SECURITY (DENOMI)	C1H+DATA
COMMUNICATION MODE	C2H+DATA	COMMUNICATION MODE	C2H+DATA
INHIBIT (ACCEPTOR)	C3H+DATA	INHIBIT (ACCEPTOR)	C3H+DATA
DIRECTION	C4H+DATA	DIRECTION	C4H+DATA
OPTIONAL FUNCTION	C5H+DATA	OPTIONAL FUNCTION	C5H+DATA
SETTING STATUS REQUEST		**SETTING STATUS**	
ENALBE/DISABLE (DENOMI)	80H	ENABLE/DISABLE (DENOMI)	80H+DATA
SECURITY (DENOMI)	81H	SECURITY (DENOMI)	81H+DATA
COMMUNICATION MODE	82H	COMMUNICATION MODE	82H+DATA
INHIBIT (ACCEPTOR)	83H	INHIBIT (ACCEPTOR)	83H+DATA
DIRECTION	84H	DIRECTION	84H+DATA
OPTIONAL FUNCTION	85H	OPTIONAL FUNCTION	85H+DATA
VERSION REQUEST	88H	VERSION INFORMATION	88H+DATA
BOOT VERSION REQUEST	89H	BOOT VERSION INFORMATION	89H+DATA
CURRENCY ASSIGN REQUEST	8AH	DENOMINATION DATA	8AH+DATA

6. Command and Response Details

6-1 STATUS REQUEST (CONTROLLER → ACCEPTOR)

A request from CONTROLLER for a response on the status of ACCEPTOR.
CONTROLLER monitors the action status, return from the error status, etc. of ACCEPTOR by using [STATUS REQUEST].

SYNC	LNG	*CMD*	CRC *(L)*	CRC *(H)*

CMD : [11H] STATUS REQUEST
Response: Status answer

a. Polling cycle is to be between 100 msec and 200 msec.
b. A response from ACCEPTOR is to be made within 50 msec.
c. CONTROLLER is to resend a message when receiving a response of communication error and/or receiving no response within 200 msec. (See 4– (3))

6-2 STATUS (ACCEPTOR → CONTROLLER)

A response from ACCEPTOR answered to [STATUS REQUEST] from CONTROLLER.
It shows a current status of ACCEPTOR. There are three statuses for ACCEPTOR; Regular status, Power-up status, and Error status.

SYNC	LNG	*SST*	*DATA*	CRC *(L)*	CRC *(H)*

SST : Status
DATA : Data to be added to status (may be omitted, depending on the status)

6-2-1 Regular Status (ACCEPTOR → CONTROLLER)

(1) [11H] : ENABLE (IDLING)
A status of being waiting for bill insertion and ready for action.

(2) [12H] : ACCEPTING
A status during receiving and discriminating bills.

(3) [13H] : ESCROW
A status waiting for a command from CONTROLLER after the completion of discriminating bills (Bills are held inside ACCEPTOR).
1 byte [ESCROW DATA] (denomination of bill received / receivable) is added.
Bills are to be returned if ACCEPTOR is not available to receive [STATUS REQUEST] within 3 seconds during ESCROW status, or if CONTROLLER does not send an OPERATION command within 10 seconds after the response of [ESCROW] from ACCEPTOR.
ESCROW DATA (Denomination of bill received / receivable)

DATA	Denomination	DATA	Denomination
61H	01	71H	
62H	02	72H	
63H	03	73H	(5EURO)
64H	04	74H	(10EURO)
65H	05	75H	(20EURO)
66H	06	76H	(50EURO)
67H	07	77H	(100EURO)
68H	08	78H	(200EURO)
69H	09	79H	(500EURO)

*) See [DATA SETTING SPECIFICATION] of each machine model for the model-by-model denomination of bill receivable.

(4) [STACKING] : STACKING

A status of conveying and stacking bills into the stacker upon receipt of OPERATION COMMANDS, [STACK-1] and [STACK-2], from CONTROLLER.
(See 6-3 and 7-2)
Due to a failure in conveying bill, a bill may be returned in the midst of conveying operation. Such returning operation makes the status change from STACKING to REJECTING, and in this case, the transaction must be interrupted.

(5) [VEND VALID] : VEND VALID

A signal confirming receipt of bills.
ACCEPTOR holds the status until CONTROLLER sends [ACK] answering to [VEND VALID].
CONTROLLER proceeds to CREDIT-UP upon receipt of [VEND VALID].
(See 7-2)

(6) [STACKED] : STACKED

An interval status, from the completion of stacking bills up to [ENABLE] status ready for the next action of receiving bills.

(7) [REJECTING] : REJECTING

A status of returning bills due to the discrimination of unacceptable bills and/or [INHIBIT] command from CONTROLLER. (See 7-3)
1 byte [REJECT DATA] (Return Description) is added.
REJECT DATA (Return Description)

DATA	Description
71H	Insertion error
72H	Mug error
73H	Return action due to residual bills, etc. (at the head part of ACCEPTOR)
74H	Calibration error/ Magnification error
75H	Conveying error
76H	Discrimination error for bill denomination
77H	Photo pattern error ①
78H	Photo level error
79H	Return by INHIBIT: Error of insertion direction / Error of bill denomination No command sent answering to ESCROW
7AH	
7BH	Operation error
7CH	Return action due to residual bills, etc. (at the stacker)
7DH	Length error
7EH	Photo pattern error ②
7FH	True bill feature error

*) Applicable descriptions of REJECT DATA depend on the machine model.

(8) [RETURNING] : RETURNING

A status of returning bills upon receipt of [RETURN] command from CONTROLLER answering to [ESCROW]. (See 7-4)

(9) [H] : HOLDING
A status of holding bills inside ACCEPTOR upon receipt of [HOLD] command from CONTROLLER answering to [ESCROW].

(10) [H] : DISABLE (INHIBIT)
A status that [INHIBIT] command from CONTROLLER inhibits ACCEPTOR from receiving bills, a status that ACCEPTOR is disabled from receiving any bill by [ENABLE/DISABLE] command or dipswitch setting, or a status that [DIRECTION] command inhibits ACCEPTOR from receiving bills in any direction. (See 7-5)

(11) [H] : INITIALIZE
A status that ACCEPTOR is in initializing action upon receipt of [RESET] command from CONTROLLER. (See 7-1) * The time required for initializing depends on the machine model.

6-2-2 Power-up Status (ACCEPTOR → CONTROLLER)

Power-up Status is a status that notifies occurrence of turning off/on the power of ACCEPTOR (hardware reset).
Extra attention must be paid to this status especially during a transaction (ESCROW through waiting for VEND VALID). Under a certain status, processing in CONTROLLER is required.

ACCEPTOR sends one of the following responses according to its status at the power-on.
ACCEPTOR holds the status until receiving [RESET] command from CONTROLLER.
(See 7-2)

(1) [H] : POWER UP
A status that ACCEPTOR is in the normal conditions at the power-on of ACCEPTOR.

(2) [H] : POWER UP WITH BILL IN ACCEPTOR
A status that there are residual bills on the conveying part of ACCEPTOR's head (the position that bills are returnable) at the power-on.
Upon receipt of [RESET] command from CONTROLLER, ACCEPTOR returns the bills and proceeds to initializing action.
If a transaction is proceeding in CONTROLLER, the transaction is cancelled.

(3) [H] : POWER UP WITH BILL IN STACKER
A status that there are residual bills in the conveying part of the stacker (the position that bills are not returnable) at the power-on.
Upon receipt of [RESET] command from CONTROLLER, ACCEPTOR stacks the bills and proceeds to initializing action.
If this status is received when waiting for VEND VALID under transaction, the residual bills, etc. continue to be accommodated by the RESET command. Therefore, CONTROLLER is allowed to complete the interrupted transaction and to give a credit.
If POWER RECOVERY OPTION is used, after issuing a RESET command, VEND VALID is waited for after accommodating the residual bills and a credit is given, and the transaction is completed by verifying VEND VALID.
* Some models are not provided with the [FUNCTION COMMAND] POWER RECOVERY [T]ION. See data setting specifications of each model.

6-2-3 Error Status (ACCEPTOR → CONTROLLER)

The types of error status and the recovering methods depend on the machine model.
See [SPECIFICATION] and [DATA SETTING SPECIFICATION] of each machine model for model-by-model details.

*) Error recovering [RESET] command is to be sent after removing causes of error.

(1) H] : STACKER FULL
A status that the stacker box is full. (See 7-6)

(2) H] : STACKER OPEN (STACKER BOX REMOVE)
A status that the door of the stacker is open, or no stacker box is installed.

(3) H] : JAM IN ACCEPTOR
A status of having a jam inside ACCEPTOR. (See 7-7)

(4) H] : JAM IN STACKER
A status of having a jam on the conveying part of the stacker.
A status of having an abnormality during stacking.

(5) H] : PAUSE
A status that ACCEPTOR is halted due to the insertion of the second bill during stacking or conveying the first bill. (Removing the second bill starts conveying.)

(6) H] : CHEATED
A status that a cheating action was possibly made to ACCEPTOR.

(7) H] : FAILURE
A status that ACCEPTOR can not take regular actions due to its failures, abnormalities or wrong setting.
1 byte [FAILURE DATA] is added.

FAILURE DATA (Failure description)

DATA	Description
A2H	Stack motor failure
A5H	Transport (feed) motor speed failure
A6H	Transport (feed) motor failure
A8H	Solenoid Failure
A9H	PB Unit failure
ABH	Cash box not ready
AFH	Validator head remove
B0H	BOOT ROM failure
B1H	External ROM failure
B2H	RAM failure
B3H	External ROM writing failure

*) Applicable descriptions of FAILURE DATA depend on the machine model.

(8) H] : COMMUNICATION ERROR
A status of having an error in the communication data. (See 4-(5))

(9) H] : INVALID COMMAND
The command from CONTROLLER is invalid. (This response of error status is sent when ACCEPTOR is in the status unsuitable for the command from CONTROLLER and the command is unknown to ACCEPTOR.) (See 4-(6))
Verify the status of ACCEPTOR by STATUS REQUEST.

6-3 OPERATION COMMAND (CONTROLLER → ACCEPTOR)

Command of operation order from CONTROLLER to ACCEPTOR

SYNC	LNG	*CMD*	*DATA*	CRC *(L)*	CRC *(H)*

CMD : Command

DATA : Data to be added to a command (may be omitted, depending on the command)

Response: ACK answer

(1) [H] : RESET

A command to reset ACCEPTOR. Whatever the status is, ACCEPTOR always accepts this command. This command is to be sent upon the power-on (Power-up status).

(2) [H] : STACK-1

A command to convey and stack the bills under ESCROW status to the stacker.
ACCEPTOR is to be in [VEND VALID] status when a bill has passed the stacker lever.
This command is valid only when the status of ACCEPTOR is [ESCROW].
*) The position of STACK-2 varies depending on the machine model.

(3) [H] : STACK-2

A command to convey and stack the bills under ESCROW status to the stacker.
ACCEPTOR is to be in [VEND VALID] status when a bill has been stacked (in the storing position).
This command is valid only when the status of ACCEPTOR is [ESCROW].
*) The position of STACK-2 varies depending on the machine model.

(4) [H] : RETURN

A command to return the bills under [ESCROW] status.
This command is valid only when the status of ACCEPTOR is [ESCROW].

(5) [H] : HOLD

SYNC	LNG	*HOLD*	CRC *(L)*	CRC *(H)*

A command to hold the bills under ESCROW status for 10 seconds.

SYNC	LNG	*HOLD*	DATA	CRC *(L)*	CRC *(H)*

A command to hold the bills under ESCROW status for a specified period of time.
(Note that this function may not be supported in some models.)
Specified time: Data (01h…,0FFh) x 10sec, DATA=00h is handled as 10sec.
To hold the bills longer than a specified period, re-sending HOLD command is required within the specified period. This command is valid only under ESCROW status.

(6) [H] : WAIT

A command to hold the current status of ACCEPTOR for 3 seconds. For continuous holding, [WAIT] command has to be resent.

6-4 K (Affirmative response)

SYNC	LNG	*ACK*	CRC *(L)*	CRC *(H)*

ACK : [50H] ACK
[ACCEPTOR→CONTROLLER]
A response to [OPERATION COMMAND] from CONTROLLER.
[CONTROLLER→ACCEPTOR]
A response to [VEND VALID] from ACCEPTOR.

6-5 SETTING COMMAND (CONTROLLER → ACCEPTOR)

A command by which CONTROLLER makes (revises) the setting of ACCEPTOR.
The setting of each function is performed according to the added data.
This command is valid only when the status of ACCEPTOR is [INITIALIZE], [ENABLE (IDLING)] or [DISABLE (INHIBIT)]. (INHIBIT is not included.)

Specify the settings of each function each time on CONTROLLER, if POWER UP STATUS is received from ACCEPTOR.

SYNC	LNG	*CMD*	*DATA*	CRC *(L)*	CRC *(H)*

CMD : Command
DATA : Data to be added to a command (may be omitted, depending on the command)
Response: ECHO BACK

(1) [C0H] : ENABLE / DISABLE

A command to set the receiving of each bill denomination.
2 byte [ENABLE/DISABLE DATA] is added. (See 6-7-(1))

C0H	DATA1	DATA2

(2) [C1H] : SECURITY

A command to set the discrimination level of each bill denomination.
2 byte [SECURITY DATA] is added. (See 6-7-(2))

C1H	DATA1	DATA2

(3) [C2H] : COMMUNICATION MODE

A command to set COMMUNICATION MODE of ACCEPTOR.
1 byte [COMMUNICATION MODE DATA] is added. (See 6-7-(3))

C2H	DATA

(3) [C3H] : INHIBIT

A command to temporarily inhibit ACCEPTOR from receiving bills. (Valid and receivable at any status.)
1 byte [INHIBIT DATA] is added. (See 6-7-(4))

C3H	DATA

Setting made during receiving bills	Set to INHIBIT status after bills have been returned
Setting made during discriminating bills	
Setting made at [ESCROW] status	
Setting made during stacking bills	Set to INHIBIT status after bills have been stacked
Setting made at [VEND VALID]	

(4) [C4H] : DIRECTION

A command to set the bill direction for receiving.
1 byte [DIRECTION DATA] is added. (See 6-7-(5))

C4H	DATA

(5) [C5H] : OPTIONAL FUNCTION

A command to set the optional function of ACCEPTOR.
2 byte [OPTIONAL FUNCTION DATA] is added. (See 6-7-(8))

C5H	DATA1	DATA2

Settings of the optional function must be specified regardless of usage of the functions.

6-6 SETTING STATUS REQUEST (CONTROLLER → ACCEPTOR)

A request from CONTROLLER by [SETTING] command for a response on the status set to ACCEPTOR.

SYNC	LNG	*CMD*	CRC *(L)*	CRC *(H)*

CMD : Command

Response: Status answer

(1) [80H] : ENABLE/DISABLE

A command to request a response on the setting status of the receiving of each bill denomination.

Response : SETTING STATUS (ACCEPTOR → CONTROLLER)

The status of the receiving of each bill denomination set by [ENABLE/DISABLE] command and dipswitch is added as 2 byte [ENABLE/DISABLE DATA]. (See 6-7-(1))

80H	DATA1	DATA2

*) See [SPECIFICATION] of each machine model for the model-by-model setting of dipswitch.

(2) [81H] : SECURITY

A command to request a response on the setting status of the discrimination level of each bill denomination.

Response : SETTING STATUS (ACCEPTOR → CONTROLLER)

2 byte [SECURITY DATA] is added. (See 6-7-(2))

81H	DATA1	DATA2

(3) [82H] : COMMUNICATION MODE

A command to request a response on the setting status of COMMUNICATION MODE of ACCEPTOR.

Response : SETTING STATUS (ACCEPTOR → CONTROLLER)

1 byte [COMMUNICATION MODE DATA] is added. (See 6-7-(3))

82H	DATA

(4) [83H] : INHIBIT

A command to request a response on the setting status of inhibiting ACCEPTOR from receiving bills.

Response : SETTING STATUS (ACCEPTOR → CONTROLLER)

1 byte [INHIBIT DATA] is added. (See 6-7-(4))

83H	DATA

(5) [84H] : DIRECTION

A command to request a response on the setting status of the bill direction for receiving.

Response : SETTING STATUS (ACCEPTOR → CONTROLLER)

1 byte [DIRECTION DATA] is added. (See 6-7-(5))

84H	DATA

(6) [88H] : VERSION REQUEST

A command to request a response on MODEL/ ID/ VERSION of ACCEPTOR.

Response : SETTING STATUS (ACCEPTOR → CONTROLLER)

Version Information is added as ASCII data. (See 6-7-(6))

(7) [89H] : BOOT VERSION REQUEST

A command to request a response on BOOT VERSION of ACCEPTOR.

Response : SETTING STATUS (ACCEPTOR → CONTROLLER)

Boot Version is added as 4 byte ASCII data. (See 6-7-(7))

(8) [85H] : OPTIONAL FUNCTION

A command to request a response on the setting status of [OPTIONAL FUNCTION] command.

Response : SETTING STATUS (ACCEPTOR → CONTROLLER)

2 byte [OPTIONAL FUNCTION DATA] is added. (See 6-7-(8))

85H	DATA1	DATA2

(9) [8AH] : CURRENCY ASSIGN REQUEST

A command to request a response on the description (DENOMINATION DATA) of [ESCROW DATA]. (PLUG & PLAY function)

Response : DENOMINATION DATA (ACCEPTOR → CONTROLLER)

The descriptions of [ESCROW DATA] are sent in turn from 61H as successive data.

Boot Version is added as 4 byte ASCII data. (See 6-7-(9))

6-7 DATA (SETTING STATUS/SETTING COMMAND)

Data formats of SETTING STATUS and SETTING COMMAND are specified.
See [DATA SETTING SPECIFICATION] of each machine model for model-by-model details.

(1) ENABLE/DISABLE DATA

CONTROLLER → ACCEPTOR			ACCEPTOR → CONTROLLER		
C0h + DATA1 + DATA2			C0h + DATA1 + DATA2		[echo back]
80h			80h + DATA1 + DATA2		

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
DATA1	08	07	06	05	04	03	02	01	← Denomination
DATA2	0	0	0	0	0	0	0	0	

0:enable
1:disable

(default:0)

(2) SECURITY DATA

CONTROLLER → ACCEPTOR			ACCEPTOR → CONTROLLER		
C1h + DATA1 + DATA2			C1h + DATA1 + DATA2		[echo back]
81h			81h + DATA1 + DATA2		

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
DATA1	08	07	06	05	04	03	02	01	← Denomination
DATA2	0	0	0	0	0	0	0	0	

0:normal
1:security level high

(default:0)

(3) COMMUNICATION MODE DATA

CONTROLLER → ACCEPTOR		ACCEPTOR → CONTROLLER		
C2h + DATA		C2h + DATA		[echo back]
82h		82h + DATA		

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DATA	0	0	0	0	0	0		

Bit1	Bit0	
0	0	:POLLING MODE
0	1	:INTERRUPT MODE-1
1	0	:INTERRUPT MODE-2

INTERRUPT MODE-1

Whenever the status of ACCEPTOR has changed, [ENQ] is sent from ACCEPTOR to CONTROLLER. Polling (STATUS REQUEST) to ACCEPTOR is conducted by CONTROLLER after its receiving [ENQ]. (See 6-8 and 7-8)

INTERRUPT MODE-2

Only when the communication with CONTROLLER is required, ACCEPTOR sends [ENQ]. Polling (STATUS REQUEST) to ACCEPTOR is conducted by CONTROLLER after its receiving [ENQ].

Communication status: [ESCROW], [VEND VALID], [INITIALIZE], [POWER UP STATUS], and [ERROR STATUS] (See 6-8 and 7-9)

*) CONTROLLER can send [STATUS REQUEST] anytime whatever the setting of COMMUNICATION MODE is.

(4) INHIBIT DATA

CONTROLLER → ACCEPTOR: C3h + DATA / 83h

ACCEPTOR → CONTROLLER: C3h + DATA / 83h + DATA [echo back]

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DATA	0	0	0	0	0	0	0	inh

0:not inhibit
1:inhibit

(default:1)

(5) DIRECTION DATA

CONTROLLER → ACCEPTOR: C4h + DATA / 84h

ACCEPTOR → CONTROLLER: C4h + DATA / 84h + DATA [echo back]

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DATA	0	0	0	0	04	03	02	01

← Direction

0:not inhibit
1:inhibit

(default:0)

(6) VERSION DATA

CONTROLLER → ACCEPTOR: 88h

ACCEPTOR → CONTROLLER: 88h + DATA*n*

ACCEPTOR, in response, sends MODEL, ID, VERSION, CRC, etc. as ASCII data.
The data length is ([LNG] – 5) byte (variable) and its designation, from the beginning in order, is shown below.

"x(xxx)-xx-xx ID003-xxvxxx-xx ddmmmyy xxxx"

- xxxx — CRC check code
- ddmmmyy — Date (e.g. December 1, 1995→"01DEC95")
- xxx — Software version
- xx — Interface type
- xx — Stacker type
- xx — Model number
- (xxx) — Country code
- x — Machine code

(7) BOOT DATA

CONTROLLER → ACCEPTOR: 88h

ACCEPTOR → CONTROLLER: 88h + DATA*n*

ACCEPTOR, in response, sends BOOT VERSION as 4 byte ASCII data.

"Bxx "

- Bxx — BOOT VERSION

(8) OPTIONAL FUNCTION DATA

CONTROLLER → ACCEPTOR	ACCEPTOR → CONTROLLER	
C0h + DATA1 + DATA2	C0h + DATA1 + DATA2	[echo back]
80h	80h + DATA1 + DATA2	

	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
DATA1	08	07	06	05	04	03	02	01
DATA2	0	0	0	0	0	0	0	0

0:disabl
1:enable

(default:0)

(9) CURRENCY ASSIGN DATA

CONTROLLER → ACCEPTOR	ACCEPTOR → CONTROLLER
8Ah	8Ah + DATA*n*

CURRENCY ASSIGN DATA of each bill denomination consists of ESCROW CODE (1 byte), COUNTRY TYPE (1 byte) and DENOMINATION DATA (2 byte) and is sent in turn from 61H as successive data.
00H is sent in the case of bill denomination without assignment setting.

61H + COUNTRY TYPE + DENOMINATION + 62H + COUNTRY TYPE + DENOMINATION + ……

ESCROW CODE : ESCROW DATA to be added to ESCROW status
COUNTRY TYPE : Corresponding country (See Table 1-1 of Country Code)
DENOMINATION DATA : Bill denomination is specified with an integer part and an exponent part.
(The same exponent is to be assigned for the same country, in principle.)

Ex). USA $1 → 61+01+01+00
USA $100 → 67+01+64+00
DEU DM10 → 64+04+01+01
DEU DM200 → 68+04+14+01
ITA 1000lire → 61+0B+01+03
ITA 100000lire → 67+0B+64+03
NOT ASSIGN → 6x+00+00+00

6-8 ENQ

ENQ is valid when *INTERRUPT MODE* has been set by [COMMUNICATION MODE] command.

SYNC	LNG	*ENQ*	CRC *(L)*	CRC *(H)*

ENQ : [05H] ENQ (Message demanding polling)
[ACCEPTOR→CONTROLLER]
INTERRUPT MODE-1
ACCEPTOR sends [ENQ] to CONTROLLER whenever its status has changed. (See 7-8)
INTERRUPT MODE-2
Only when the communication with CONTROLLER is required, ACCEPTOR sends [ENQ]. (See 7-9)
Communication status: [ESCROW], [VEND VALID], [INITIALIZE], [POWER UP STATUS], and [ERROR STATUS]

7. Timing Chart

7-1 POWER UP

(1) From Power-on to Standby status

CONTROLLER		ACCEPTOR	State
STATUS REQUEST	→		*Power-on* Approximately 3 to 5 seconds is required before starting communication. (The period depends on model.)
STATUS REQUEST	→		
STATUS REQUEST	→		
	←	POWER UP	
VERSION REQUEST	→		(SETTING REQUEST)
	←	VERSION INFORMATION	
RESET	→		(OPERATION COMMAND)
			Initializing
	←	ACK	
STATUS REQUEST	→		
	←	INITIALIZE	
ENABLE/DISABLE	→		(SETTING COMMAND)
	←	ENABLE/DISABLE	
SECURITY	→		(SETTING COMMAND)
	←	SECURITY	
OPTIONAL FUNCTION	→		(SETTING COMMAND)
	←	OPTIONAL FUNCTION	
INHIBIT	→		(SETTING COMMAND)
	←	INHIBIT	
STATUS REQUEST	→		
	←	INITIALIZE	
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDLING)	

Specify the SETTING COMMANDS each time POWER UP STATUS is received from ACCEPTOR, in addition to the cases of resetting by turning on the power of CONTROLLER.

(2) From Power-on to Standby status

The case that there are residual bills in ACCEPTOR at the power-on

CONTROLLER		ACCEPTOR	State
STATUS REQUEST	→		
STATUS REQUEST	→		
			Power-on
STATUS REQUEST	→		
		POWER UP WITH BILL IN ACCEPTOR (POWER UP WITH BILL IN ACCEPTOR)	Bills remaining in the position available for return (Bills remaining in the position unavailable for return)
	←		(OPERATION COMMAND)
RESET	→		[RESET] command to conduct initializing to return (stack) the bills
	←	ACK	
			Initializing
STATUS REQUEST	→		
	←	INITIALIZE	
STATUS REQUEST	→		
	←	INITIALIZE	
STATUS REQUEST	→		
	←	INITIALIZE	
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDLING)	

7-2 Accepting Bill

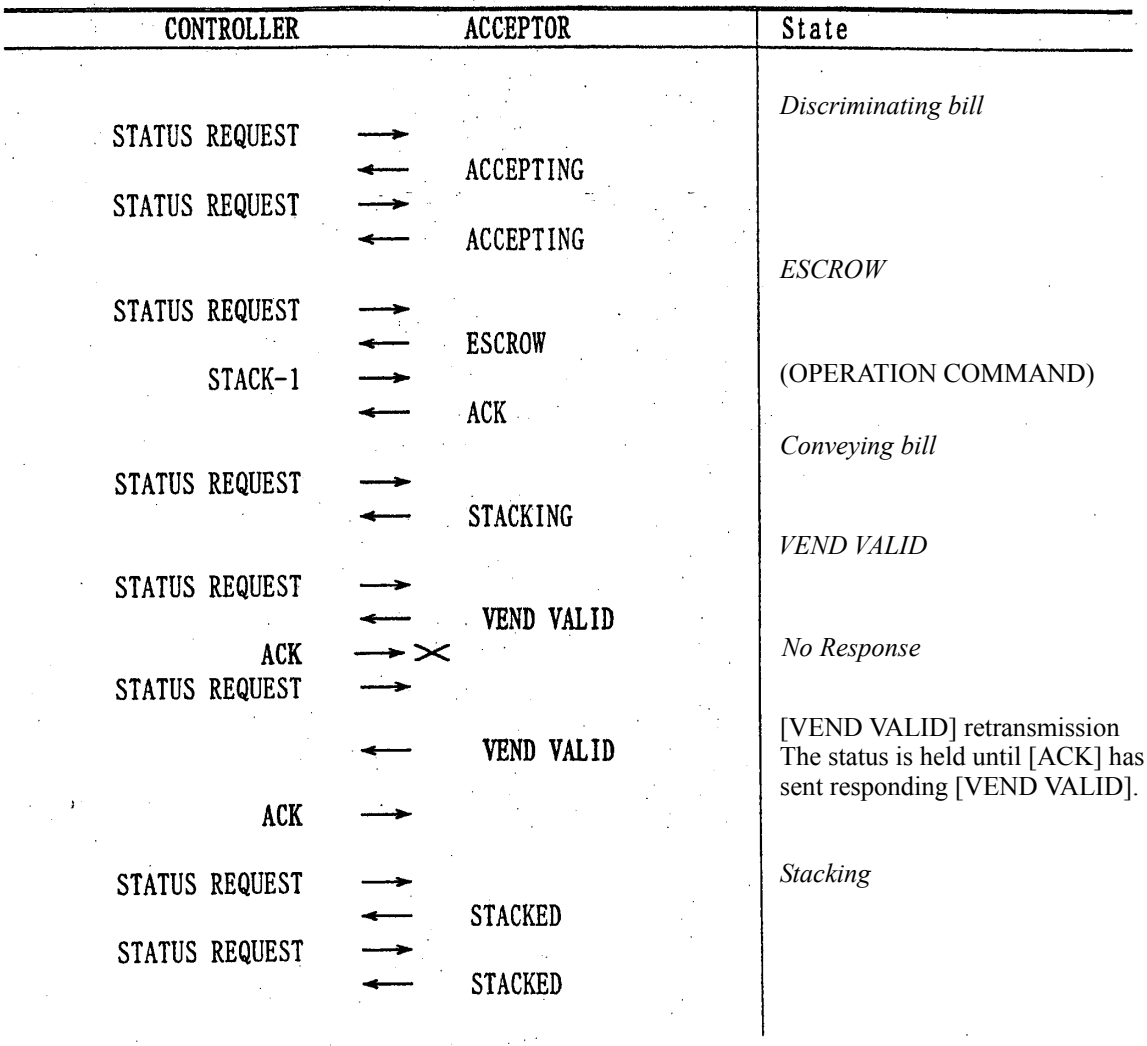
(1) Accepting bill by [STACK-1] command

CONTROLLER		ACCEPTOR	State
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDLING)	
			Bill insertion
STATUS REQUEST	→		
	←	ACCEPTING	
			Discriminating bill
STATUS REQUEST	→		
	←	ACCEPTING	
			ESCROW Bills are returned if no [STATUS REQUEST] comes out within 3 seconds during ESCROW status.
STATUS REQUEST	→		
	←	ESCROW	(OPERATION COMMAND) Bills are returned if no [OPERATION COMMAND], responding [ESCROW], comes out within 10 seconds.
STACK-1	→		
	←	ACK	*Conveying bill*
STATUS REQUEST	→		
	←	STACKING	*VEND VALID* conveying to output position completes.
STATUS REQUEST	→		
	←	VEND VALID	CONTROLLER receives this VEND VALID and increments the credit.
ACK	→		
			Stacking
STATUS REQUEST	→		
	←	STACKED	
STATUS REQUEST	→		
	←	STACKED	
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDLING)	

(2) Receiving bill by [STACK-2] command

CONTROLLER		ACCEPTOR	State
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDLING)	
			Bill insertion
STATUS REQUEST	→		
	←	ACCEPTING	
			Discriminating bill
STATUS REQUEST	→		
	←	ACCEPTING	
			ESCROW
STATUS REQUEST	→		
	←	ESCROW	
STACK-2	→		(OPERATION COMMAND)
	←	ACK	
			Conveying bill
STATUS REQUEST	→		
	←	STACKING	
			Stacking
STATUS REQUEST	→		
	←	STACKING	
			VEND VALID
STATUS REQUEST	→		
	←	VEND VALID	
ACK	→		
			Stacking
STATUS REQUEST	→		
	←	STACKED	
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDLING)	

(3) [VEND VALID] retransmission



7- 3 Rejecting Bill

(1) Return of Rejected Bill by Discrimination

CONTROLLER		ACCEPTOR	State
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDLING)	
STATUS REQUEST	→		*Bill insertion*
	←	ACCEPTING	
STATUS REQUEST	→		*Discriminating bill*
	←	ACCEPTING	
STATUS REQUEST	→		*Return*
	←	REJECTING	
STATUS REQUEST	→		
	←	REJECTING	
STATUS REQUEST	→		
	←	REJECTING	
STATUS REQUEST	→		
	←	REJECTING	
			(Clearing of returned bill)
STATUS REQUEST	→		*On standby*
	←	ENABLE (IDILING)	
STATUS REQUEST	→		
	←	ENABLE (IDILING)	

(2) Return of Bill from Process of Conveying for Accommodation

If a failure is detected in the bill conveying process from ESCROW position through VEND VALID output position, a bill may be returned.

CONTROLLER		**ACCEPTOR**	**State**
			On standby
STATUS REQUEST	→		
	←	ESCROW	
STACK-1	→		(OPERATION COMMAND)
	←	ACK	
			Conveying bill
STATUS REQUEST	→		
	←	STACKING	
STATUS REQUEST	→		
	←	STACKING	
STATUS REQUEST	→		***Conveying failure -> Return***
	←	**REJECTING**	
STATUS REQUEST	→		
	←	**REJECTING**	
			(Clearing of returned bill)

STATUS REQUEST	→	***On standby***
	← ENABLE (IDILING)	

7-4 Rejecting Bill by [RETURN] Command

CONTROLLER		ACCEPTOR	State
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDLING)	
			Bill insertion
STATUS REQUEST	→		
	←	ACCEPTING	
			Discriminating bill
STATUS REQUEST	→		
	←	ACCEPTING	
			ESCROW
STATUS REQUEST	→		
	←	ESCROW	
RETURN	→		(OPERATION COMMAND)
	←	ACK	
			Return
STATUS REQUEST	→		
	←	RETURNING	
STATUS REQUEST	→		
	←	RETURNING	
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDILING)	

7-5 Inhibiting Bill Acceptance of ACCEPTOR

CONTROLLER		ACCEPTOR	State
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDLING)	
STATUS REQUEST	→		
	←	ENABLE (IDLING)	
INHIBIT	→		(SETTING COMMAND)
	←	INHIBIT	(SETTING STATUS)
			INHIBIT
STATUS REQUEST	→		
	←	DISABLE (INHIBIT)	
STATUS REQUEST	→		
	←	DISABLE (INHIBIT)	

7-6 Stacker Full (STACK-1)

CONTROLLER		ACCEPTOR	State
STATUS REQUEST	→		*On standby*
	←	ENABLE (IDLING)	
STATUS REQUEST	→		*Bill insertion*
	←	ACCEPTING	
STATUS REQUEST	→		*Discriminating bill*
	←	ACCEPTING	
STATUS REQUEST	→		*VEND VALID*
	←	VEND VALID	
ACK	→		
STATUS REQUEST	→		*Stacking*
	←	STACKED	
STATUS REQUEST	→		
	←	STACKED	
STATUS REQUEST	→		
	←	STACKER FULL	
STATUS REQUEST	→		
	←	STACKER FULL	
			(Clearing bills out of Stacker)
			Initial
STATUS REQUEST	→		
	←	INITIALIZE	
STATUS REQUEST	→		
	←	INITIALIZE	
			On standby
STATUS REQUEST	→		
	←	DISABLE (INHIBIT)	

*) The method to cancel [STACKER FULL] status varies depending on the machine model.

7-7 Jam in Bill Rejection

CONTROLLER		ACCEPTOR	State
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDLING)	
			Bill insertion
STATUS REQUEST	→		
	←	ACCEPTING	
			Discriminating bill
STATUS REQUEST	→		
	←	ACCEPTING	
			Return
STATUS REQUEST	→		
	←	REJECTING	
STATUS REQUEST	→		
	←	REJECTING	
STATUS REQUEST	→		
	←	REJECTING	
STATUS REQUEST	→		
	←	REJECTING	<Occurrence of a jam of bill> *FAIL*
STATUS REQUEST	→		
	←	JAM IN ACCEPTOR	
STATUS REQUEST	→		
	←	JAM IN ACCEPTOR	
			<Clearing jammed bill> *On standby*
STATUS REQUEST	→		
	←	DISABLE (INHIBIT)	

7-8 Accepting Bill [INTERRUPT MODE-1]

CONTROLLER		ACCEPTOR	State
			On standby
STATUS REQUEST	→		
	←	ENABLE (IDLING)	
			Bill insertion
	←	ENQ	
STATUS REQUEST	→		
	←	ACCEPTING	
			Discriminating bill *ESCROW*
	←	ENQ	
STATUS REQUEST	→		
	←	ESCROW	
STACK-1	→		(OPERATION COMMAND)
	←	ACK	
			Conveying bill
	←	ENQ	
STATUS REQUEST	→		
	←	STACKING	
			VEND VALID
	←	ENQ	
STATUS REQUEST	→		
	←	VEND VALID	
ACK	→		
			Stacking
	←	ENQ	
STATUS REQUEST	→		
	←	STACKED	
			On standby
	←	ENQ	
STATUS REQUEST	→		
	←	ENABLE (IDLING)	

7-9 Accepting Bill [INTERRUPT MODE-2]

CONTROLLER		ACCEPTOR	State
STATUS REQUEST	→		*On standby*
	←	ENABLE (IDLING)	
STATUS REQUEST	→		*Bill insertion*
	←	ACCEPTING	
	←	ENQ	*Discriminating bill* *ESCROW*
STATUS REQUEST	→		
	←	ESCROW	
STACK-1	→		(OPERATION COMMAND)
	←	ACK	*Conveying bill*
STATUS REQUEST	→		
	←	STACKING	*VEND VALID*
	←	ENQ	
STATUS REQUEST	→		
	←	VEND VALID	
ACK	→		*Stacking*
STATUS REQUEST	→		
	←	STACKED	
STATUS REQUEST	→		
	←	STACKED	*On standby*
STATUS REQUEST	→		
	←	ENABLE (IDLING)	

7-10 POWER INTERRUPT/Hardware RESET during Bill Stacking

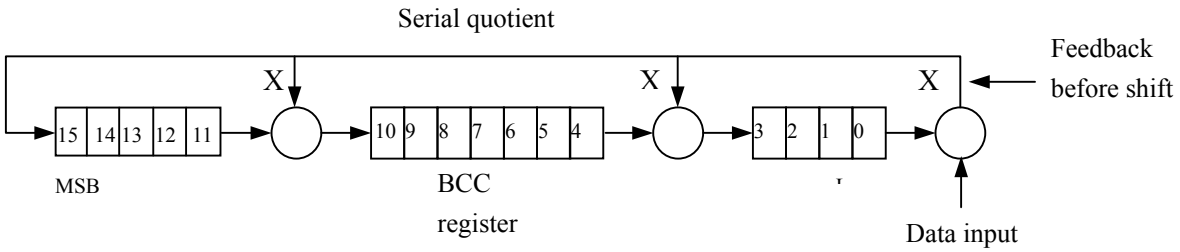
CONTROLLER		ACCEPTOR	State
			Discriminating bill
STATUS REQUEST	→		
	←	ACCEPTING	
			ESCROW
STATUS REQUEST	→		
	←	ESCROW	
STACK-1,2	→		(OPERATION COMMAND)
	←	**ACK**	
			Conveying bill
STATUS REQUEST	→		
	←	STACKING	
			POWER INTERRUPT occurred
STATUS REQUEST	→	(NO RESPONSE)	Recovery of communication takes 3 to 5 seconds (depending on models).
STATUS REQUEST	→		
STATUS REQUEST	→		
STATUS REQUEST	→	**POWER UP WITH BILL IN STACKER**	Occurrence of POWER INTERRUPT in ACCEPTOR is notified by POWER UP STATUS.
	←		
RESET	→		Initialization starts by RESET command.
	←	**ACK**	
			Initializing
STATUS REQUEST	→		
	←	INITIALIZE	***Accommodating bill in the midst of conveying for Accommodation***
SETTING COMMAND	→		Settings are specified just as normal POWER UP process.
	←	SETTING COMMAND	
INHIBIT	→		(ACCEPTOR ENABLE)
	←	INHIBIT	
STATUS REQUEST	→		
	←	INITIALIZE	
STATUS REQUEST	→		
	←	**VEND VALID** (OPTIONAL FUNCTION)	If POWER RECOVERY is set as valid, VEND VALID is sent at this point.
STATUS REQUEST	→		
	←	ENABLE(IDLING)	

Some models are not provided with the [FUNCTION COMMAND] POWER RECOVERY OPTION. See DATA setting specifications of each model.

On CONTROLLER, specify a period of 30 seconds or longer as a wait time for VEND VALID in consideration of the recovery case above.

Appendix 1. About CRC (CRC-CCITT)

[CRC-CCITT $P(X) = X^{16} + C^{12} + C^{8} + 1$]



[STATUS REQUEST]	FCh	05h	11h	27h	56h

	MSB		LSB		
Initial value	00000	0000000	0000	[FCh]	
1	00000	0000000	0000	0	LSB
2	00000	0000000	0000	0	
3	10000	1000000	1000	1	
4	11000	1100000	1100	1	
5	11100	1110000	1110	1	
6	11110	1111000	1111	1	
7	01111	0111100	0111	1	
8	00111	1011110	0011	1	MSB
				[05h]	
1	00011	1101111	0001	1	LSB
2	10001	0110111	0000	0	
3	11000	0011011	0000	1	
4	01100	0001101	1000	0	
5	00110	0000110	1100	0	
6	00011	0000011	0110	0	
7	00001	1000001	1011	0	
8	10000	0100000	0101	0	MSB
				[11h]	
1	01000	0010000	0010	1	LSB
2	00100	0001000	0001	0	
3	10010	1000100	1000	0	
4	01001	0100010	0100	0	
5	10100	0010001	1010	1	
6	01010	0001000	1101	0	
7	10101	1000100	1110	0	MSB
8	01010	1100010	0111	0	

5627h

– CONCLUDED –

REVISION HISTORY

Edition	Date	Description
1	January 16, 1996	First issue (Attached document: 1, Table 1-1 for Country Code)
2	April 17, 1996	2(7), 6-2-1(10), 6-6(1): Supplement added. 6-7(1), 6-7(2): Denomination “08” added. 6-7(5): CRC check code added. Data length revised.
3	August 7, 1996	Page revised. 5, 6-5(5), 6-6(7), 7-1(1): [OPTIONAL FUNCTION] command added. 6-7(7): [OPTIONAL FUNCTION] added. 6-2-1(3), 6-2-1(7), 6-2-3, 6-3(2), 6-3(3), 6-7: Supplement added. 6-5(3), 6-6(3), 6-6(4), 7-6, 7-7: Error revised.
4	February 2, 2001	Document format revised. Page revised. Supplement added. 4(7): Communication error ⑤ added. 5, 6-5(3), 6-6(3), 6-7(3): [COMMUNICATION MODE] command added. 6-6(3), 6-7(3), 7-8, 7-9: [INTERRUPT MODE – 1/2] added. 5, 6-6(9), 6-7(9): [CURRENCY ASSIGN REQUEST] command added. 6-7(9): [CURRENCY ASSIGN DATA] added. 5, 6-8: [ENQ] command added. 6-2-1(3): ESCROW DATA (EURO) added. 6-2-1(7): REJECT DATA [7FH] added. 6-2-3(7): FAILURE DATA [A8], [A9H] added.
5	August 20, 2004	4(1) (2) (3) (6), 6-2-1(4), 6-2-2, 6-2-2(2), and 6-2-2 (3) added. 6-2-3(9), 6-5, 6-5(5), 7-1(1), and 7-2(1) added. Errors in 5 corrected (INVALID COMMAND). 6-3(5) Extended HOLD command added. Errors in 6-6(9), 6-7(3), 6-7(7), 6-7(8), and 7-1(2) corrected. 7-3(2) [Return of Bill from Process of Conveying for Accommodation] added. 7-10 [POWER INTERRUPT/Hardware RESET During Bill Accommodating Operation] added.