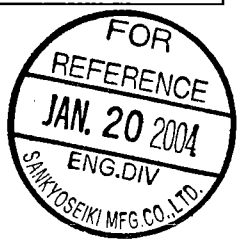
SPECIFICATION

Type Name :

ICM330-3R1170

Spec. No.	ASR-NP-06179-01

Notes :



Distribution

No. of sheet

Custody

		B	Change of Operating temperature		7	EB-04156	Nov.06.2003	K.Takahashi	K.Hirasawa
		Sym.	Revision		Page	Cha. No.	Date	By	Appr.
			K.Takahashi	Jun.13.2003	Reference Document				
		Design	T.Baba	Jun.13.2003					
			Y.Yamamoto	Jun.13.2003					
	ICM350-3R1170	Det-che	T.Tatai	Jul.23.2003					
	ICM330-3R1170		Y.Uemura	Jul.25.2003	SANKYO SEIKI				
	Type Name	Appro.	Y.Isono	Jul.25.2003	MFG.CO.,LTD. JAPAN				

REGISTERED JUL.28.2003 ENG.DIV

No. S39Z-032-00-02B

Revision History

Rev	Date	Author	Description
Pre.002	04.Jul.2003	T.Baba	Add the explanation in the figure of connector pin assignment. P. 9 Change the explanation of "Transmission control method". P. 17 Correct the description of the Reset command. P.104 Correct in the Error matrix. P. 105-107 Add the description about the error code"74". P. 112 Correct the description of "Explanation of basic function". P.113 Add "Calculation method of CRCC" as ANNEX6. P.141
Pre.003	08.Jul.2003	K.Takahashi	Correction of contents (Addition of item 11., 12.). P. 1 Correction of “8.2 Storage temperature and humidity”. P. 7
B	06.Nov.2003	K.Takahashi	Change of Operating temperature (item 8.1). P.7

Contents

[Part1.PRODUCT SPECIFICATION]

1. Model No.
: ICM330-3R1170

2. Appearance
2.1 Appearance drawing
: T01A279A01

2.2 Weight
: 145 [g] approx.

3. Functions
3.1 Card operation
: Manual insert and pull out operation.

3.2 Output/Input signal
: RS232C compatible

3.3 Mag.-Stripe Read
: Simultaneous Read on ISO Track No.1 , 2 and 3.
Read Operation speed : 10 - 100 cm/S (At flat card)

3.4 IC card Read/Write
: Protocol Handling (T=0 and T=1)
: IC contact location (ISO7816 Front side only)
: Dual Voltage Vcc (5V, 3V)

3.5 Memory card Read/Write
: Though it becomes an option, it copes with it by the request.

3.6 LED controller
: It can be indicated in accordance with the command from HOST by three colors.
When ICM is powered correctly and normally, LED shows Green with blinking.

3.7 Card Latch
: When a card is fully inserted , a card is latched during the communication with IC card.
Normal Open (A card can be pulled out at the time of power off)
Note1) When the card is not pushed in completely, it may not be able to latch.
Note2) If a user is going to pull out a card forcibly during a latch,
even if ICRW cancels a latch, a latch may not be able to open.
In this case, once a user must push in a card, and then, pull out a card.

3.8 Download
: The host can change a program by the down load. Max 100 times.

3.9 SAM
: Security Access Module (Icc:10mA max./Module) Plug-in SIM type

4. Applicable card

4.1 Magnetic card

: ISO/IEC 7810 , 7811 , 7813

4.2 IC card

: ISO/IEC 7816/1 -3 (Icc: 60mA max)

: EMV '96 Ver 3.1.1

EMV standard is given priority if there are some difference in same item between EMV and ISO.

Communication speed is establishment of global parameters F and D of TA1 which is returning with ATR. See ANNEX 1.

Vpp is isolated from other contacts.

5. Basic operation

5.1 Block diagram

: Refer to a Fig. 1.

5.2 State change chart

: Refer to a Fig. 2.

5.3 Flow chart

: Refer to a Fig. 3.

5.4 Communication sequence

: Refer to a Fig. 4.

6. Basic performance

6.1 Insulation resistance

: 10 [MΩ] or more at D.C. 250 [V]

6.2 Insulation voltage proof

: No discrepancy for one minute at D.C. 250 [V]

6.3 Vibration Amplitude

Test methods-Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests :IEC 60068-2-47:

6.3.1 Vibration amplitude during operating

:IEC 60068-2-64:Test methods-Test Fh: Vibration, broadband random (digital control) and guidance.

Test frequency range : 5-500 Hz.

Acceleration spectral density : 0.5 GRMS.

Shape of acceleration spectral density curve Flat.

Duration : axis z for 100 minutes.

6.3.2 Vibration amplitude during storage

:IEC 60068-2-64:Test methods-Test Fh: Vibration, broadband random (digital control) and guidance.

Test frequency range : 5-500 Hz.

Acceleration spectral density : 2.16 GRMS.

Shape of acceleration spectral density curve Flat.

Duration : total 100 minutes for three axis (x, y, z).

6.4 EMI

: EN55022 Radiated emission Class B
(Shielded cables are required)

6.5 EMS

:EN55024:1998;Information Technology Equipment-Immunity characteristics
-Limits and method of measurements.

6.5.1 Immunity against electrostatic discharge :IEC61000-4-2
Air Discharge +/- 8kV / Contact Discharge +/- 4kV
Discharge points (Front side of the Gate only)

Shielded USB cable is necessary. And FG is needed to connect completely between ICM330 and earth grounding through USB cable and host equipment. The level against ESD is changed due to FG connecting status or mounting posture. Then it is needed to confirm the ESD test requirement level at whole system.

6.5.2 Immunity against radiated field :IEC61000-4-3 AM 3 V/m 80M-1GHz

6.5.3 Immunity against power frequency magnetic field : IEC61000-4-8 3 A/m (50Hz/60Hz)

7. Power requirement

7.1 Power requirement

Voltage : D.C. +12 [V] ± 10 %
Ripple : Less than 100 [mVp-p].
Power impedance: 1 [Ω] or less.

7.2 Current consumption

Waiting(LED off) : Less than 150 [mA].
solenoid on : Less than 400 [mA].
rush (ICC on) : Less than 700 [mA] within 2mS

8. Environmental conditions

8.1 Operating temperature and humidity

△B : -20 [°C] ~ +50 [°C] , 10 % ~ 95 % R.H. Non-condensation
No permanent damage occurs between +50 ~ +60 [°C].

8.2 Storage temperature and humidity

: -20 [°C] ~ +70 [°C] , 10 % ~ 95 % R.H. , 96 [h]

8.3 Operating Maximum altitude

: 3,000 meters above sea level

8.4 Wet bulb temperature

: Less than +30 [°C]

9. Life

9.1 Unit life

: More than 1,200,000 passes. (Excepting Magnetic head and IC contacts.)
Note) Unit life is limited to use in the office room and varies from the stained card.
One pass is defined as operation of one time insertion and pull out of card.

9.2 Magnetic card life

: More than 1,000 passes.
(In normal in office condition with ABA standard card)

9.3 IC card life

: More than 3,000 passes.

10. Failure rate

: Less than 10,000 Fit. (For P.C.B.)

11. Safety standard

: IEC60950 compliant

12. Mounting posture

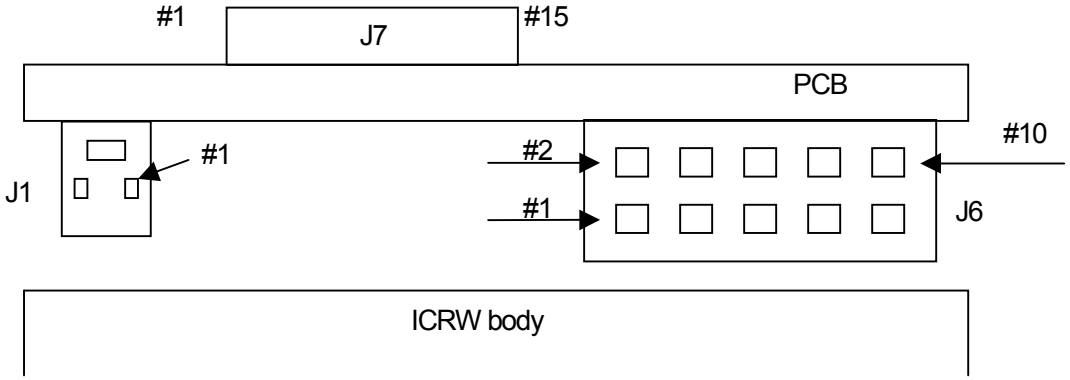
: Card reader shall be set with the coin drop hole (debris hole) side down.

[Part2.INTERFACE SPECIFICATION]

Hereafter, the card reader unit is referred as "ICRW" ,and also host unit is referred as "HOST"

1. Physical level

1.1 Connector pin assignment



1.2 Explanation of signal (J1)

Pin No.	Signal Name	I/O Direction	Mean
1	+12V	IN	Vcc
2	GND	--	Vcc ground
3	TXD (SD)	OUT	Send data
4	RXD (RD)	IN	Receive data
5	RTS (RS)	OUT	Request to send
6	CTS (CS)	IN	Clear to send
7	Reset	IN	Reset signal
8	S.G.	--	Signal ground
9	N.C.	--	Not connected
10	F.G.	--	Frame ground

* SG is connected to GND at the inside of ICRW.

** Usable connector : 3662-5002LCSC(3M)

1) TXD (SD) Data transmission line and being effective when CS stays ON.
Does not make any data transmission when CS stays OFF.
Stays "MARK" condition when no data transmission is being taken place.

2) RXD (RD) Data reception line and being effective when RS stays ON.
Should be hold "MARK" condition when on data transmission is being taken place.

3) RTS (RS) Should become ON when ICRW is available to receive data.
If ICRW is ready to send the Status-report, ICRW will be turning off
RTS signal for requesting the data transmission of this report.
When CTS signal is in OFF state, RTS signal will be also in OFF state for about 100ms.
If CTS signal becomes ON within 100ms,
ICRW will begin the Status-report and turns on RTS signal.
If ICRW receives STX after turned off RTS signal, ICRW turns on
RTS signal and delays the request to the end of this period.

4) CTS (CS) Should become ON when HOST is available to receive data.

5) Reset Should become RESET status when Reset stays Mark/1/OFF.
Also should become RESET status when Reset signal is not connected anywhere.

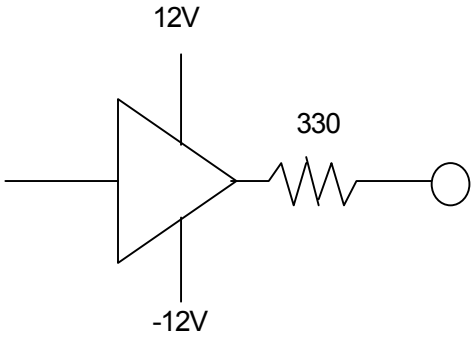
6) FG FG must be connected in short circuit using thick wire to the Host Frame ground.
There is a capacitor (4700pF/250V) connection between SG and FG on main board.

1.3 Signal level

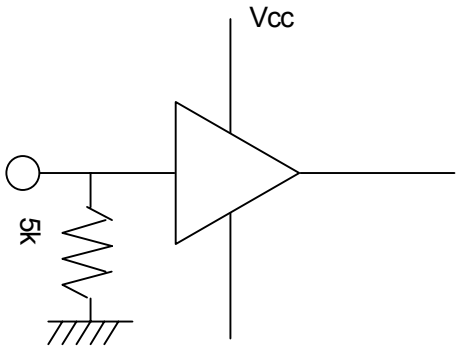
Name	Space	Mark
Mean	0 / ON	1 / OFF
*Output	+5 to +15 [V]	-15 to -5 [V]
Input	+3 to +20 [V]	-20 to -3 [V]

*Typical value of ICRW output level is ± 9 [V]

1.4 Input / Output

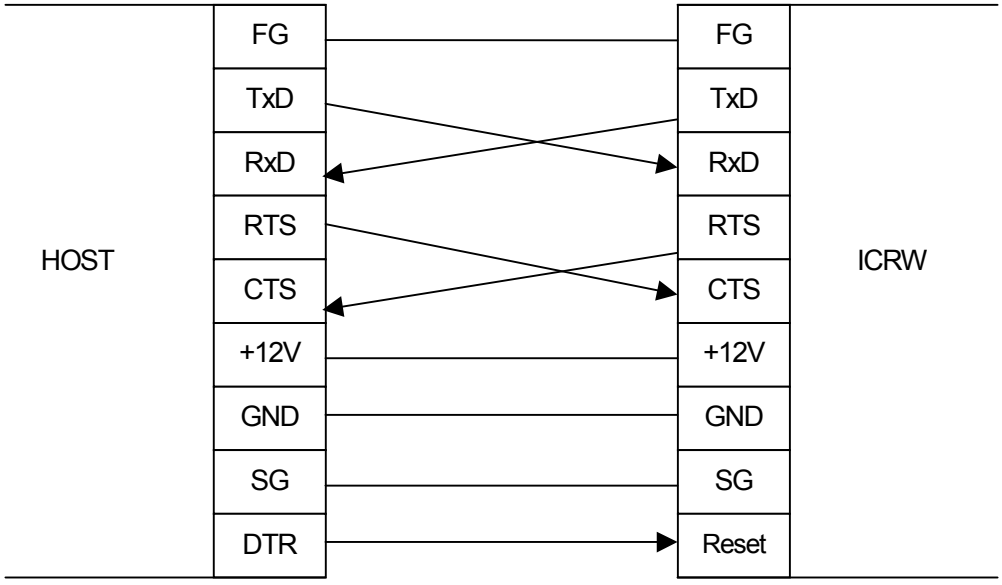


ST207EBTR(ST Microelectronics) or equivalent.



ST207EBTR(ST Microelectronics) or equivalent.

1.5 Connection Example



1.6 SAM Interface

1.6.1 4 more SAMs available on another board. (option) I/F connector (J7)

Pin No.	Signal name	I/O
1	SEDCT	IN
2	PWRON	OUT
3	MCINT	IN
4	RDYMOD	I/O
5	RST	OUT
6	IO	I/O
7	GND	-
8	N.C.	-
9	SYNCLK	OUT
10	CSE	OUT
11	CSA	OUT
12	CSB	OUT
13	SEIN	IN
14	SECON	IN
15	+12V	-

Usable connector : 53261-1590 (MOLEX) : for Flat Cable

The SAM BOARD is able to handle maximum 4 SAMs. Each SAM is managed by means common multiplexed signals. For this reason, the SAM must be selected before to access to it. In order to maintain the SAM state, the handling of RST,VCC,CLK,VPP signals is on latches. All 4 SAMs are Plug-in SIM types. SAM Icc maximum is 10mA per module.
* Board dimension 158mm x 61.5mm x 14.6mm

1.6.2 SAM connector on the main board pin assign

Connector ID1A-6S-2.54SF(21) (HIROSE) for Plug-in SIM type (GSM11.11)

Pin No	Mean
1	C1 VCC
2	C2 RST
3	C3 CLK
4	C5 GND
5	C6 VPP
6	C7 I/O

1.7 Capacitor connector for power failure transaction

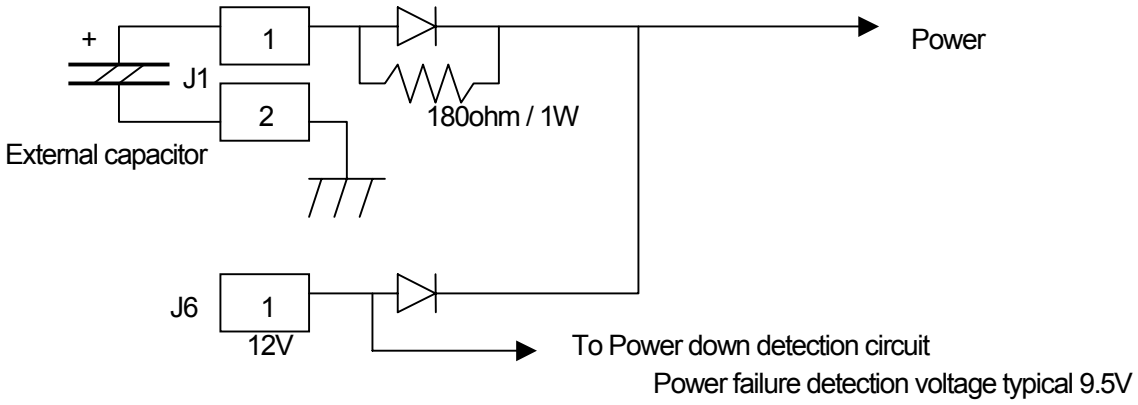
This model can operate power failure transaction using outside capacitor for future card application or something another purpose.

1.7.1 Pin assignment (J1)

J1 Connector 5046-02A (MOLEX)

Pin No	Signal name	Function
1	ECP	External capacitor +
2	ECM	External capacitor -

1.7.2 Power circuit



1.8 Cables requirement

All connecting cables are required less than 3 meters. I/F cable is needed shielded one for EMC.

In case of using option SAM expansion board, this cable length is recommended less than 0.2 meters.

2. Logical level

After the power was turned on, ICRW judges Protocol that a message is transmitted by HOST automatically.
After it is judged, communication is decided to be done in accordance with each protocol.
The type of protocol is judged only at the time of the data reception immediately after the power was turned on.
Then, protocol can't move to the other protocol in the middle of the communication.

2.1 Transmission / Control Specification

1) Synchronous method : Asynchronous
2) Transmission method : Half duplex
3) Baud rate : 1200, 2400, 4800, 9600, 19200, 38400 bps (automatic recognition)
Try to communicate as much as possible at high speed.
4) Data length : 8bit + 1 parity (even)
5) Stop bit : 1 bit

ST	b0	b1	b2	b3	b4	b5	b6	b7	P	SP

6) Character Code : ASCII 8 bit code
7) Parity check method : Vertical (Even) parity check

2.2 Transmission control method

Command / Response method

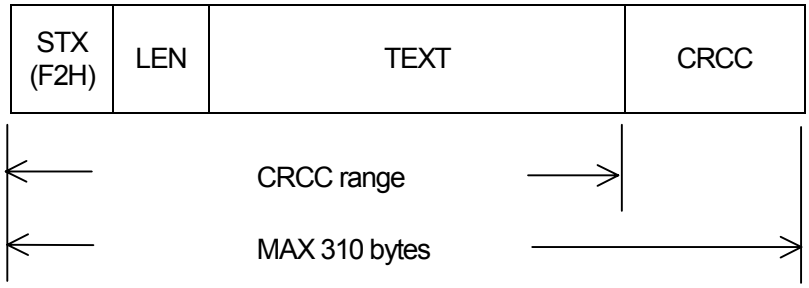
ICRW executes particular operation according to text (command) received from HOST then reports result of execution to HOST.

2.3 Transmission Control Characters

Transmission Control Characters (TCC) of ICRW are as follow.

STX (F2H)	Indicate start of text. It is different from the usual STX code.
ACK (06H)	Acknowledge.
DLE,EOT(10H 04H)	Cancel command.
NAK (15H)	Negative acknowledge.
LEN (2bytes)	Text length.
TEXT	Command or response.
CRCC (2bytes)	Cyclic redundancy code. Polynomial X16+X12+X5+1. Initial value is 0000H.

2.4 Transmission Format



Note) A time interval between each character to CRCC from STX should be less than 250mS.

2.5 Format and meaning of TEXT

HOST sends command to ICRW and instruct operation. Command is followed by data necessary for operation. ICRW sends result of execution as response.

1) Command (from HOST to ICRW)

"C"	cm	pm	data

cm : Command code

pm: Parameter

This is a transmission format that HOST commands ICRW.
The first character should be "C"(=43H).
There are commands with data part and without data part.

2) Positive response (form ICRW to HOST)

"P"	cm	pm	st1	st0	data

st1,st0: Status code

This is a transmission format that ICRW informs HOST of the proper completion of command execution.
The first character should be "P"(=50H).
There are positive responses with data part and without data part.
In this format cm and pm returns the same values which were received with command transmission.
In case of the IC card command, parameter code, pm, given with the response message is not always the same as the one sent with the command message.

3) Negative response (from ICRW to HOST)

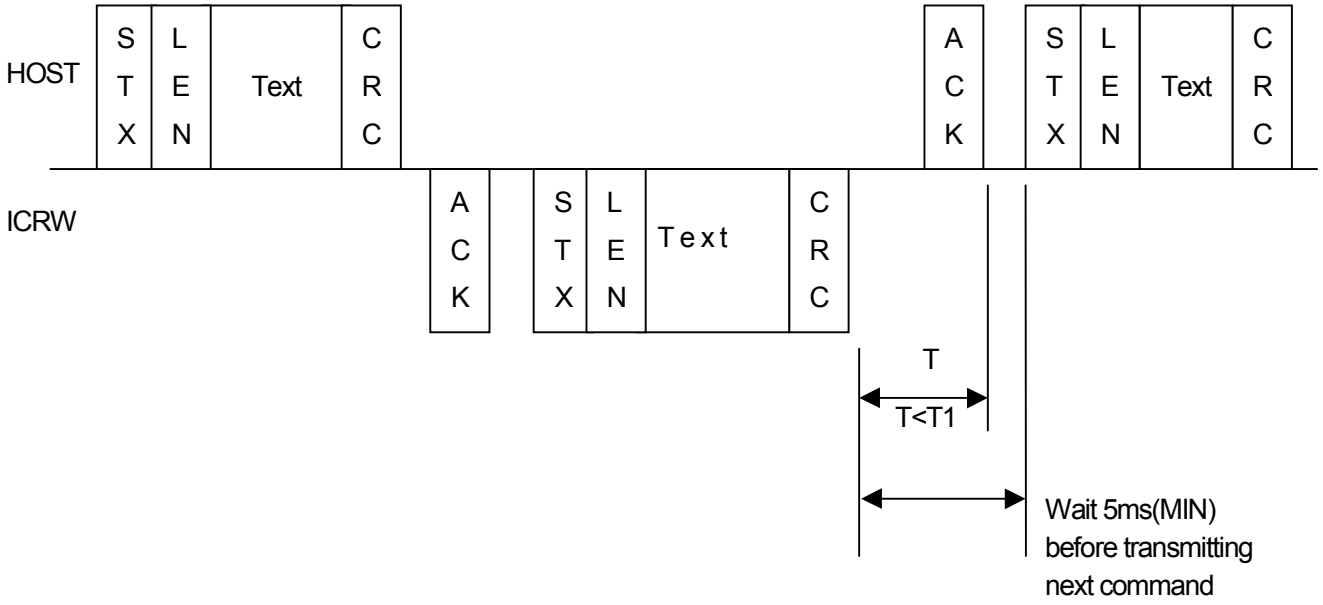
"N"	cm	pm	er1	er0	data

er1,er0: Error code

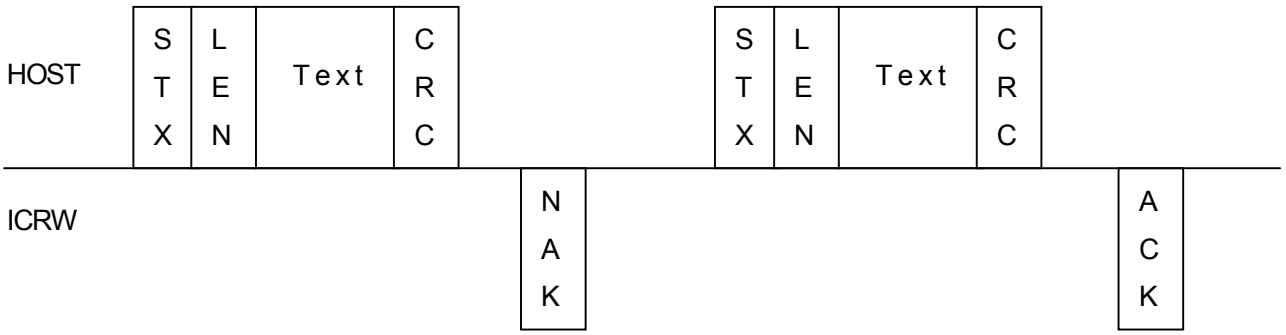
This is a transmission format that ICRW informs HOST of the abnormal completion of command execution.
The first character should be "N"(=4EH).
There are negative responses with data part and without data part.
In this format cm and pm returns the same values which were received with command transmission.

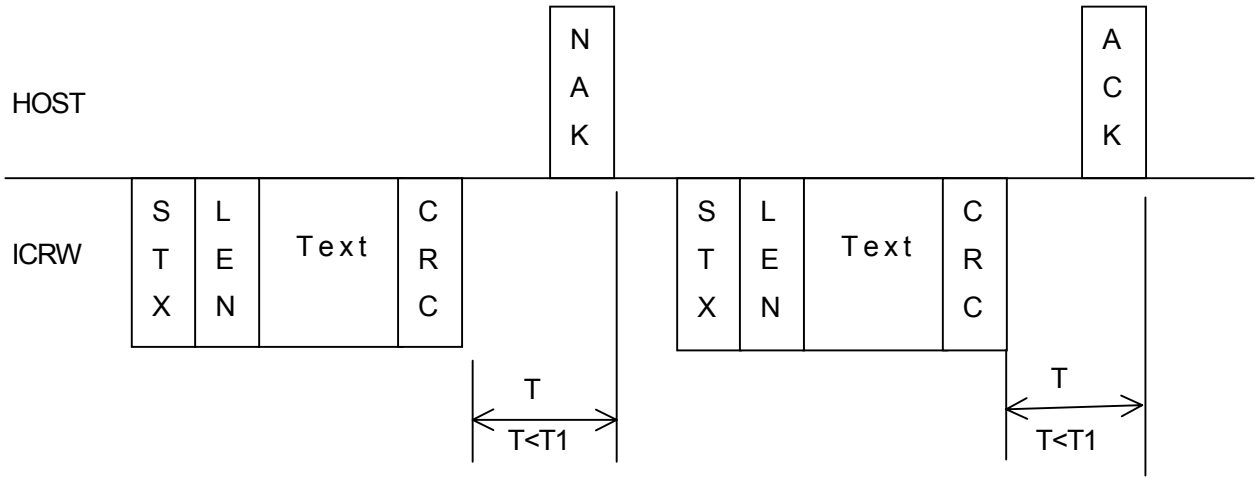
2.6 Transmission protocol

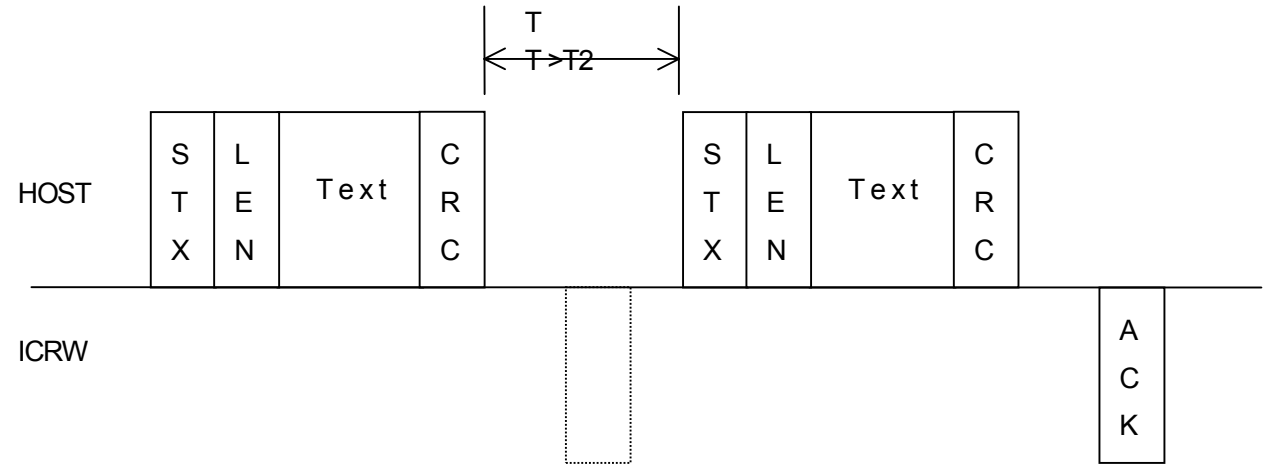
1) Command transmission



2) Re-transmission

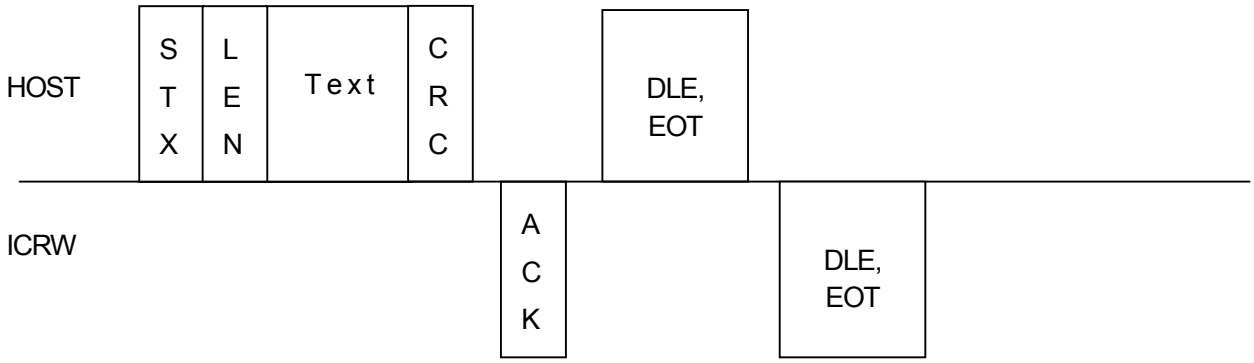




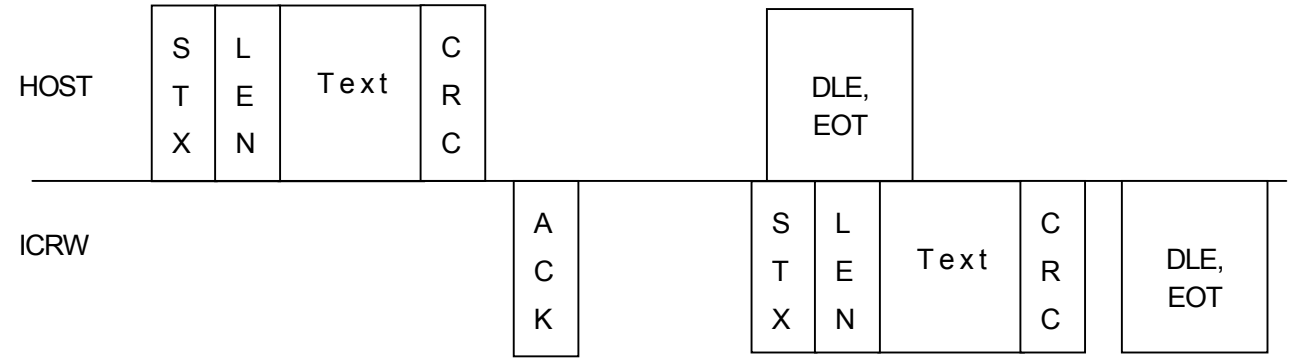


3) Cancel command (User program code area only)

Whenever receiving "DLE,EOT" characters, ICRW stops current execution command right away, and sends "DLE,EOT". Then ICRW wait for next command.



If "DLE,EOT" command is received during response transmission, the ICRW returns to command receive mode after completion of current response.



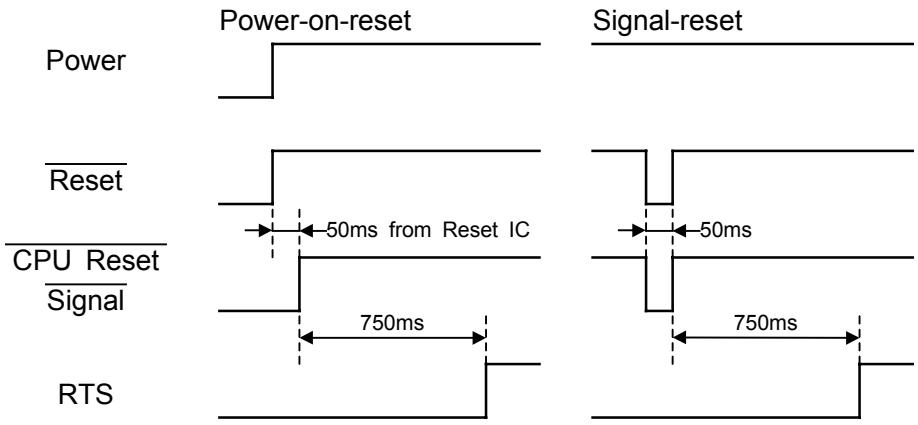
2.7 Transmission control method

1)Power-on-reset and Signal-reset

"RTS" signal is turned on after the reset operation.

HOST should watch a RTS signal being turned on after power-on-reset or the Reset input.

Make it effective more than 50mS about the Reset input.



2)LED blinking after reset (User program code area only)

When the reset-operation was finished in normal, The LED of ICRW blinks in green.

If ICRW received a command for initializing, It stops blinking.

3) Data gap

During the receiving mode, if Time-out(250ms) occurred, ICRW considers that the reception of the text character is completed.

2.8 State transition matrix

1) HOST

Mode \ Character	ACK	NAK	STX(F2H)	Others	Time out	Timer
(1) Wait for ACK after command	Go to (2)	Re-send command Go to (1)*	Ignore	Ignore	Re-send command Go to (1)*	300msec (T2)
(2) Wait for response after ACK	Ignore	Ignore	Go to (3)	Ignore	Re-send command Go to (1)*	2sec (**)
(3) Wait for LEN	Receive 2 bytes as Length. Receive 2 bytes then go to (4)				Send NAK Go to (2)	250msec
(4) Wait for Text	Receive Text in the Length. Receive the Length bytes then go to (5)				Send NAK Go to (2)	250msec
(5) Wait for CRCC	Receive 2 bytes as CRCC. OK then Normal receipt: Send ACK & go to (1) NG then Irregular receipt: Re-send NAK & go to (2)				Send NAK Go to (2)	250msec

* : If it is over the re-try count, it will be judged an error.

**: Except for Intake,withdraw and IC card control command.

2)ICRW

Character / Mode	STX (F2H)	ACK	NAK	DLE,EOT	Others	Time out	Timer
(1) Neutral	Go to (2)	Ignore	Ignore	Go to (1) after send DLE,EOT	Ignore	None	
(2) Wait for LEN	Receive 2 bytes as Length. Receive 2 bytes then go to (3)					Send NAK & go to (1)	250 msec
(3) Wait for Text	Receive Text in the Length bytes Receive the Length bytes then go to (4)					Send NAK & go to (1)	250 msec
(4) Wait for CRCC	Receive 2 bytes as CRCC OK then send ACK, execute command and go to (5) NG then send NAK and go to (1)					Send NAK & go to (1)	250 msec
(5) Wait for ACK after sending Resp	Go to (2)	Go to (1)	Resend Resp. Go to (5)	Go to (1) after send DLE,EOT	Go to (1)	Go to (1)	250 msec (T1)

During command execution, all characters except "DLE,EOT" are ignored.

3. Structure of Firmware areas

Firmware of ICRW is divided into two parts.

(1) Supervisor program code area

To execute the download firmware.
This area can not be changed later.

(2) User program code area

Store area of user's ICRW control firmware.
This area can be reprogrammed (under 100 times) by HOST.
If the firmware is successfully downloaded in this area, ICRW executes this area after power on.
So HOST usually doesn't care Supervisor program code area.

When the error response "02" returns against initialize command,
User program code area is in abnormal condition.
And ICRW executes Supervisor program code area.
HOST should download the User program code.

Switch command is to switch Supervisor program code area and User program code area.
Initialize command shall be executed when after Switch command is executed.

4. Supervisor program code area

4.1 Command list of Supervisor program code area

cm: Command code pm: Parameters

Command	cm	Function	pm	Details of operation
INITIALIZE	30H	Initialize ICRW	xxH	Designate communication format
REVISION	41H	Revision	30H	Send the revision of Supervisor program code area
			3AH	Send the CRCC value of Supervisor program code area
DOWNLOAD	4AH	Download	30H	Erase the User program code area
			31H	Execute download
			32H	Confirm User program code area
			33H	Inquire download count
			34H	Download attestation
Switch	4BH	Area switch	30H	Switch to the User program code area
RESET	7AH	Reset	30H	Reset

Notes. Example 30H present ASCII code, "0", "01" present ASCII character.
Initialize command includes fixed original data.
Do not use any other codes than those shown by this table.

4.2 Status code of Supervisor program code area.

st1, st0 : ICRW status code

status code	Meaning
“00”	Always “00” in Supervisor program code area.

4.3 Error code

er1, er0 : error code

error code	Meaning
“00”	A given command code is undefined
“01”	Parameter is not correct
“02”	Command execution is impossible. Under Supervisor program code area
“04”	Command data error
“70”	F-ROM write error
“71”	CRC error of User program code area

5. Command explanation of Supervisor program code area

5.1 Initialize command

Command	"C"	30H	xxH		
Positive response	Nothing				
Negative response	"N"	30H	xxH	30H	32H

Execute this command whenever power is turned on or after switch from User program code area.
ICRW determines text configuration.

Positive response doesn't exit in Initialize command in this area.
Surely return error code "02" of negative response.

5.2 Revision command

Command	"C"	41H	pm			
Positive response	"P"	41H	pm	30H	30H	Supervisor code area revision 8 bytes Or CRC value 4 bytes
Negative response	"N"	41H	pm	er1	er0	

pm=30H : Send eight characters of Supervisor program code area's firmware revision to HOST.
Ex) "1234-01A"

Pm=3AH : Send four characters of Supervisor program code area's CRCC value to HOST.

5.3 Download command

Command	"C"	4AH	pm	Download Data(ASCII 176bytes)		
Positive response	"P"	4AH	pm	30H	30H	Download Count (ASCII 3bytes)
Negative response	"N"	4AH	pm	e1	e0	

Execution of this command rewrites program in the User program code area by downloading from HOST.
This command is used in case to write latest firmware.

pm=30H: Erase current User program code area.
Need to execute first to execute download.
Error "70" arise in case Erase isn't executed normally.
This error relates to board degradation. Need to change the board.

pm=31H: Write download data (Fixed length 176bytes).
HOST use this command write the date of download data file, Sankyo supplies, per each line.
Download is completed when all download data file is sent.
Error "70" arise in case Write isn't executed normally.
Repeat the download again (from pm=30H).

pm=32H: Execute the CRC check of User program code area and confirm it's condition.
Error "71" arise in case CRC check is wrong.
Repeat the download again (from pm=30H).

pm=33H: Inquire download count
This command reports the download count as three digit of ASCII decimal number.
100 times download is guaranteed by CPU on ICRW.

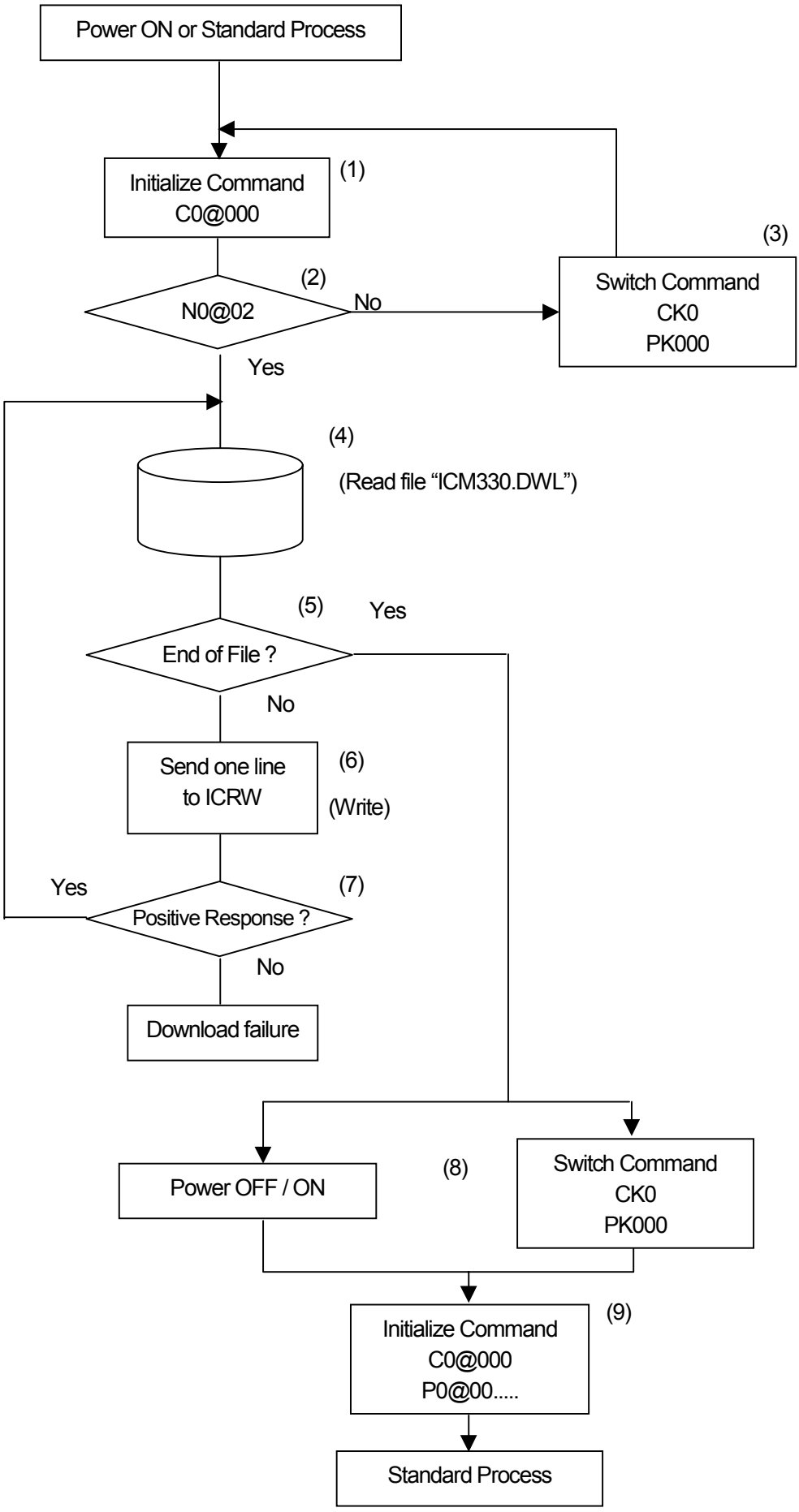
Pm=34H: Download attestation
A supervisor checks the right download file. When this command is not executed or the response of negative is returned, download cannot be performed.

Structure of the file for downloading

```
Rev1234-01A [CRLF]                                              <= Sankyo revision Header
CJ41xxxxxxx[CRLF]                                               <= Download attestation
CJ0 [CRLF]                                                       <= Erase command.
CJ1xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx(176bytes) [CRLF]       <= transmit download data
    :                                                                 :
CJ1xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx(176bytes) [CRLF]            :
CJ2[CRLF]                                                       <= CRC check command
(EOF)                                                            <= End of File
```

(CTRL-Z(1AH) code is not added at the EOF)

The flow chart of the download procedure



(1) Execute the Initialize command.
(2) If response is "N0@02", the program in "Supervisor Program Area" is execute and move to (4).
(3) If response is not "N0@02", move to the "Supervisor Program Area" using "Switch command" and restart from (1).
(4) Characters are read from the 2nd line of the Download file that Sankyo supplies for line by line.
(5) If Host finds EOF then move to (8). Downloading is completed.
(6) The characters read by (3) are sent to ICRW as a command.
(7) If ICRW detected positive response, repeat (4).
If ICRW detected negative response, downloading is failure.
(8) Turn off the ICRW. Or Change to "User Area Command" using "Switch command".
(9) Execute "Initialize command".

5.4 Switch command

Command	"C"	4BH	30H		
Positive response	"P"	4BH	30H	30H	30H
Negative response	"N"	4BH	30H	er1	er0

Execute the CRC check of User program code area.
Switch the control to User program code area from Supervisor program code area in case of normal.
Error "71" arise and not switch to the User program code area, in case the CRC check is wrong.
Repeat the download again.

Note : Start from Initialize command of User program code area after the switch is completed.

5.5 Reset command

Command	“C”	7AH	30H		
Positive response	“P”	7AH	30H	30H	30H
Negative response	Nothing				

ICRW send the response and start from supervisor program code.

5.6 Command – Error matrix

Command			Error code					
Cm	Pm	Function	00	01	02	04	70	71
30H	xxH	Initialize		O	O	O		
41H	30H	Revision				O		
	3AH	Revision				O		
4AH	30H	Download				O	O	
	31H	Download				O	O	
	32H	Download				O		O
	33H	Download				O		
	34H	Download				O		
4BH	30H	Switch				O		O
7AH	30H	Reset				O		
Other			O	O				

6. User program code area

6.1 Command list

List1 cm: Command code pm: Parameters

The next operation is available for HOST-

a) To make ICRW send the status response.

b) To make ICRW send the read data.

Command	cm	Function	pm	Details of operation
INITIALIZE	30H	Initialize ICRW	40H	Disable automatic lighting of LED
STATUS	31H	Inquire status	30H	Status inquiry. Status response is sent back.
		Card intake	31H	Waiting the card intake.
		Card withdraw	32H	Waiting the card withdraw.
READ	32H	Read Mag.-data	31H	Transmit the ISO #1 data.
			32H	Transmit the ISO #2 data.
			33H	Transmit the ISO #3 data.
			36H	Clear read buffer.
			41H	Transmit the ISO #1 enciphered data
			42H	Transmit the ISO #2 enciphered data
			43H	Transmit the ISO #3 enciphered data
LED-CONT	33H	LED Off	30H	Turns LED off.
		LED Red On	31H	Turns R-LED on. (G&Y-LED is turned off.)
		LED Green On	32H	Turns G-LED on. (R&Y-LED is turned off.)
		LED Yellow On	33H	Turns Y-LED on. (R&G-LED is turned off.)
INFOR-MATION	36H	EMV No	30H	Transmit the EMV approval number
		GIE-CB No	31H	Transmit the GIE-CB approval number
		Pass counter	32H	Transmit the card insertion counter value.
SHUTTER	40H	Open Shutter	30H	To open the shutter.
REVISION	41H	Supervisor Revision	30H	Transmit the firmware revision of Supervisor program
		User Revision	31H	Transmit the firmware revision of user program
		ICC Revision	32H	Transmit the firmware revision of ICC controller
		User CRC	3BH	Transmit the firmware CRCC of user program
		ICC CRC	3CH	Transmit the firmware CRCC of ICC controller
Key generation	47H	Device attestation	30H	Generation of the Device attestation and the key
		for magnetic data	31H	Generation of the key for the magnetic data
		for PIN verification	32H	Generation of the key for Plaintext offline PIN verification

There is continuance in the next page

List 2 cm: Command code pm: Parameters

Command	cm	Function	pm	Details of operation
ICC CONTROL	49H	Activate ICC	30H	To activate IC card and To close the shutter.
		Deactivate ICC	31H	To deactivate IC card.
		Status of ICC	32H	To inquire ICRW status. (IC card)
		Communication 0	33H	To exchange data between IC card by protocol T=0
		Communication 1	34H	To exchange data between IC card by protocol T=1
		Communication1-1	35H	To transmit continuously data. Extended comm.
		Communication1-2	36H	To transmit last data. Extended comm.
		Communication1-3	37H	To require next data. Extended comm.
		Warm Reset ICC	38H	To warm reset IC card
		Automatic Communication	39H	To exchange data between IC card by protocol T=0 or T=1
		Plaintext offline PIN verification (Triple-DES)	53H	Plaintext offline PIN verification by protocol T=0
			54H	Plaintext offline PIN verification by protocol T=1
			59H	Plaintext offline PIN verification by protocol T=0 or T=1 (Automatic Communication)
		Plaintext offline PIN verification (Single-DES)	63H	Plaintext offline PIN verification by protocol T=0
			64H	Plaintext offline PIN verification by protocol T=1
			69H	Plaintext offline PIN verification by protocol T=0 or T=1 (Automatic Communication)
SAM CONTROL		Activate SAM	40H	To activate SAM.
		Deactivate SAM	41H	To deactivate SAM.
		Status of SAM	42H	To inquire SAM status.
		Communication 0	43H	To exchange data between SAM by protocol T=0
		Communication 1	44H	To exchange data between SAM by protocol T=1.
		Communication1-1	45H	To transmit continuously data. Extended comm.
		Communication1-2	46H	To transmit last data. Extended comm.
		Communication1-3	47H	To require next data. Extended comm.
		Warm Reset SAM	48H	To warm reset SAM.
		Automatic comm.	49H	To exchange data between SAM by its protocol
		Select SAM	50H	To select SAM.
Switch	4BH	Area switch	30H	Switch to Supervisor program code area.

There is continuance in the next page

List 3 cm: Command code pm: Parameters

Command	cm	Function	pm	Details of operation
SMART CARD CONTROL	4DH	Activate GPM896	30H	To activate GPM896 and To close the shutter
		Deactivate GPM896	31H	To deactivate GPM896
		Status of GPM896	32H	To inquire status of GPM896
		Communication	33H	To exchange data between GPM896
Siemens Memory Card Control	52H	Activate Siemens	30H	To activate Siemens card and To close the shutter
		Deactivate Siemens	31H	To deactivate Siemens card
		Status of Siemens	32H	To inquire status of Siemens card
		Communication	33H	To exchange data between 4442 card
		Communication	34H	To exchange data between 4428 card
I2C MEMORY CONTROL	53H	Activate I2C	30H	To activate I2C and To close the shutter
		Deactivate I2C	31H	To deactivate I2C
		Status of I2C	32H	To inquire status of I2C
		Communication	33H	To exchange data between I2C
Performance Log	66H	Performance Log	30H	Send the Performance log to HOST.
Error log		Error Log	31H	Send the Error log to HOST.
Clear performance log	67H	Clear performance log	31H	Clear log about magnetic head pass counter
			32H	Clear log about reading of the magnetic card
			33H	Clear log about ICC
			34H	Clear log about SAM1
			35H	Clear log about SAM2~SAM5
			36H	Clear log about Latch
Reset	7AH	Reset	30H	Reset

Notes. Example 30H present ASCII code, “0”, “01” present ASCII character.
Initialize command includes fixed original data.
Do not use any other codes than those shown by this table.

*1 Data on the Mag.Card are transmitted to the HOST after converted into the ASCII code.
*2 Do not send any command which is not inside above.

6.2 Status code

st1 st0

Card data status

st0	ISO#3	ISO#2	ISO#1
30H	No data	No data	No data
31H	No data	No data	Data exist
32H	No data	Data exist	No data
33H	No data	Data exist	Data exist
34H	Data exist	No data	No data
35H	Data exist	No data	Data exist
36H	Data exist	Data exist	No data
37H	Data exist	Data exist	Data exist

Card position status

st1	LOCK	RES	FRS
30H	OFF	OFF	OFF
31H	OFF	OFF	ON
32H	OFF	ON	OFF
33H	OFF	ON	ON
34H	ON	OFF	OFF
35H	ON	OFF	ON
36H	ON	ON	OFF
37H	ON	ON	ON

FRS: Detection signal of front position

RES: Detection signal of rear position

LOCK: Detection signal of lock sensor

6.3 Error code

List 1 er1, er0 : error code

error code	Meaning
“00”	
“01”	Un-defined command
“02”	Command execution is impossible.
“03”	Hardware is not present.
“04”	Command data error
“05”	
“06”	ICRW does not have keys that decipher the data.
“07”	Incomplete at intake and/or withdraw (except error "08" and "09")
“08”	Time-out at intake (completed reading at least one magnetic data)
“09”	Time-out at Intake and/or withdraw
“10”	Latch operation error
“11”	
“12”	
“13”	
“14”	
“15”	
“16”	
“17”	
“18”	
“19”	

List 2 er1, er0 : error code

error code	Meaning
“20”	Card has not been read yet or other errors
“21”	No Start sentinel
“22”	VRC error
“23”	No End sentinel. Too many data
“24”	LRC error
“25”	No mag.stripe or No encoded card
“26”	
“27”	SS-ES-LRC card
“28”	
“29”	
“30”	Detection of Power failure
“31”	
“32”	
“33”	
“34”	
“35”	
“36”	
“37”	
“38”	
“39”	

List 3 er1, er0 : error code

error code	Meaning
“40”	
“41”	
“42”	
“43”	
“44”	
“45”	
“46”	
“47”	
“48”	
“49”	
“50”	
“51”	
“52”	
“53”	
“54”	
“55”	
“56”	
“57”	
“58”	
“59”	
“60”	Abnormal condition was found on the power-line (Vcc) of ICC (or SAM).
“61”	The receiving error of ATR.
“62”	The specified protocol does not agree with that of IC card.
“63”	IC card (SAM) communication error (IC card does not respond)
“64”	IC card (SAM) communication error (Other than “63”)
“65”	HOST sends command for IC card communication before receiving ATR.
“66”	Tried to communicate with IC card not supported in ICRW.
“67”	
“68”	
“69”	IC card(SAM) returned ATR which does not match EMV’96 ver3.1.1.
“70”	F-ROM write error
“71”	CRC error of User program code area
“72”	EEPROM operation error
“73”	
“74”	RAM error

6.4 Detection of Power failure

ICRW has a power failure detection circuit.
If ICRW detect power failure, it release the latch and turn off LED,ICRW refuses execution of a command in error code "30."
If ICRW detect power failure, other commands during execution, these command continue processing using a capacitance power.

After finishing using a capacitance power, ICRW will stop a function.
Before ICRW stops a function, when a main power supply returns normally, ICRW continues maintaining this state.
An initial command can cancel this error state.

7. Command explanation of User program code area

7.1 Initialize command

Command	"C"	30H	40H	Lt	Ft	Led
Positive response	"P"	30H	40H	st1	st0	Type recognizing code
Negative response	"N"	30H	40H	er1	er0	

This is to set the operation conditions for ICRW and to initialize ICRW.
Execute this command at first whenever power is turned on or after switch from Supervisor program code area.
ICRW determines text configuration.
In case error response "02" arises, ICRW executes Supervisor program code area,
then HOST should execute download. Because User program code area is in abnormal condition.

Lt: A setup of the mode of latch.
- Lt=30H A latch operation is interlocked with IC command.
- Lt=31H A latch operation is interlocked with RES.
- Lt=32H A latch operation is interlocked with IC command, and read only backward.
- Lt=34H A latch operation is interlocked with RES when there are no effective magnetic data
- Lt=38H A latch operation is interlocked with RES when some magnetic data could be read.

Ft: Always 30H. (This code must not omit.)

Led A setup of the behavior of lighting of LED.
- Led=30H ICRW holds the present state of lighting of LED.
- Led=31H ICRW switches off LED and changes it into an initial state.

Note)
After power supply is turned on or ICRW switches from Supervisor program code area by execution of switch command (waiting for execution of an Initialize command), blink of green LED is ended and turned off even led=30H.

Type recognizing code (14 characters)

ISO#1	ISO#2	ISO#3	"0"	ICM/MCM	SAM1	SAM2	SAM3	SAM4	SAM5
"0"	"0"	"0"	"0"						

Value of recognizing code.

Item	Explanation
ISO#1,ISO#2,ISO#3	"0" – None "1" – Read
ICM/MCM	"0" – MCM "1" – ICM
SAMn (SAM2-5: option)	"0" – Socket is absence "1" – Socket is presence "2" – SAM chip is presence "3" – Vcc error

Note1) ICRW doesn't lock when an initialize command is received so that it can pull out the card which isn't known. even if ICRW detects a card with RES and Lt at that time receives it with 31H.

Note2) Initialize command to be executed each time after power-on or after switch from Supervisor program code area.

7.2 Status request command

Command	"C"	31H	30H		
Positive response	"P"	31H	30H	st1	st0

Negative response Nothing

ICRW sends Status response.

7.3 Intake command

Command	"C"	31H	31H	Monitoring timer 8characters ASCII	
Positive response	"P"	31H	31H	st1	st0
Negative response	"N"	31H	31H	er1	er0

ICRW is monitoring until the card is available or monitoring timer of ICRW expires.
Monitoring timer is 00000000 to 99999999 (msec) 00000000 : infinitely
ICRW sends a positive response when a front sensor is turned on within the setting time of the monitoring timer and a rear sensor is turned on within 1 second after that.
In other than this, a negative response is sent.
An error "09" is sent when a front sensor is not turned on within the setting time of the monitoring timer.
The monitoring timer is not cleared even if a front sensor is turned on. It is counting until response is returned.
When a front sensor is turned off after it was turned on, if it is turned on again within the setting time of the monitoring timer, an error "09" is not sent.

When a front sensor is turned on, the timer for 1 second is start. If a front sensor is turned off, this timer is canceled. If it is turned on again, this timer will begin to count for 1 second.
When a rear sensor is not turned on within 1 second after a front sensor is turned on, the error shown below is sent.
An error "08" is sent when ICRW has completed reading of magnetic data.
An error "07" is sent when ICRW has not completed taking in a card.

For example
If the card was stopped just in front of the RES(Rear End Sensor), Host can read magnetic data even if the Intake is not completed
If ICRW can be reading data completely even when it is taken out after inserting a card to the middle, an error "08" is sent and magnetic data can be read.
This command is canceled by Cancel command.

7.4 Withdraw command

Command	"C"	31H	32H	Monitoring timer 8characters ASCII	
Positive response	"P"	31H	32H	st1	st0
Negative response	"N"	31H	32H	er1	er0

ICRW is monitoring until the card is removed or monitoring timer of ICRW expires.
Monitoring timer is 00000000 to 99999999 (msec) 00000000 : infinitely
ICRW send positive response when the rear sensor was turned off within the setting time of the monitoring timer and a card is removed within 1 second after that. In other than this, a negative response is sent.
Error "09" is sent when the monitoring timer of ICRW expires before a rear sensor is turned off.
Error "07" is sent when a card is not removed within 1 second after a rear sensor is turned off.

This command is canceled by Cancel command.

Note)
When ICC is being activated and the shutter has closed, ICRW executes this command after deactivating ICC and opening a shutter.
When ICRW receives this command in the state where a card is detected only by the front sensor,.error "07" will be sent if a card is not removed within 1 second.

7.5 Mag-Track Read command

Command	"C"	32H	pm			
Positive response	"P"	32H	pm	st1	st0	Reading data
Negative response	"N"	32H	pm	er1	er0	

This function is to read data from mag-stripe and to transmit the data to HOST.

pm=31H : read data on ISO Track #1
pm=32H : read data on ISO Track #2
pm=33H : read data on ISO Track #3

ICRW transmits the reading data on the magnetic stripe.
The transmitted data exclude Start sentinel, End sentinel, LRC, or Parity bit on the magnetic stripe.
When Read Error occurs, ICRW sends negative response.
Data on the magnetic stripe is converted to ASCII code according to conversion table and transmitted.

EX):

ISO Track #1				ISO Track #2,#3			
bit	5 4 3 2 1 0			bit	3 2 1 0		
data=0	0 1 0 0 0 0	->	30H	data=0	0 0 0 0	->	30H
data=A	1 0 0 0 0 1	->	41H	data=9	1 0 0 1	->	39H

When the card has no magnetic track, ICRW sends negative response.
When the card has a track with the sentinels but no data, ICRW sends negative response.

Note) After card insertion, these reading commands need to be executed, before beginning the communication with IC card or SAM..
Magnetic data disappears by communication with IC/Smart/Memory card or SAM.

pm=36H : Clear reading data buffer-
Normal mode(Lt=30H,31H at Initialize command)
a) To start reading in backward when ICRW detects card at rear-sensor.
b) To start reading in forward when ICRW retains previous card's data.
Backward read only mode(Lt=32H at Initialize command)
a) It is no need to issue this command when operating in the backward read only mode, to start reading in backward.
However, It is need to issue this command when ICRW read magnetic data at card insertion and compensating the data which was not able to be read by it at the time of backward read.
b) To start reading in forward when ICRW retains previous card's data.

pm=41H : read data on ISO Track #1
pm=42H : read data on ISO Track #2
pm=43H : read data on ISO Track #3

These pm encrypt in the form of DES-CBC and transmit data.
Other processing are the same processing as pm=31H to 3BH.
Before using these pm, execution of "Key generation command" is necessary.
A 0x80 and some 0x00 code are padded in the end of read data, HOST must ignore after 0x80.

Ex) Original data : 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x39 0x30
Transmit data : 0x?? 0x?? 0x?? 0x?? 0x?? 0x?? 0x?? 0x?? 0x?? 0x?? 0x?? 0x?? 0x?? 0x?? 0x?? 0x?? 0x??
Decipher data : 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0x39 0x30 0x80 0x00 0x00 0x00 0x00 0x00

7.6 LED control command

Command	"C"	33H	pm	Ft	
Positive response	"P"	33H	pm	st1	st0
Negative response	"N"	33H	pm	er1	er0

This function controls the LED connected with the outside of ICRW.
LED On commands for every color are able to change directly from the condition of other color on.

pm: The lighting color establishment of LED
- pm=30H : LED Off
- pm=31H : LED Red On
- pm=32H : LED Green On
- pm=33H : LED Yellow On

Ft: A setup of an interval of flashing
As for the flash control (the interval of the flash) of LED, lighting time changes by the parameter "Ft".

Ft=30H	(When "Ft" is omitted) no flashing. the lighting mode.
Ft=31H	4sec lighting and 4sec lights-out are repeated
Ft=32H	2sec lighting and 2sec lights-out are repeated
Ft=33H	1sec lighting and 1sec lights-out are repeated
Ft=34H	0.5sec lighting and 0.5sec lights-out are repeated
Ft=35H	0.25sec lighting and 0.25sec lights-out are repeated
Ft=36H	0.125sec lighting and 0.125sec lights-out are repeated

Note1) When the number of the data of the receiving telegram was small by one character,
It is handled as "Ft" of the parameter being omitted and, make it Ft=30H when it is made lights-out.

7.7 Unit information

7.7.1 Read Approval number

Command	"C"	36H	pm			
Positive response	"P"	36H	pm	st1	st0	Approval Number
Negative response	"N"	36H	pm	er1	er0	

pm=30H : Send twenty one characters of EMV approval number to HOST.
pm=31H : Send twenty two characters of GIE-CB approval number to HOST.
If an approval number is not defined, ICRW sends spaces (0x20) to HOST.
Approval number will be encoded after the approval.

7.7.2 Read Pass counter

Command	"C"	36H	32H			
Positive response	"P"	36H	32H	st1	st0	Counter 7 characters ASCII
Negative response	"N"	36H	32H	er1	er0	

This is to count removals after full insertion
Count value = "0000000" to "9999999"
Up to 1,000,000 counts are guaranteed. Counts more than 1,000,000 are not guaranteed.
This counts is stored in a nonvolatile memory.

7.8 OPEN SHUTTER

Command	"C"	40H	30H		
Positive response	"P"	40H	30H	st1	st0
Negative response	"N"	40H	30H	er1	er0

This command is used to open the shutter.
Use this command after deactivating IC card.

7.9 Revision read command

Command	"C"	41H	pm			
Positive response	"P"	41H	pm	st1	st0	Revision data 8 bytes Or CRC 4 bytes
Negative response	"N"	41H	pm	er1	er0	

pm=30H : Send eight characters of Supervisor program code area's firmware revision to HOST.
ex) "1234-01A"
pm=31H : Send eight characters of User program code area's firmware revision to HOST.
ex) "2345-01A"
pm=32H : Send eight characters of ICC controller's firmware revision to HOST.
ex) "3456-01A"

Pm=3BH : Send four characters of user program code area's CRCC value to HOST.
Ex) "1234"

Pm=3CH : Send four characters of ICC controller's CRCC value to HOST.
Ex) "5678"

7.10 Key generation command

NOTE: About KEY performance, this document has just outline about it. If you need detail, please contact us.(Sankyo Seiki)

Purpose of this command is generation of the key suitable to “Plaintext offline PIN verification command” and “ciphering/deciphering the magnetic data”.

7.10.1 Generation of the Device attestation data and the key

Command	“C”	47H	30H	Encryption data A (32 bytes : binary value)		
Positive response	“P”	47H	30H	st1	st0	Encryption data B (16 bytes : binary value)
Negative response	“N”	47H	30H	e1	e0	

ICRW deciphers the reception data by using a Peculiar key.
ICRW obtains Devices attestation data and a key that generates the key for
"Plaintext offline PIN verification command" and "ciphering/deciphering the magnetic data".
ICRW encrypts the attestation data by using the key that was obtained and transmits the enciphered data to HOST.

If the generated key is weak key or semi weak key, ICRW sends an error code "04".

7.10.2 Generation of the key for the magnetic data

Command	"C"	47H	31H	Encryption data (16 bytes : binary value)	
Positive response	"P"	47H	31H	st1	st0
Negative response	"N"	47H	31H	e1	e0

ICRW deciphers the reception data by using the key that was obtained by pm=30H.
ICRW obtains the key and Initialize Vector that are used with "ciphering/deciphering the magnetic data".

If the generated key is weak key or semi weak key, ICRW sends an error code "04".
In case that ICRW has no key before receiving the command for ciphering/deciphering the magnetic data, ICRW sends an error code "06".

7.10.3 Generation of the key for Plaintext offline PIN verification

Command	"C"	47H	32H	Encryption data (16 bytes : binary value)	
Positive response	"P"	47H	32H	st1	st0
Negative response	"N"	47H	32H	e1	e0

ICRW deciphers the reception data by using the key that was obtained by pm=30H.
ICRW obtains the key that is used with "Plaintext offline PIN verification command".
The key for Single-DES is the first 8bytes in 16 bytes data.

If the generated key is weak key or semi weak key, ICRW sends an error code "04".
In the case that the first 8 bytes and the second 8 bytes are the same data, ICRW sends an error code "04".
In case that ICRW has no key before receiving the "Plaintext offline PIN verification command",
ICRW sends an error code "06".

7.11 IC Card control command

7.11.1 ICC power on

Command	"C"	49H	30H	Vcc		
Positive response	"P"	49H	30H	st1	st0	ATR
Negative response	"N"	49H	30H	e1	e0	ATR

To close the shutter. Then to activate IC card (ICC), power (VCC) and clock (CLK) are supplied and reset (RST) is released.
Vcc=30H : ICRW supplies with +5V to VCC and activates in line with the EMV'96
Vcc=33H : ICRW supplies with +5V to VCC and activates in line with the ISO/IEC7816-3.
Vcc=35H : ICRW supplies with +3V to VCC and activates in line with the ISO/IEC7816-3. After ATR reception, ICRW supplies voltage to VCC in accordance with the value of ATR on T=15.
Vcc=36H : ICRW supplies with +5V to VCC and activates in line with the ISO/IEC7816-3. After ATR reception, ICRW supplies voltage to VCC in accordance with the value of ATR on T=15

In case there is no Vcc word, it will have 30H as a default value.

Vcc=30H is used on EMV'96 comply card.
Vcc=33H is used on old ISO/IEC7816-3 card. (only 5v card)
Vcc=35H is used on ISO/IEC7816-3 card.
Vcc=36H is used on ISO/IEC7816-3 /Amd 1:2001 card.

Also, Answer To Reset (ATR) from ICC is received and transmitted to HOST.

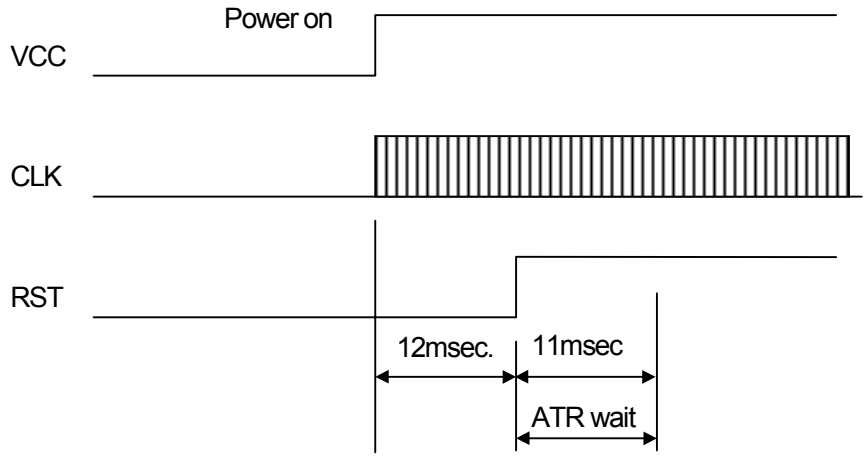
ATR	TS	TO	TA1	TB1	…	TCK

When content of ATR is not based on such protocol which is supported by ICRW, Negative response with ATR data from ICC and error code "66" or "69" will be sent back and ICRW will deactivate the card.
An error code "60" is returned when a power failure is recognized while a power supply is supplied to the card.
If ATR should not be received within 11msec after supply of RST, ICRW initiate the deactivation sequence, error message "61" is sent.
At the time of ICC of T=1 protocol, when a proper answer isn't returned from ICC toward the S (IFSreq), ICRW returns Negative response that the error-code is "63" or "64", added with the ATR-data from ICC.

ICRW will not release the latch when the error arises if IC card is under communication.

Vcc is not relation with ICC communication. ICC communication complies with EMV'96.

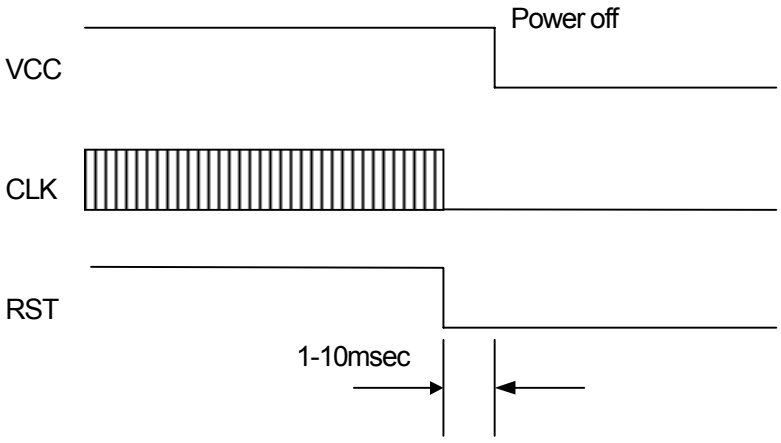
Time chart of activating IC card (ICC) is as under:



7.11.2 ICC power off

Command	"C"	49H	31H		
Positive response	"P"	49H	31H	st1	st0
Negative response	"N"	49H	31H	er1	er0

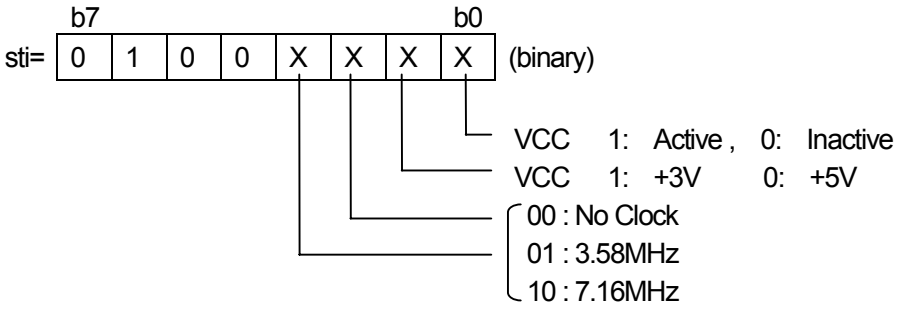
This deactivates IC card.
Time chart of deactivating IC card (ICC) is as under:



7.11.3 Inquire ICC Status command

Command	"C"	49H	32H			
Positive response	"P"	49H	32H	st1	st0	sti
Negative response	"N"	49H	32H	er1	er0	

ICRW tells the status of IC card with sti.



While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error "60" is returned when a power failure is detected.

7.11.4 ICC communication 0 (T=0)

Command	"C"	49H	33H	C-APDU		
Positive response	"P"	49H	px	st1	st0	R-APDU
Negative response	"N"	49H	33H	er1	er0	

This exchanges data between IC card by protocol T=0. About the format of C-APDU, see ANNEX 3.

C-APDU	CLA	INS	P1	P2	Lc	Data1	...	Data(Lc)	Le

Set the chipdata ICRW received from ICC to "R-APDU" and transmit HOST.

R-APDU	Data1	...	Data(Licc)	SW1	SW2

Maximum size of data ICRW can handle is 261 bytes.
If ICC is not supporting protocol T=0, error code "62" is sent.
If any other protocol error occurs, error code "64" is sent.

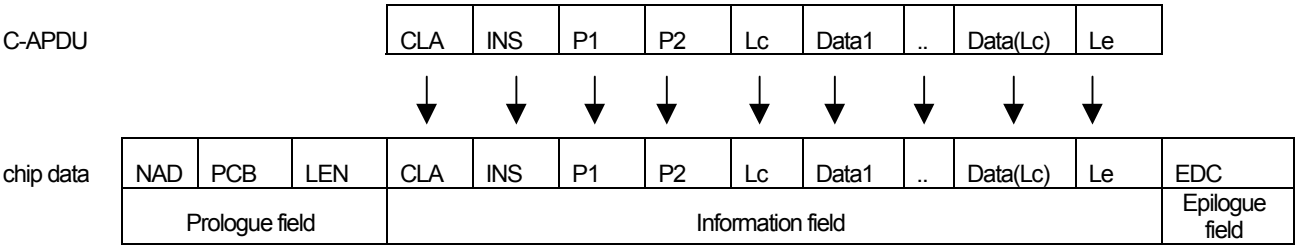
While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error "60" is returned when a power failure is detected.

px=33H : The IC card's data is 300 bytes or less.
px=35H : The IC card's data is 301 bytes or more.
ICRW requires transmitting next IC card's data.
HOST needs to receive the remaining data by using "CI7" command.

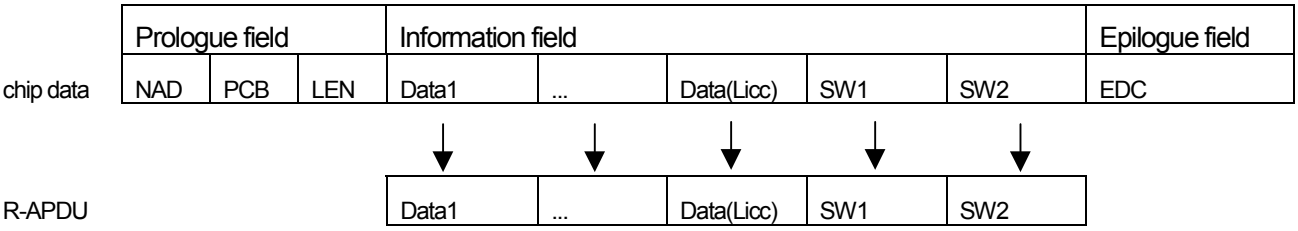
7.11.5 ICC communication 1 (T=1)

Command	"C"	49H	34H	C-APDU		
Positive response	"P"	49H	px	st1	st0	R-APDU
Negative response	"N"	49H	34H	er1	er0	

This exchanges data between IC card by protocol T=1.
The data ICRW can handle is data of Information field.
Set Information field to "C-APDU".



Set the chipdata ICRW received from ICC to "R-APDU" and transmit HOST.



Maximum size of data ICRW can handle is 300 bytes.

px=34H : The IC card's data is 300 bytes or less.
px=35H : The IC card's data is 301 bytes or more.
ICRW requires transmitting next IC card's data.
HOST needs to receive the remaining data by using "CI7" command.
px=3FH : ICRW received the ABORT-request from the IC card, terminated data transmission to the IC card, and deactivated the IC card. This positive response doesn't have the R-APDU. After this condition, ICRW rejects the transmission commands for the following chaining data from HOST.

If ICC is not supporting protocol T=1, error code "62" is sent.
If any other protocol error occurs, error code "64" is sent.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.

NOTE.

* In case there is any trouble in sequence of command receipt,
  Error code "02" shall be sent.
* In case command length exceeds the value in the specifications (=300 bytes),
  then error code "04" shall be sent.

If error code "02" or "04" is returned, please re-start from ATR.

7.11.6 ICC communication 1-1 (T=1)

Command	"C"	49H	35H	C-APDU	
Positive response	"P"	49H	px	st1	st0
Negative response	"N"	49H	35H	er1	er0

In the protocol T=1, in case the transmitted data to IC card is 301 bytes or more, this command is used repeatedly. Host needs to divide the data by 300 bytes or less.

px=37H : ICRW requires to receive next IC card's data. There is no data portion.
HOST needs to transmit the remaining data by using command "CI5" or "CI6".

px=3FH : ICRW received the ABORT-request from the IC card, terminated data transmission to the IC card, and deactivated the IC card. This positive response doesn't have the R-APDU. After this condition, ICRW rejects the transmission commands for the following chaining data from HOST.

If IC card is not supporting protocol T=1, error code "62" is sent.
If any other protocol error occurs, error code "64" is sent.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error "60" is returned when a power failure is detected.

7.11.7 ICC communication 1-2 (T=1)

Command	"C"	49H	36H	C-APDU		
Positive response	"P"	49H	px	st1	st0	R-APDU
Negative response	"N"	49H	36H	er1	er0	

In the protocol T=1, this command is used when the last data are transmitted.
The size of data Host can transmit (C-APDU) is 300 bytes or less by ICC's data.

px=34H : The IC card's data is 300 bytes or less.
px=35H : The IC card's data is 301 bytes or more.
ICRW requires transmitting next IC card's data.
HOST needs to receive the remaining data by using "CI7" command.
px=3FH : ICRW received the ABORT-request from the IC card, terminated data transmission to the IC card, and deactivated the IC card. This positive response doesn't have the R-APDU. After this condition, ICRW rejects the transmission commands for the following chaining data from HOST.

If any other protocol error occurs, error code "64" is sent.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error "60" is returned when a power failure is detected.

7.11.8 ICC communication 1-3 / 0-1 (T=1/T=0)

Command	"C"	49H	37H			
Positive response	"P"	49H	px	st1	st0	R-APDU
Negative response	"N"	49H	37H	er1	er0	

This command is used when receiving the followed data from ICRW.
HOST should send this command repeatedly till the response "px=36H".

px=35H : The IC card's data is 301 bytes or more.
ICRW requires transmitting next IC card's data.
HOST needs to receive the remaining data by using "CI7" command.
px=36H : ICRW does not have more transmit IC card's data.
px=3FH : ICRW received the ABORT-request from the IC card, terminated data transmission to the IC card, and deactivated the IC card. This positive response doesn't have the R-APDU. After this condition, ICRW rejects the transmission commands for the following chaining data from HOST.
When ICC protocol is T=0, ICRW does not respond with this parameter.

If any other protocol error occurs, error code "64" is sent.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error "60" is returned when a power failure is detected.

7.11.9 ICC Warm Reset

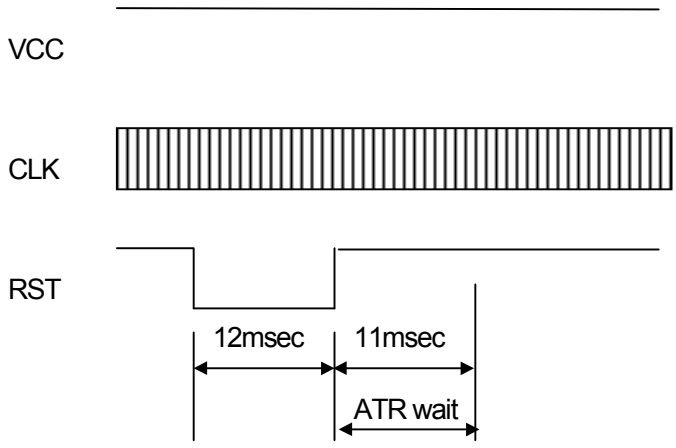
Command	"C"	49H	38H			
Positive response	"P"	49H	38H	st1	st0	ATR
Negative response	"N"	49H	38H	er1	er0	ATR

ICRW sends a reset pulse, keeping the status of the IC contact activated, then returns response upon receiving "ATR" again. The reset pulse width is around 12msec.
This command gives effect to change into the specific mode.

This command will take as error when ATR content is not based on such protocol which is supported by this device, ATR from ICC and error code "66" or "69" is sent.
This command to be done, even if the card does not support the specific mode.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.

If ATR should not be received within 11msec, after sends a reset pulse, ICRW initiate the deactivation sequence, error code "61" is sent.
ICRW returns error code "65" if the IC card does not activated.
Time chart of activating IC card is as under:



7.11.10 ICC automatic communication

Command	"C"	49H	39H	C-APDU		
Positive response	"P"	49H	px	st1	st0	R-APDU
Negative response	"N"	49H	39H	er1	er0	

This exchanges data between IC card by protocol T=0 or T=1. Protocol recognized automatically.
Set Data to "C-APDU". About C-APDU format, see ANNEX 3.

Set chipdata ICRW received from ICC to "R-APDU" and transmit HOST.

Maximum size of data (C-APDU) ICRW can handle is 300 bytes for T=1 protocol, and 261 bytes for T=0 protocol.
If ICC is not supporting protocol T=0 nor T=1, error code "62" is sent.
If any other protocol error occurs, error code "64" is sent.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card).
An error “60” is returned when a power failure is detected.

When protocol is T=1, If the data for transmitting is 301 bytes or more, use command "CI5" and "CI6".

px=34H : The IC card’s data is 300 bytes or less.
px=35H : The IC card’s data is 301 bytes or more.
ICRW requires transmitting next IC card’s data.
HOST needs to receive the remaining data by using "CI7" command.
px=3FH : ICRW received the ABORT-request from the IC card, terminated data transmission to the IC card, and deactivated the IC card. This positive response doesn't have the R-APDU. After this condition, ICRW rejects the transmission commands for the following chaining data from HOST.
(Only T=1 protocol)

7.11.11 Plaintext offline PIN verification

Command	"C"	49H	pm	C-APDU (Verify command)(13byte)							
				CLA 0xH	INS 20H	P1 00H	P2 80H	Lc 08H	Encrypted offline PIN block (8byte)		
Positive response	"P"	49H	px	st1	st0	R-APDU					
Negative response	"N"	49H	pm	er1	er0						

This command deciphers Verify command's offlince PIN block and changes into C-APDU, then transmits to an IC card.
This function intends plain text offline PIN block (8bytes fixed) defined by Verify command that P2 value is 80H to transmit ICRW safely.

pm = 53H: Communication T=0 using "Triple-DES"
pm = 54H: Communication T=1 using "Triple-DES"
pm = 59H: Automatic communication using "Triple-DES"
pm = 63H: Communication T=0 using "Single-DES"
pm = 64H: Communication T=1 using "Single-DES"
pm = 69H: Automatic communication using "Single-DES"

Key(PINKEY) to use with decoding is set by "Generation of the key for Plaintext offline PIN verification" command.
If "Generation of the Device attestation data and the key" command or "Generation of the key for Plaintext offline PIN verification" command are not complete, error code "06" is sent.

px=33H: T=0 protocol IC card's response.
px=34H : T=1 protocol IC card's response.
px=3FH :ICRW received the S(ABTreq) block from the IC card, so suspended transmission, and deactivated the IC card. (Only T=1 protocol).

Reference:
The plaintext offline PIN block shall be formatted as follows:

C	N	P	P	P	P	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F	F	F

Where

	Name	Value
C	Control field	Binary 2(hex. 0010)
N	PIN length	4-bit binary number with permissible values of hex. 0100 to hex. 1100
P	PIN digit	4-bit field with permissible values of hex. 0000 to hex. 1001
P/F	PIN/filler	Determined by PIN length
F	Filler	4-bit binary number with value of hex. 1111

(Reference: EMV96 Integrated Circuit Card Specification for Payment Systems, Version 3.1.1 May 31, 1998. PartII Data Elements and Commands.)

7.12 SAM control command

7.12.1 SAM power on

Command	"C"	49H	40H	Vcc		
Positive response	"P"	49H	40H	st1	st0	ATR
Negative response	"N"	49H	40H	er1	er0	ATR

To activate SAM, power (VCC) and clock (CLK) are supplied and reset (RST) is released.
Vcc=30H : ICRW supplies with +5V to VCC and activates in line with the EMV'96.
Vcc=33H : ICRW supplies with +5V to VCC and activates in line with the ISO/IEC7816-3.
Vcc=35H : ICRW supplies with +3V to VCC and activates in line with the ISO/IEC7816-3. After ATR reception, ICRW supplies voltage to VCC in accordance with the value of ATR on T=15.
Vcc=36H : ICRW supplies with +5V to VCC and activates in line with the ISO/IEC7816-3. After ATR reception, ICRW supplies voltage to VCC in accordance with the value of ATR on T=15

In case there is no Vcc word, ICRW supplies with +5V to VCC as default value.

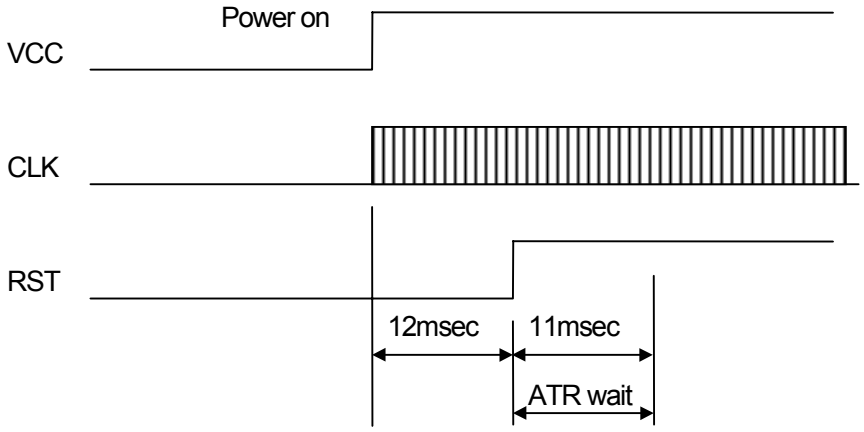
Vcc=30H is used on EMV'96 comply card.
Vcc=33H is used on old ISO/IEC7816-3 card. (only 5v card)
Vcc=35H is used on ISO/IEC7816-3 card.
Vcc=36H is used on ISO/IEC7816-3 /Amd 1:2001 card.

Also, Answer To Reset (ATR) from SAM is received and transmitted to HOST.

ATR	TS	TO	TA1	TB1		TCK

When content of ATR is not based on such protocol which is supported by ICRW, Negative response with ATR data from SAM and error code "66" or "69" will be sent back and ICRW will deactivate the SAM.
An error code "60" is returned when a power failure is recognized while a power supply is supplied to the card.
If ATR should not be received within 11msec after supply of RST, ICRW initiate the deactivation sequence, error message "61" is sent.
At the time of SAM of T=1 protocol, when a proper answer isn't returned from SAM toward the S (IFSreq), ICRW returns Negative response that the error-code is "63" or "64", added with the ATR-data from SAM.

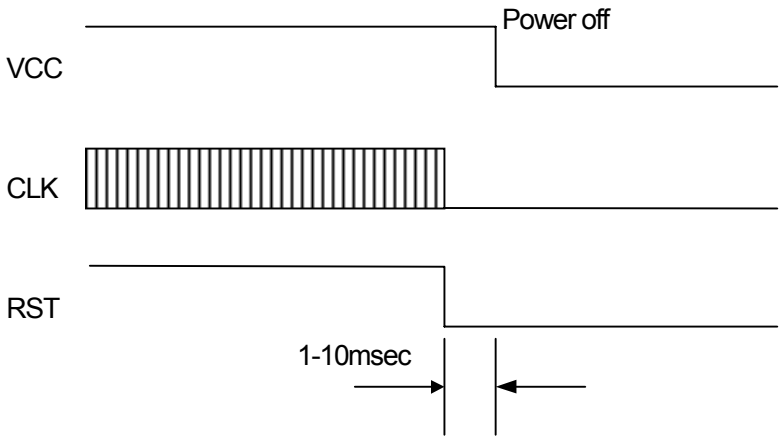
Time chart of activating SAM is as under:



7.12.2 SAM power off

Command	"C"	49H	41H		
Positive response	"P"	49H	41H	st1	st0
Negative response	"N"	49H	41H	er1	er0

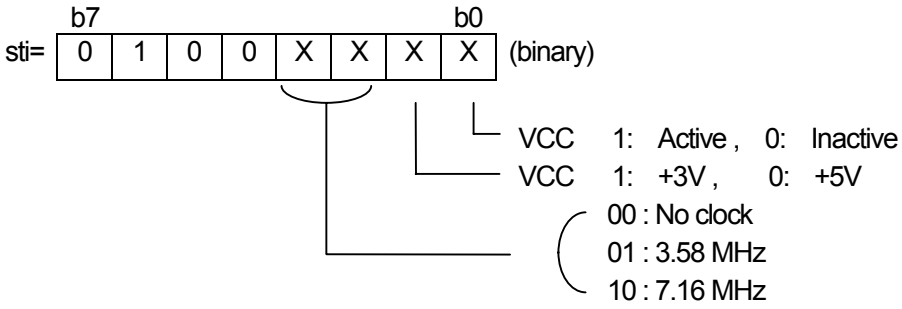
This deactivates SAM.
Time chart of deactivating SAM is as under:



7.12.3 Inquire SAM status command

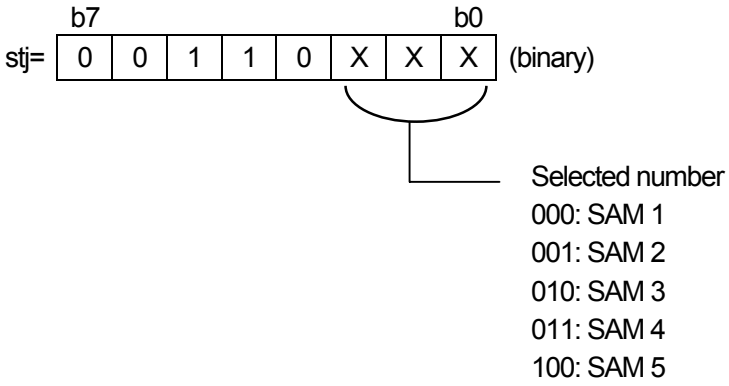
Command	"C"	49H	42H				
Positive response	"P"	49H	42H	st1	st0	sti	stj
Negative response	"N"	49H	42H	er1	er0		

This tells the status of SAM (sti).



While a power supply is supplied to the SAM, the ICRW monitors VCC (the power supply line of the SAM). An error "60" is returned when a power failure is detected.

And also, ICRW tells the address of the selected SAM's number with stj



Before selecting the SAM's number, ICRW responds that ICRW selects the SAM 1. (stj=30H)

7.12.4 SAM communication 0 (T=0)

Command	"C"	49H	43H	C-APDU		
Positive response	"P"	49H	px	st1	st0	R-APDU
Negative response	"N"	49H	43H	er1	er0	

This exchanges data between SAM by protocol T=0. About the format of C-APDU, see ANNEX 3.

C-APDU	CLA	INS	P1	P2	Lc	Data1	...	Data(Lc)	Le

Set the chipdata ICRW received from SAM to "R-APDU" and transmit HOST.

R-APDU	Data1	...	Data(Licc)	SW1	SW2

Maximum size of data ICRW can handle is 261 bytes.
If SAM is not supporting protocol T=0, error code "62" is sent.
If any other protocol error occurs, error code "64" is sent.

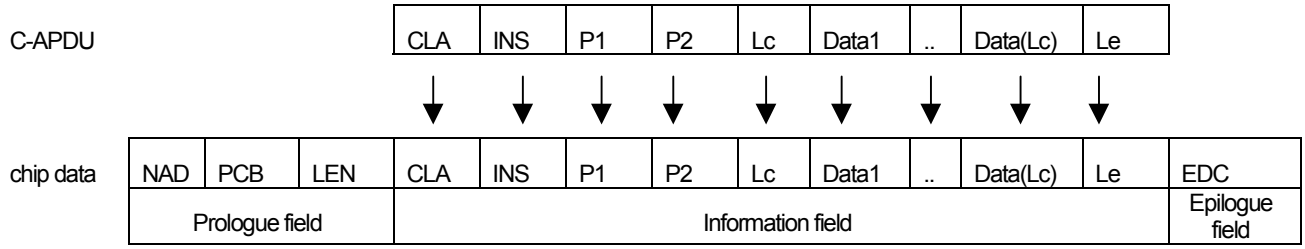
While a power supply is supplied to the SAM, the ICRW monitors VCC (the power supply line of the SAM). An error "60" is returned when a power failure is detected.

px=43H : The SAM's data is 300 bytes or less.
px=45H : The SAM's data is 301 bytes or more.
ICRW requires transmitting next SAM's data.
HOST needs to receive the remaining data by using "CIG" command.

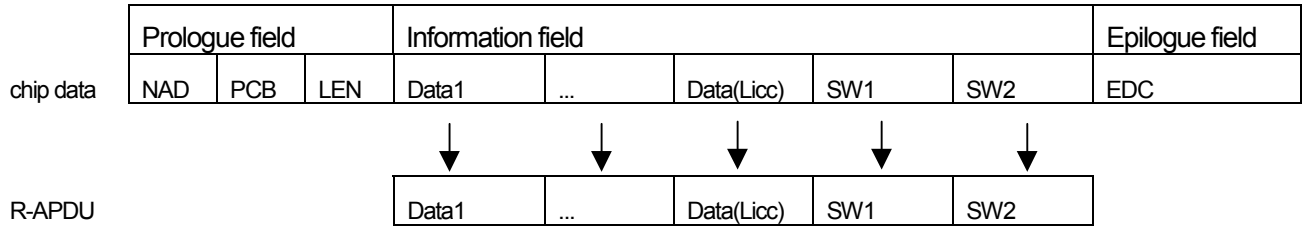
7.12.5 SAM communication 1 (T=1)

Command	"C"	49H	44H	C-APDU		
Positive response	"P"	49H	px	st1	st0	R-APDU
Negative response	"N"	49H	44H	er1	er0	

This exchanges data between SAM by protocol T=1.
The data ICRW can handle is data of Information field.
Set Information field to "C-APDU".



Set the chipdata ICRW received from SAM to "R-APDU" and transmit HOST.



Maximum size of data ICRW can handle is 300 bytes.

px=44H : The SAM's data is 300 bytes or less.
px=45H : The SAM's data is 301 bytes or more.
ICRW requires transmitting next SAM's data.
HOST needs to receive the remaining data by using "CIG" command.
px=4FH : ICRW received the ABORT-request from the SAM, terminated data transmission to the SAM, and deactivated the SAM. This positive response doesn't have the R-APDU. After this condition, ICRW rejects the transmission commands for the following chaining data from HOST.

If SAM is not supporting protocol T=1, error code "62" is sent.
If any other protocol error occurs, error code "64" is sent.

While a power supply is supplied to the SAM, the ICRW monitors VCC (the power supply line of the SAM). An error “60” is returned when a power failure is detected.

NOTE.

* In case there is any trouble in sequence of command receipt,
  Error code "02" is sent.
* In case command length exceeds the value in the specifications (=300 bytes),
  then error code "04" is sent.

If error code "02" or "04" is returned, please re-start from ATR.

7.12.6 SAM communication 1-1 (T=1)

Command	"C"	49H	45H	C-APDU	
Positive response	"P"	49H	px	st1	st0
Negative response	"N"	49H	45H	er1	er0

In the protocol T=1, in case the transmitted data to SAM is 301 bytes or more, this command is used repeatedly. Host needs to divide the data by 300 bytes or less.

px=47H : ICRW requires to receive next SAM's data. There is no data portion.
HOST needs to transmit the remaining data by using command "CIE" or "CIF".
px=4FH : ICRW received the ABORT-request from the SAM, terminated data transmission to the SAM, and deactivated the SAM. This positive response doesn't have the R-APDU. After this condition, ICRW rejects the transmission commands for the following chaining data from HOST.

If SAM is not supporting protocol T=1, error code "62" is sent.
If any other protocol error occurs, error code "64" is sent.

While a power supply is supplied to the SAM, the ICRW monitors VCC (the power supply line of the SAM). An error "60" is returned when a power failure is detected.

7.12.7 SAM communication 1-2 (T=1)

Command	"C"	49H	46H	C-APDU		
Positive response	"P"	49H	px	st1	st0	R-APDU
Negative response	"N"	49H	46H	er1	er0	

In the protocol T=1, this command is used when the last data are transmitted.
The size of data Host can transmit (C-APDU) is 300 bytes or less by SAM's data.

px=44H : The SAM's data is 300 bytes or less.
px=45H : The SAM's data is 301 bytes or more.
ICRW requires transmitting next SAM's data.
HOST needs to receive the remaining data by using "CIG" command.
px=4FH : ICRW received the ABORT-request from the SAM, terminated data transmission to the SAM, and deactivated the SAM. This positive response doesn't have the R-APDU. After this condition, ICRW rejects the transmission commands for the following chaining data from HOST.

If any other protocol error occurs, error code "64" is sent.

While a power supply is supplied to the SAM, the ICRW monitors VCC (the power supply line of the SAM). An error "60" is returned when a power failure is detected.

7.12.8 SAM communication 1-3 / 0-1 (T=1/T=0)

Command	"C"	49H	47H			
Positive response	"P"	49H	px	st1	st0	R-APDU
Negative response	"N"	49H	47H	er1	er0	

This command is used when receiving the followed data from ICRW.
HOST should send this command repeatedly till the response "px=46H".

px=45H : The SAM's data is 301 bytes or more.
ICRW requires transmitting next SAM's data.
HOST needs to receive the remaining data by using "CIG" command.
px=46H : ICRW does not have more transmit SAM's data.
px=4FH : ICRW received the ABORT-request from the SAM, terminated data transmission to the SAM, and deactivated the SAM. This positive response doesn't have the R-APDU. After this condition, ICRW rejects the transmission commands for the following chaining data from HOST. When SAM protocol is T=0, ICRW does not respond with this parameter.

If any other protocol error occurs, error code "64" is sent.

While a power supply is supplied to the SAM, the ICRW monitors VCC (the power supply line of the SAM). An error "60" is returned when a power failure is detected.

7.12.9 SAM Warm Reset

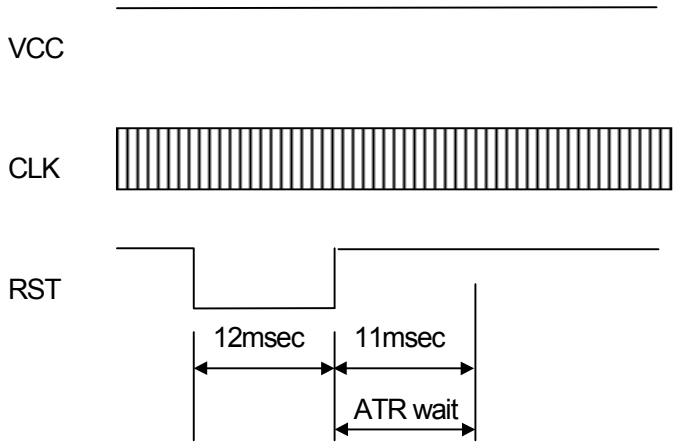
Command	"C"	49H	48H			
Positive response	"P"	49H	48H	st1	st0	ATR
Negative response	"N"	49H	48H	er1	er0	ATR

ICRW sends a reset pulse, keeping the status of SAM contact activated, then returns response upon receiving "ATR" again. The reset pulse width is around 12msec.
This command gives effect to change into the specific mode.

This command will take as error when ATR content is not based on such protocol which is supported by this device, ATR from SAM and error code "66" or "69" is sent.
This command to be done, even if the card does not support the specific mode.

While a power supply is supplied to the SAM, the ICRW monitors VCC (the power supply line of the SAM). An error “60” is returned when a power failure is detected.

If ATR should not be received within 11msec, after sends a reset pulse, ICRW initiate the deactivation sequence, error code "61" is sent.
ICRW returns error code "65" if the SAM does not activated.
Time chart of activating SAM is as under:



7.12.10 SAM automatic communication

Command	"C"	49H	49H	C-APDU		
Positive response	"P"	49H	px	st1	st0	R-APDU
Negative response	"N"	49H	49H	er1	er0	

This exchanges data between SAM by protocol T=0 or T=1. Protocol recognized automatically.
Set Data to "C-APDU". About C-APDU format, see ANNEX 3.

Set chipdata ICRW received from SAM to "R-APDU" and transmit HOST.

Maximum size of data (C-APDU) ICRW can handle is 300 bytes for T=1 protocol, and 261 bytes for T=0 protocol.
If SAM is not supporting protocol T=0 nor T=1, error code "62" is sent.
If any other protocol error occurs, error code "64" is sent.

While a power supply is supplied to the SAM, the ICRW monitors VCC (the power supply line of the SAM).
An error “60” is returned when a power failure is detected.

When protocol is T=1, If the data for transmitting is 301 bytes or more, use command "CIE" and "CIF".

px=44H : The SAM’s data is 300 bytes or less.
px=45H : The SAM’s data is 301 bytes or more.
ICRW requires transmitting next SAM’s data.
HOST needs to receive the remaining data by using "CIG" command.
px=4FH : ICRW received the ABORT-request from the SAM, terminated data transmission to the SAM, and deactivated the SAM. This positive response doesn't have the R-APDU. After this condition, ICRW rejects the transmission commands for the following chaining data from HOST.
(Only T=1 protocol)

7.12.11 Select SAM

Command	"C"	49H	50H	Sel	
Positive response	"P"	49H	50H	st1	st0
Negative response	"N"	49H	50H	er1	er0

HOST can select SAM 1,2,3,4 or 5.

Sel = 30H: SAM 1. (on board)
Sel = 31H: SAM 2. (option)
Sel = 32H: SAM 3. (option)
Sel = 33H: SAM 4. (option)
Sel = 34H: SAM 5. (option)

This command is effective only in the SAM selection.
When Initialize command is executed, SAM 1 will be selected.

7.13 Switch command

Command	"C"	4BH	30H		
Positive response	"P"	4BH	30H	st1	st0
Negative response	"N"	4BH	30H	er1	er0

Switch the control to Supervisor program code area from User program code area.

Note: Start from Initialize command of Supervisor program code area after the switch is completed.

7.14 GPM896 control

7.14.1 Activate GPM896

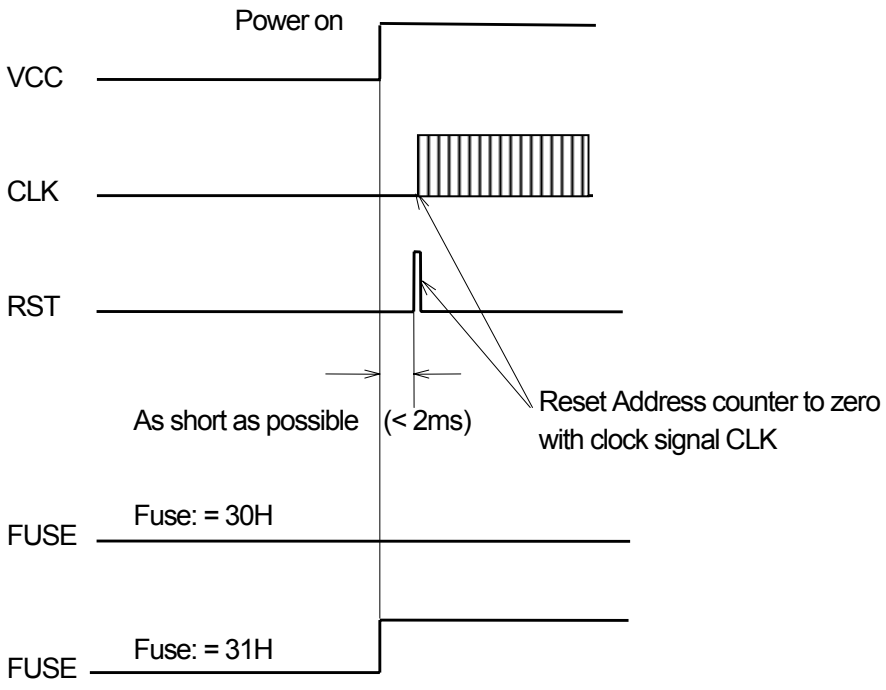
Command	"C"	4DH	30H	Fuse	
Positive response	"P"	4DH	30H	st1	st0
Negative response	"N"	4DH	30H	er1	er0

To close the shutter, then to activate GPM896 smart card, power (VCC) is supplied. reset (RST) signal is set to "1", and clock (CLK) is supplied.

Fuse=30H: ICRW sets FUSE(C4) contact to Logical"0". (Act as in standard operation mode)
Fuse=31H: ICRW sets FUSE(C4) contact to Logical"1". (Act as in real mode)
In case there is no Fuse word, ICRW sets FUSE contact to Logical"0".

After the manufacturer's code of GPM896 smart card was read twice,
When each content didn't correspond, ICRW repeats the same process from the place to issue RST.
A negative response is returned when it doesn't still correspond.
A negative response is also returned when it is the elimination condition of the data even if it corresponds.

An error code "60" is returned when a power failure is recognized while a power supply is supplied to the card.
Even if an error happens with smart card, shutter isn't opened regardless of the existence of the automatic latch.

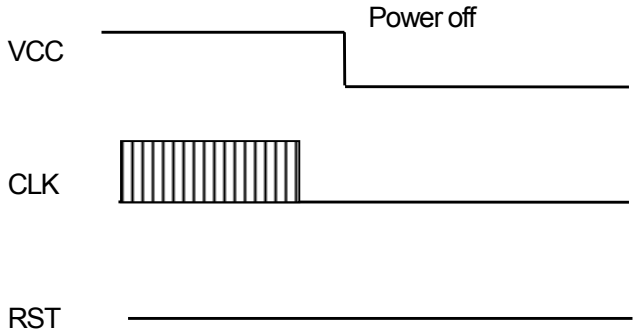


7.14.2 Deactivate GPM896

Command	"C"	4DH	31H		
Positive response	"P"	4DH	31H	st1	st0
Negative response	"N"	4DH	31H	er1	er0

Turn off the VCC Power to deactivate GPM896 smart card.

Time chart of deactivating GPM896 smart card is as under:



7.14.3 Inquire Status of GPM896

Command	"C"	4DH	32H			
Positive response	"P"	4DH	32H	st1	st0	sti
Negative response	"N"	4DH	32H	er1	er0	

ICRW tells the status of GPM896 smart card with sti.

	b7							b0	
sti=	0	1	0	0	0	0	X	X	(binary)

VCC 1: Active , 0: Inactive
Fuse 1: real 0: standard operation

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error "60" is returned when a power failure is detected.

7.14.4 Communicate with GPM896

The GPM896, a synchronous smart card, has no protocol handler.
The ICRW provides partial protocol handling for the smart card.

When communicating with the GPM896 smart card (memory card), ICRW receives the data from the HOST and controls the GPM896 accordingly. There are prepared sequences to control the GPM896. These commands, as described below, are based on the ISO/IEC 7816-3 T=0 standard.

After the ICRW has processed a command, It returns the 90H, 00H by sending response data 90H + 00H.
In case an error occurs during communication with the GPM896, the ICRW sends back sw1+sw2 based on the ISO/IEC 7816-3 T=0 standard.

7.14.4.1 Read data from GPM896

Command	"C"	4DH	33H	00H + B0H + 00H + abH + cdH		
Positive response	"P"	4DH	33H	st1	st0	Data
Negative response	"N"	4DH	33H	er1	er0	

This command is recognized as follows.

Value
abH(Hexa-decimal) : Start address to read data
cdH(Hexa-decimal) : Number of bytes to read

After reading data from GPM896 smart card, ICRW sends cdH number of bytes starting from address abH.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error "60" is returned when a power failure is detected.

7.14.4.2 Write bytes into GPM896

Command	"C"	4DH	33H	00H + D0H + 00H + abH + cdH + efH + ...		
Positive response	"P"	4DH	33H	st1	st0	Data
Negative response	"N"	4DH	33H	er1	er0	

This command is recognized as follows.

Value
abH(Hexa-decimal) : the start address to write data
cdH(Hexa-decimal) : the number of bytes of data to write
efH(Hexa-decimal) : the data to write first

Even when writing only one bit of the memory.
An access rule is specified by the card specification to write one byte of data in the memory.

ICRW finds the position of a bit to rewrite before starting writing, by comparing data on the origin of the address which it wants to write data in with the data which it wants to write.

After writing data, ICRW checks the data written to the smart card and returns a result.
If a writing error is detected, an error code is returned with sw1 +sw2.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card).
An error "60" is returned when a power failure is detected.

Notes:
1. It is also possible to blow the fuse for personalization.
The following command is sent to the ICRW to blow the fuse (only possible if the Card Secret Code is presented).

"CM3"+00H+D0H+00H+7CH+01H+00H
: The data (00h) of one byte are written in the address 7Ch. (Outside of memory area)

*** Blowing the fuse is irreversible.

2. The condition of bit can't be rewritten to "1" when it is "0".
Before data can be written there, the data must be erased. This is the specification of GPM896.

7.14.4.3 Erase data of GPM896

Command	"C"	4DH	33H	00H + DEH + abH + cdH + 00H		
Positive response	"P"	4DH	33H	st1	st0	Data
Negative response	"N"	4DH	33H	er1	er0	

This command is recognized as follows.

Value
abH(Hexa-decimal) : the number of bytes of data to erase
cdH(Hexa-decimal) : the start address to erase data

The access rule for erasing data is by word (erases 16bits at a time).
Therefore, the start address and the number of bytes of data to be erased must be even numbers.
But in the Application Area 1 and 2 of GPM896, all the contents of an Application Area will be erased when one word of data is erased in that Application Area. ICRW returns the result by the data on sw1+sw2 after erasing the data.

The data on 16bits are erased at a time except for application area 1 and 2.
After data are erased, the contents of the data are checked, and ICRW returns the result by the data on sw1+sw2.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card).
An error "60" is returned when a power failure is detected.

7.14.4.4 Present secret code of GPM896

Command	"C"	4DH	33H	00H + 20H + xyH + abH + cdH + efH + ...		
Positive response	"P"	4DH	33H	st1	st0	Data
Negative response	"N"	4DH	33H	er1	er0	

This command is recognized as follows.

Value

xyH(Hexa-decimal) : the error counter value which relates to each secret code

abH(Hexa-decimal) : the start address of data to compare

cdH(Hexa-decimal) : the number of bytes of data to compare

efH(Hexa-decimal) : the data to compare first

There are some secret codes of GPM896 to add a limitation to the free access to that inside. GPM896 is permitted by using this command. GPM896 itself compares the data given to it with secret code. If it is right, the card is permitted.

There are some secret codes to permit each card function.

1. Card Secret code.

If the card secret code is not presented, write and erase operation will not be possible (sometimes, the card can not be read). There is an error counter for security. The card is locked after four consecutive incorrect presentation of the Card Secret Code. The error counter is updated with each incorrect presentation of the Card Secret Code. If the value of the error code is less than 3, the value of the error counter is reset to zero by presenting the correct Card Secret Code.

ex.) "CM3"+00H+20H+04H+0AH+02H+XXH+XXH

XXH+XXH is Card Secret Code. (2byte)

2. Erase code 1.

To erase application area 1. When Erase Code 1 is presented correctly. All of the contents of Application Area 1 are erased.

ex.) "CM3"+00H+20H+00H+36H+06H+YYH+YYH+YYH+YYH+YYH+YYH

YYH+YYH+YYH+YYH+YYH+YYH is Erase code 1. (6bytes)

3. Erase code 2.

To erase Application Area 2. When Erase Code 2 is presented correctly, whole the contents of Application Area 2 are erased. There is an erase counter for application area. This limits the number of times the contents of Application Area 2 can be erased to 128 times.

ex.) "CM3"+00H+20H+80H+5CH+04H+ZZH+ZZH+ZZH+ZZH

ZZH+ZZH+ZZH+ZZH is Erase code 2. (4bytes)

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error "60" is returned when a power failure is detected.

7.15 Siemens memory card control command

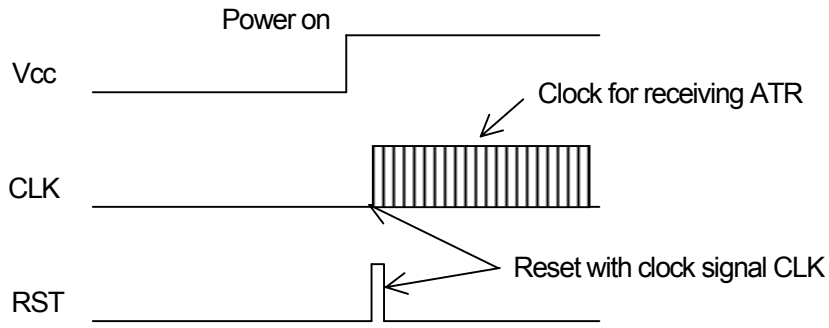
7.15.1 Siemens memory card Power on

Command	"C"	52H	30H			
Positive response	"P"	52H	30H	st1	st0	ATR
Negative response	"N"	52H	30H	er1	er0	

To close the shutter, then to activate the memory card. ICRW supply power (Vcc) and clock(CLK), and assert reset (RST) signal. Then, the memory card is activated and return ATR.

ICRW returns a negative response when proper ATR isn't received from the memory card.

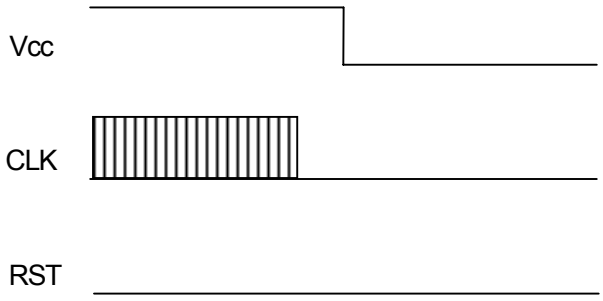
An error code "60" is returned when a power failure is recognized while a power supply is supplied to the card.



7.15.2 Siemens memory card Power off

Command	"C"	52H	31H		
Positive response	"P"	52H	31H	st1	st0
Negative response	"N"	52H	31H	er1	er0

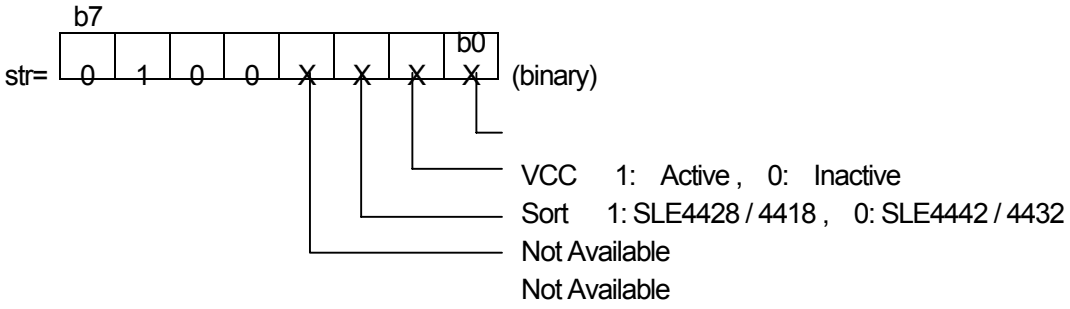
This command deactivate the memory card.
ICRW asserts reset (RST) signal, and stops clock (CLK) and power supply (Vcc).
Then, the memory card is deactivated.



7.15.3 Inquire Status of Siemens memory card

Command	"C"	52H	32H			
Positive response	"P"	52H	32H	st1	st0	str
Negative response	"N"	52H	32H	er1	er0	

This command report the status of Siemens memory card in "str" byte.
While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.



7.15.4 Communicate with SLE4442

The SLE4442 memory card has no protocol handler in it. So, ICRW builds in protocol handler to control the memory card. When a usual IC card is controlled, ICRW doesn't check the contents of the data. (A message is transmitted and received between ICRW and the IC card)
Then, the data that it was received from HOST are transmitted through ICRW to the IC card.

About SLE4442, ICRW must control the signal line of the memory card directly about each data transmission by the hardware. Therefore, some functions to control SLE4442 were prepared in ICRW. These functions are specified by a command data form like C-APDU which format is based on ISO/IEC 7816-3 T=0 standard.
Therefore, ICRW recognizes the meaning of the command data, and carries out the treatment related to the card by controlling hardware.
After the command was executed properly, ICRW returns a positive response with response data 9000H like from the IC card.
When an error occurs during the communication with SLE4442, ICRW returns a positive response with status information in response data "sw1+sw2" which is based on the ISO/IEC7816-3 T=0 standard.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.

7.15.4.1 Data read from main memory on SLE4442

Command	"C"	52H	33H	00B000H + abH + cdH		
Positive response	"P"	52H	33H	st1	st0	Data
Negative response	"N"	52H	33H	er1	er0	

This command is recognized as follows.
ab H : the start address to read data in the main memory
cd H : the number of bytes of data to read
ICRW reads data from the main memory of SLE4442, and transmits data on cdH bytes from the address abH. The capacity of the main memory is 256 bytes. The byte number "00" of data to read means 256bytes. All the contents of the main memory can be read with the following command.
ex). "CR3"+00B0000000

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.

7.15.4.2 Data read from protection memory on SLE4442

Command	"C"	52H	33H	00B001H + abH + cdH		
Positive response	"P"	52H	33H	st1	st0	Data
Negative response	"N"	52H	33H	er1	er0	

This command is recognized as follows.
ab H : the start address to read data in the protection memory
cd H : the number of bytes of data to read
ICRW handles the data of all 32bits in the protection memory as the data on 4bytes.
The contents (32bit) of the protection memory can be read with the following command.
ex). "CR3"+00B0010004
ICRW reads data from the protection memory of SLE4442, and transmits data on cdH bytes from the address abH.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card).
An error “60” is returned when a power failure is detected.

7.15.4.3 Data read from security memory on SLE4442

Command	"C"	52H	33H	00B002H + abH + cdH		
Positive response	"P"	52H	33H	st1	st0	Data
Negative response	"N"	52H	33H	er1	er0	

This command is recognized as follows.
ab H : the start address to read data in the security memory
cd H : the number of bytes of data to read

The security code inside the security memory can't be read properly if the check of PSC (programmable security code) isn't finished normally. ICRW returns three bytes of 00H as the security code

ICRW handles the data of all 32bits in the security memory as the data on 4bytes.
The contents (32bit) of the security memory can be read with the following command.
ex). "CR3"+00B0020004
ICRW reads data from the security memory of SLE4442, and transmits data on cdH bytes from the address abH.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card).
An error “60” is returned when a power failure is detected.

7.15.4.4 Data write to main memory on SLE4442

Command	"C"	52H	33H	00D000H + abH + cdH + efH + ...		
Positive response	"P"	52H	33H	st1	st0	Data
Negative response	"N"	52H	33H	er1	er0	

This command is recognized as follows.

ab H : the start address to write data in the main memory
cd H : the number of bytes of data to write
ef H : the data to write first (cd H bytes)

ICRW writes data in the main memory. ICRW returns a result after written data are checked.
Before doing this operation, PSC (Programmable Security Code) check must be done.

The capacity of the main memory is 256 bytes. The byte number "00" of data to write means 256bytes.
The example that data are written in the whole area of the main memory is shown in the following.

ex). "CR3"+ 00D0000000 + Write Data (256byte)

After command execution, ICRW returns response with 9000H or sw1+sw2 as the result.

If the addressed data on main memory is protected by the protection memory, the write operation is not available.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card).
An error “60” is returned when a power failure is detected.

7.15.4.5 Data write to protection memory on SLE4442

Command	"C"	52H	33H	00D001H + abH + cdH + efH		
Positive response	"P"	52H	33H	st1	st0	Data
Negative response	"N"	52H	33H	er1	er0	

This command is recognized as follows.

ab H : the start address of the protection of the main memory
cd H : the number of bytes that it is protected continuously
ef H : the contents of data to protect (cd H bytes)

ICRW can set up writing protection in a part of the main memory which can be protected. Once it is set up, the protection can't be canceled. Before doing this operation, PSC (Programmable Security Code) check must be done.

The address of the main memory that the protection is possible is 1Fh from 00h. Each protection condition of the protectable main memory can be controlled with 4byte (32bits) in the protection memory. For example, if bit0 of the protection memory byte0 is '1', data on the address 00H of the main memory are protected.

The contents of data must be presented to protect data in main memory. Therefore, the contents of the protection memory can't be operated directly.

For example, protection is set up with the next command when the value of the address 10H of the main memory is 20H and protection isn't set up in the bit address 10H of the protection memory.

ex). "CR3" + 00D001100120

After command execution, ICRW returns response with 9000H or sw1+sw2 as the result.

ICRW reads data first from the main memory, and it is compared with the value that it was received. When this is wrong, writing isn't begun.
Protection condition can be set up at a time in the data which continued in the main memory.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.

7.15.4.6 Data write to security memory on SLE4442

Command	"C"	52H	33H	00D002H + abH + cdH + efH		
Positive response	"P"	52H	33H	st1	st0	Data
Negative response	"N"	52H	33H	er1	er0	

This command is recognized as follows.

ab H : the start address to write data in the security memory

cd H : the number of bytes of data to write

ef H : the data to write first (cd H bytes)

After a PSC check is finished normally, the Reference-Data area of 3byte can be changed.
All 32bits are handled as 4bytes. How to change the Reference-Data is as the following.

ex). "CR3"+ 00D0020103123456

After command execution, ICRW returns response with 9000H or sw1+sw2 as the result.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card).
An error “60” is returned when a power failure is detected.

Caution : It is only writing though data writing to Error-Counter is always possible. Therefore, be careful of writing to Error-Counter. Or, the card can't be written any more. Error-Counter is controlled when PSC is checked.

7.15.4.7 Verification data present to SLE4442

Command	"C"	52H	33H	0020H + 03H + 01H + 03H + efH		
Positive response	"P"	52H	33H	st1	st0	Data
Negative response	"N"	52H	33H	er1	er0	

This command is recognized as follows.

03 H : Fixed value (the maximum value of the error counter)
01 H : Fixed value (the start address of the security code in the security memory)
03 H : Fixed value (the number of bytes of data to compare)
ef H : the data to compare (3bytes)

Before changing data, PSC(Programmable Security Code) must be checked properly with SLE4442. Because this function should be made effective, the issue of the next command is necessary.

ex). "CR3"+ 0020030103xxxxxx (xxxxxx : security code 3bytes)

The presented data are compared with internal Reference-Data by SLE4442 card itself.
Writing treatment becomes effective until a power supply is turned off when a check is finished normally.

The writing function of the card is lost when the command is carried out continuously three times with the wrong code. A user must know PSC at least when a user wants to rewrite the data on SLE4442 card.

Error-Counter can be reset in the zero if PSC is given to SLE4442 card properly if the value of Error-Counter is 2 or less.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.

7.15.5 Communicate with SLE4428

Same as SLE4442, The SLE4428 memory card has no protocol handler in it.
So, ICRW also builds in protocol handler to control SLE4428.
The control method of SLE4428 is done in the same way as SLE4442.
Refer to SLE4442 for the details of the contents.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card).
An error “60” is returned when a power failure is detected.

7.15.5.1 Data Reading of main-memory of SLE4428

Command	"C"	52H	34H	00B0H + 0aH + bcH + deH		
Positive response	"P"	52H	34H	st1	st0	Data
Negative response	"N"	52H	34H	er1	er0	

This command is recognized as follows.
abc H : the start address to read data in the main memory
de H : the number of bytes of data to read

ICRW reads data from the main memory of SLE4428, and transmits data on deH bytes from the address abcH.
The capacity of the main memory is 1024bytes. The byte number "00" of data to read means 256bytes.
The head part of the main memory can be read with the following command.
ex). "CR4"+00B0000000

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card).
An error “60” is returned when a power failure is detected.

7.15.5.2 Condition data reading of protection-bit of SLE4428

Command	"C"	52H	34H	00B0H + 10H + abH + cdH		
Positive response	"P"	52H	34H	st1	st0	Data
Negative response	"N"	52H	34H	er1	er0	

This command is recognized as follows.
ab H : the start address to read the image of protection data of the main memory
cd H : the number of bytes of data to read

The protection conditions of 1024bytes of main-memory are changed into the data on 1024bits, and it is read. 1024bits is equivalent to 128bytes. (1024 = 128 x 8)
Data to read first become protection information to address007H from address000H of main-memory in the case of abH=00H.
The contents of the whole protection image can be read with the following command.
ex). "CR4"+00B0100080
ICRW reads data as the protection image of SLE4428, and transmits data on cdH bytes from the address abH.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.

7.15.5.3 Data writing to main-memory of SLE4428

Command	"C"	52H	34H	00D0H + 0aH + bcH + deH + fgH + ...		
Positive response	"P"	52H	34H	st1	st0	Data
Negative response	"N"	52H	34H	er1	er0	

This command is recognized as follows.
abc H : the start address to write data in the main memory
de H : the number of bytes of data to write
fg H : the data to write first (de H bytes)
ICRW writes data in the main memory. ICRW returns a result after written data are checked.
Before doing this operation, PSC (Programmable Security Code) check must be done (SLE4428).

The capacity of the main memory is 1024 bytes. The byte number "00" of data to write means 256bytes.
The example that data are written in from the address 100H is shown in the following.
ex). "CR4"+ 00D0010000 + Write Data (256byte)
After command execution, ICRW returns response with 9000H or sw1+sw2 as the result.

If the addressed data on main memory is protected, the write operation is not available.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card).
An error “60” is returned when a power failure is detected.

7.15.5.4 Data writing to main-memory of SLE4428 (with protecting it)

Command	"C"	52H	34H	00D0H + 1aH + bcH + deH + fgH + ...		
Positive response	"P"	52H	34H	st1	st0	Data
Negative response	"N"	52H	34H	er1	er0	

This command is recognized as follows.
abc H : the start address to write data in the main memory
de H : the number of bytes of data to write
fg H : the data to write first (de H bytes)
ICRW writes data in the main memory. ICRW returns a result after written data are checked.
Before doing this operation, PSC (Programmable Security Code) check must be done (SLE4428).

This command is the same as data writing except for Protect's being done at the same time with writing.
Renewal becomes impossible when data are written with this command.

7.15.5.5 Protection-bit is written by the completion of the verification

Command	"C"	52H	34H	00D0H + 2aH + bcH + deH + fgH + ...		
Positive response	"P"	52H	34H	st1	st0	Data
Negative response	"N"	52H	34H	er1	er0	

This command is recognized as follows.

abc H : the start address of the protection of the main memory

de H : the number of bytes that it is protected continuously

fg H : the contents of data to protect (de H bytes)

ICRW can set up writing protection in a part of the main memory which can be protected. Once it is set up, the protection can't be canceled. Before doing this operation, PSC (Programmable Security Code) check must be done. The contents of data must be presented to protect data in main memory.

For example, protection is set up with the next command when the value of the address 010H of the main memory is 20H and protection isn't set up.

ex). "CR4" + 00D020100120

After command execution, ICRW returns response with 9000H or sw1+sw2 as the result.

ICRW reads data first from the main memory, and it is compared with the value that it was received. When this is wrong, writing isn't begun.

Protection condition can be set up at a time in the data which continued in the main memory.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error "60" is returned when a power failure is detected.

7.15.5.6 Verification data present to SLE4428

Command	"C"	52H	34H	00200000H + 02H + efH		
Positive response	"P"	52H	34H	st1	st0	Data
Negative response	"N"	52H	34H	er1	er0	

This command is recognized as follows.

02 H : Fixed value (the number of bytes of data to compare)

ef H : the data to compare (2bytes)

Before changing data, PSC(Programmable Security Code) must be checked properly with SLE4428. Because this function should be made effective, the issue of the next command is necessary.

ex). "CR4"+ 0020000002xxxx (xxxx : security code 2bytes)

The presented data are compared with internal Reference-Data by SLE4428 card itself.
Writing treatment becomes effective until a power supply is turned off when a check is finished normally.

The writing function of the card is lost when the command is carried out continuously eight times with the wrong code. A user must know PSC at least when a user wants to rewrite the data on SLE4428 card.

Error-Counter can be reset in the zero if PSC is given to SLE4428 card properly if the value of Error-Counter is 7 or less.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.

7.16 I2C memory card control command

7.16.1 I2C Power on

Command	"C"	53H	30H	Vcc	Wrd
Positive response	"P"	53H	30H	st1	st0
Negative response	"N"	53H	30H	e1	e0

To close the shutter, then to activate an I2C memory card.
ICRW supplies a power supply (Vcc) to the card. After that, ICRW initializes the card inside.
An error code "60" is returned when a power failure is recognized while a power supply is supplied to the card.

Vcc: The choice of a power supply voltage to supply
Vcc=30H : ICRW supplies with +5V to VCC and activates the card.
Vcc=31H : ICRW supplies with +3V to VCC and activates the card.

Wrd: The number of bytes of the word address of an I2C memory card to use
Wrd=31H : ICRW accesses an I2C memory card in the Word address of 1byte.
Wrd=32H : ICRW accesses an I2C memory card in the Word address of 2bytes.

7.16.2 I2C Power off

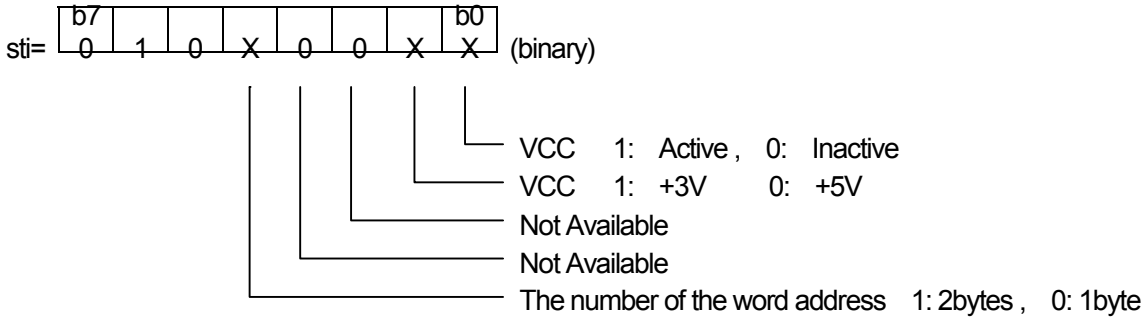
Command	"C"	53H	31H		
Positive response	"P"	53H	31H	st1	st0
Negative response	"N"	53H	31H	e1	e0

When this command is received, ICRW deactivates an I2C card.
ICRW suspends the supply of the power supply (Vcc). An I2C memory card is deactivated as a result.

7.16.3 Inquire Status of I2C

Command	"C"	53H	32H			
Positive response	"P"	53H	32H	st1	st0	sti
Negative response	"N"	53H	32H	e1	e0	

When this command is received, ICRW reports the condition of an I2C memory card by byte of "stj".
While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card).
An error “60” is returned when a power failure is detected.



7.16.4 I2C Communication

The I2C memory card has no protocol handler in it. So, ICRW builds in protocol handler to control this. When a usual IC card is controlled, ICRW doesn't check the contents of the data.
(A message is transmitted and received between ICRW and the IC card)
Then, the data that it was received from HOST are transmitted through ICRW to the IC card.

About the I2C memory card, ICRW must control the signal line of the I2C memory card directly about each data transmission by the hardware.
Therefore, some functions to control an I2C memory card were prepared in ICRW. These functions are specified by a command data form like C-APDU which format is based on ISO/IEC 7816-3 T=0 standard.

Therefore, ICRW recognizes the meaning of the command data, and carries out the treatment related to the card by controlling hardware.

After a command is carried out properly, ICRW returns 9000H by the positive response as if it was just received from the IC card.

When an error occurs during the communication with the I2C memory card, ICRW returns a positive response with status information in response data "sw1+sw2" which is based on T=0 standard of ISO/IEC7816-3.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.

7.16.4.1 Read data from I2C

Command	"C"	53H	33H	00B0H + ab H + cd H + ef H		
Positive response	"P"	53H	33H	st1	st0	Data
Negative response	"N"	53H	33H	e1	e0	

This command is recognized as follows.

Value
ab H : The upper address of head address which begins to read data
cd H : The lower address of head address which begins to read data
ef H : The number of bytes of data to read

ICRW reads data from the I2C memory card, and transmits data on efH bytes from the address abcdH.
The value established with efH bytes is the value which makes the value which it can access without striding over a page by an I2C memory card to use an upper limit

When the following command is transmitted, data can be read from the I2C memory card.
ex). "CS3"+00B0000008

Note) It doesn't change to the next page automatically when it tries to read it by the bigger value than the page size of the used I2C memory card or when it changes in the next page from the middle of the page. Therefore, access it not to cross the boundary of the page. If it is not so, it isn't finished normally.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.

7.16.4.2 Write data into I2C

Command	"C"	53H	33H	00D0 H + ab H + cd H + ef H + gh H + ...		
Positive response	"P"	53H	33H	st1	st0	Data
Negative response	"N"	53H	33H	e1	e0	

This command is recognized as follows.

ab H : The upper address of head address which begins to write data
cd H : The lower address of head address which begins to write data
ef H : The number of bytes of data to write
gh H : the data to write first (the head data of the data on ef H bytes)

ICRW writes data in the I2C memory card. ICRW returns a result after written data are checked.

The example which data on 8bytes are written in by the continuance from the head address of the I2C memory card is shown in the following.

ex). "CS3"+ 00D0000008 + Write Data (8bytes)

After command execution, ICRW returns response with 9000H or sw1+sw2 as the result.

Note) It doesn't change to the next page automatically when it tries to write it by the bigger value than the page size of the used I2C memory card or when it changes in the next page from the middle of the page. Therefore, access it not to cross the boundary of the page. If it is not so, it isn't finished normally.

While a power supply is supplied to the card, the ICRW monitors VCC (the power supply line of the card). An error “60” is returned when a power failure is detected.

7.17 Timer Set command

Command	"C"	57H	pm	tm1	tm0
Positive response	"P"	57H	pm	st1	st0
Negative response	"N"	57H	pm	er1	er0

The timer to make the magnetic data read by ICRW ineffective is built in.
The read data are left for 5 seconds if this command isn't transmitted. (This is the setting of default)
When this command is issued, The read data will be abandoned at the favorite time in one-second unit.
It is set up by the value of the time from the reading completion.
The time can be set up respectively with the card insertion and the card withdrawal.
It sets up time until it returns to a default state after changing a method of reading magnetic data.
If its time passes after changing a method, it will return to a default state.
The method of reading the magnetic data on ISO Track #2 can be changed by withdrawing after fully inserting a card.

pm = 30H : To set up the timer to abandon the read data at the card insertion.
pm = 31H : To set up the timer to abandon the read data at the card withdrawal.

tm1,tm0 : It can be set up by the decimal number from "01" to "99". (from 1second to 99 seconds)
If this is "00", The read data are left all the time.

pm = 32H : A setup of time until the method of reading magnetic data returns to a default state.

tm1,tm0 : It can be set up by the decimal number from "01" to "99". (from 1second to 99 seconds)
If this is "00", The magnetic reading method is not changed.

Note) Usually, the change of a method which reads magnetic data is not performed.

7.18 Performance log command

Command	"C"	66H	30H			
Positive response	"P"	66H	30H	st1	st0	Performance log 128 bytes
Negative response	"N"	66H	30H	er1	er0	

ICRW transmit the performance log data to HOST

Performance log contents

Offset	Size	Description	Error code	PLB No.
0	4	Total Number of card pass. (life counter)		
4	4	Reserved.		
8	4	Number of magnetic head pass counter		1
12	4	Number of mag-cards read free of errors on Trk1.		2
16	4	Number of mag-cards read with error on Trk1.	21,22,23,24,27	
20	4	R.F.U. : Reserved for future use		
24	4	R.F.U. : Reserved for future use		
28	4	Number of mag-cards read free of errors on Trk2.		
32	4	Number of mag-cards read with error on Trk2.	21,22,23,24,27	
36	4	R.F.U. : Reserved for future use		
40	4	R.F.U. : Reserved for future use		
44	4	Number of mag-cards read free of errors on Trk3.		
48	4	Number of mag-cards read with error on Trk3.	21,22,23,24,27	
52	4	R.F.U. : Reserved for future use		
56	4	R.F.U. : Reserved for future use		
60	4	The number of activation free of errors about IC-cards.	-	3
64	2	The number of activation with errors about IC-cards.	61,63,64	
66	2	The number of non-supported IC-cards.	66,69	
68	2	The number of communication error about IC-cards.	63,64	

Note) One pass is one round trip of the card in the transport.
If the error is 25 (No Magnetic Data) on reading mag-card, the both numbers of error and no-error are not counted up.
They are not counted up at the time of an error "20" (magnetic data has not been read), either.
Each counter value is described in hexadecimal.

Performance log contents

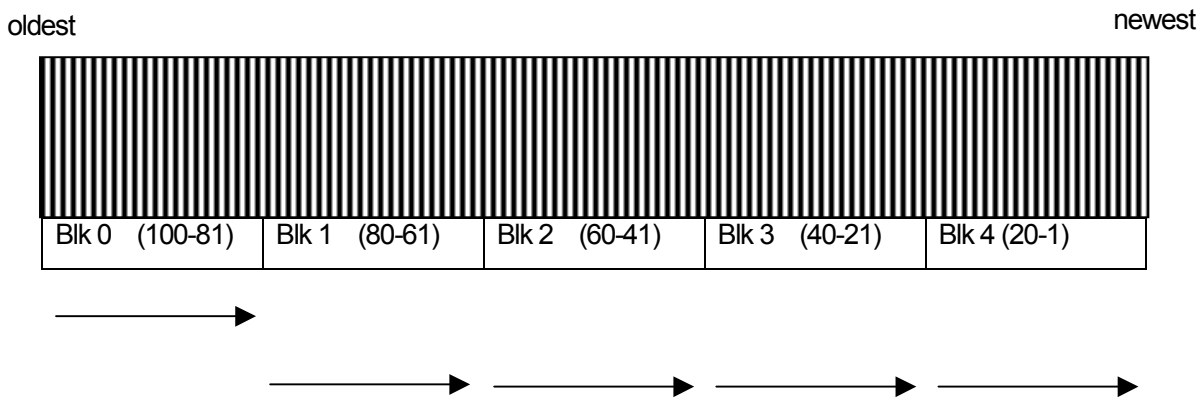
Offset	Size	Description	Error code	PLB No.
70	4	The number of activation free of errors about SAM1.	-	4
74	2	The number of activation with errors about SAM1.	61,63,64	
76	2	The number of non-supported SAM about SAM1.	66,69	
78	2	The number of communication error about SAM1.	63,64	
80	4	The number of activation free of errors about SAM2.	-	5
84	2	The number of activation with errors about SAM2.	61,63,64	
86	2	The number of non-supported SAM about SAM2.	66,69	
88	2	The number of communication error about SAM2.	63,64	
90	4	The number of activation free of errors about SAM3.	-	
94	2	The number of activation with errors about SAM3.	61,63,64	
96	2	The number of non-supported SAM about SAM3.	66,69	
98	2	The number of communication error about SAM3.	63,64	
100	4	The number of activation free of errors about SAM4.	-	
104	2	The number of activation with errors about SAM4.	61,63,64	
106	2	The number of non-supported SAM about SAM4.	66,69	
108	2	The number of communication error about SAM4.	63,64	
110	4	The number of activation free of errors about SAM5.	-	
114	2	The number of activation with errors about SAM5.	61,63,64	
116	2	The number of non-supported SAM about SAM5.	66,69	
118	2	The number of communication error about SAM5.	63,64	
120	4	Number of latch operations.	-	6
124	4	Number of the errors at latch opening and latch closing.	10	

Note) PLB No. means Performance log block number.

7.19 Error log command

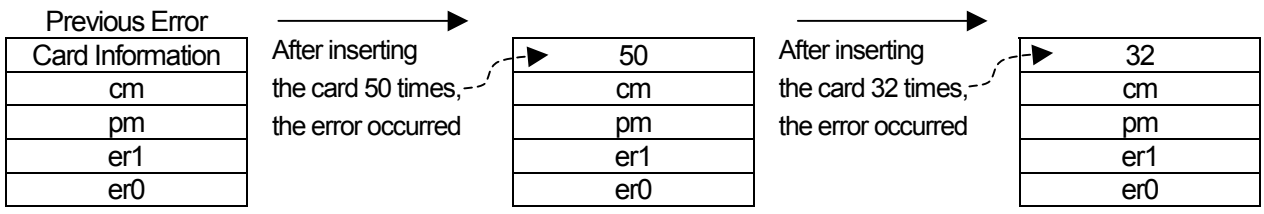
Command	"C"	66H	31H	Blk		
Positive response	"P"	66H	31H	st1	st0	Error log data 100 bytes
Negative response	"N"	66H	31H	er1	er0	

ICRW transmit the error log data to HOST
ICRW can store 100 newest error codes, An error code is stored whenever it returns negative responses.
This command trasnsmits 1 block error log. 1 block consists of 20 errors.
Therefore, HOST can acquire all error logs by repeating this command 5 times.
A demand block specifies Blk (0-4). Blk0 is the oldest data and Blk4 is the newest data.
The error data in a block is transmitted to old order.



One error data consists of 1 byte of card information, "cm","pm" and 2 bytes of error code.
One error data : Card information + cm + pm + er1 + er0. Total 5 bytes
An insertion number is saved as card information. (0-255)

Example of logging errors.



If the error occurred after inserting 255times or more, the Card Information is always 255.
If the same error has occurred for the one card continuously, those errors are not logged except the first error.

7.20 Performance log clear command

Command	"C"	67H	pm		
Positive response	"P"	67H	pm	st1	st0
Negative response	"N"	67H	pm	er1	er0

This is the command to erase the Performance Log that was mentioned in the former clause in the block unit. A block to erase is indicated by pm.

pm=31H : Clear PLB No.1 Clear performance log about magnetic head pass counter.
pm=32H : Clear PLB No.2 Clear performance log about reading of the magnetic card.
pm=33H : Clear PLB No.3 Clear performance log about ICC.
pm=34H : Clear PLB No.4 Clear performance log about SAM1.
pm=35H : Clear PLB No.5 Clear performance log about SAM2~SAM5.
pm=36H : Clear PLB No.6 Clear performance log about Latch.

7.21 Reset command

Command	"C"	7AH	30H		
Positive response	"P"	7AH	30H	st1	st0

Negative response Nothing

ICRW will send response and it will start from User program code again.
ICRW will be removed and be attached again.
When the reset-operation is finished in normal, The LED of ICRW blinks in green.
If ICRW received a command for initializing, ICRW stops blinking the LED.

8. Command – Error matrix

Table1-1

Command			Error code									
Cm	Pm	Function	01	02	03	04	06	07	08	09	10	30
30H	40H	Initialize				O					O	O
31H	30H	Inquire status		O		O						O
	31H	Intake		O		O		O	O	O		O
	32H	Withdraw		O		O		O		O	O	O
32H	31-33H	Read		O		O						O
	36H	Clear read buffer		O		O						O
	41-43H	Transmit the enciphered data		O		O	O					O
33H	30-33H	LED-control		O		O						O
36H	30-32H	Information		O		O						O
40H	30H	Shutter		O	(O)	O					O	O
41H	30-32H	Revision		O		O						O
	3B-3CH	CRC		O		O						O
47H	30H	Key generation		O		O						O
	31-32H			O		O	O					O
49H	30-39H	ICC		O	(O)	O	O				O	O
	40-49H	SAM		O	(O)	O						O
	50H	Select SAM		O	(O)	O						O
4BH	30H	Switch		O		O					O	O
4DH	30H-33H	GPM896		O	(O)	O					O	O
52H	30H-34H	Siemens		O	(O)	O					O	O
53H	30H-33H	I2C		O	(O)	O					O	O
66H	30H,31H	Logging		O		O						O
67H	31H-36H	Performance log clear		O		O						O
7AH	30H	Reset		O		O					O	O
Other			O									

1) When ICRW receives other commands before Initialize command reception, error code "02" occurs.
2) When the control command of ICC is received while ICRW is not detecting the card by the rear sensor "RES", an error code "02" occurs.
3) If other commands accessed to ICC or SAM are received while ICRW is communicating to ICC or SAM, an error code "02" occurs.
4) If ICRW receives a reading command etc. during magnetic card reading, an error code "02" occurs.
5) After ICRW detects a power failure and carries out power supply recovery, an error code "30" occurs until it receives the initialize command.
6) An error code “03” is returned when a command is sent to ICRW which can't cope with it on Hardware.

Table1-2

Command			Error code										
Cm	Pm	Function	20	21	22	23	24	25	27	70	71	72	74
30H	40H	Initialize										O	
31H	30H	Inquire status											
	31H	Intake											
	32H	Withdraw											
32H	31-33H	Read	O	O	O	O	O	O	O				
	36H	Clear read buffer											
	41-43H	Transmit the enciphered data	O	O	O	O	O	O	O				O
33H	30-33H	LED-control											
36H	30-32H	Information										O	
40H	30H	Shutter											
41H	30-32H	Revision											
	3B-3CH	CRC											
47H	30H	Key generation										O	O
	31-32H											O	O
49H	30-39H	ICC											O
	40-49H	SAM											
	50H	Select SAM											
4BH	30H	Switch											
4DH	30H-33H	GPM896											
52H	30H-34H	Siemens											
53H	30H-33H	I2C											
66H	30H,31H	Logging										O	
67H	31H-36H	Performance log clear										O	
7AH	30H	Reset											
Other													

Table1-3

Command			Error code							
Cm	Pm	Function	60	61	62	63	64	65	66	69
30H	40H	Initialize								
31H	30H	Inquire status								
	31H	Intake								
	32H	Withdraw								
32H	31-33H	Read								
	36H	Clear read buffer								
	41-43H	Transmit the enciphered data								
33H	30-33H	LED-control								
36H	30-32H	Information								
40H	30H	Shutter								
41H	30-32H	Revision								
	3B-3CH	CRC								
47H	30-32H	Key generation								
49H	30H	Activate ICC	O	O		O	O		O	O
	31H	Deactivate ICC								
	32H	Status of ICC	O							
	33H	Comm 0	O		O	O	O	O		
	34H	Comm 1	O		O	O	O	O		
	35H	Comm 1-1	O		O	O	O	O		
	36H	Comm 1-2	O		O	O	O	O		
	37H	Comm 1-3	O		O	O	O	O		
	38H	Warm Reset ICC	O	O		O	O	O	O	O
	39H	Automatic Comm	O		O	O	O	O		
	40H	Activate SAM	O	O		O	O		O	O
	41H	Deactivate SAM								
	42H	Status of SAM	O							
	43H	Comm 0	O		O	O	O	O		
	44H	Comm 1	O		O	O	O	O		
	45H	Comm 1-1	O		O	O	O	O		
	46H	Comm 1-2	O		O	O	O	O		
	47H	Comm 1-3	O		O	O	O	O		
	48H	Warm Reset SAM	O	O		O	O	O	O	O
	49H	Automatic Comm	O		O	O	O	O		
	50H	Select SAM								

Table1-4

Command			Error code							
Cm	Pm	Function	60	61	62	63	64	65	66	69
4BH	30H	Switch								
4DH	30H-33H	GPM896	O					O	O	
52H	30H-34H	Siemens	O					O	O	
53H	30H-33H	I2C	O					O	O	
66H	30H,31H	Logging								
67H	31H-36H	Performance log clear								
7AH	30H	Reset								
Other										

9. Explanation of error code

Every error status can be cleared by procedure of (Re-Start by initialize to complete normal).
Also, eliminating the cause (i.e.: taking card out of ICRW) clear the error status.
In this case, uses Status request command and confirm before next step that no error code remain.

9.1 Error in communication soft

"01" Meaning : To show command parameter error.

Clear : Cleared by receiving command with correct parameter.

"02" Meaning : To show that un-executable command was received.
Cf. Receiving read command while card is not staying inside the ICRW.

Clear : Cleared by receiving executable command.

"02" Meaning : To show that ICRW executes Supervisor program code area.
(Initialize command only on supervisor mode)

"03" Meaning: To shows that the command to the hardware that does not exist was received.

Clear: Cleared by receiving correct commands to the hardware that exists.

"04" Meaning : To show that error data was included in command.

Clear : Cleared by receiving command including correct data.

"06" Meaning: ICRW does not have keys that decipher the data.

Clear: Execute the command (CS0) to give key.

“07” Meaning : To show that time-out at intake and ICRW has not completed taking in a card.
Or to show that time-out at withdraw and rear sensor is turned off.

“08” Meaning : To show that time-out at intake and ICRW has completed reading at least one magnetic data.

“09” Meaning : To show that time-out at intake after a front sensor is turned off.
Or to show that time-out at withdraw after rear sensor is turned on.

9.2 Error in lattch

“10” Meaning : To show that the latch is different detection from control.

9.3 Error in reading

“20” Meaning : To show that the magnetic data has not been read. (or reading data buffer is clear)

“21” Meaning : To show that there was no start sentinel to synchronize with.

"22" Meaning : To show that there was parity error on reading data.

"23" Meaning : To show that there was no end sentinel to terminate the data block.
The data block has more data than that specified in ISO.

"24" Meaning : To show that error was found at LRC code.

"25" Meaning : To show that the requested track has no magnetic data.
(In other words, there was magnetic data on other track.)

"27" Meaning : To show that there was no data block about magnetic data.
(Only Start-sentinel, End-sentinel ,and LRC)

9.4 Error in Power failure

"30" Meaning : To show that ICRW has detected power failure

Clear : No way. After finishing using a capacitance power, ICRW will stop a function.
Before ICRW stops a function, when a main power supply returns normally,
ICRW continues maintaining this state. An initial command can cancel this error state.

9.5 Error on ICC/SAM handling

"60" Meaning : To show that there found abnormal condition on the power-line (Vcc) of ICC.
ICRW disconnects ICC/SAM automatically.

Clear :
- Metal card (Ask customer to remove the card.)
- Defect chip card ((Ask customer to remove the card.)
- Vcc short to GND (Ask customer to remove the card and repair.)
- RES and ICSEN turn on and Host should use IC power on command, "CI0".

"61" Meaning : The receiving error of ATR. ICRW has disconnected already.
- No ATR (TS is not received from 380 clock cycle and 42000 clock cycle after time set RST to High).
- Parity error on ATR.
- ATR interval time between two consecutive characters is over 9600etus.
- ATR duration over 19200etus.
- TCK error on ATR.
- ATR length is longer than 64 byte (not include TS).
- TS is neither 3FH nor 3BH

Clear :
- No chip card. (Ask customer to remove the card)
- Defect chip card. (Ask customer to remove the card.)
- Contact broken. (Ask customer to remove the card and repair.)

"62" Meaning : To show that the specified protocol does not agree with that of ICC. ICRW still connected.
- Host use "CI4" or "CI5" command with T=0 protocol IC card.
- Host use "CI3" command with T=1 protocol IC card.
- Host use "CID" or "CIE" command with T=0 protocol SAM.
- Host use "CIC" command with T=1 protocol SAM.

Clear : Host should use correct command, "CI9". or "CII"

"63"	Meaning :	In case T=1 cards, after ATR receiving, IFS exchange is failed. ICRW detects time out. During communication with IC card, ICRW detects time out (WT, CWT or BWT). ICRW disconnected the IC card.
	Clear :	Defect chip card. (Ask customer to remove the card.) Non ISO-standard card. IFSresp receiving error(Ask customer to remove the card.)
"64"	Meaning :	In case T=1 cards, after ATR receiving, IFS exchange is failed. ICRW detects protocol error. To show that there is protocol error. (other than "63") T=0 IC card: - 5 parity errors in received from IC card. - 5parity errors in transmitting mode to IC card. - Status byte error (SW1 is different from 6xH or 9xH). - Procedure byte error (Procedure bytes is different from INS, Not INS, 60H, 61H or 6CH). T=1 IC card: - Bad NAD (NAD is different from 00H) - Bad PCB - Bad EDC - Parity error
	Clear :	Defect chip card. (Ask customer to remove the card.)
"65"	Meaning :	Host tried to communicate with IC card without card activation. ICRW has disconnected already.
	Clear :	Host should activate ICC(SAM) command before communication.
"66"	Meaning :	ICRW tried to activate with IC card, but the card returned ATR, which is not supported. cf. ANNEX1, ANNEX2 ICRW has disconnected already. This error is returned with "CI03", "CI05" or "CI06". This error is returned with "CI@3", "CI@5" or "CI@6".
	Clear :	Ask customer to remove the card.
"69"	Meaning :	ICRW tried to activate with IC card, but the card returned ATR, which does not match EMV. cf. ANNEX1,ANNEX2 ICRW has disconnected already. This error is returned with "CI0", "CI00" ICRW has disconnected already. This error is returned with "CI@", CI@0
	Clear :	Host try other activates command "CI03", "CI05" or "CI06". Host try other activates command "CI@3", "CI@5" or "CI@6". Or Ask customer to remove the card.

9.6 Error on F-ROM written mode

"70" Meaning : Failure on Flash ROM write / erase operation.
Clear : Replaceing PCB.

"71" Meaning : User program area is wrong. (CRC error)
Clear : Execute the download again by the correct file.

9.7 Error on EEPROM operation

"72" Meaning : Failure on EEPROM operation.
Clear : replacing PCB.

9.8 Error on RAM operation

"74" Meaning : Failure on RAM operation.
Clear : replacing PCB.

10. Explanation of basic function

(Refer to a Fig.2. : State change chart)

10.1 Power on procedure

This process starts when the power is turned on or when a Reset command is executed.
The ICRW initializes hardware, and carries out Selftest after that.

10.2 Hardware Failure

The ICRW stops a function when some problems are detected in ROM/RAM.
Try to turn on the power again.
Exchange it for another equipment when the same error is still repeated.

10.3 Initialization procedure

After ICRW finished initialization after the power supply injection normally,
LED of ICRW goes on and off by green as a sign of waiting for the reception of the INITIAL-command.
Then, A RTS signal line becomes active to permit data transmission from HOST.

After it confirms that a RTS signal is Active condition, Host must transmit INITIAL-command as the first command.
ICRW recognizes baud-rate by this command reception, and does the establishment of the much more necessary inside. After power supply injection is thrown, HOST must transmit this command first.
ICRW doesn't set up the baud-rate again if it is not which condition of "After the power was turned on" and "After the mode was switched".

10.4 Unknown Card

The ICRW expects that a card isn't left behind inside.
Therefore, when a card is left, it is judged that it is in the condition that ICRW is unusual.
ICRW waits for that a card is pulled out.
By the Initialize command, When it was set that ICRW reads a card only while card is pulled out,
When a card is being detected with RES at that time, backward read is done while card is pulled out.

10.5 No Card is in the ICRW

The ICRW waits for the card insertion.
When ICRW received the initialize-command from HOST, ICRW turns off a LED.
When a card is inserted, ICRW starts magnetic reading in the insertion, and magnetic data are read from magnetic-stripe. (Except for the mode that magnetism is read only at the time of pulling out)

ICRW also becomes this condition when a card is completely pulled out.
(Except for the mode that a card is read only at the time of pulling out)
It is the condition that a card isn't detected with the sensor FRS and RES.

The data are decoded when reading in pulling out is done with ICRW.
After that, a BUFFER-CLEAR command is waited for to accept the insertion of the next card.

HOST can transmit a READ command to know the data on the magnetic stripe read by magnetic reading in pulling out or error data (error condition).
The ICRW keeps these data until a BUFFER-CLEAR command is issued.
Before going into the operation of the next card, it means that HOST must clear buffer memory for reading of ICRW.

When a card was pushed in before HOST transmitted a BUFFER-CLEAR command. read-buffer which read magnetic data is destroyed.

10.6 The Card is in the ICRW

After the insertion of the card is started, when RES doesn't become active within 1.0 seconds or,
After pulling out of the card is started, when FRS doesn't become inactive within 1.0 seconds,
ICRW puts a status code.
The HOST can know that a card was left inside ICRW by this.

10.7 The Card is in the ICRW completely

When a card is completely inserted, the card reaches a RES position.
Reading in the card insertion is completed here, and data are decoded.
(The condition that a card is read only at the time of pulling out is excluded.)

ICRW puts a status code even on the unwilling reading result.
The HOST can know the existence of the data on each track by the code.
The HOST can transmit a READ command to read data on the magnetic stripe.

After a BUFFER-CLEAR command is received, ICRW clears read-buffer, and starts reading in the card pulling out. (The condition that a card is read only at the time of pulling out is excluded.)
When a card is held by a RES position, ICRW starts reading in the card pulling out by receiving this command.

A BUFFER-CLEAR command is unnecessary to start reading in pulling out when it is used by the card reading mode only at the time of the card pulling out.

The ICRW waits that the Host activates the IC card and starts a communication.
The HOST must issue an ACTIVATE command.

10.8 The Card is locked with the shutter

The HOST can choose timing to lock a card with the Initialize command.
The card is locked by issuing an ACTIVATE command by the shutter, and Vcc is added. (Lt=30H)
Or, the card is locked by the card's reaching a RES position with the shutter.(Lt=31H)
Then the HOST does communication by using the IC CONTROL command toward the IC card.
When communication with the IC card is finished, HOST must transmit a DEACTIVATE command and a SHUTTER command.
Then, ICRW turns off Vcc of the IC card, and ICRW opens a shutter.

10.9 LED color

LED of three colors which isn't turned on at the same time is connected with the outside of ICRW.

The color indicated under the default condition has the following special meaning.
But, the color is replaced in another color when two and more condition continues and happens.

Before initialize	Blinking Green	(It can't be controlled)
Initial Self test (CRC) error	Stable OFF	(It can't be controlled)

Fig.1. Block diagram

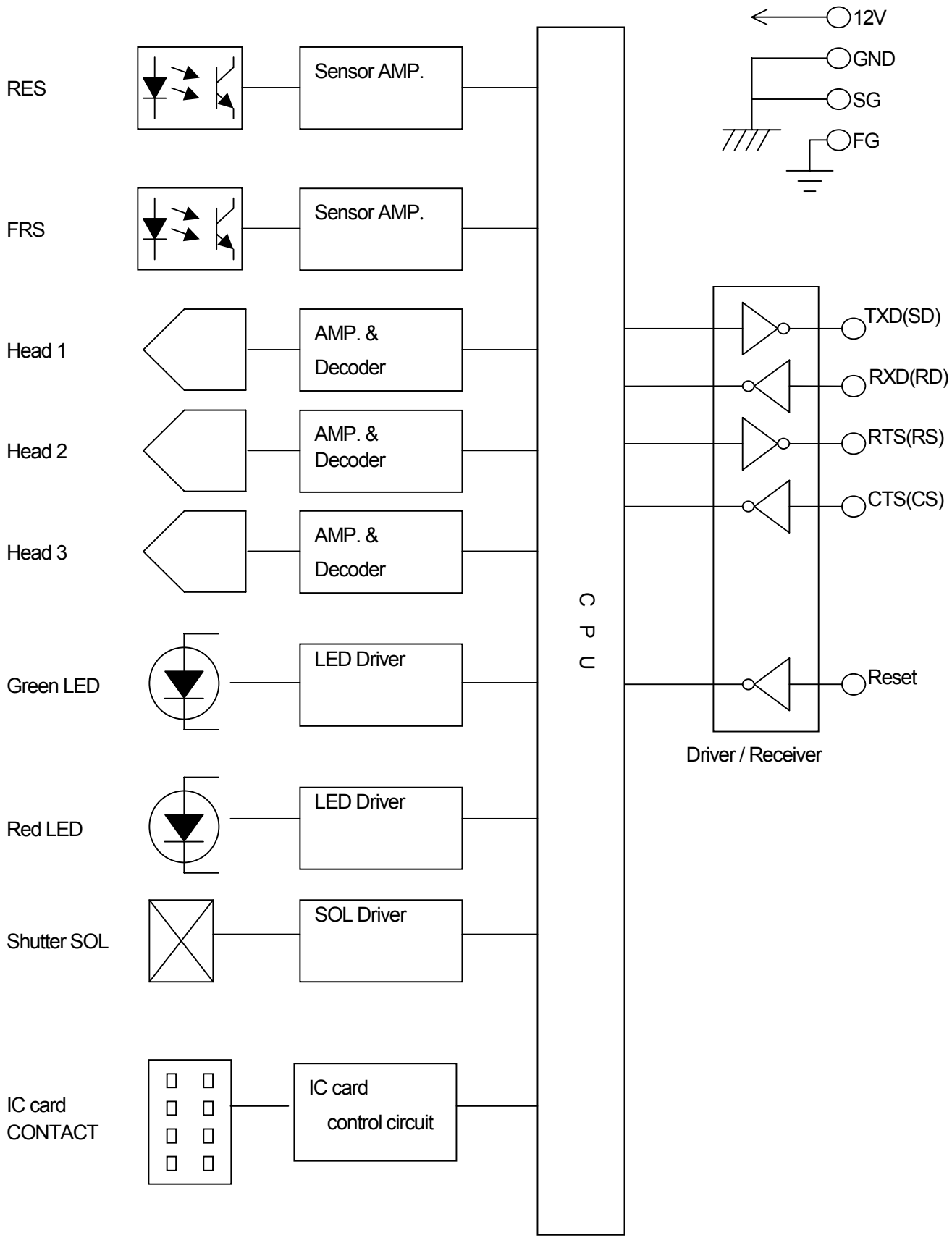


Fig.2. State Change chart

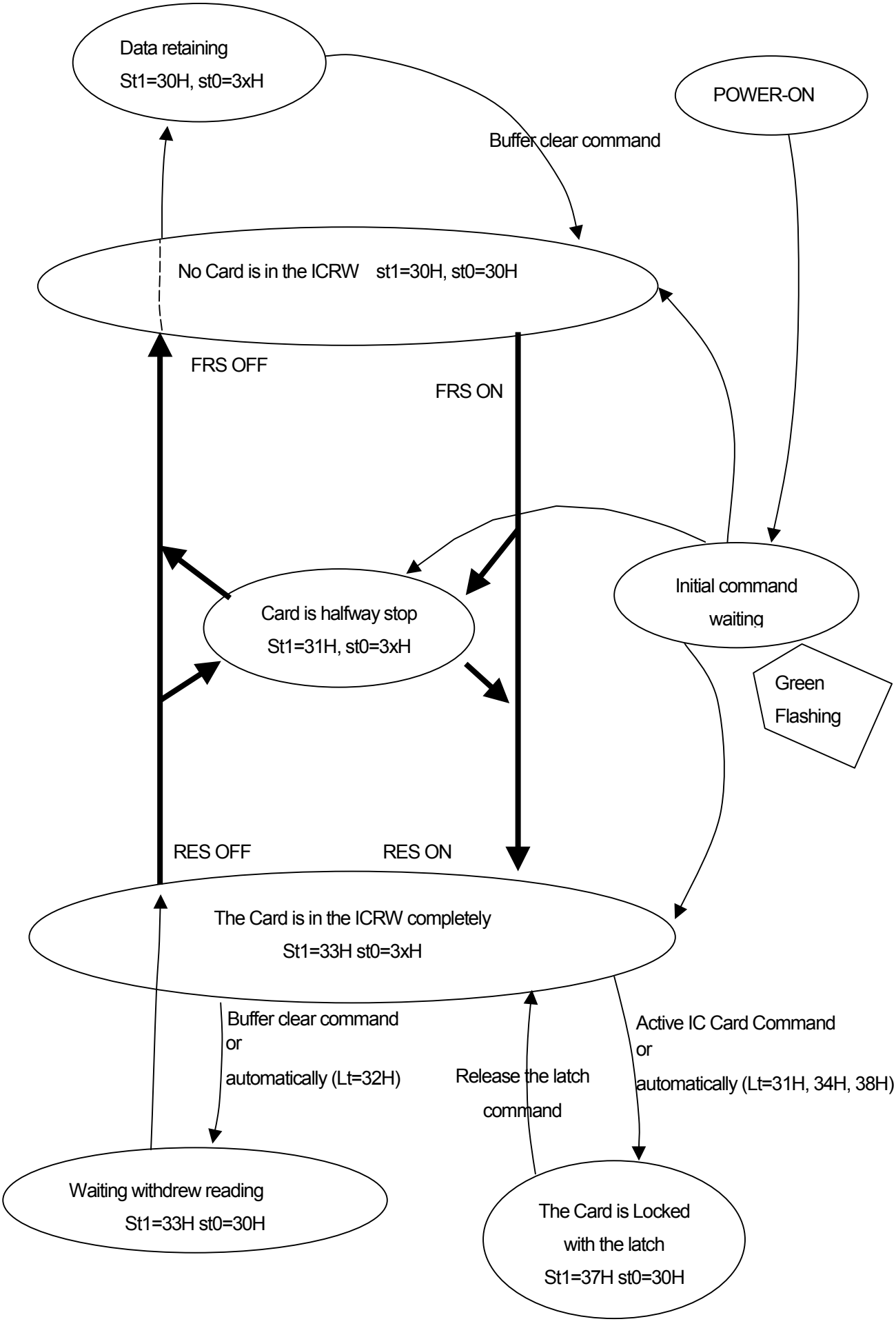
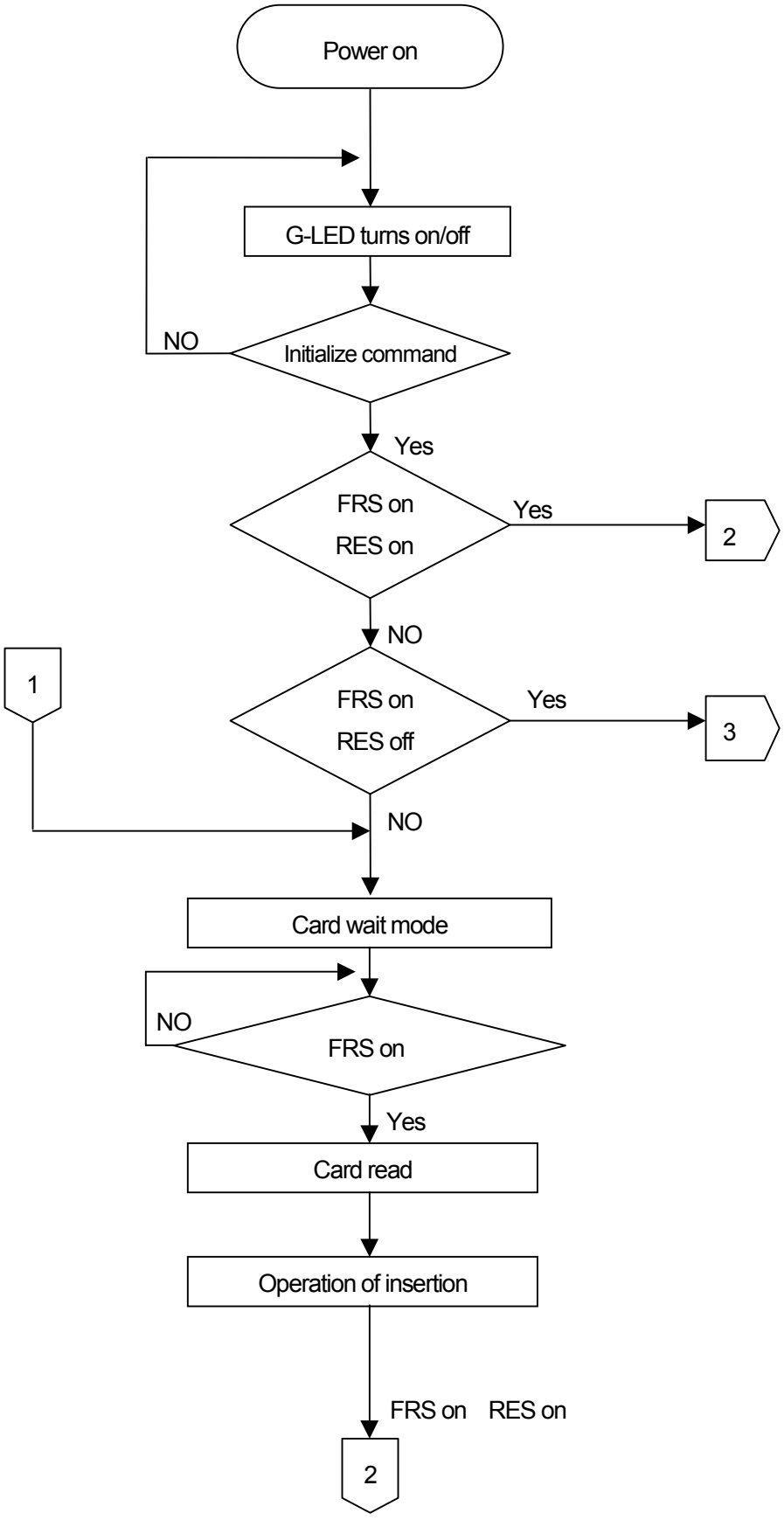
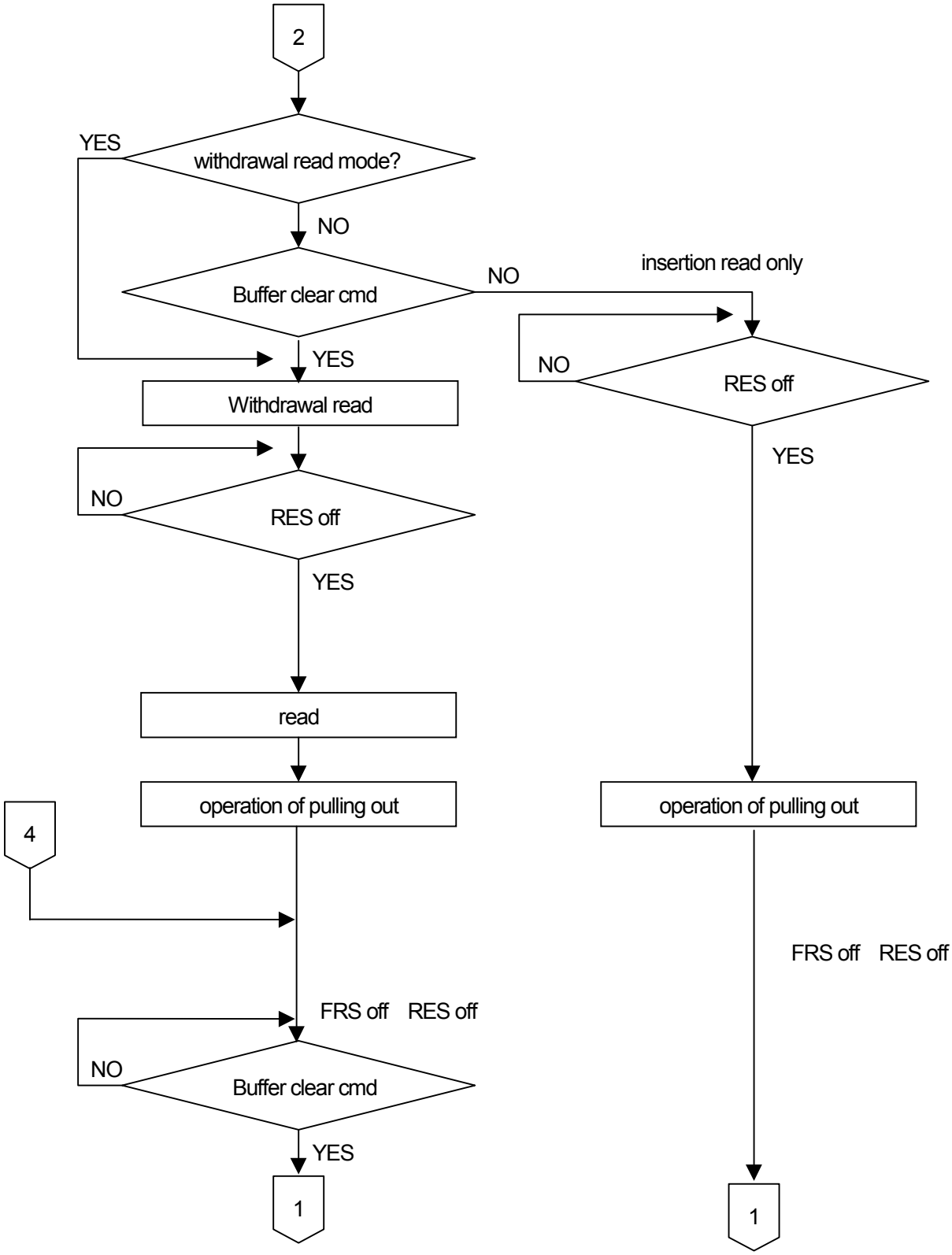


Fig.3. Flow chart




2
withdrawal read mode?
YES
NO
Buffer clear cmd
NO
insertion read only
YES
Withdrawal read
NO
RES off
YES
NO
RES off
YES
read
operation of pulling out
operation of pulling out
4
FRS off RES off
FRS off RES off
NO
Buffer clear cmd
YES
1
1

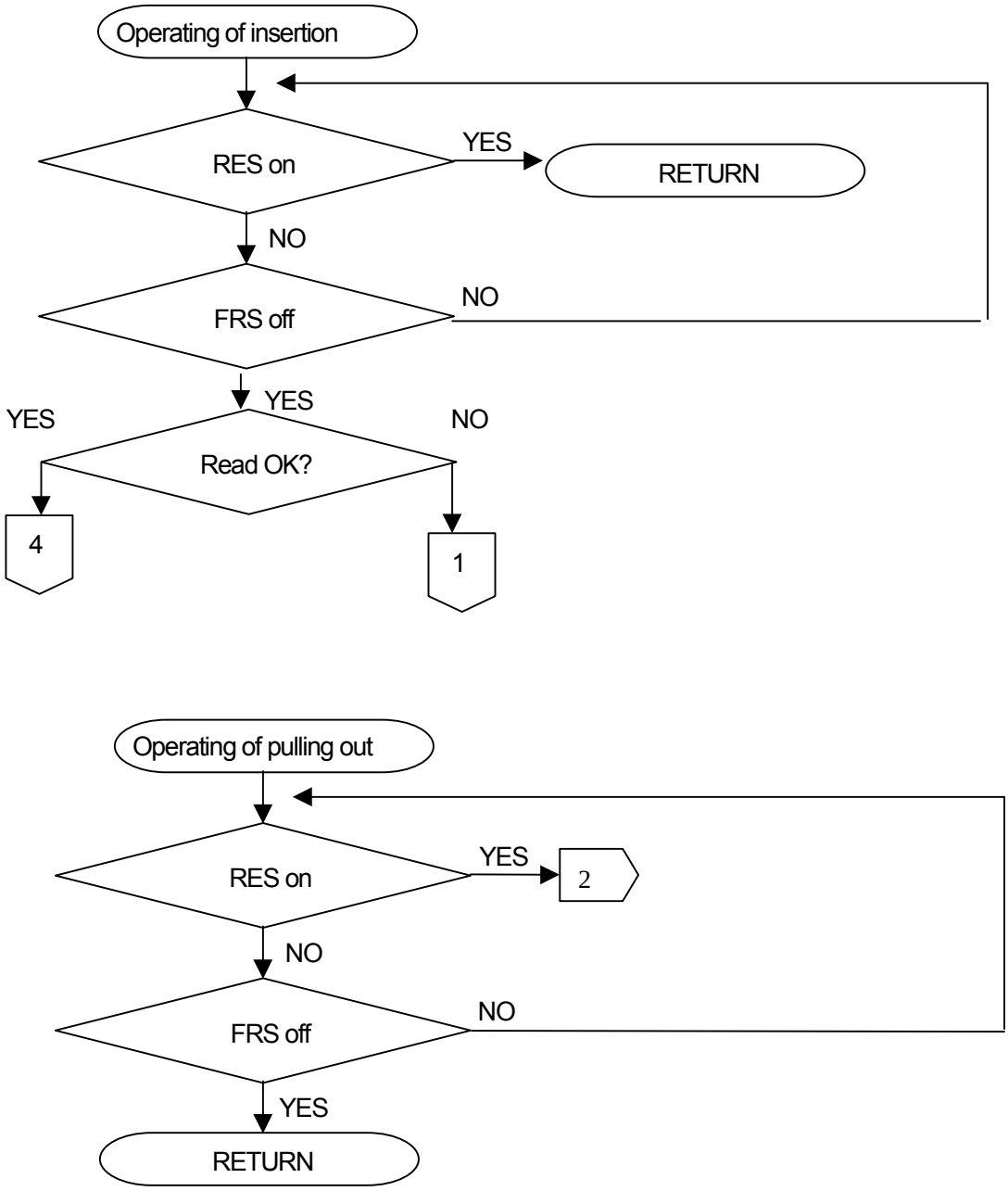
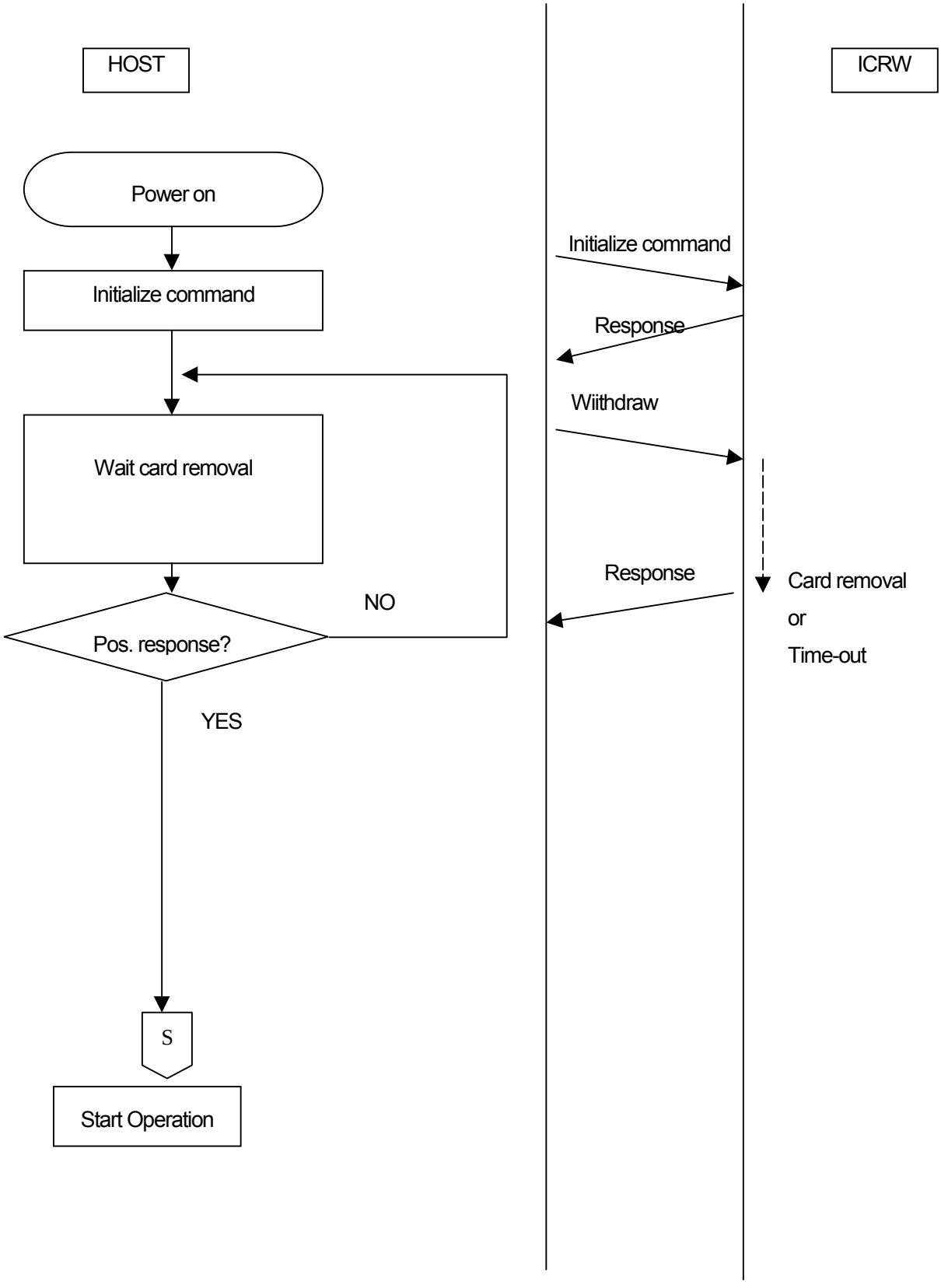
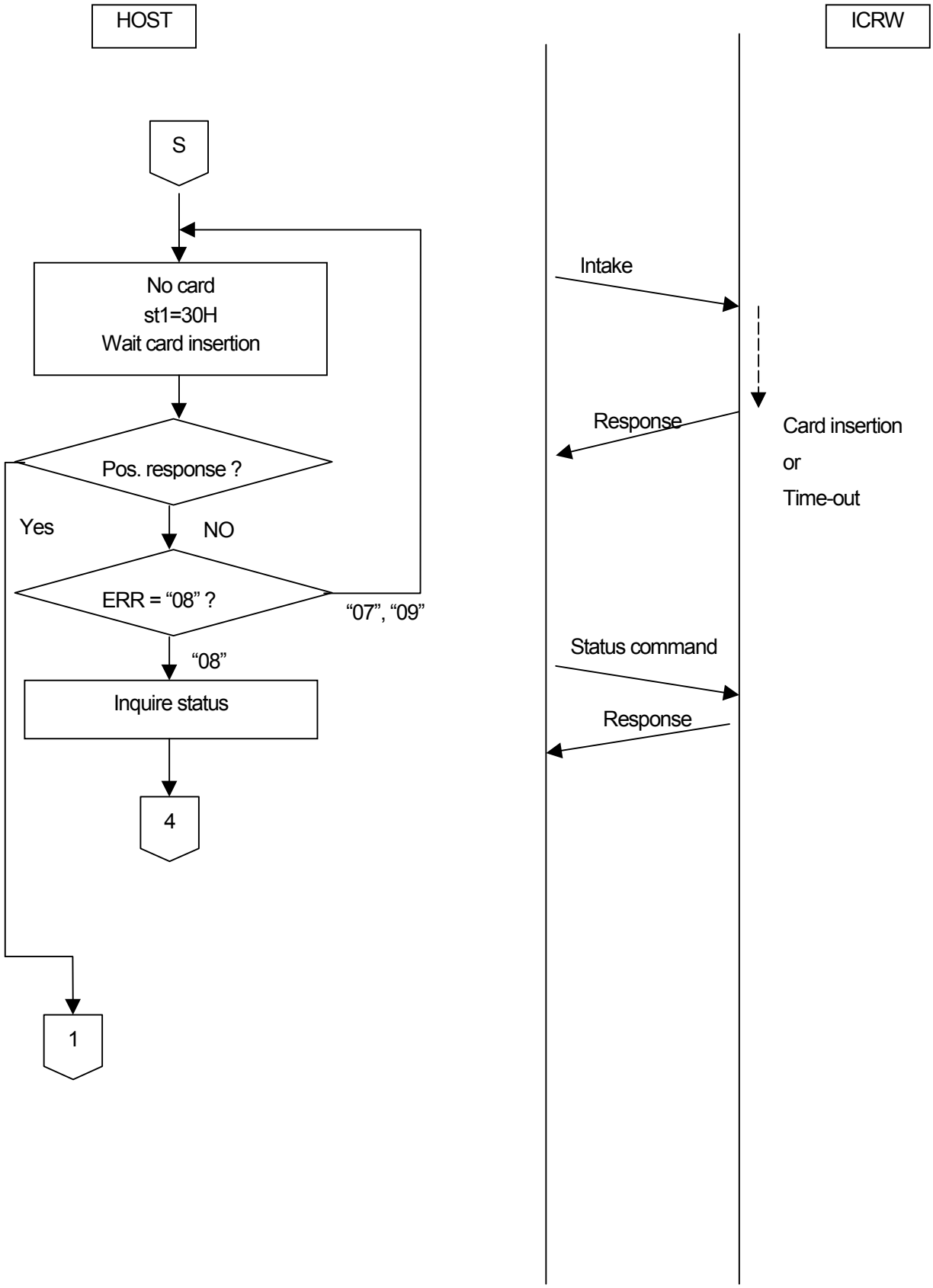

Operating of insertion
RES on
YES
RETURN
NO
FRS off
NO
YES
YES
NO
Read OK?
4
1
Operating of pulling out
RES on
YES
2
NO
FRS off
NO
YES
RETURN

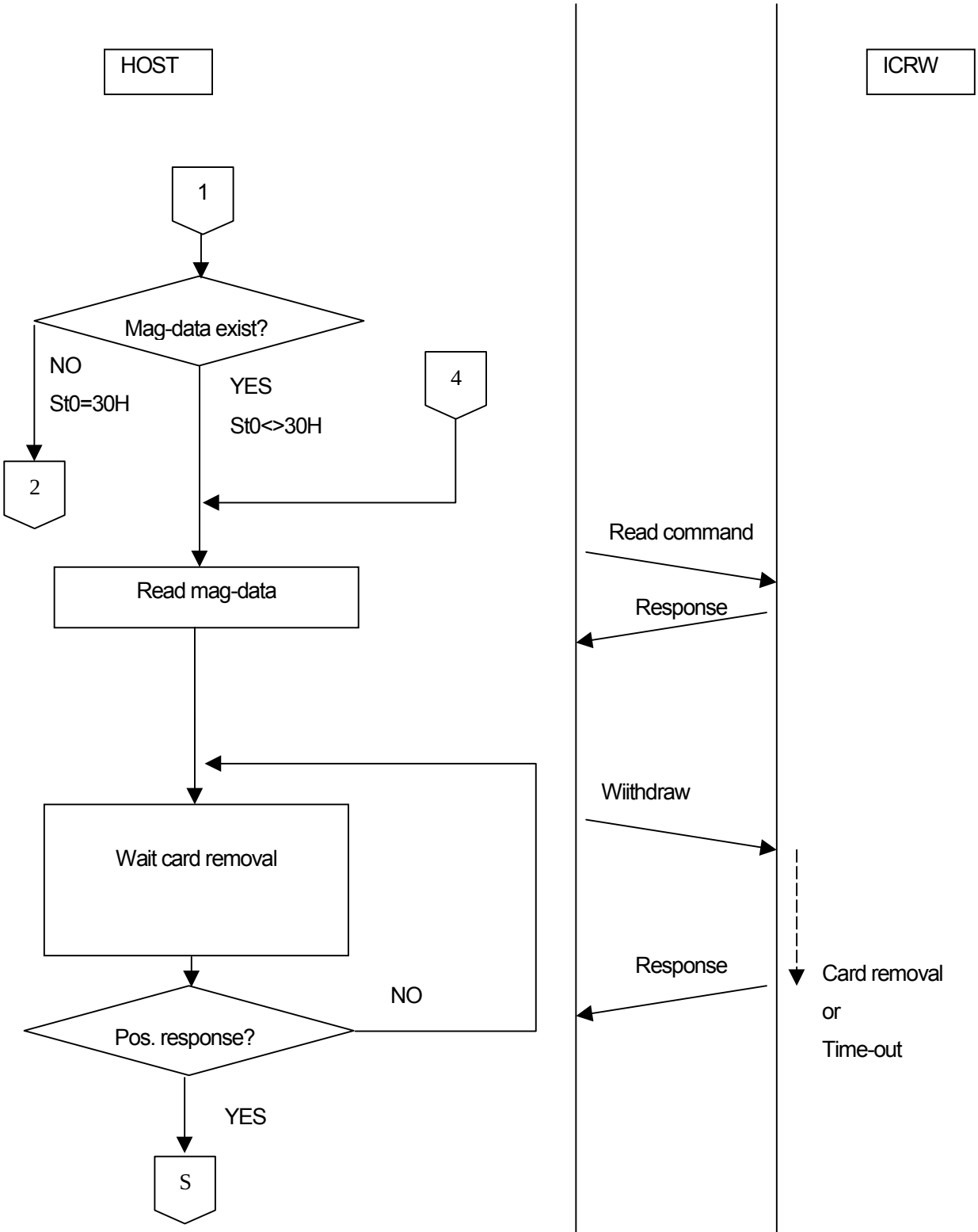
Fig.4. Communication sequence

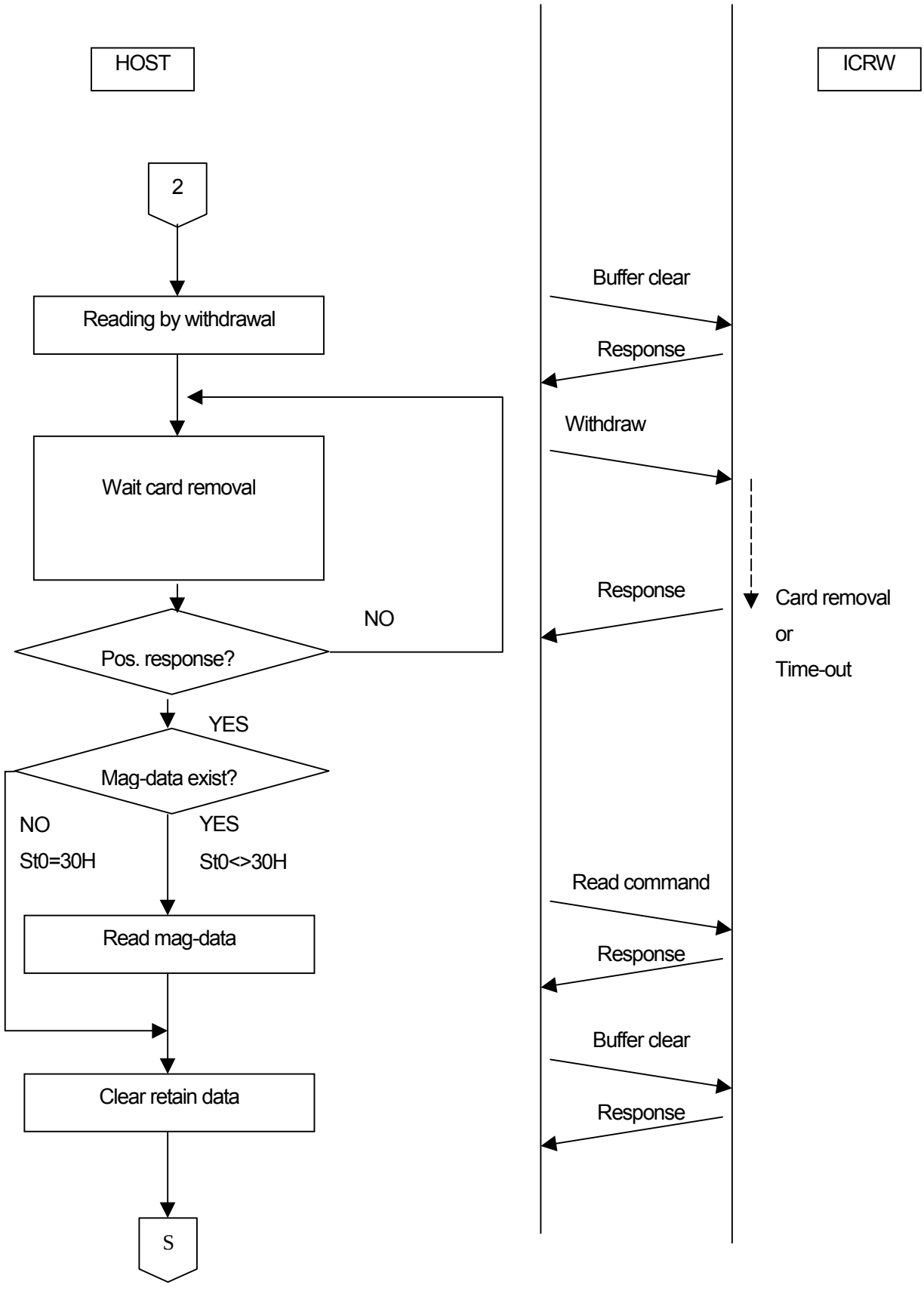
a) Power on sequence



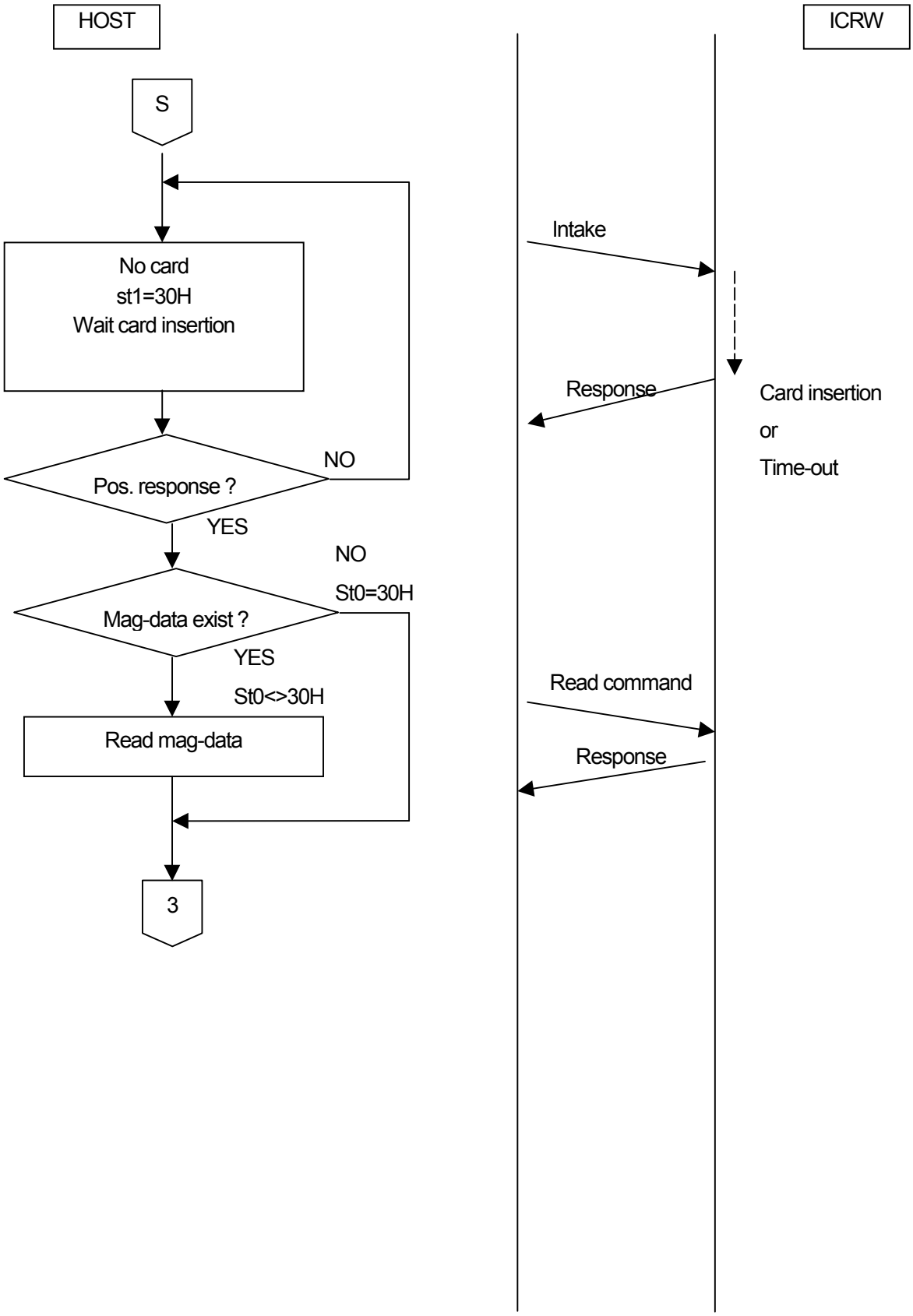
b) Reading by insertion and withdrawal sequense (without IC card operation)

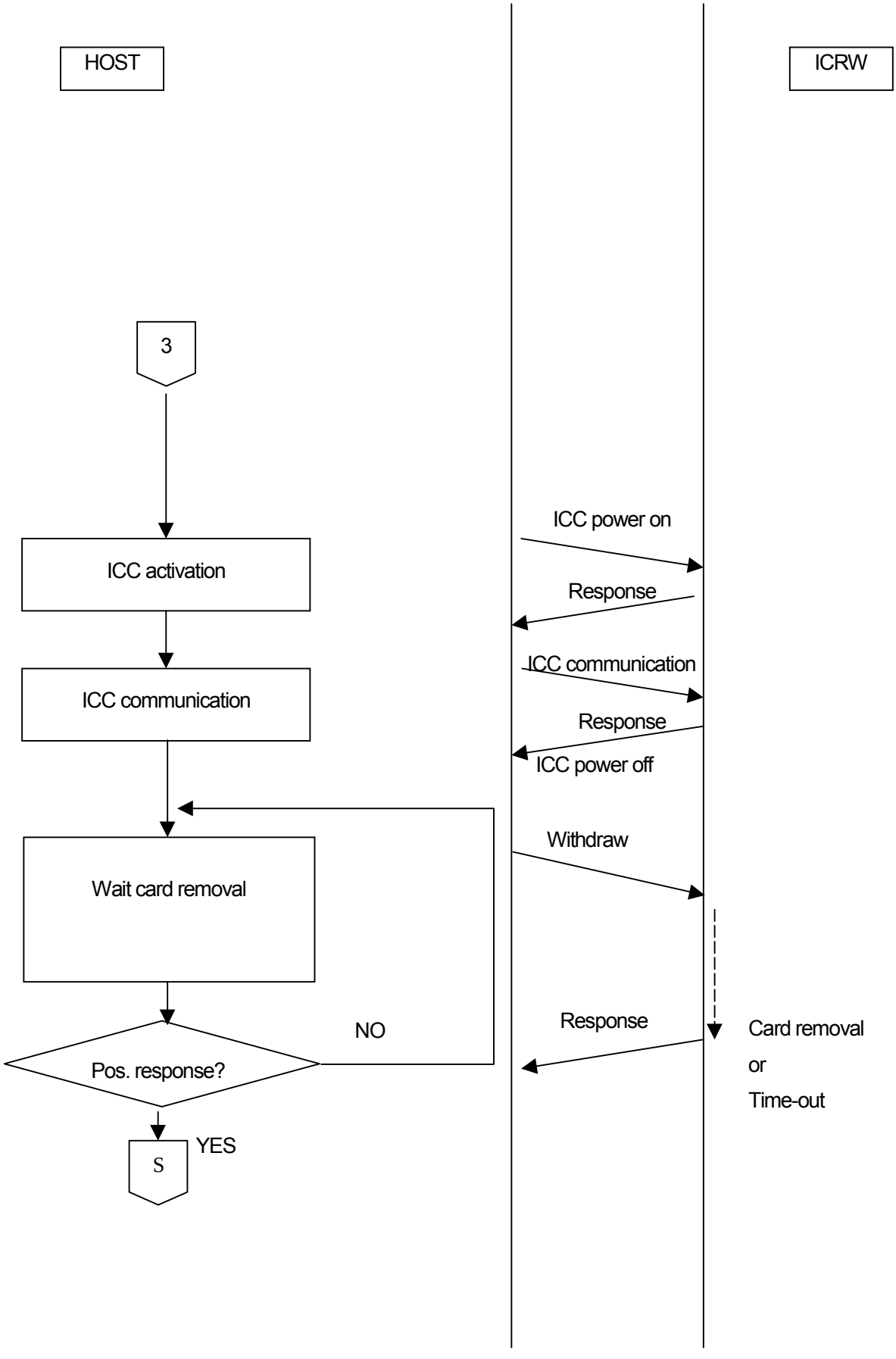



HOST
ICRW
1
Mag-data exist?
NO
St0=30H
YES
St0<>30H
4
2
Read command
Read mag-data
Response
Wiithdraw
Wait card removal
Response
Card removal
or
Time-out
NO
Pos. response?
YES
S


HOST
ICRW
2
Reading by withdrawal
Buffer clear
Response
Withdraw
Wait card removal
Response
Card removal
or
Time-out
NO
Pos. response?
YES
Mag-data exist?
NO
St0=30H
YES
St0<>30H
Read command
Read mag-data
Response
Buffer clear
Clear retain data
Response
S

c) Reading by insertion and IC card operation




HOST
ICRW
3
ICC power on
ICC activation
Response
ICC communication
ICC communication
Response
ICC power off
Withdraw
Wait card removal
Response
Card removal
or
Time-out
NO
Pos. response?
YES
S

d) Reading by withdrawal operation (initialize command Lt=32H)

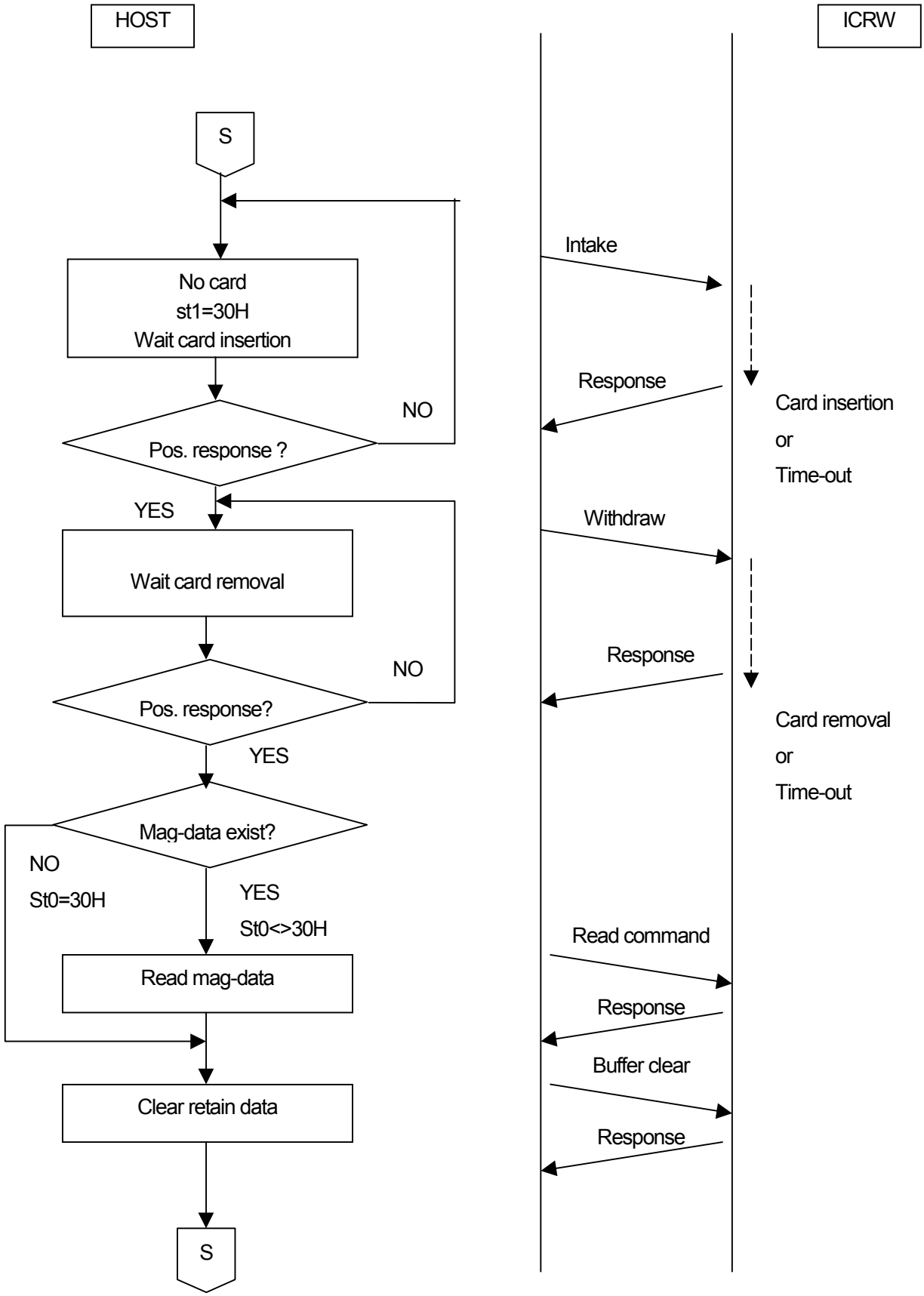


Table2. Mag. data conversion table (ISO #1)

Mag. Data (HEX code)*1	Character	Transfer data (HEX code)*2	Mag. Data (HEX code)*1	Character	Transfer data (HEX code)*2
00	SP	20	10	0	30
01	(a)	21	11	1	31
02	(a)	22	12	2	32
03	(c)	23	13	3	33
04	$	24	14	4	34
05	Start sentinel	25	15	5	35
06	(a)	26	16	6	36
07	(a)	27	17	7	37
08	(	28	18	8	38
09	)	29	19	9	39
0A	(a)	2A	1A	(a)	3A
0B	(a)	2B	1B	(a)	3B
0C	(a)	2C	1C	(a)	3C
0D	-	2D	1D	(a)	3D
0E	.	2E	1E	(a)	3E
0F	/	2F	1F	end sentinel	3F

*1 On the Mag. stripe data without parity bit.

*2 On line ASCII code without parity bit.
(a) to (c) refer to ISO standard.

*3 Start sentinel and End sentinel are not transmitted

Mag. Data (HEX code)*1	Character	Transfer data (HEX code)*2	Mag. Data (HEX code)*1	Character	Transfer data (HEX code)*2
20	(a)	40	30	P	50
21	A	41	31	Q	51
22	B	42	32	R	52
23	C	43	33	S	53
24	D	44	34	T	54
25	E	45	35	U	55
26	F	46	36	V	56
27	G	47	37	W	57
28	H	48	38	X	58
29	I	49	39	Y	59
2A	J	4A	3A	Z	5A
2B	K	4B	3B	(b)	5B
2C	L	4C	3C	(b)	5C
2D	M	4D	3D	(b)	5D
2E	N	4E	3E	A	5E
2F	O	4F	3F	(a)	5F

*1 On the Mag. stripe data without parity bit.

*2 On line ASCII code without parity bit.

(a) to (c) refer to ISO standard.

*3 Start sentinel and End sentinel are not transmitted

Table3. Mag. data conversion table (ISO #2,3)

bits					Column	Character	Transfer data (HEX code)*2
P	4	3	2	1			
1	0	0	0	0	0	0	30
0	0	0	0	1	1	1	31
0	0	0	1	0	2	2	32
1	0	0	1	1	3	3	33
0	0	1	0	0	4	4	34
1	0	1	0	1	5	5	35
1	0	1	1	0	6	6	36
0	0	1	1	1	7	7	37
0	1	0	0	0	8	8	38
1	1	0	0	1	9	9	39
1	1	0	1	0	10	(a)	3A
0	1	0	1	1	11	Start sentinel	3B
1	1	1	0	0	12	(b)	3C
0	1	1	0	1	13	Separator	3D
0	1	1	1	0	14	(c)	3E
1	1	1	1	1	15	end sentinel	3F

* These codes are not transmitted.

(a) to (c) refer to ISO standard.

ANNEX1 TA1 values supported in specific mode.

TA1 values that ICRW is supporting with activation of EMV'96

TA1='11' and TA2=none : D=1 F=372
TA1<> '11' and TA2=none : Not support
TA1='any' and TA2.b5=0 : Comply with Table4
TA1='any' and TA2.b5=1 : Not support

TA1 values that ICRW is supporting with activation of ISO/IEC7816-3

TA1='any' and TA2=none : D=1 F=372
TA1='any' and TA2.b5=0 : Comply with Table4
TA1='any' and TA2.b5=1 : D=1 F=372

Table4: Supported TA1 values in specific mode.

D= / F=	1	2	4	8	16	Clock Freq.
372	01 or 11	02 or 12	03 or 13	-	-	3.58MHz
558	-	-	-	-	-	-
744	31	32	33	-	-	7.16MHz
1116	-	-	-	-	-	-
1488	-	52	53	54	-	7.16MHz
1860	-	-	-	-	-	-
512	91	92	93	-	-	3.58MHz
768	-	-	-	-	-	-
1024	B1	B2	B3	-	-	7.16MHz
1536	-	-	-	-	-	-
2048	-	D2	D3	D4	-	7.16MHz

ANNEX2 Values of ATR parameter

Table5: Supported values of ATR

Vcc / ATR		30H	33H	35H	36H
		Supported values			
TS		'3F', '3B'			
TA1		See Table1			
TB1		'00' (cold reset) Any value (warm reset) (*1)	Any value (*1)		
TC1		Any value			
TD1		m.s. nibble : any value l.s. nibble : '0' or '1'	m.s. nibble : any value l.s. nibble : any value		
TA2		See ANNEX1			
TB2		None (prohibit)	Any value (*1)		
TC2		'01'… '0A'	'01'… 'FF'		
TD2		m.s. nibble : any value l.s. nibble : '1','E'	m.s. nibble : any value l.s. nibble : any value		
NOT T=15					
	TA3,TA4	'10'...'FE'	'01' ... 'FE'		
	TB3,TB4	m.s. nibble : '0'...'4' and l.s. nibble : '0'...'5' and 2^{CWI} >= (N+1)	m.s. nibble : '0'...'9' and l.s. nibble : '0'...'15' and 2^{CWI} >= (N+1)		
	TC3,TC4	'00'	Any value		
	TD3,TD4	any value	any value		
T=15					
	TA3	(*2)	b1=1	b2=1 or b1=1	
	TB3,TC3, TD3	(*2)	any value		
	TA4	b1=1	b1=1	b2=1 or b1=1	
	TB4,TC4 TD4	any value			

A meaning of Vcc parameter please refer "activate ICC command".

(*1) ICRW does not generate Vpp.
(*2) 'F'(T=15) is prohibited in TD2 l.s.nibble.

ANNEX3 C-APDU Format

The C-APDU consists of a mandatory header of four consecutive bytes denoted CLA, INS, P1 andP2, followed by a conditional body of variable length. The meanings of every byte are below.

	byte	Meanings
Mandatory Header	CLA	Instruction Class
	INS	Instruction Code
	P1	Instruction Parameter 1
	P2	Instruction Parameter 2
Conditional Body	Lc	Byte Length of Data Field
	Data	Data Field
	Le	Byte Length of Expected Response Length

About the details of each bytes, refer to specifications of every card's standard.

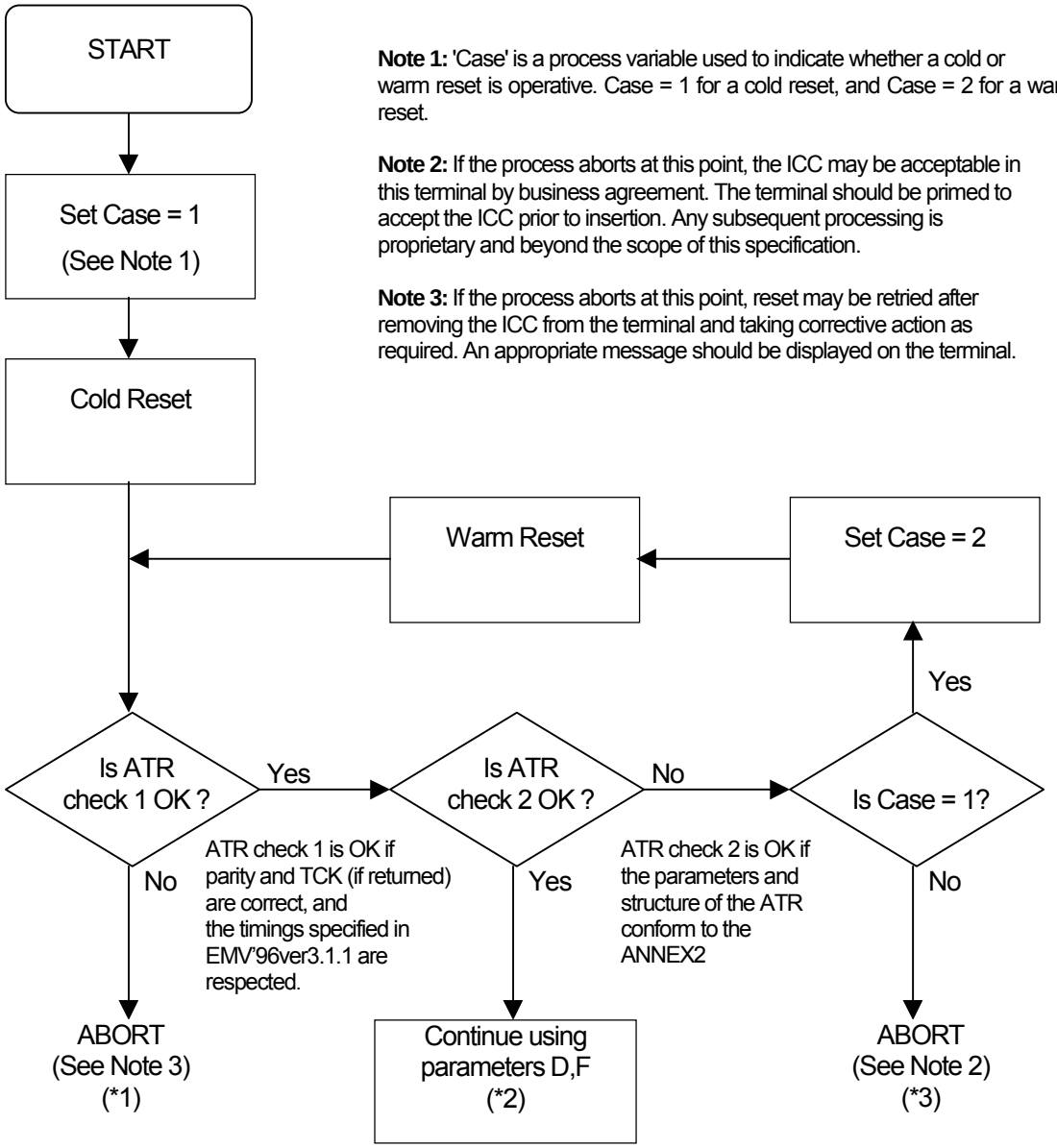
The C-APDU structure has following four cases.

Case	Structure
1	CLA INS P1 P2
2	CLA INS P1 P2 Le
3	CLA INS P1 P2 Lc Data
4	CLA INS P1 P2 Lc Data Le

The host shall transmit the command of Case1, Case2, Case3 and Case4 correctly.
Especially for the case 1 on T=0 protocol, ICRW adds '00' internally as the fifth byte of the command to the card.

ANNEX4 Sequence of activating IC card / SAM

1. In case of Vcc=30H



Note 1: 'Case' is a process variable used to indicate whether a cold or warm reset is operative. Case = 1 for a cold reset, and Case = 2 for a warm reset.

Note 2: If the process aborts at this point, the ICC may be acceptable in this terminal by business agreement. The terminal should be primed to accept the ICC prior to insertion. Any subsequent processing is proprietary and beyond the scope of this specification.

Note 3: If the process aborts at this point, reset may be retried after removing the ICC from the terminal and taking corrective action as required. An appropriate message should be displayed on the terminal.

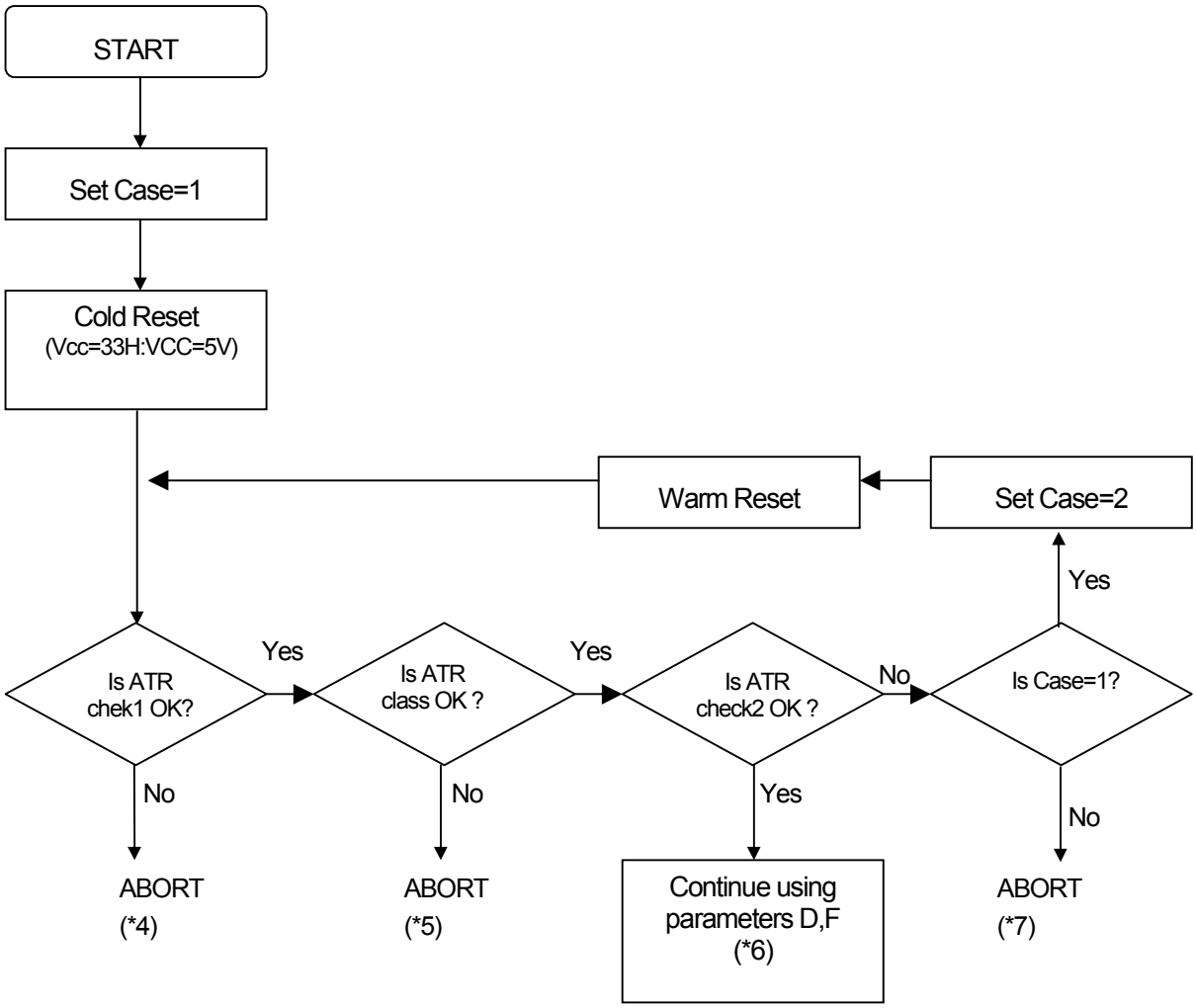
(*1)ICRW initiates the deactivation of ICC, and sends back error code " 61".

(*2)After ICRW received ATR which shows T=1 protocol, ICRW transmits S (IFSreq) to ICC.
If S (IFSresp) can't be received properly from ICC, ICRW initiates the deactivation of ICC, and sends back error code " 63" or "64".
When S (IFSresp) is received properly in the above or when ATR is not T=1 protocol, ICRW transmits the contents of ATR which is received from ICC to HOST.

(*3)When ATR content is not based on such protocol, which is supported by ICRW, error code "69" with ATR data will be sent back and ICRW will deactivate the IC card.

(Reference: EMV '96 Integrated Circuit Card Specification for Payment Systems. version 3.1.1 May 31,1998)

2. In case of Vcc=33H



(*4)ICRW initiates the deactivation of ICC, and sends back error code " 61".

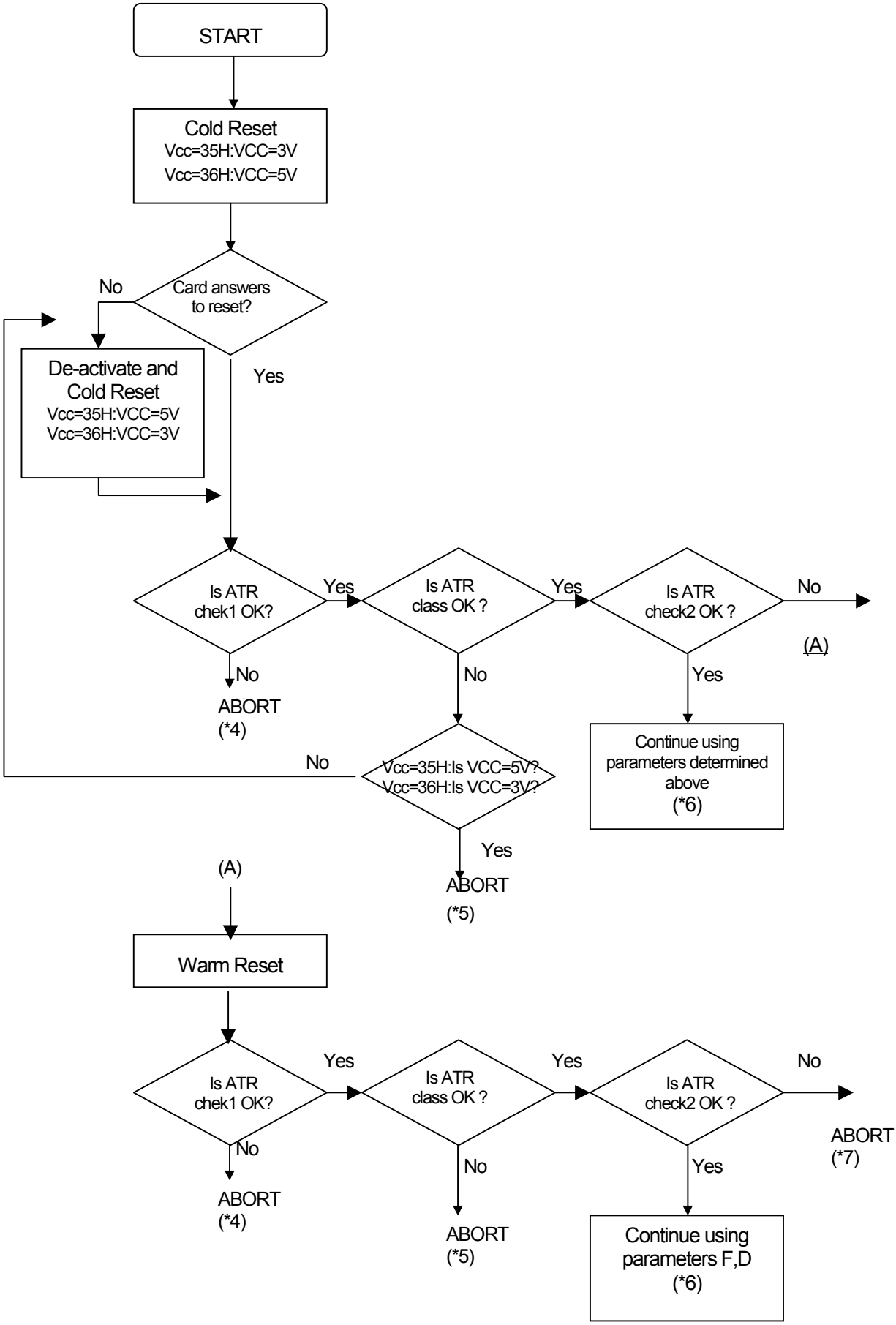
(*5)ICRW checks IC-card's class indicator, which is not supported by ICRW,
error code "66" with ATR data will be sent back and ICRW will deactivate the IC card.

(*6) After ICRW received ATR which shows T=1 protocol, ICRW transmits S (IFSreq) to ICC.
If S (IFSresp) can't be received properly from ICC, ICRW initiates the deactivation of ICC,
and sends back error code " 63" or "64".
When S (IFSresp) is received properly in the above or when ATR is not T=1 protocol,
ICRW transmits the contents of ATR which is received from ICC to HOST.

(*7)When ATR content is not based on such protocol, which is supported by ICRW,
error code "66" with ATR data will be sent back and ICRW will deactivate the IC card.

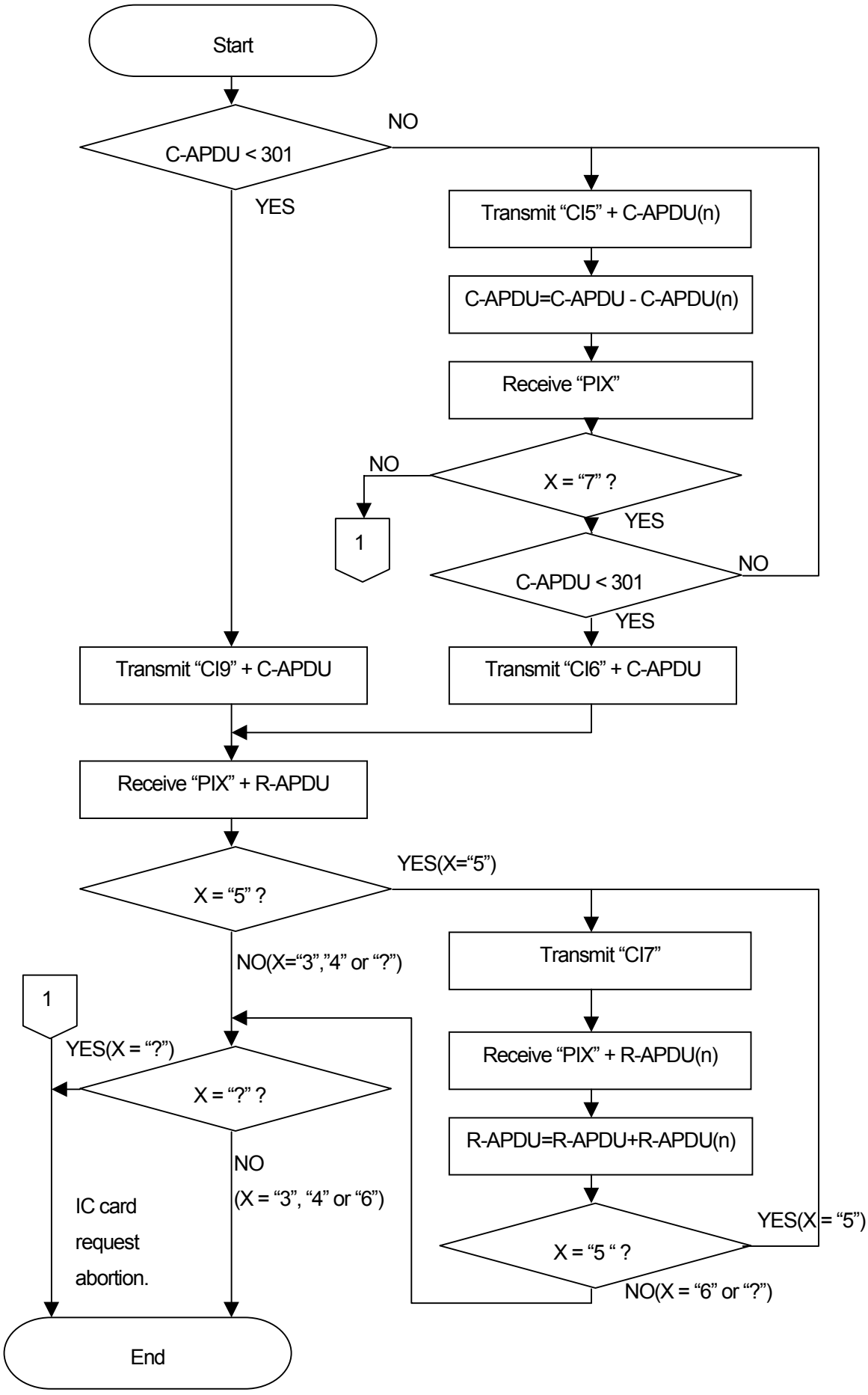
(Reference: ISO/IEC 7816-3:1997)

3. In case of Vcc=35H or 36H



ANNEX5 Method of IC card communication

IC card communication flow



Example

HOST ICRW

(exp.1) Transmit 300 bytes or less of data.
Receive 300 bytes or less of data.

"CI9" data →
← "PI4" data

(exp.2) Transmit data by command chaining(Each data size is 300 bytes or less)
Receive 300 bytes or less of data

"CI5" data1 →
← "PI7"
"CI5" data2 →
← "PI7"
"CI6" data3 →
← "PI4" data

(exp.3) Transmit 300 bytes or less of data
Receive data by command chaining (Each data size is 300 bytes or less)

"CI9" data →
← "PI5" data1
"CI7" →
← "PI5" data2
"CI7" →
← "PI6" data3

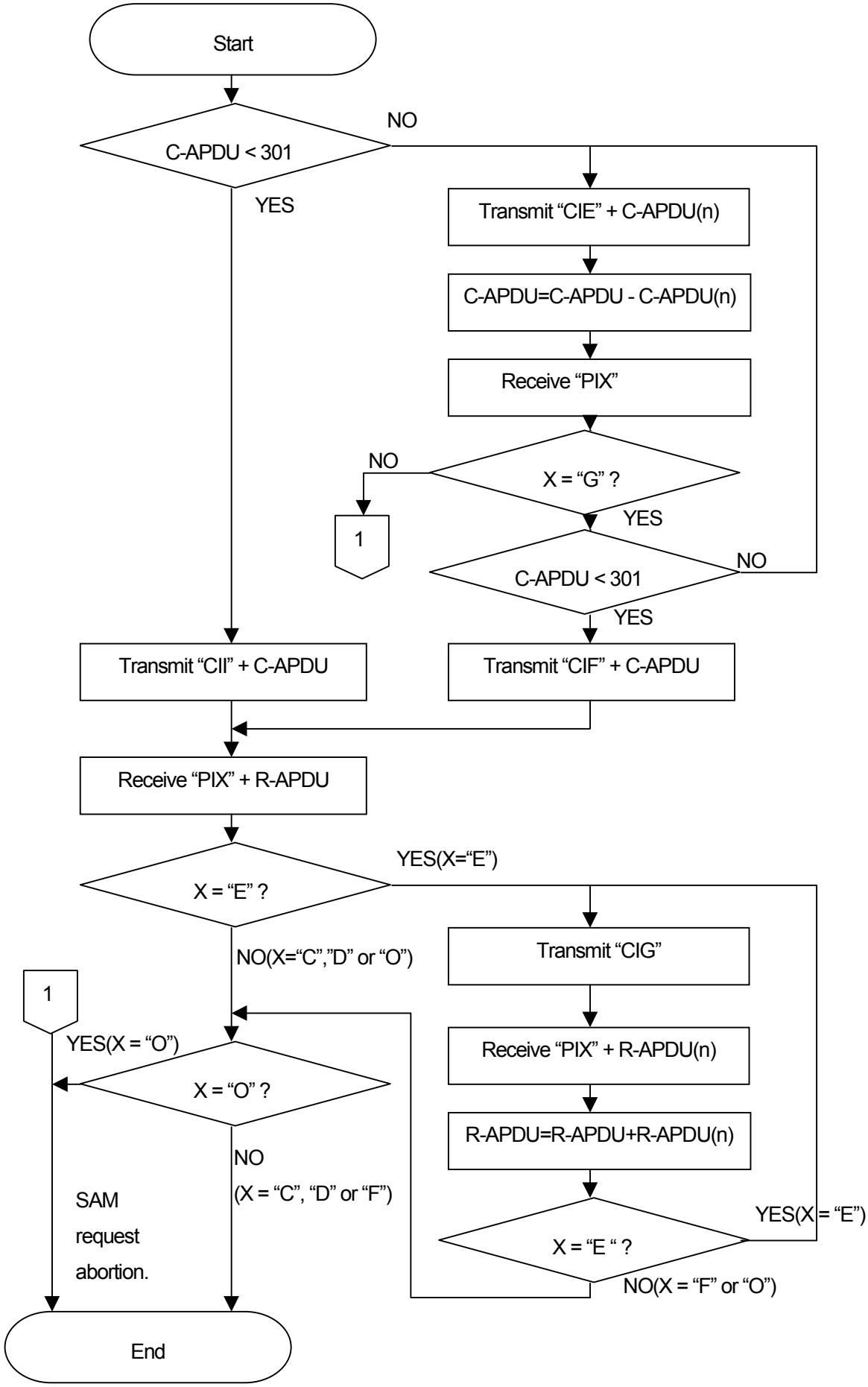
(exp.4) Transmit data by command chaining (Each data size is 300 bytes or less)
Receive data by command chaining (Each data size is 300 bytes or less)

"CI5" data1 →
← "PI7"
"CI5" data2 →
← "PI7"
"CI6" data3 →
← "PI5" data1
"CI7" →
← "PI5" data2
"CI7" →
← "PI6" data3

(exp.5) Interruption with receipt of ABORT request

"CI5"data1 →
← "PI? "

SAM communication flow



Example

HOST ICRW

(exp.1) Transmit data 300 bytes or less of data.
Receive 300 bytes or less of data.

"CII" data →
← "PID" data

(exp.2) Transmit data by command chaining(Each data size is 300 bytes or less)
Receive 300 bytes or less of data

"CIE" data1 →
← "PIG"
"CIE "data2 →
← "PIG"
"CIF" data3 →
← "PID" data

(exp.3) Transmit 300 bytes or less of data
Receive data by command chaining (Each data size is 300 bytes or less)

"CII" data →
← "PIE" data1
"CIG" →
← "PIE" data2
"CIG" →
← "PIF" data3

(exp.4) Transmit data by command chaining (Each data size is 300 bytes or less)
Receive data by command chaining (Each data size is 300 bytes or less)

"CIE" data1 →
← "PIG"
"CIE" data2 →
← "PIG"
"CIF" data3 →
← "PIE" data1
"CIG" →
← "PIE" data2
"CIG" →
← "PIF" data3

(exp.5) Interruption with receipt of ABORT request

"CIE" data1 →
← "PIO"

ANNEX6 Calculation method of CRCC

CRCC(X16+X12+X5+1) is made by the following method.

```
/*
        [data]
        hex     0xF2, 0x00, 0x03, 0x43, 0x30, 0x30
        CRC     0xF61B
*/
#define INIT                0x0000          /* Initial value */
#define POLINOMIAL          0x1021          /* Polynomial X16+X12+X5+1 */

unsigned short calc_crc(unsigned short crc,unsigned short ch);
unsigned short GetCRC(unsigned char *p,unsigned short n);

unsigned short calc_crc(unsigned short crc,unsigned short ch)
{
    unsigned short i;
    ch <<= 8;
    for (i = 8; i > 0; i--) {
        if ((ch ^ crc ) & 0x8000) {
            crc = (crc << 1) ^ POLINOMIAL;
        } else {
            crc <<= 1;
        }
        ch <<= 1;
    }
    return crc;
}

/* Generate GetCRC */
unsigned short GetCRC(unsigned char *p,unsigned short n)
{
    unsigned char   ch;
    unsigned short  i;
    unsigned short  crc = INIT;

    for (i = 0; i < n; i++) {
        ch = *p++;
        crc = calc_crc(crc,(unsigned short)ch);
    }
    return crc;
}

int main(void)
{
    /* Transmission command
        STX : F2H
        LEN : 00 03H
        TEXT: Initialize command ("C00")
    */
    unsigned char TransCommand[8] ={0xF2,0x00,0x03,0x43,0x30,0x30,0x00,0x00};
    unsigned short TextLength = 6;          /* length of (STX+LEN+TEXT) */
    unsigned short crc;                     /* CRC */

    crc = GetCRC(TransCommand, TextLength);
    TransCommand[11] = (crc >> 8) & 0xFF;
    TransCommand[12] = crc & 0xFF;

    return 0;
}
```

The end of the document