INTERFACE SPECIFICATION

Type Name :

ICT3K5-3R4245

Spec. No.	ASL-NP-06554-02

Notes :

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Revision History

Rev.	Date	Author	Description	
Pre.A	Oct.17,2002	T.Shiomi	first preliminary edition release	
Pre.B	Feb.26,2003	T.Shiomi	add and revice the explanations of the interval between commands	P.6,10
			add the explanation of the EOF of the download file	P.14
			add the shutter error code	P.21
			revise the reader type recognition code	P.25
			revising the setting value “Re” in the data of the initialize command	P.25
			add the capture sensor bit on the status command response data	P.26
			revice the read command explanation	P.30,31
			add the CAP bit on the input port command response	P.34
			revise the explanation of the standard capture counter	P.23,36
			add the function for SLE4428 in the Siemens memory card command	P.20,65,72 – 76
			revise the parameter of the authentication function	P.84
			add the explanation of the shutter error	P.86
A	Apr.29,2003	T.Shiomi	revise the sensor status figure of the status request command	P.26
			revise the explanation of the card carry command	P.28
			revise the explanation of the read command parameters	P.31
			revise the sensor status figure of the port input command	P.34
			revise the explanation of the sensor level transmit command	P.35
			add the explanation of the counter command	P.36
			revise the explanation of the RAS function	P.88,89

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Functional correspondence table

This model corresponds to the following function in the specification.

Hard Ware Functions		Function (**V**:Available)
Magnetic Stripe Read	ISO Track #1	**V**
	ISO Track #2	**V**
	ISO Track #2	**V**
	JIS **II** Track	**-**
Contact IC Card	T=0,T=1, Memory Card (SLE4442/4428,I2C)	**V**
Contactless IC Card	mifare® standard type	**V**
Mechanism	Capture Mechanism	**V**
	Shutter Type (Full Shutter or Pin Shutter)	**Full**

Section	Command	cm	pm	Details of operation	Function (**V**:Available)
5.Command list of Supervisor program code area					
5.1	INITIALIZE	30H	30H	Designate communication format	**V**
5.2	REVISION	41H	30H	Send the revision of Supervisor program code area	**V**
5.3	DOWNLOAD	4AH	30H	Erase the User program code area	**V**
			31H	Execute download	**V**
			32H	Confirm User program code area	**V**
			33H	Inquire download count	**V**
5.4	SWITCH	4BH	30H	Switch to the User program code area	**V**
7.Command list of User program code area					
7.1	INITIALIZE	30H	30H	Initialize and designate ICRW and eject a card	**V**
			31H	Initialize and designate ICRW and capture a card	**V**
			32H	Initialize and designate ICRW and re-positioning a card	**V**
			33H	Initialize and designate ICRW with no card operation	**V**
			34H	pm=30H and set capture counter	**V**
			35H	pm=31H and set capture counter	**V**
			36H	pm=32H and set capture counter	**V**
7.2	STATUS REQUEST	31H	30H	Report presence of card and its position	**V**
			31H	Report presence of sensor status in detail	**V**
7.3	ENTRY	32H	30H	Card Entry (Mag-Track read)	**V**
7.4	CARD CARRY	33H	30H	Move card to Gate from inside of ICRW	**V**
			31H	Capture card to rear side of ICRW	**V**
7.5	RETRIEVE	34H	30H	Retrieve card from eject position	**V**
7.6	LED	35H	30H	All Color LED Off	**V**
			31H	Green On from All Off or directly from Other Color On	**V**
			32H	Red On from All Off or directly from Other Color On	**V**
			33H	Orange On from All Off or directly from Other Color On	**V**
7.7	Mag-Track READ	36H	31H	ISO Track #1 reads Transmit read data	**V**
			32H	ISO Track #2 reads Transmit read data	**V**
			33H	ISO Track #3 reads Transmit read data	**V**
			34H	JIS II Track reads Transmit read data	-
			35H	Transmit All channel data	**V**
			37H	Data buffer status read	**V**
			39H	ISO Track #1 another reads Transmit read data	**V**
			3AH	ISO Track #2 another reads Transmit read data	**V**
			3BH	ISO Track #3 another reads Transmit read data	**V**
			3CH	JIS II Track another reads Transmit read data	-
7.8	ENABLE / DISABLE	3AH	30H	Enable card entry	**V**
			31H	Disable card entry	**V**
7.9	PORT IN / OUT	3DH	30H	Enter maintenance mode	**V**
			31H	Release maintenance mode	**V**
			32H	Check operation of a motor and solenoid	**V**
			33H	Check operation of a sensor	**V**

Section	Command	cm	pm	Details of operation	Function (**V**:Available)
7.10	SENSOR LEVEL TRANSMIT	3EH	30H	Transmit the sensor A/D level on normal condition	**V**
			31H	Transmit the sensor A/D level on adjust condition	**V**
7.11	REVISION	41H	31H	Revision of User program code area	**V**
			32H	Revision of ICC control code area	**V**
7.12	COUNTER	43H	30H	Inquire of card capture count (Compatibility)	**V**
			31H	Set card capture count (Compatibility)	**V**
			32H	Inquire of card pass count	**V**
			33H	Inquire of card capture count (Standard)	**V**
			34H	Set capture alert count (Standard)	**V**
7.14	IC CARD CONTROL	49H	30H	Power Supply and Activate to IC card	**V**
			31H	Deactivate to IC card	**V**
			32H	Inquire of ICRW status for IC card	**V**
			33H	Exchange data with IC card by T=0 protocol	**V**
			34H	Exchange data with IC card by T=1 protocol	**V**
			35H	Transmit chaining data to IC card by T=1 protocol	**V**
			36H	Transmit Last chaining data to IC card by T=1 protocol	**V**
			37H	Require of chaining data by T=0 / T=1	**V**
			38H	Warm reset to IC card	**V**
			39H	Exchange data with IC card by automatic protocol recognition	**V**
			40H	Power Supply and Activate to SAM	**V**
			41H	Deactivate to SAM	**V**
			42H	Inquire of ICRW status for SAM	**V**
			43H	Exchange data with SAM by T=0 protocol	**V**
			44H	Exchange data with SAM by T=1 protocol	**V**
			45H	Transmit chaining data to SAM by T=1 protocol	**V**
			46H	Transmit Last chaining data to SAM by T=1 protocol	**V**
			47H	Require of chaining data by T=0 / T=1	**V**
			48H	Warm reset to SAM	**V**
			49H	Exchange data with SAM by automatic protocol recognition	**V**
			50H	Select SAM	**V**
7.15	SWITCH	4BH	30H	Switch to Supervisor program code area	**V**
7.16	Siemens Memory Card Control	52H	30H	Power Supply and Activate to Siemens card	**V**
			31H	Deactivate to Siemens card	**V**
			32H	Inquire of ICR status for Siemens card	**V**
			33H	Exchange data for SLE4442 card	**V**
			34H	Exchange data for SLE4428 card	**V**
7.17	I2C MEMORY CONTROL	53H	30H	To activate I2C and To close the shutter	**V**
			31H	To deactivate I2C	**V**
			32H	To inquire status of I2C	**V**
			33H	To exchange data between I2C	**V**
7.18	Contactless IC CARD CONTROL	5AH	30H	Activate to the Contactless IC card	**V**
			31H	Deactivate to the Contactless IC card	**V**
			33H	Data Access with the Mifare® Standard Functions	**V**
9	RAS Function	Power on / Reset		RAS function	**V**
ANNEX 1				Calculation method of CRCC	**V**
ANNEX 2, 3, 4, 5				Additional explanation of ICC control function	**V**

Contents

1. Logic level

The protocol transmitted from HOST is automatically recognized by ICRW after a power-on.
After the recognition, communication is executed according to each protocol.
Protocol type is recognized only after power-on.
And the protocol can not be switched to another protocol during communication.

1.1 Transmission / Control Specification

1) Synchronous method : Asynchronous
2) Transmission method : Half duplex
3) Baud rate : 9600, 19200, 38400, 115200 BPS (automatic recognition)

note) Baud rate is recognized and set up by STX of the first time command after a power-on / reset, and it is cleared by power-off/reset.
Therefore, baud rate recognition and a setup are not performed for every initialization command.
The parity check result of the following data of STX is also made into recognition conditions as a measure against an incorrect recognition.

4) Data length : 8bit + 1 parity

ST	b0	b1	b2	b3	b4	b5	b6	b7	P	SP

5) Stop bit : 1 bit
6) Character Code : ASCII 8 bit code
7) Parity check method : Vertical (Even) parity check

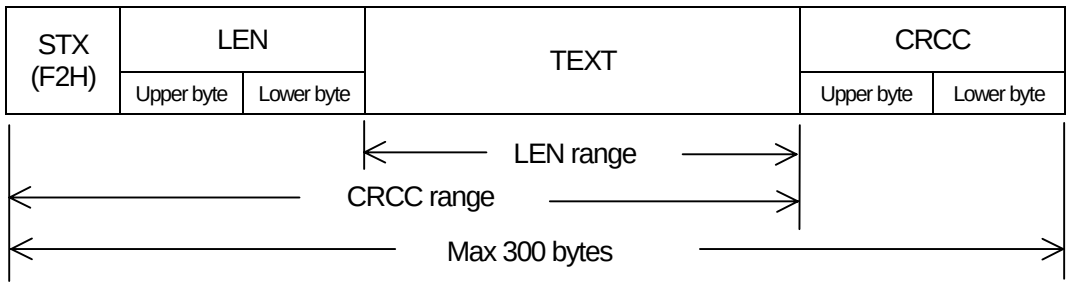
1.2 Transmission control method

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

1.3 Transmission Control Characters

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

1.4 Transmission Format



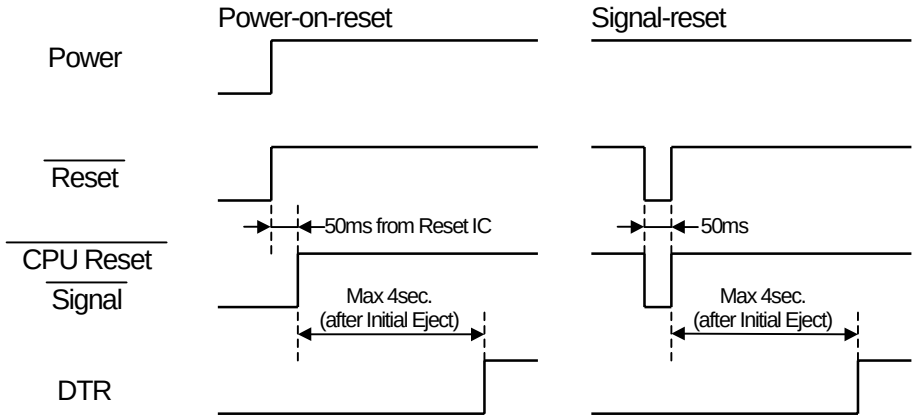
Notes 1.Gap between characters STX to CRCC is less than 250 msec.

2. Transmission / Control protocol

2.1 Timing chart

1)Power-on-reset and Signal-reset (User program code area only)

After the reset operation, ICRW ejects the card in ICRW. "DTR" is turned on after the card was ejected.
The HOST should monitor if the ICRW turn on "DTR" after power-on-reset or signal-reset.
For the signal reset, the reset line should be activating more than 50msec.
The time concerning ICRW initializing and card discharging is a maximum of 4sec at the time of card jam was occurring.
At the time of RAS mode operation, “DTR” is not turned on until ICRW ends RAS operation and changes to the normal mode. “DTR” is turned off while detecting the fall of power supply voltage.



2)LED blinking after reset

On normal reset operation, ICRW blinks green LED. The blinking interval is 2 sec.
If the user area program is illegal condition, card is not ejected and the blinking interval is 1 sec.
After receiving the initial command correctly, ICRW turns off LED.

3) Data gap

During reception mode, if 250ms Time-out occurs, ICRW assumes receiving the Text characters data is completed.

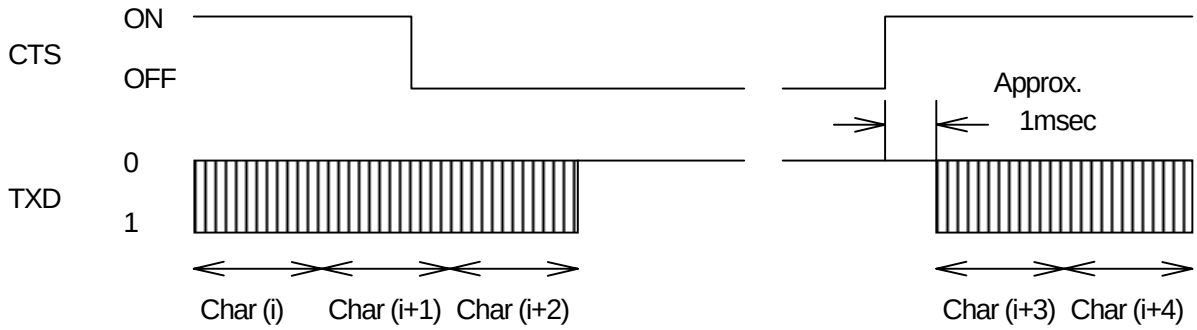
4) Monitoring state of HOST

ICRW is monitoring "DTR" from HOST.
When "DTR" is off, ICRW considers that the state of HOST is not normal and interrupts the command under execution.
It depends on specification by initialize command whether a card ejects after that.

5) Cancel/Resume of transmission (User program code area only)

During text transmission from ICRW, when CTS signal goes OFF, ICRW stops its transmission with Max 2 characters' delay.

After CTS is turned on, text transmission is resumed within about 1msec.



6) Eject Operations (User program code area only)

All of eject operations caused by reset, power down, DSR off, initial command and eject command moves card to a gate and a card stops in the state where it was held at the roller.

Therefore, the eject2 command is not necessary to 8bit mode.

2.2 Cancel of command (User program code area only)

When ICRW receives "DLE,EOT", ICRW will interrupt execution of a command immediately.

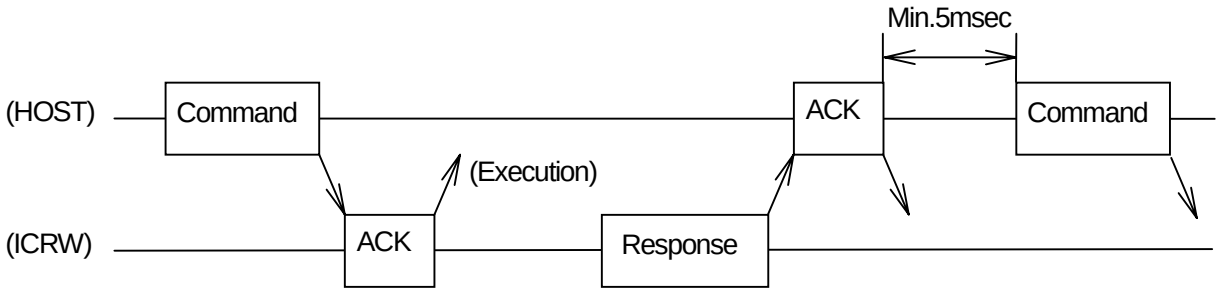
And then ICRW transmits "DLE,EOT" and waits for the following command.

If "DLE,EOT" is received during response transmission, ICRW will be in the state waiting for a command, after it completes response transmission.

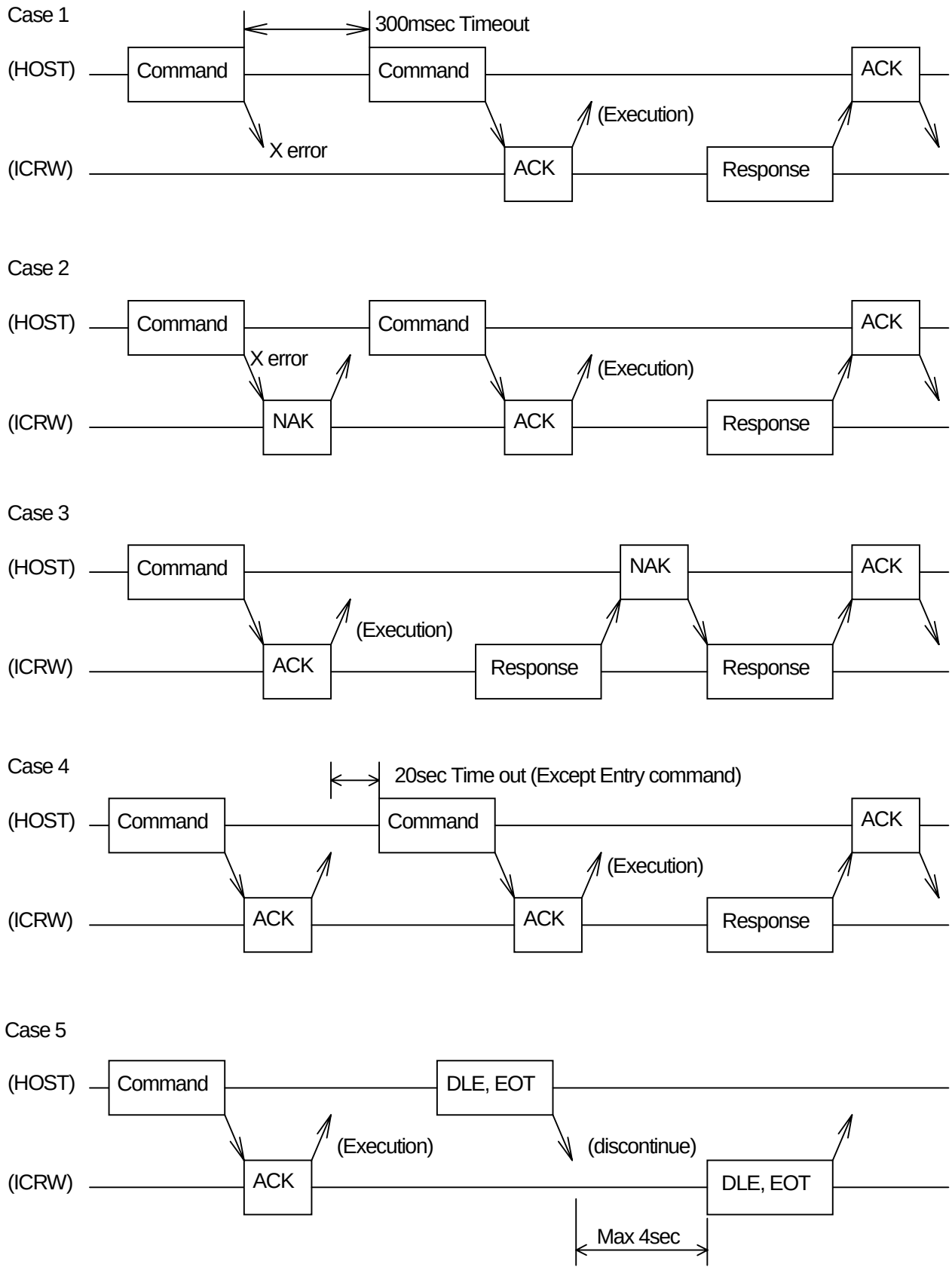
If "DLE,EOT" is received for the entry, retrieve, and eject commands at the time of execution, each operation will be interrupted and a card will be ejected.

2.3 Protocol

2.3.1 Ordinary operation



2.3.2 Irregular operation and back-up



2.3.3 State transition matrix

1) HOST

Character Mode	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
(2) Wait for response after ACK	Ignore	Ignore	Go to (3)	Ignore	Re-send command Go to (1)* (except Entry)	20sec
(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.

2)ICRW

Character Mode	ACK	NAK	STX(F2H)	DLE,EOT	Others	Time out	Timer
(1) Neutral	Ignore	Ignore	Go to (2)	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)	250msec
(3) Wait for Text	Receive Text in the Length bytes. Receive the Length bytes then go to (4)					Send NAK & go to (1)	250msec
(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)	250msec
(5) Wait for ACK after sending Resp	Go to (1)	Resend Resp. Go to (5)	Go to (2)	Go to (1) after send DLE,EOT	Ignore	go to (1)	300msec

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

3. Command /Response

HOST sends command to ICRW and instruct operation.
Command is followed by data necessary for operation.
ICRW sends result of execution as response.
Command must be transmitted more than 5msec after sending ACK to the response from ICRW.

3.1 Text format

An ASCII code is expressed as shown in "C", and a binary code is shown like 30H (= "0") by hexadecimal.
Command and response format is as follows.

"C"	30H	30H	Data (Binary 2bytes)

Especially when not written clearly, it becomes 1 byte of one division. The division surrounded by the dotted line shows the data which may not be considered as the case where it exists.

1) Command format (HOST -> ICRW)

"C"	cm	pm	Data

cm: Command code
pm: Parameters

This is the format of the command transmit to ICRW from HOST.
The first character should be "C"(=43H).
There are commands with data part and without data part.

2) Positive response format (ICRW -> HOST)

"P"	cm	pm	st1	st0	Data

st1,st0: Status code

This is the format of response when command was executed normally.
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.
(pm : except for IC card control)

3) Negative response format (ICRW -> HOST)

"N"	cm	pm	e1	e0	Data

e1,e0: Error code

This is the format of response when command was executed abnormally.
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.
(pm : except for IC card control)

3.2 Structure of Firmware areas

Firmware of ICRW is divided into two parts.

(1) Supervisor program code area
To execute the download and rewrite the firmware of a user part with directions of HOST.
HOST can not rewrite this area.

(2) User program code area
This area usually performs control of the function of ICRW.
HOST can reprogram this area (under 100 times).
If the firmware is downloaded normally in this area, ICRW executes the program in it after power-on.
So HOST usually doesn't care Supervisor program code area.

In case error response "02" arises in initialize command,User program code area is abnormal condition.
This state shows that ICRW executes Supervisor program code area.
And it needs to perform user part program rewriting by the download from HOST.

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.

In addition to this, the firmware holds the sensor adjustment value for card detection,
the download counter of user program code area, and the path counter, as non-volatility data.
Moreover, since a firmware does not have the function of execution record of a command,
or memory dumping, it needs the communication log of HOST for the analysis of an error.

4. Supervisor program code area

4.1 Command list

cm: Command code pm: Parameters

Command	cm	Function	pm	Details of operation
INITIALIZE	30H	Initialize ICRW	30H	Designate communication format
REVISION	41H	Revision	30H	Send the revision 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
SWITCH	4BH	Area switch	30H	Switch to the User program code area

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

4.2 Status code

st1, st0 : ICRW status code

status code	Meaning
"00"	always "00" in Supervisor program code area.

4.3 Error code

e1, e0 : error code

error code	Meaning
"00"	A given command code is unidentified
"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
"B0"	Not received Initialize command

5. Command explanation of Supervisor program code area

5.1 Initialize command

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

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

fm : Not use. Always 30H.

A positive response is not transmitted to HOST with the initialization command of Supervisor program code area.
A response is surely set to negative response and returns the error code “02” to HOST.

5.2 Revision command

Command	"C"	41H	30H			
Positive response	"P"	41H	30H	30H	30H	Supervisor code area revision (ASCII 8bytes)
Negative response	"N"	41H	30H	e1	e0	

Eight characters that show firmware revision of Supervisor program code area
are added to an positive response, and it transmits to HOST.
Ex) "1234-01A"

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.

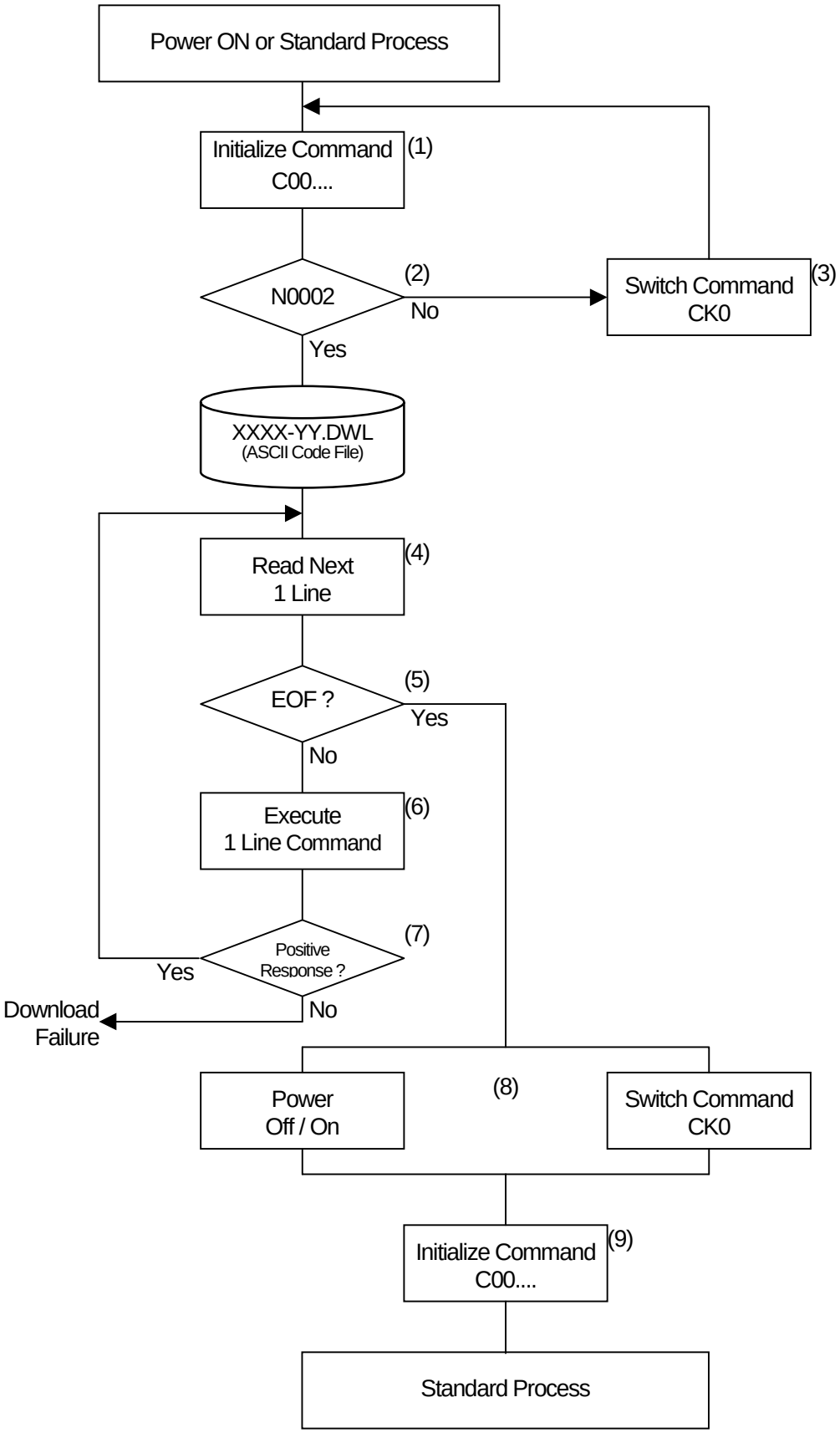
Structure of the file for downloading

```
Rev1234-01A [CRLF]                                          <= Sankyo revision Header
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)
```

Explanation of the download procedure

(1) Execute the Initialize command.
(2) If response is "N0002", the program in "Supervisor Program Area" is executed and goes to (4).
(3) If response is not "N0002", 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 except of CRLF that Sankyo supplies for line by line.
(5) If Host finds EOF then goes to (8). Downloading is completed.
(6) The characters read by (3) are sent to ICRW as a command.
(7) If ICRW detected positive response, goes to (4).
If ICRW detected negative response, downloading is failure.
(8) Reboot or change to "User Area Command" using "Switch command".
(9) Execute "Initialize command" and execute standard process.

The flow chart of the download procedure



5.4 Switch command

Command	"C"	4BH	30H		
Positive response	"P"	4BH	30H	30H	30H
Negative response	"N"	4BH	30H	e1	e0

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.

ex) Under the supervisor program code area operation

↓

Switch command “CK0”

↓

Switch the control to User program code area

↓

Execute initialize command of user program code area

↓

Usual operation

6. User program code area

6.1 Command list

List1 cm: Command code pm: Parameters

Command	cm	Function	pm	Details of operation
INITIALIZE	30H	Initialize ICRW	30H	Initialize and designate ICRW and eject a card
			31H	Initialize and designate ICRW and capture a card
			32H	Initialize and designate ICRW and re-positioning a card
			33H	Initialize and designate ICRW with no card operation
		Initialize ICRW And Set capture counter	34H	pm=30H and set old model compatible capture counter
			35H	pm=31H and set old model compatible capture counter
			36H	pm=32H and set old model compatible capture counter
STATUS REQUEST	31H	Inquire status	30H	Report presence of card and its position
			31H	Report presence of sensor status in detail
ENTRY	32H	Card Entry	30H	Card Entry (Mag-Track read)
CARD CARRY	33H	Eject	30H	Move card to Gate from inside of ICRW
		Capture	31H	Capture card to rear side of ICRW
RETRIEVE	34H	Retrieve	30H	Retrieve card from eject position
LED	35H	LED Off	30H	All Color LED Off
		LED Green On	31H	Green On from All Off or directly from Other Color On
		LED Red On	32H	Red On from All Off or directly from Other Color On
		LED Orange On	33H	Orange On from All Off or directly from Other Color On
Mag-Track READ	36H	ISO #1 read	31H	ISO Track #1 reads Transmit read data
		ISO #2 read	32H	ISO Track #2 reads Transmit read data
		ISO #3 read	33H	ISO Track #3 reads Transmit read data
		JIS II read	34H	JIS II Track reads Transmit read data
		All tracks read	35H	Transmit All channel data
		Read Status	37H	Data buffer status read
		ISO#1 another read	39H	ISO Track #1 reads Transmit read data
		ISO#2 another read	3AH	ISO Track #2 reads Transmit read data
		ISO#3 another read	3BH	ISO Track #3 reads Transmit read data
		JIS II another read	3CH	JIS II Track reads Transmit read data
ENABLE / DISABLE	3AH	Enable	30H	Enable card entry
		Disable	31H	Disable card entry
PORT IN / OUT	3DH	Mode Change	30H	Enter maintenance mode
			31H	Release maintenance mode
		Output port	32H	Check operation of a motor and solenoid.
		Input port	33H	Check operation of a sensor.
SENSOR LEVEL TRANSMIT	3EH	NORMAL check	30H	Transmit the sensor A/D level on normal condition
		for ADJUST	31H	Transmit the sensor A/D level on adjust condition

List 2 cm: Command code pm: Parameters

Command	cm	Function	pm	Details of operation
REVISION	41H	Revision	31H	Revision of User program code area
			32H	Revision of ICC control code area
COUNTER	43H	Capture Counter Read	30H	Inquire of card capture count (Compatible)
		Capture Counter Set	31H	Set card capture count (Compatible)
		Pass Counter Read	32H	Inquire of card pass count
		Capture Counter Read	33H	Inquire of card capture count (Standard)
		Capture Alert Count Set	34H	Set capture alert count (Standard)
IC CARD CONTROL	49H	Power on	30H	Power Supply and Activate to IC card
		Power off	31H	Deactivate to IC card
		Status request	32H	Inquire of ICR status for IC card
		Communication 0	33H	Exchange data with IC card by T=0 protocol
		Communication 1	34H	Exchange data with IC card by T=1 protocol
		Communication1-1	35H	Transmit chaining data to IC card by T=1 protocol
		Communication1-2	36H	Transmit Last chaining data to IC card by T=1 protocol
		Communication1-3	37H	Require of chaining data by T=0 / T=1
		Warm Reset	38H	Warm reset to IC card
		Automatic Communication	39H	Exchange data with IC card by automatic protocol recognition
SAM CONTROL	49H	Activate	40H	Power Supply and Activate to IC card
		Deactivate	41H	Deactivate to IC card
		Status	42H	Inquire of ICR status for IC card
		Communication 0	43H	Exchange data with IC card by T=0 protocol
		Communication 1	44H	Exchange data with IC card by T=1 protocol
		Communication1-1	45H	Transmit chaining data to IC card by T=1 protocol
		Communication1-2	46H	Transmit Last chaining data to IC card by T=1 protocol
		Communication1-3	47H	Require of chaining data by T=0 / T=1
		Warm Reset	48H	Warm reset to IC card
		Automatic Communication	49H	Exchange data with IC card by automatic protocol recognition
		Select SAM	50H	Select SAM.
SWITCH	4BH	Area switch	30H	Switch to Supervisor program code area.

List 3 cm: Command code pm: Parameters

Command	cm	Function	pm	Details of operation
Siemens Memory Card Control	52H	Power on	30H	Power Supply and Activate to Siemens card
		Power off	31H	Deactivate to Siemens card
		Status request	32H	Inquire status of Siemens card
		Communication	33H	Exchange data for 4442 card
		Communication	34H	Exchange data for 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
Contactless IC CARD CONTROL	5AH	Contactless ICRW	33H	Contactless ICRW control
		Communication 1	34H	Exchange data with IC card by T=CL protocol
		Communication 2	35H	Transmit chaining data to IC card by T=CL protocol
		Communication 3	36H	Transmit Last chaining data to IC card by T=CL protocol
		Communication 4	37H	Require of chaining data by T=CL
		Reset	38H	Reset Contactless ICRW

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.

6.2 Status code

st1, st0 : ICRW status code

status code	Meaning
"00"	No card detected within ICRW (including card gate)
"01"	Card locates at card Gate
"02"	Card locates inside ICRW (Transport)

6.3 Error code

List 1 e1, e0 : error code

error code	Meaning
"00"	A given command code is unidentified
"01"	Parameter is not correct
"02"	Command execution is impossible.
"03"	Function is not implemented.
"04"	Command data error
"05"	
"06"	
"07"	
"08"	
"09"	
"10"	Card jam
"11"	Shutter error
"12"	
"13"	Irregular card length (LONG)
"14"	Irregular card length (SHORT)
"15"	Flash Memory Parameter Area CRC error
"16"	Card position Move (and Pull out error)
"17"	Jam error at retrieve
“18”	Two card error
"19"	

List 2 e1, e0 : error code

error code	Meaning
"20"	Read Error (Parity error)
"21"	Read Error (Other errors)
"22"	
"23"	Read Error (Only Start sentinel - End sentinel - LRC Card)
"24"	Read Error (No Magnetic Data)
"25"	
"26"	
"27"	
"28"	
"29"	
"30"	Power Down
"31"	DSR signal was turned to OFF
"32"	
"33"	
"34"	
"35"	
"36"	
"37"	
"38"	
"39"	Electric fan breaks down.

List 3 e1, e0 : error code

error code	Meaning
"40"	Pull Out Error
"41"	
"42"	
"43"	IC Positioning Error
"44"	
"45"	
"46"	
"47"	
"48"	
"49"	
"50"	Capture Counter Overflow Error
"51"	
"52"	
"53"	
"54"	
"55"	
"56"	
"57"	
"58"	
"59"	
"60"	Abnormal condition was found on the power-line (Vcc) of ICC.
"61"	Answer to reset was not received from IC card.
"62"	The specified protocol does not agree with that of IC card.
"63"	Protocol error (ICC does not respond).
"64"	Protocol 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 Protocol ISO/IEC7816-3.
"67"	
"68"	
"69"	Tried to communicate with IC card not supported in Protocol EMV'96 ver3.1.1.
"73"	EEPROM error
"B0"	Not received Initialize command.

7. Command explanation of User program code area

7.1 Initialize command

* * * * =>See Notes 1

Command	"C"	30H	pm	33H	32H	34H	31H	fm	Pd	Ty	Ds	Cc	Re
Positive response	"P"	30H	pm	st1	st0	Type recognizing code (ASCII 16bytes)							
Negative response	"N"	30H	pm	e1	e0								

This command set the operation conditions for ICRW and initializes ICRW.
Execute this command whenever power on, reset and code area change from supervisor program to user program by switch command.
If this command is executed when the card is in the ICRW, the ICRW moves the card according to the parameter of the command.
When the enable condition of the card insertion, this command disables the card insertion condition.
This command returns the ICRW from various error conditions to normal condition.
And this command clears the mag stripe data buffer.

Notes 1. * These parameters have no meaning, but remained for the command format compatibility to the command format of the other models. The parameter codes 30H to 34H are admitted as the correct parameter to get positive response with the type recognizing code under the condition that the model type is unknown.

pm : This parameter sets the card move mode and the conventional model compatible capture counter mode.
- 30H, 34H : Eject the card to the gate portion and finish the command even if the card is not taken out.
- 31H, 35H : Capture the card to the rear side.
- 32H, 36H : Re-position the card to the home position in the ICRW.
- 33H : Don't move the card.
- 30H – 33H : Turn off the conventional model compatible capture counter.
- 34H – 36H : Turn on the conventional model compatible capture counter.

fm : Not used. Always 30H. (This code is not omissible.)

Pd : Power down card control
- 30H : The ICRW ejects the card in the ICRW. (Default value at omit this code)
- 31H : The ICRW keeps the card in the ICRW.

Ty : Reader type recognition code control

30H: No data is contained in the response. (Default value at omit this code)

31H: Response includes type recognition code.

Type recognition code (16bytes)	ISO#1	ISO#2	ISO#3	JIS II	IC contact	RF	Pinpad	Capture	Fan	Full Shutter	"0"	SAM1	SAM2	SAM3	SAM4	SAM5
	Magnetic Head : "0" = Not Available "1" = Available				Function : "0" = Not Available "1" = Available							SAM Information : "0" = Socket is not mounted "1" = Socket is empty "2" = SAM is inserted "3" = SAM is inserted but Vcc error				

Ds : DSR off card control

30H : ICRW ejects the card in ICRW (Default value at omit this code)

31H : ICRW keeps the card in ICRW

Cc : Standard capture counter control

30H : Turn off the standard capture counter (Default value at omit this code)

31H : Turn on the standard capture counter

Re : Reset eject control

This code sets on / off of the card eject function after power on and reset. The setting is memorized and is available after the next reset condition.

30H : Turn on the reset eject function. The ICRW eject the card to the gate after reset.

31H : Turn off the reset eject function. The ICRW don't eject the card after reset.

Omit : The previous value is valid.

Default : If the value has never been set, the ICRW control the card according to the following default value.

ICRW without the capture function : 30H (The ICRW ejects the card)

ICRW with the capture function : 31H (The ICRW don't eject the card)

Notes Pd, Ty, Ds, Cc and Re are omissible. When Pd, Ty, Ds or Cc are not set, these are set "0" a default value.
When Re is not set, the ICRW control the card according to the previous value.
When power failure occurs at the same timing of DSR OFF, power failure handling routine has priority.

7.2 Status request command

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

Negative response is sent against Status request command if mechanical failure remains from the prior operation.

pm=30H :Report current status of after execution of previous command ICRW.
pm=31H :Response is returned in form of “Se”, with the status information obtained.
“Se” is added also in the time of negative response transmission.

The locations of sensor are referred to appearance drawing.

	b7							b0	
Se=	0	X	X	X	X	X	X	X	(binary)

Card Width Sensor (full shutter model) or PD1 (pin shutter model)
1: Card exists, 0: Card does not exist
PD2 1: Card exists, 0: Card does not exist
PD3 1: Card exists, 0: Card does not exist
PD4 1: Card exists, 0: Card does not exist
PI1 1: Shutter Close, 0: Shutter Open
PI2 1: IC Contact is set, 0: IC Contact is not set
(The IC contact is set mechanically at the card entry)
CAP 1: Capture Sensor Connector High Level
0: Capture Sensor Connector Low Level
(This connector terminal is pulled up, therefore this bit is “1” when the connector is open or no mount.)

7.3 Entry command

Command	"C"	32H	pm	mg	
Positive response	"P"	32H	pm	st1	st0
Negative response	"N"	32H	pm	e1	e0

This is to accept to carry the card inside ICRW. This command doesn't allow ICRW to send response to HOST until ICRW completes to carry the card inside ICRW.
If ICRW can not move the card on the way of carrying it, ICRW sends jam error "10" to HOST.
If another card already stays inside ICRW, ICRW sends error "02" to HOST.
Send DLE,EOT from HOST in order to cancel this command.
While the card is carried inside ICRW, data on the mag stripe is read to data buffer by ICRW.
(Even if read error occurs, ICRW sends positive response to HOST upon completion of carrying the card inside ICRW.)
If ICRW is in the ENABLE mode, ICRW sends execution impossible error to HOST.

pm=30H : To accept the card
When receiving the command with this parameter, ICRW becomes card insertion waiting mode.
After detecting a card insertion, ICRW rotate the motor forward and carry the card into inside of ICRW.
When ICRW completes to carry the card to the rear end of ICRW, ICRW closes the shutter.
ICRW stops the motor and sends positive response.
If the card is pulled out before roller catch the card, ICRW becomes card insertion waiting mode again without error response.
Then, if a card is not inserted for 5sec, card ejecting error "40" will be transmitted to HOST.

mg=30H : Mag data detect Off
ICRW executes card accept operation without mag data detection. "mg" is omissible and this value is default.
mg=31H : Mag data detect On
ICRW executes card accept operation with mag data detection. If mag data is not detect, ICRW stops the card accept operation and eject the card with negative response "24" (No mag error) .
The point of mag data detection is approx. 34mm from card front edge.

7.4 Card carry command

Command	"C"	33H	pm		
Positive response	"P"	33H	pm	st1	st0
Negative response	"N"	33H	pm	e1	e0

pm=30H : EJECT

ICRW moves the card from inside of ICRW to Gate with roller on position.
After executing this command, ICRW can execute a retrieve command.
After card was ejected, ICRW executes a status request command, and when the status code is "00", it is shown that the card was completely pull out from the gate.
It takes a maximum of 7sec after ICRW receives a command until it returns a response.
If a card is not in ICRW, ICRW does not executes the card move operation and returns positive response.

pm=31H : CAPTURE

ICRW moves the card from inside of ICRW to rear side.
After card was captured, ICRW executes a status request command and when its status code is "00", it is shown that the card was completely discharged from the ICRW.
It takes a maximum of 7sec after ICRW receives a command until it returns a response.
If a card is not in ICRW, ICRW sends error "02" to HOST against receipt of this command.

7.5 Retrieve command

Command	"C"	34H	30H		
Positive response	"P"	34H	30H	st1	st0
Negative response	"N"	34H	30H	e1	e0

ICRW moves card from gate with roller on position to inside of ICRW.
This command is available after Eject command.

This command does not ensure mag stripe read operation for read command after this command.

7.6 LED command

Command	"C"	35H	pm		
Positive response	"P"	35H	pm	st1	st0
Negative response	"N"	35H	pm	e1	e0

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

pm=30H : LED Off
pm=31H : LED Green On
pm=32H : LED Red On
pm=33H : LED Orange On

7.7 Mag-Track Read command

Command	"C"	36H	pm			
Positive response	"P"	36H	pm	st1	st0	Read Data (ASCII Max 219bytes (pm=35H))
Negative response	"N"	36H	pm	e1	e0	Read Data (ASCII Max 104bytes (pm=3BH))

pm=31H : read data on ISO Track #1
pm=32H : read data on ISO Track #2
pm=33H : read data on ISO Track #3
pm=34H : read data on JIS II

When ICRW takes in a card, the magnetic data read into the buffer is edited and is converted into an ASCII code. If this data is normal, it will transmit to HOST as read data.
The data transmitted to HOST excepts the Start code, End code, and LRC on mag stripes.
The command with the above parameters allows ICRW not to read the card, but only to transmit the data of buffer, which have been normally read during the card acceptance.
When Read Error occurs, ICRW sends negative response.
In case of card jamming, ICRW sends negative response too.

When the card has no magnetic track, ICRW makes no retrying and sends negative response (Error code "24" is no magnetic track).
When the card has a track with the sentinels but no data, ICRW sends negative response (error code"23")

EX) ISO Track #1 (Max 76bytes)

bit	5 4 3 2 1 0		
data=0	0 1 0 0 0 0	->	30H
data=A	1 0 0 0 0 1	->	41H

ISO Track #2 (Max 37bytes)

bit	3 2 1 0		
data=0	0 0 0 0	->	30H
data=9	1 0 0 1	->	39H

ISO Track #3 (Max 104char)

bit	3 2 1 0		
data=0	0 0 0 0	->	30H
data=9	1 0 0 1	->	39H

JIS II Track (Max 69bytes)

bit	6 5 4 3 2 1 0		
data=0	0 1 1 0 0 0 0	->	30H
data=A	1 0 0 0 0 0 1	->	41H

pm=35H : All tracks simultaneous read and transmit.

The contents of read data are the order of track 1 data, track 2 data, track 3 data, and JIS II track data.
Among those, a maximum of three tracks to which ICRW corresponds are transmitted by HOST on both sides of separator “7EF”.
When one of the tracks is not read, its data area becomes blank.
Either of the tracks are not read, error "20","21","23" or "24" is sent to HOST.

Ex)

Track 1 Data	7EH	Track 2 Data	7EH	Track 3 Data

(Max 219bytes)

pm=37H : Indicates in response if track is encoded/not encoded.

ICRW doesn’t carry the card.
ISO#1: 30H: ISO #1 is not encoded. 31H: ISO #1 is encoded.
ISO#2: 30H: ISO #2 is not encoded. 31H: ISO #2 is encoded.
ISO#3: 30H: ISO #3 is not encoded. 31H: ISO #3 is encoded.
JIS II : 30H: JIS II is not encoded. 31H: JIS II is encoded.

ISO#1	ISO#2	ISO#3	JIS II

30H : 31H :

pm=39H : read data on ISO Track #1 by another way.
pm=3AH : read data on ISO Track #2 by another way.
pm=3BH : read data on ISO Track #3 by another way.
pm=3CH : read data on JIS II by another way.

The above parameters differ from pm=31H,32H,33H and 34H in the following contents.
If the parity error occurs, the ICRW tries to send the data row before the error portion.
This partial readied data is concatenated the negative response.
If start sentinel is not detected, ICRW doesn’t read data.

7.8 Enable/Disable command

Command	"C"	3AH	pm	mg	
Positive response	"P"	3AH	pm	st1	st0
Negative response	"N"	3AH	pm	e1	e0

Control command to accept/inhibit card entry. ICRW sends response upon receipt of this command.
ICRW status should be recognized by Status request command from HOST.
Choose Enable/Disable command or Entry command according to customer's control system.
Although a card will be taken in if the enable command is executed when the discharged card is in a gate position, the reading result of magnetic data is not guaranteed.
Since execution of the entry command becomes impossible at the time of enable command execution, combined use of the enable command and the entry command cannot be performed.

pm=30H : Enable to accept card . (Enable mode)
ICRW is changed into a card entry state, and positive response is immediately transmitted to HOST.
And ICRW detected insertion of a card at a gate, it will rotate a motor in the right direction and will take in a card to inside. If a card is drawn out before being taken in by the roller, ICRW will suspend a motor and will be again set to card entry state.
If a card is conveyed to an internal rear side, motor will stop its rotation and a shutter will be closed automatically. In this operation, a response is not transmitted to HOST.

pm=31H : Disable to accept card. (Disable mode)
It changes into a prohibition state from the permission state of accepting a card.

mg=30H : Mag data detect Off
ICRW executes card accept operation without mag data detection.
"mg" is omissible and this value is default.

mg=31H : Mag data detect On
ICRW executes card accept operation with mag data detection. If mag data is not detect, ICRW stops the card accept operation and eject the card with negative response "24". (No mag error)
The point of mag data detection is approx. 34mm from card front edge.

Notes; 1) Enable mode change automatically to Disable mode in case of the following conditions.
* Receipt of Initialize command.
* When power failure occurred.
* ICRW detects DSR signal off.

7.9 Port In/Out command

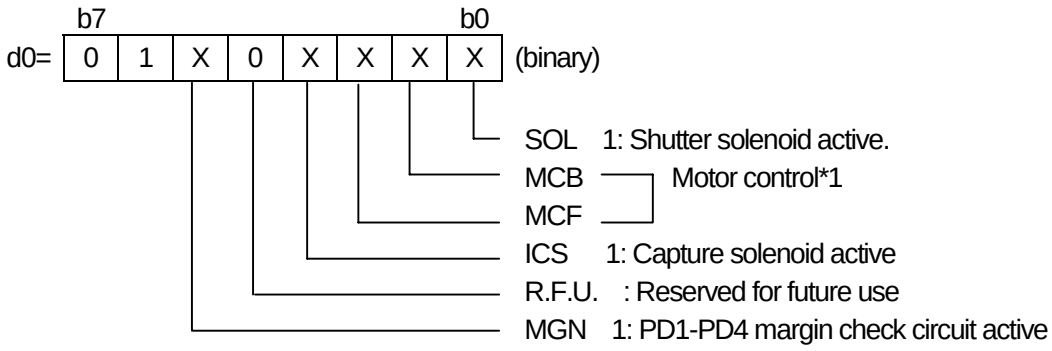
Command	"C"	3DH	pm	d0	
Positive response	"P"	3DH	pm	st1	st0	Se0
Negative response	"N"	3DH	pm	e1	e0	

This is to check ICRW in maintenance. Operation checks can be done by this command for the motor, the solenoids, the switch, and the sensors.

pm=30H : To enter maintenance mode.
In this mode, no commands other than initialize or switch command can be executed.
After executing initialize or switch command, ICRW will usually return from maintenance mode to Normal mode automatically.

pm=31H : To release maintenance mode.
ICRW is returned from maintenance mode to normal mode.
Eject the card if it is within the reader transport.

pm=32H :To output port.
To designate the operation for the motor and solenoids.

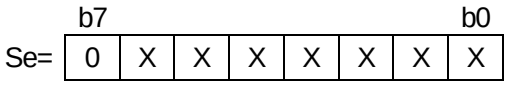


*1 MCB:1, MCF:1 — BRAKE; MCB:1, MCF:0 — FWD; MCB:0, MCF:1 — BWD; MCB:0, MCF:0 — BRAKE

Note: Every function can not be simultaneously performed.

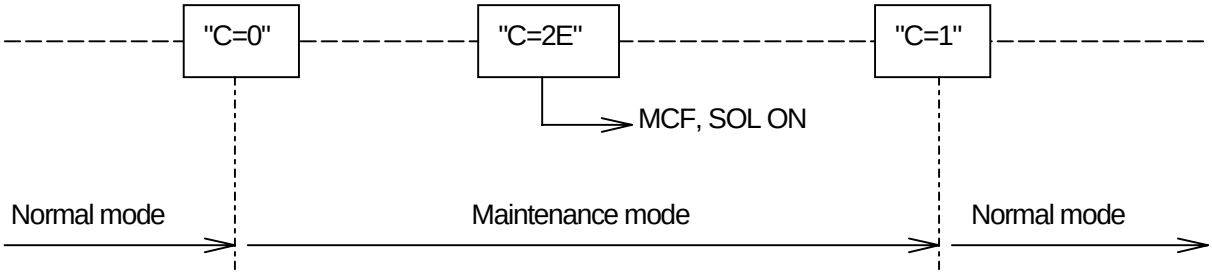
pm=33H : To input port.

To input the status on the switch and the sensors.



Card Width Sensor (full shutter model) or PD1 (pin shutter model)
1: Card exists, 0: Card does not exist
PD2 1: Card exists, 0: Card does not exist
PD3 1: Card exists, 0: Card does not exist
PD4 1: Card exists, 0: Card does not exist
PI1 1: Shutter Close, 0: Shutter Open
PI2 1: IC Contact is set, 0: IC Contact is not set
CAP 1: Capture Sensor Connector High Level
0: Capture Sensor Connector Low Level
(This connector terminal is pulled up, therefore this bit is “1” when the connector is open or no mount.)

** Basic flow (example)



The normal mode shows command modes other than the maintenance mode.
The method of going into the maintenance mode from the normal mode is only transmitting "C=0" command shown in the above figure.
In order to return from the maintenance mode to the normal mode, please transmit "C=1" command shown in the above figure.
However, Initialize command is executed, after returning to the normal mode, when transmitting Initialize command into the maintenance mode.

7.10 Sensor Level transmit command

Command	"C"	3EH	pm										
Positive response	"P"	3EH	pm	st1	st0	v1h	v1l	v2h	v2l	v3h	v3l	v4h	v4l
Negative response	"N"	3EH	pm	e1	e0								

This command converts voltage level of photo sensor from Analog to Digital and reports the value. "vih", "vil" are upper nibble and lower nibble divided from 1 byte of A/D conversion value and 30H added respectively.

Ex) : A/D data=E5(H)
Convert to the Voltage data.
E5H = 229 (DEC) => 5[V] × (229/255) = 4.5[V] => vih=34H, vil=35H
Comparison of vi and each sensor is as follows;
v1: PD1 , v2: PD2 , v3: PD3 , v4: PD4 (PD1 is valid only the pin shutter model)

pm=30H: Emission amount of LED is normal level. If sensor voltage is less than 4.2V without any presence of card on sensor, the sensor cleaning must be done as soon as possible. (Attention)
If sensor voltage is less than 3.0V, maintenance such as sensor cleaning must be done immediately (Warning) .

pm=31H: Emission amount of LED is around one fifth of normal level.
Objective of voltage measurement with this parameter is to verify sensor work in maintenance.
If the sensor voltage is more than 1.5V without any presence of card on sensor, the sensor is normal.

7.11 Revision command

Command	"C"	41H	pm			
Positive response	"P"	41H	pm	st1	st0	Revision data (ASCII 8bytes)
Negative response	"N"	41H	pm	e1	e0	

pm=31H : Indicates User program code area revision in positive response.(Data length = 8)
ex) "1234-01A"
pm=32H : Indicates ICC controller's firmware revision in positive response.(Data length = 8)
ex) "5678-01A"

7.12 Counter command

Command	"C"	43H	pm	Counter value (ASCII Max 3bytes)		
Positive response	"P"	43H	pm	st1	st0	Counter value (ASCII Max 3bytes)
Negative response	"N"	43H	pm	e1	e0	

pm=30H : This command functions as a capture counter that has compatibility to the conventional model.
This command reports the cards capture count from the card transport to the back end of the ICRW.
The count up function operates by the pm parameter setup of the initialize command.
The capture count number is reported as the two digit of ASCII decimal number from '00' to '99'.
If a capture command is executed when The capture count number is "99", capture operation will be performed to usual and will transmit capture counter overflow error"50" to HOST.

pm=31H : This command functions as a capture counter that has compatibility to the conventional model.
This command sets the cards capture count in the ICRW.
The set capture count number should be the two digit of ASCII decimal number from '00' to '99'.

pm=32H : This command reports cards pass count of the card transport in the ICRW.
One pass is one round trip of the card in the transport.
The pass count number is reported as the seven digit of ASCII decimal number.

pm=33H : This command is for the standard capture counter function.
This command reports the cards capture count from the card transport to the back end of the ICRW.
The count up function operates by the Cc parameter setup of the initialize command.
The capture count number is reported as the three digit of ASCII decimal number from '000' to '999'.
If a capture command is executed when the capture count number is over the alart count set by the bellow function, the capture operation performs to usual and transmits thecapture counter overflow error"50" to the HOST.

pm=34H : This command is for the standard capture counter function.
This command sets the capture alert count number in the ICRW.
The set capture alert count should be the three digit of ASCII decimal number from '000' to '999'.

7.13 IC Card control command

7.13.1 ICC power on

Command	"C"	49H	30H	Vcc		
Positive response	"P"	49H	30H	st1	st0	ATR (Binary max 33bytes)
Negative response	"N"	49H	30H	e1	e0	ATR (Binary max 33bytes)

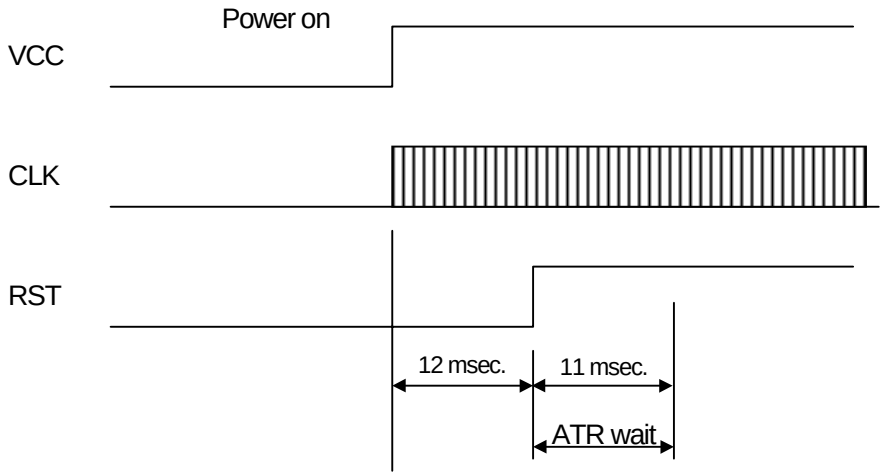
To activate IC card (ICC), power (VCC) and clock (CLK) are supplied and reset (RST) is released.
Vcc=30H : ICRW supplies with +5V to VCC and activates in line with the EMV'96.
Vcc=33H : ICRW supplies with +5V to VCC and activates in line with the ISO/IEC7816-3:97.
Vcc=35H : ICRW supplies with +3V to VCC and activates in line with the ISO/IEC7816-3:97.
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/IEC7816-3:97.
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 default value.
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,
When the ATR parameter to which ICRW does not correspond is received, ICRW will deactivate the card and will transmit error code “66” or ”69”.
When this command is executed in the state where the ICC is already activated, it is once deactivated and is activated again.
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.
ICRW will not release latch when error arises if ICC is under communication.

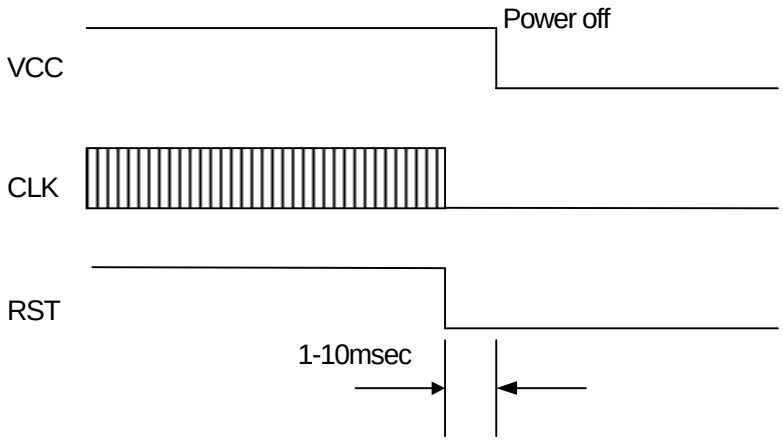
The timing chart of ICC activation



7.13.2 ICC power off

Command	"C"	49H	31H		
Positive response	"P"	49H	31H	st1	st0
Negative response	"N"	49H	31H	e1	e0

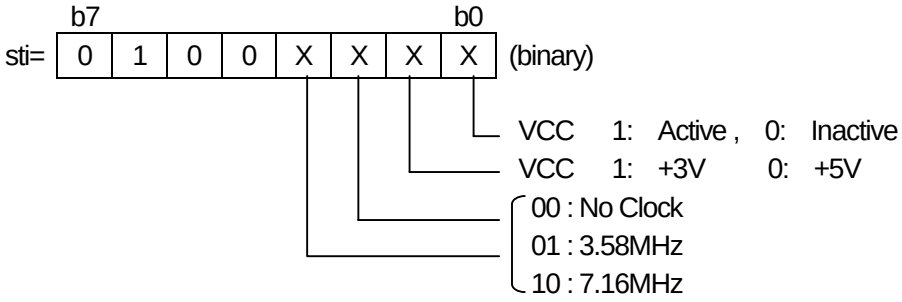
This deactivates ICC.
Time chart of deactivating ICC is as follows.



7.13.3 ICRW Status request

Command	"C"	49H	32H			
Positive response	"P"	49H	32H	st1	st0	sti
Negative response	"N"	49H	32H	e1	e0	

ICRW reports the state of IC card in the sti of a positive response.

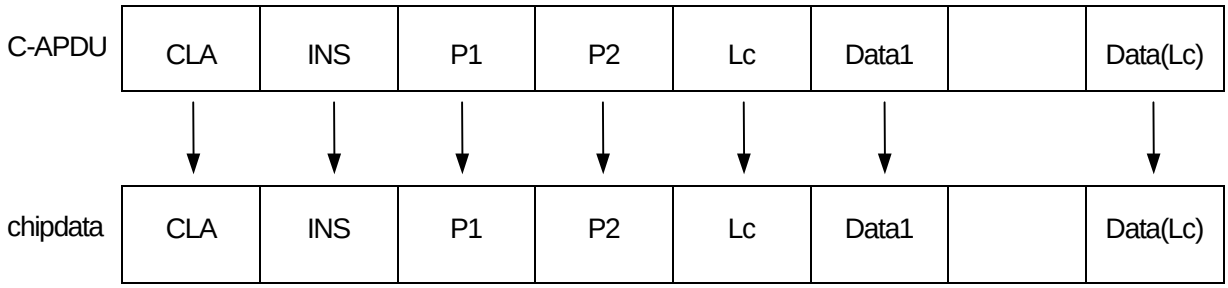


While ICC is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

7.13.4 ICC communication 0 (T=0)

Command	"C"	49H	33H	C-APDU (Binary max 261bytes)		
Positive response	"P"	49H	px	st1	st0	R-APDU (Binary max 258bytes)
Negative response	"N"	49H	33H	e1	e0	

This exchanges data between IC card by protocol T=0. About the format of C-APDU, see ANNEX 4.
ICRW sets C-APDU to chipdata and transmits to ICC.



ICRW sets to R-APDU chipdata which received from ICC, and transmits to HOST.

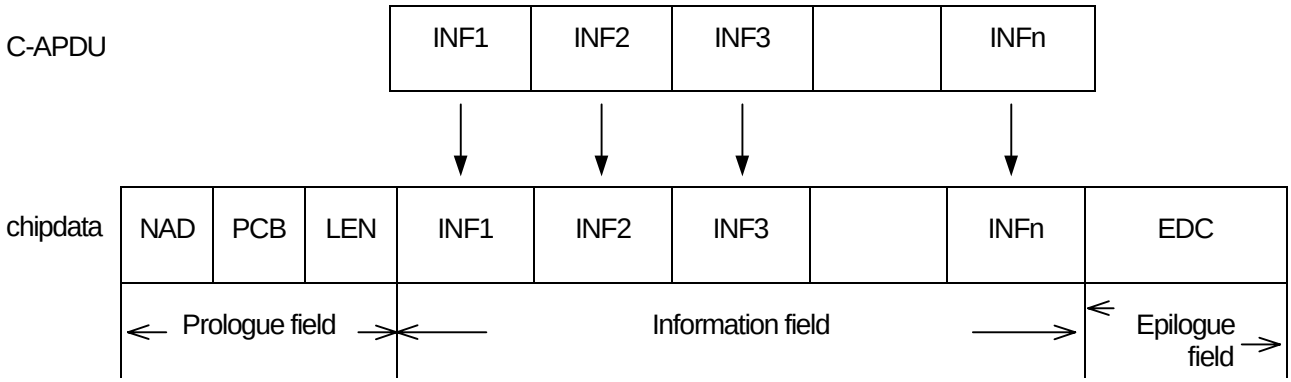
Maximum size of data ICRW can handle is 261 bytes.
px=33H : The received data from IC card is 258 bytes or less.
px=35H : The received data from IC card is 259 bytes or more.
HOST needs to receive remaining data by using "CI7" command.

If ICC is not supporting protocol T=0, error code "62" is sent.
If ICRW hang-up and cannot be recovered at the time of communication with ICC, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If ICC is not activated, error code "65" is sent.
While ICC is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution
of this command, error code "60" is sent.

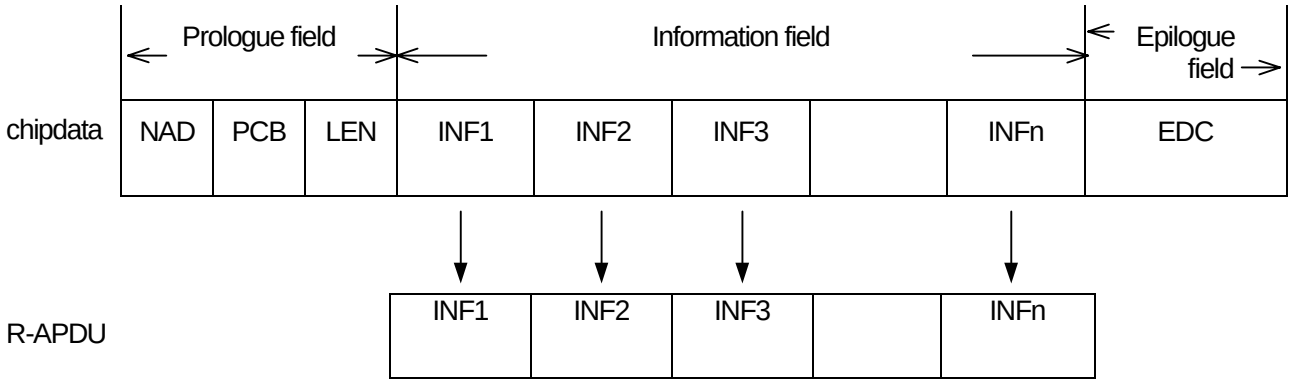
7.13.5 ICC communication 1 (T=1)

Command	"C"	49H	34H	C-APDU (Binary max 261bytes)		
Positive response	"P"	49H	px	st1	st0	R-APDU (Binary max 258bytes)
Negative response	"N"	49H	34H	e1	e0	

This exchanges data between ICC by protocol T=1.
ICRW sets C-APDU to Information field and transmits to ICC.



ICRW sets to R-APDU Information field which received from ICC, and transmits to HOST.



The data length of C-APDU is a maximum of 261 bytes.
px=34H : The received data from IC card is 258 bytes or less.
px=35H : The received data from IC card is 259 bytes or more.
ICRW requires transmitting the following data.
HOST needs to receive remaining data by using "CI7" command.
px=3FH : ICRW received ABORT request and suspended transmission of data to SAM,
and deactivated SAM. This positive response doesn't have the R-APDU.
After this operation, ICRW does not receive the transmitting command for obtaining the following data from HOST.

If ICC is not supporting protocol T=1, error code "62" is sent.
If ICRW hang-up and cannot be recovered at the time of communication with ICC, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If ICC is not activated, error code "65" is sent.
While ICC is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

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 (=261 bytes), then error code "04" shall be sent.
* If error code "02" or "04" is returned, please re-start from activation.

7.13.6 ICC communication 1-1 (T=1)

Command	"C"	49H	35H	C-APDU (Binary max 261bytes)	
Positive response	"P"	49H	px	st1	st0
Negative response	"N"	49H	35H	e1	e0

In the protocol T=1, in case the transmitted data to IC card is 262 bytes or more, this command is used repeatedly.

px=37H : ICRW requires to receive next IC card's data. There is no data portion.
When the length of data is 262 bytes or more, the remaining data is transmitted to ICRW using this command. And the length of data is 261 bytes or less, the remaining data is transmitted to ICRW using "CI6" command.

px=3FH : ICRW received ABORT request and suspended transmission of data to the IC card, and deactivated the IC card. This positive response doesn't have the R-APDU.
After this operation, ICRW does not receive the transmitting command for obtaining the following data from HOST.

If IC card is not supporting protocol T=1, error code "62" is sent.
If ICRW hang-up and cannot be recovered at the time of communication with ICC, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If ICC is not activated, error code "65" is sent.
While ICC is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

7.13.7 ICC communication 1-2 (T=1)

Command	"C"	49H	36H	C-APDU (Binary max 261bytes)		
Positive response	"P"	49H	px	st1	st0	R-APDU (Binary max 258bytes)
Negative response	"N"	49H	36H	e1	e0	

In the protocol T=1, this command is used when the last data are transmitted.

px=34H : The received data from IC card is 258 bytes or less.
px=35H : The received data from IC card is 259 bytes or more.
ICRW requires transmitting following data.
HOST needs to receive remaining data by using "CI7" command.
px=3FH : ICRW received the ABORT request and suspended transmission of data 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 ICRW hang-up and cannot be recovered at the time of communication with ICC, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If ICC is not activated, error code "65" is sent.
While ICC is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

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

Command	"C"	49H	37H			
Positive response	"P"	49H	px	st1	st0	R-APDU (Binary max 258bytes)
Negative response	"N"	49H	37H	e1	e0	

In the protocol is T=0 or T=1, if received data from IC card is 259 bytes or more, ICRW divides and receives it. And HOST should send this command repeatedly till the response "px=36H".

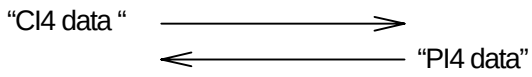
px=35H : The received data from IC card is 259 bytes or more.
ICRW requires transmitting following data.
HOST needs to receive remaining data by using "CI7" command.
px=36H : ICRW does not have more transmit IC card's data.
px=3FH : When ICC protocol is T=0, ICRW does not respond with this parameter.
ICRW received ABORT request and suspended transmission of data 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 ICRW hang-up and cannot be recovered at the time of communication with ICC, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If ICC is not activated, error code "65" is sent.
While ICC is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

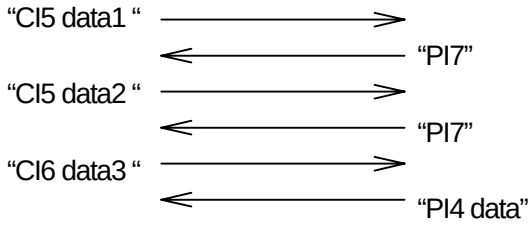
7.13.9 Example (T=1 protocol)

HOST ICRW

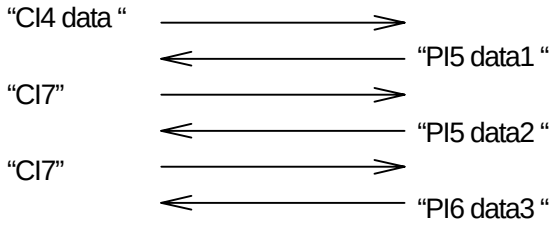
(exp.1) Transmit 261 bytes or less of data.
Receive 258 bytes or less of data.



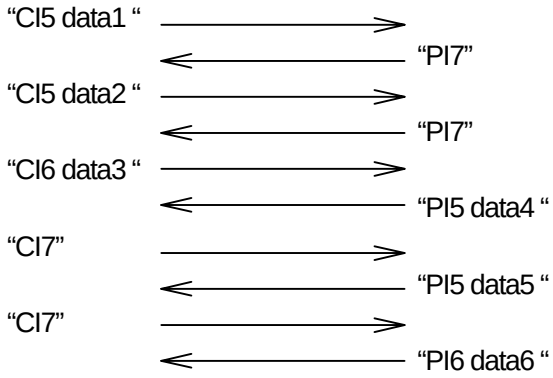
(exp.2) Transmit data by command chaining (Each data size is 261 bytes or less)
Receive 258 bytes or less of data



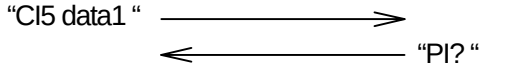
(exp.3) Transmit 261 bytes or less of data
Receive data by command chaining (Each data size is 258 bytes or less)



(exp.4) Transmit data by command chaining (Each data size is 261 bytes or less)
Receive data by command chaining (Each data size is 258 bytes or less)



(exp.5) Interruption with receipt of ABORT request



7.13.10 ICC warm reset

Command	"C"	49H	38H			
Positive response	"P"	49H	38H	st1	st0	ATR (Binary max 33bytes)
Negative response	"N"	49H	38H	e1	e0	ATR (Binary max 33bytes)

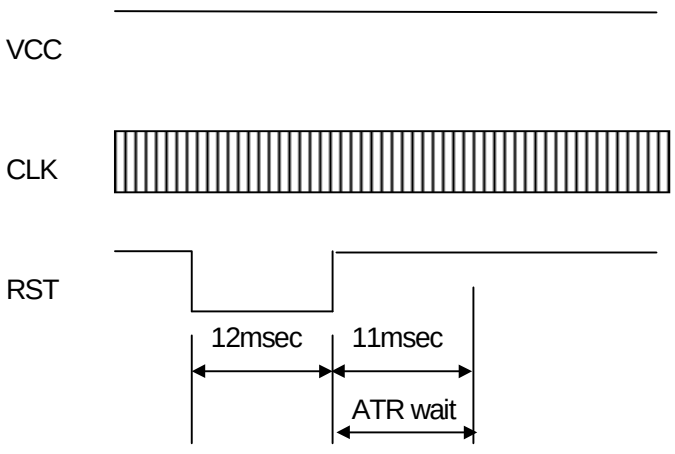
ICRW sends a reset pulse, keeping the status of the IC contact activated (VCC,CLK), then returns response upon receiving "ATR" again. The reset pulse width is around 12msec.
This command gives effect to change into the specific mode.

This command will take as error when ATR content is not based on such protocol that 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.

If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

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:



7.13.11 ICC automatic communication

Command	"C"	49H	39H	C-APDU (Binary max 261bytes)		
Positive response	"P"	49H	px	st1	st0	R-APDU (Binary max 258bytes)
Negative response	"N"	49H	39H	e1	e0	

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 4.
Set chipdata ICRW received from ICC to "R-APDU" and transmit HOST.

px=34H : The received data from IC card is 258 bytes or less.
px=35H : The received data from IC card is 259 bytes or more.
ICRW requires transmitting following data.
HOST needs to receive remaining data by using "CI7" command.
px=3FH : When ICC protocol is T=0, ICRW does not respond with this parameter.
ICRW received ABORT request and suspended transmission of data 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.

Maximum size of data ICRW can handle is 261 bytes.
When protocol is T=1, If the data for transmitting is 262 bytes or more, use command "CI5" and "CI6".

If ICC is not supporting protocol T=0 nor T=1, error code "62" is sent.
If ICRW cannot recover the communication hang-up to ICC, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If ICC is not activated, error code "65" is sent.
While ICC is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution
of this command, error code "60" is sent.

7.14 SAM (Secure Application Module) control command

7.14.1 Activate SAM command

Command	"C"	49H	40H	Vcc		
Positive response	"P"	49H	40H	st1	st0	ATR (Binary max 33bytes)
Negative response	"N"	49H	40H	e1	e0	ATR (Binary max 33bytes)

To activate SAM, power (VCC) and clock (CLK) are supplied and reset (RST) is released.
Vcc=30H: SAM supplies with +5V to VCC and activates in line with the EMV'96.
Vcc=33H: SAM supplies with +5V to VCC and activates in line with the ISO/IEC7816-3:97.
Vcc=35H: SAM supplies with +3V to VCC and activates in line with the ISO/IEC7816-3:97.
After ATR reception, SAM supplies voltage to VCC in accordance with the value of ATR on T=15.
Vcc=36H: SAM supplies with +5V to VCC and activates in line with the ISO/IEC7816-3:97.
After ATR reception, SAM supplies voltage to VCC in accordance with the value of ATR on T=15.

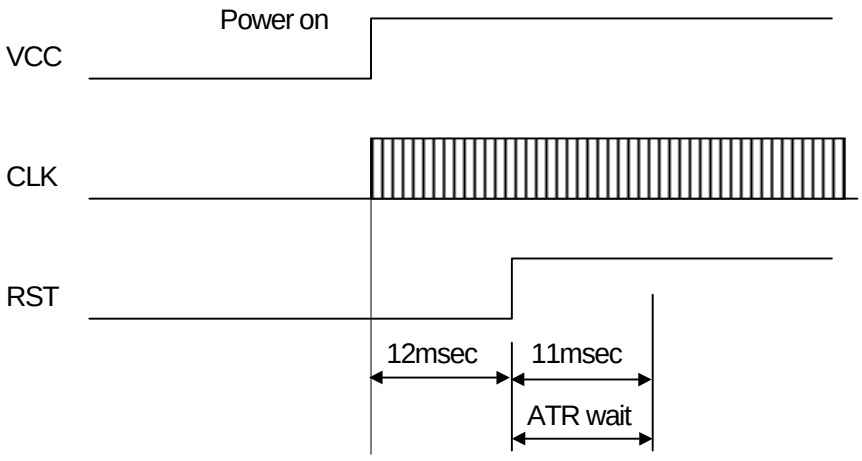
In case there is no Vcc word, it will have 30H as default value.
See ANNEX5 about sequence of activating SAM by Vcc.
Also, Answer To Reset (ATR) from SAM is received and transmitted to HOST.

ATR	TS	TO	TA1	TB1		TCK

This command will take as error, when ATR content is not based on such protocol, which is supported by ICRW, Negative response ("66" or "69") with ATR data will be sent back and ICRW will deactivate the SAM.
If excess current should be detected during power supply, error code "60" is sent.
If ATR is not be received within 12msec, after supply of RST, ICRW initiates the deactivation of SAM and sends back error code "61".

If the number of characters in the ATR exceeds 32 (including the historical bytes but not including TS), ICRW initiates the deactivation of SAM, and sends back error code " 61".

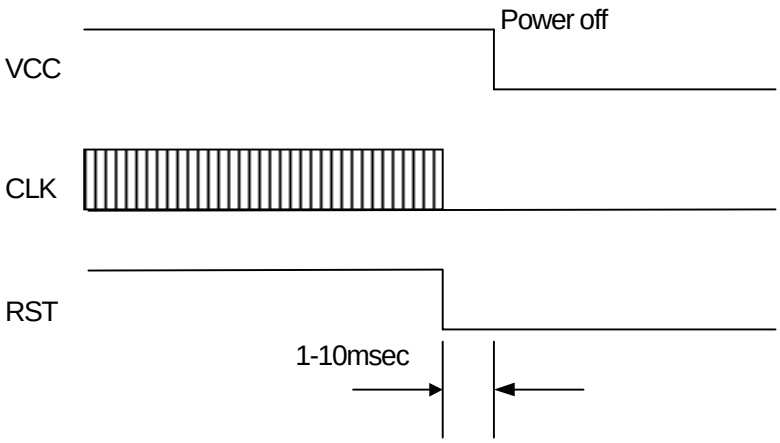
Time chart of activating SAM is as follows



7.14.2 Deactivate SAM command

Command	“C”	49H	41H		
Positive response	“P”	49H	41H	st1	st0
Negative response	“N”	49H	41H	e1	e0

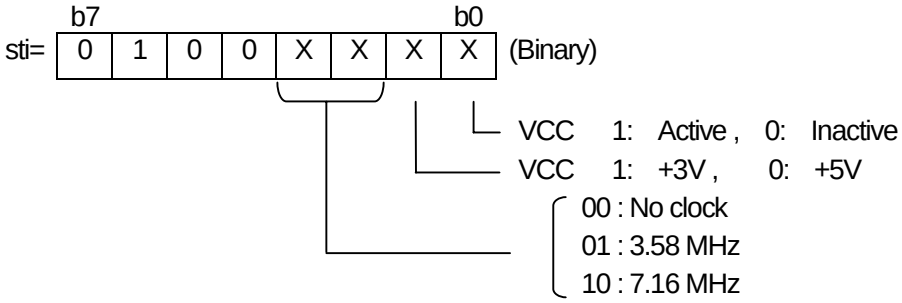
This deactivates SAM.
Time chart of deactivating SAM is as follows.



7.14.3 Inquire SAM Status command

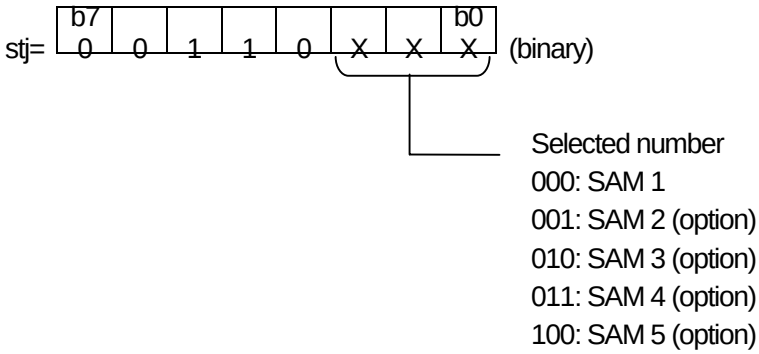
Command	"C"	49H	42H				
Positive response	"P"	49H	42H	st1	st0	sti	stj
Negative response	"N"	49H	42H	e1	e0		

This tells the status of SAM (sti).



While SAM is being activated, ICRW is monitoring VCC to detect excess current of VCC. If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

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

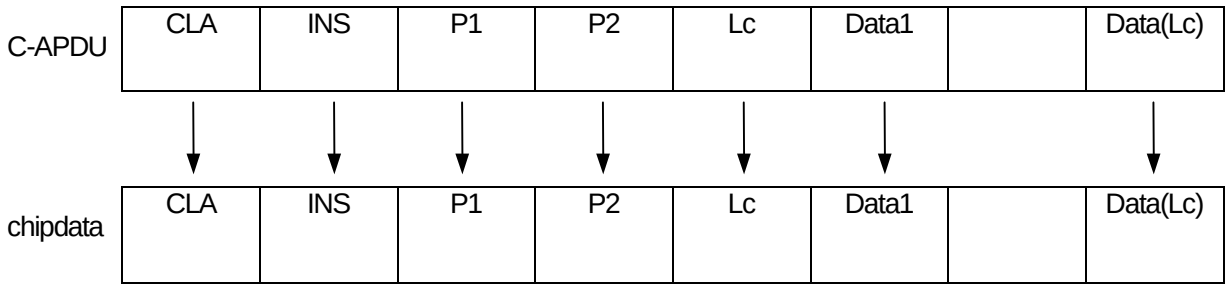


Before selecting the module number, ICRW responds that ICRW selects the module number 1. (stj=30H)

7.14.4 SAM communication 0 (T=0)

Command	"C"	49H	43H	C-APDU (Binary max 261bytes)		
Positive response	"P"	49H	px	st1	st0	R-APDU (Binary max 258bytes)
Negative response	"N"	49H	43H	e1	e0	

This exchanges data between SAM by protocol T=0. About the format of C-APDU, see ANNEX 4.
ICRW sets C-APDU to chipdata and transmits to SAM.



ICRW sets to R-APDU chipdata that received from SAM, and transmits to HOST.

Maximum size of data ICRW can handle is 261 bytes.

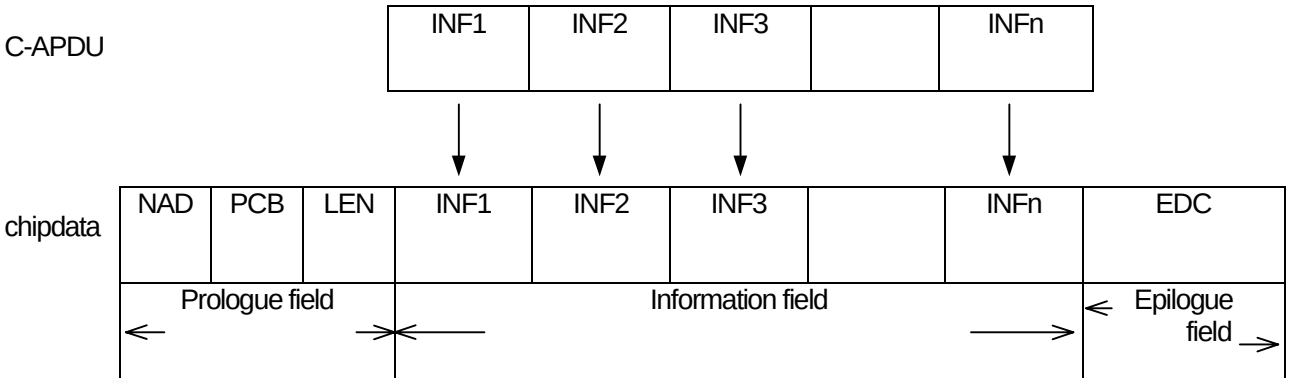
px=43H : The received data from SAM is 258 bytes or less.
px=45H : The received data from SAM is 259 bytes or more.
ICRW requires transmitting following data.
HOST needs to receive remaining data by using "CI7" command.

If SAM is not supporting protocol T=0, error code "62" is sent.
If ICRW cannot recover the communication hang-up to ICC, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If SAM is not activated, error code "65" is sent.
While SAM is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

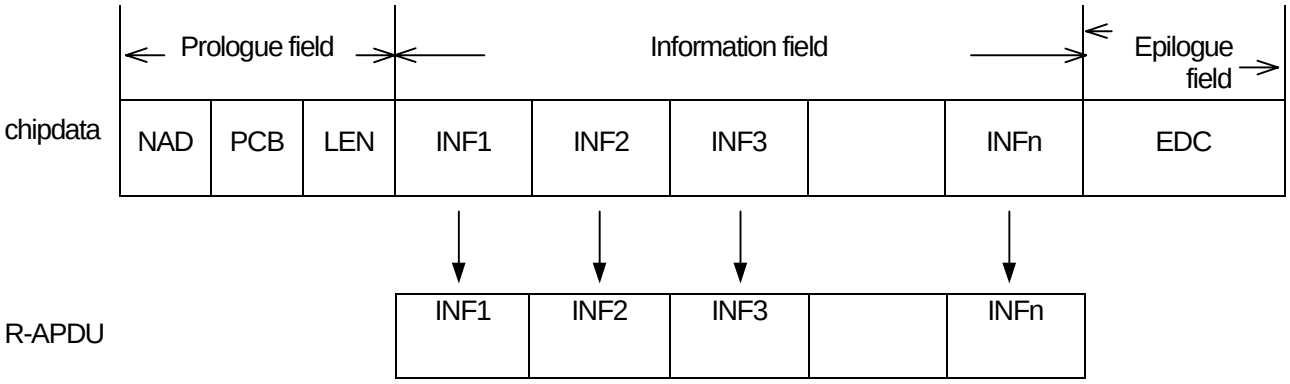
7.14.5 SAM communication 1 (T=1)

Command	"C"	49H	44H	C-APDU (Binary max 261bytes)		
Positive response	"P"	49H	px	st1	st0	R-APDU (Binary max 258bytes)
Negative response	"N"	49H	44H	e1	e0	

This exchanges data between SAM by protocol T=1.
ICRW sets C-APDU to Information field and transmits to SAM.



ICRW sets to R-APDU Information field that received from SAM, and transmits to HOST.



Maximum size of data ICRW can handle is 261 bytes.

px=44H : The received data from SAM is 258 bytes or less.
px=45H : The received data from SAM is 259 bytes or more.
ICRW requires transmitting following data.
HOST needs to receive remaining data using "CI7" command.
px=4FH : ICRW received ABORT request and suspended transmission of data to SAM,
and deactivated SAM. This positive response doesn't have the R-APDU.
After this operation, ICRW does not receive the transmitting command for obtaining the following data from HOST.

If SAM is not supporting protocol T=1, error code "62" is sent.
If ICRW cannot recover the communication hang-up to ICC, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If SAM is not activated, error code "65" is sent.
While SAM is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

7.14.6 SAM communication 1-1 (T=1)

Command	“C”	49H	45H	C-APDU (Binary max 261bytes)	
Positive response	“P”	49H	px	st1	st0
Negative response	“N”	49H	45H	e1	e0

In the protocol T=1, in case the transmitted data to SAM is 262 bytes or more, this command is used repeatedly.

px=47H : ICRW requires receiving following data. There is no data portion.
When the length of data is 262 bytes or more, the remaining data is transmitted to ICRW using this command. And the length of data is 261 bytes or less, the remaining data is transmitted to ICRW using “CI6” command.

px=4FH : ICRW received ABORT request and suspended transmission of data to SAM, and deactivated SAM. This positive response doesn't have the R-APDU.
After this operation, ICRW does not receive the transmitting command for obtaining the following data from HOST.

If SAM is not supporting protocol T=1, error code "62" is sent.
If ICRW cannot recover the communication hang-up to ICC, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If SAM is not activated, error code "65" is sent.
While SAM is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

7.14.7 SAM communication 1-2 (T=1)

Command	"C"	49H	46H	C-APDU (Binary max 261bytes)		
Positive response	"P"	49H	px	st1	st0	R-APDU (Binary max 258bytes)
Negative response	"N"	49H	46H	e1	e0	

In the protocol T=1, this command is used when the last data are transmitted.

px=44H : The received data from SAM is 258 bytes or less.
px=45H : The received data from SAM is 259 bytes or more.
ICRW requires transmitting following data.
HOST needs to receive remaining data using "CI7" command.
px=4FH : ICRW received ABORT request and suspended transmission of data to SAM, and deactivated 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 ICRW cannot recover the communication hang-up to ICC, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If SAM is not activated, error code "65" is sent.
While SAM is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

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

Command	"C"	49H	47H			
Positive response	"P"	49H	px	st1	st0	R-APDU (Binary max 258bytes)
Negative response	"N"	49H	47H	e1	e0	

In the protocol is T=0 or T=1, if received data from IC card is 259 bytes or more, ICRW divides and receives it. And HOST should send this command repeatedly till the response "px=46H".

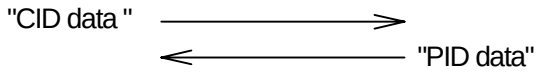
px=45H : The received data from SAM is 259 bytes or more.
ICRW requires transmitting following data.
HOST needs to receive remaining data using "CI7" command.
px=46H : ICRW does not have more transmit SAM data.
px=4FH : When SAM protocol is T=0, ICRW does not respond with this parameter.
ICRW received ABORT request and suspended transmission of data to SAM, and deactivated 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 ICRW hang-up and cannot be recovered at the time of communication with SAM, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If SAM is not activated, error code "65" is sent.
While SAM is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

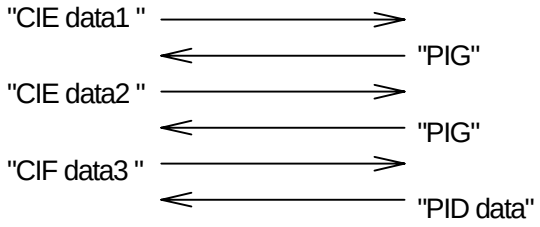
7.14.9 Example (T=1 protocol)

HOST ICRW

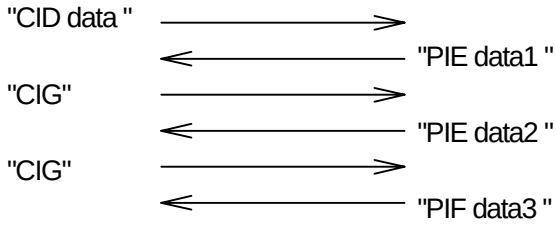
(exp.1) Transmit data 261 bytes or less of data.
Receive 258 bytes or less of data.



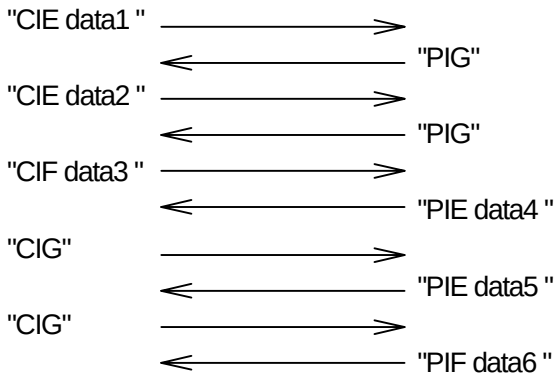
(exp.2) Transmit data by command chaining(Each data size is 261 bytes or less)
Receive 258 bytes or less of data



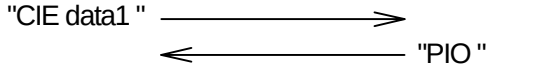
(exp.3) Transmit 261 bytes or less of data
Receive data by command chaining (Each data size is 258 bytes or less)



(exp.4) Transmit data by command chaining (Each data size is 261 bytes or less)
Receive data by command chaining (Each data size is 258 bytes or less)



(exp.5) Interruption with receipt of ABORT request



7.14.10 SAM warm reset

Command	"C"	49H	48H			
Positive response	"P"	49H	48H	st1	st0	ATR (Binary max 33bytes)
Negative response	"N"	49H	48H	e1	e0	ATR (Binary max 33bytes)

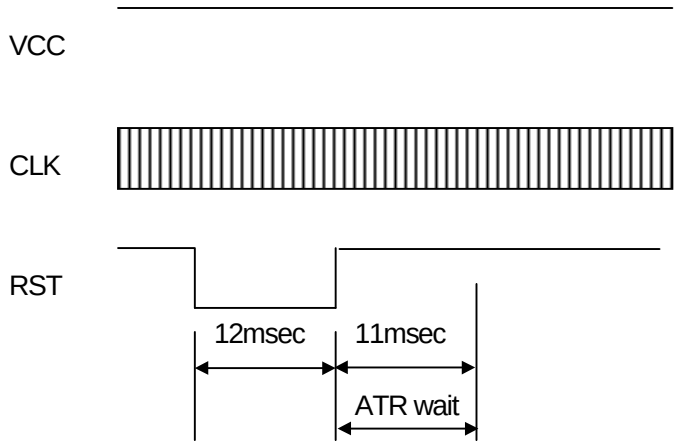
ICRW sends a reset pulse, keeping the status of the SAM activated (VCC,CLK), then returns response upon receiving "ATR" again. The reset pulse width is around 12msec.
This command gives effect to change into the specific mode.

This command will take as error when ATR content is not based on such protocol that 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.

If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

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 follows



7.14.11 SAM automatic communication

Command	“C”	49H	49H	C-APDU (Binary max 261bytes)		
Positive response	“P”	49H	px	st1	st0	R-APDU (Binary max 258bytes)
Negative response	“N”	49H	49H	e1	e0	

This exchanges data between SAM by protocol T=0 or T=1. Protocol is recognized automatically.
Set Data to "C-APDU". About C-APDU format, see ANNEX 4.
Set chipdata ICRW received from SAM to "R-APDU" and transmit HOST.

px=44H : The received data from SAM is 258 bytes or less.
px=45H : The received data from SAM is 259 bytes or more.
ICRW requires transmitting following data.
HOST needs to receive remaining data using "CI7" command.
px=4FH : When ICC protocol is T=0, ICRW does not respond with this parameter.
ICRW received ABORT request and suspended transmission of data to SAM.
and deactivated 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.

Maximum size of data ICRW can handle is 261 bytes.
When protocol is T=1, If the data for transmitting is 262 bytes or more, use command "CI5" and "CI6".

If SAM is not supporting protocol T=0 nor T=1, error code "62" is sent.
If ICRW cannot recover the communication hang-up to ICC, error code "63" is sent.
If any other protocol error occurs, error code "64" is sent.
If SAM is not activated, error code "65" is sent.
While SAM is being activated, ICRW is monitoring VCC to detect excess current of VCC.
If excess current should be detected before receiving this command or during execution of this command, error code "60" is sent.

7.14.12 Select SAM

Command	"C"	49H	50H	Sel	
Positive response	"P"	49H	50H	st1	st0
Negative response	"N"	49H	50H	e1	e0

HOST can select SAM 2,3,4 or 5. The SAM 1 is R.F.U. (Reserved for Future Use).
These SAMs are available with the additional SAM extension board.

Sel = 31H: SAM 2. (option)
Sel = 32H: SAM 3. (option)
Sel = 33H: SAM 4. (option)
Sel = 34H: SAM 5. (option)
(This model cannot mount SAM1.)

SAM command is effective only in the module selection.
SAM2 is selected by initialization command execution.

7.15 Switch command

Command	"C"	4BH	30H		
Positive response	"P"	4BH	30H	st1	st0
Negative response	"N"	4BH	30H	e1	e0

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.

Ex) Under user program code area is operated

↓

Execute switch command “CK0”

↓

Switch the control to Supervisor program code area

↓

Execute Initialize command of Supervisor program code area

↓

Execute download command group

↓

Execute switch command “CK0”

↓

Switch the control to User program code area

↓

Execute Initialize command of User program code area

↓

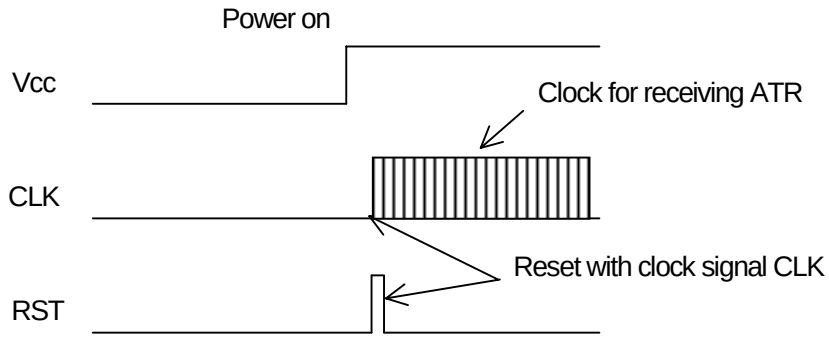
Usual operation

7.16 Siemens memory card control command

7.16.1 Siemens memory card Power on

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

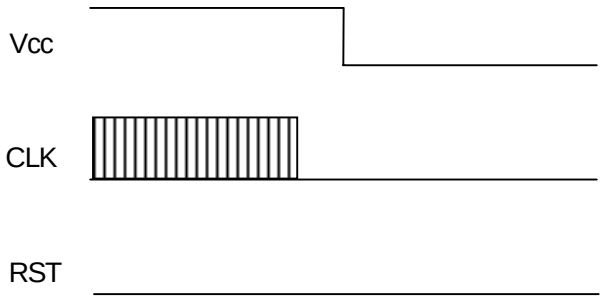
This command activates the memory card. ICRW supply power (Vcc) and clock(CLK), and assert reset (RST) signal. Then, the memory card is activated and return ATR. ICRW returns a negative response when proper ATR isn't received from the memory card. An error code "60" is returned when a power failure is recognized while a power supply is supplied to the card.



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



7.16.3 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.

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

- VCC 1: Active , 0: Inactive
- Sort 1: SLE4428 / 4418 , 0: SLE4442 / 4432
- Not Available
- Not Available

7.16.4 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.

7.16.4.1 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.

7.16.4.2 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.

7.16.4.3 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.

7.16.4.4 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.

7.16.4.5 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.

7.16.4.6 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.

7.16.4.7 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.

7.16.5 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.

7.16.5.1 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.

7.16.5.2 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.

7.16.5.3 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.

7.16.5.4 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.

7.16.5.5 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.

7.16.5.6 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.

7.17 I2C memory card control command

7.17.1 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.

7.17.2 I2C Power off

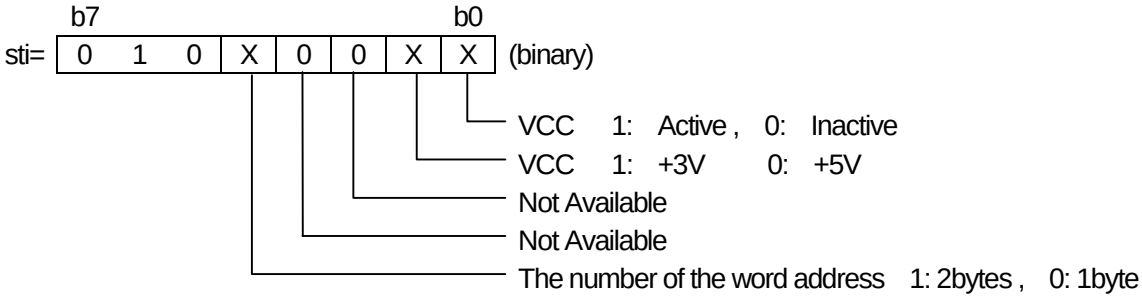
Command	"C"	53H	31H		
Positive response	"P"	53H	31H	st1	st0
Negative response	"N"	53H	31H	e1	e0

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.

7.17.3 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.



7.17.4 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.

7.17.4.1 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.

7.17.4.2 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.

abH : The upper address of head address which begins to write data
cdH : The lower address of head address which begins to write data
efH : The number of bytes of data to write
ghH : the data to write first (the head data of the data on efH 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.

7.18 Contactless IC card control

This model supports the Mifare® standard cards using Philips' reader IC MFRC500.
The additional informations are nesessary to use the following commands for the Mifare® cards.
Please refer the Philips' documents.

7.18.1 Contactless IC Card Activation

Command	"C"	5AH	30H					
Positive response	"P"	5AH	30H	st1	st0	ATQ (Hex 2bytes)	Card Serial Number (Hex 4byte)	Select ACK 1 byte
Negative response	"N"	5AH	30H	e1	e0	ATQ (Hex 2bytes)	Card Serial Number (Hex 4byte)	Select ACK 1 byte

This command activates the contactress IC card. This model is correspond to the activation process of the Mifare® standard cards. The activation process to the card is below.

Mifare® card activation process 1). Request 2). Anticollision 3). Select

When the activation is suceeded, the ICRW return the positive response with the ATQ (2byte), the card serial number (4bytes) and select acknowledge (1byte). If some errors are occur in the activation process, the ICRW returns the negative response with the error code and the return value of each activation process.

7.18.2 Contactless IC Card Deactivation

Command	"C"	5AH	31H		
Positive response	"P"	5AH	31H	st1	st0
Negative response	"N"	5AH	30H	e1	e0

This command deactivates the contactress IC card.

7.18.3 Contactless IC Card Communication

Command	"C"	5AH	33H	function code (ASCII 1byte)	parameter, data (Hex)		
Positive response	"P"	5AH	33H	st1	st0	status (Hex 1byte)	return data (Hex)
Negative response	"N"	5AH	33H	e1	e0		

This command is for the communication to the Mifare® standard cards using the Mifare® Classic protocol. Please refer to the Mifare® specifications about the detail of the following functions.
If the status of the command execution result is not 'OK', the ICRW returns the status in the positive response as the correct card response.

Load Key Function

function code	=	'L'	
parameter	=	key select	(1byte Hex, keyA=00, keyB=01h) +
(Total 8bytes)		sector number	(1byte Hex, 00 – 15h) +
		uncoded keys	(6bytes Hex)
response data	=	status	(1byte Hex, OK=00)

This function stores the keys in the non volatile memory in the ICRW. The stored keys are chose and used automatically by the authentication command. This function does not operate to the card, and can be executed during the ICRW operation at any time.

Authentication Function

function code	=	'A' (41h)	
parameter	=	key select	(1byte Hex, keyA=00, keyB=01h)
(Total 2bytes)		sector number	(1byte Hex, 00 – 0Fh)
response data	=	status	(1byte Hex, OK=00)

This function stores the keys in the non volatile memory in the ICRW. The stored keys are chose and used automatically by the authentication command.

Read Function

function code	=	'R' (52h)	
parameter	=	block number	(1byte Hex, 00 – 3Fh)
(Total 1byte)			
response data	=	status	(1byte Hex, OK=00)
(Total 17byte)		read data	(16bytes Hex)

This function reads the 16bytes data from the authenticated block on the card.

Write Function

function code	=	'W' (57h)	
parameter	=	block number	(1byte Hex, 00 – 3Fh)
(Total 17bytes)		write data	(16bytes Hex)
response data	=	status	(1byte Hex, OK=00)

This function writes the 16bytes data to the authenticated block on the card.

Increment Transfer Function

function code	=	'I' (49h)	
parameter	=	source block number	(1byte Hex, 00 – 3Fh)
		destination block number	(1byte Hex, 00 – 3Fh)
(Total 6bytes)		increment value	(4bytes Hex)
response data	=	status	(1byte Hex, OK=00)

This function increments the source block value by the increment value and transfers the incremented value to the destination block. The source block data and destination block data should be the value block format.

Decrement Transfer Function

function code	=	'D' (44h)	
parameter	=	source block number	(1byte Hex, 00 – 3Fh)
		destination block number	(1byte Hex, 00 – 3Fh)
(Total 6bytes)		decrement value	(4bytes Hex)
response data	=	status	(1byte Hex, OK=00)

This function decrements the source block value by the decrement value and transfers the decremented value to the destination block. The source block data and destination block data should be the value block format.

8. 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.

8.1 Error in communication soft

"00" Meaning : To shows that received command was undefined.

Clear : Cleared by receiving correct commands.

"01" Meaning : To show command parameter error.

Clear : Cleared by receiving command with correct parameter.

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

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

Clear : Cleared by receiving executable command.

"03" Meaning : The function (hardware) required for execution of a command is not carried.
The function may not be carried or be out of order.
(The existence of each function is automatically recognized by the firmware.)
Clear : The check of hardware is needed.

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

Clear : Cleared by receiving command including correct data.

"B0" Meaning : Other commands were received before performing initialize command
after a power supply injection, reset or switch command execution.
Clear : Execute Initialize command.

8.2 Error at card feeding

"10" Meaning : To show that the card was not carried to the specific location after specified number of trial for specified time duration during execution of command of carrying card in various ways.
Clear : To execute a command again and a card is conveyed in a normal position.
Or, cleared when the card is taken out from the card reader manually.
In this case, confirm the recovery by Status request command.

"11" Meaning : To show that the full shutter does not close when the card entry is completed.

Clear : Cleared in case card is returned to card gate by eject command.
After the card is inserted, the unexpected objects are inserted into the gate or the full shutter is not work collect. Please conferm those condition.

"13" Meaning : To show that the card longer than 88.5mm is inserted into ICRW.

Clear : Cleared in case card is returned to card gate by eject command.

"14" Meaning : To show that the card shorter than 83.5mm is inserted into ICRW.

Clear : Cleared in case card is returned to card gate by eject command.

"16" Meaning : To show that card staying inside the ICRW was moved up to the point where status request information changes.

Clear : Cleared in the case card is ejected.

"17" Meaning : To show that the card was not carried to the specific location after specified number of trial for specified time duration during execution of Retrieve command.

Clear : To execute a Retrieve command again and a card is normally taken in. Or, cleared when the card is taken out from the card reader manually. Confirm the recovery by Status request command in this case.

"18" Meaning : ICRW detected that two cards were inserted, and ejected it.

Clear : Remove ejected card from a gate.

"40" Meaning : To show that card is pulled out against card feed in operation.

Clear : Command execution is normally possible continuously.

8.3 Error in reading card

The following errors may be recovered if ICRW re-take in and read a card.
When an error is not recovered after this operation, it is unrecoverable since magnetic record of a card is unusual

"20" Meaning : To show that parity error exists in read error.

"21" Meaning : To show that other read error than "20", "23" and "24" (cf : no start sentinel is recorded in the card).

"23" Meaning : To show that only start sentinel, end sentinel, LRC are contained in the card. There are no contents of data.

"24" Meaning : To show that the card has no magnetic track. For entry and enable command with mag check, this code is used to indicate error.

8.4 Other error codes

"30" Meaning : To show that power down (or power cut in short instant) is detected (or being detected). It is to be recognized as normal power down if back up power supply goes down below +12V.

Clear : Cleared when a card is ejected and pulled out after a power supply recovery.

"31" Meaning : To show that DSR signal was turned to OFF (communication is cut).

Clear : Cleared when a card is ejected and pulled out after DSR signal recovery.

9. RAS (Reliability, Availability, and Serviceability) Function

9.1 The power on / reset boot mode

The ICRW selects the boot modes by the shade conditions of the card detect sensors after the power on or hardware reset. The boot modes are the standard mode for normal operation and RAS mode to check their functions and report the results by LED.

9.2 The boot check items and result

The ICRW checks the following items with this order before booting as the standard mode or RAS mode.

Check Items	Result
User Program Area CRC Check	The ICRW work only on the supervisor program area (The Initialize command response is always "N0002")
Flash ROM Parameter Area CRC Check	The functions of the user program area are not available. (The Initialize command response is always "N0015")
EEPROM Read Check	The functions of user program area are not available. (The Initialize command response is always "N0073")
Remained Card Eject and Card Jam Check	The functions of user program area are not available. (The Initialize command response is always "N0010")
Implemented Functions Self Recognition (Magnetic Head and the available tracks, IC Contact and Contactless Read / Write Module*1)	The result of the implemented functions self recognition are able to be confirmed by the initialize command response. The commands using not implemented functions are not available. (The command response using not implemented function is "Nxx02")

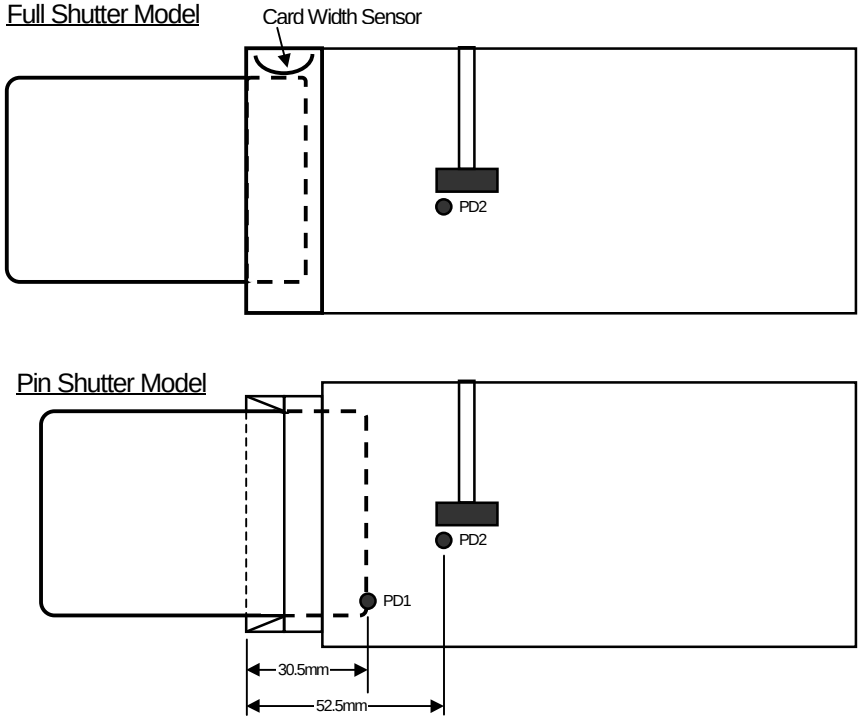
*1.This model doesn't implement the contactless read / write module.

9.3 The condition for boot on RAS mode

The ICRW boots on RAS mode when the card turn on only the card witdth sensor (full shutter model) or the PD1 (pin shutter model) and the power supply is turned on or the ICRW is reset. The ICRW starts the card entry motion after booting on RAS mode.

The entry motion tries while 2 seconds with rotating the motor and retries 2 times.

If the card is not inserted while the entry motion, the ICRW finishes the RAS mode and starts the standard mode.



9.4 The finish condition of RAS mode

In the RAS mode, the ICRW finishes the RAS mode and start standard mode when the card is pulled out from the card reader. And when the abnormal conditions which discontinue the RAS function is detected, the RAS function stops and finishes the RAS mode when the card is pulled out.

9.5 The overview of RAS operation

1). When the ICRW enter the RAS mode, the ICRW checks the basic functions for RAS operation. If the basic functions are not normal condition, the ICRW stops the RAS operation, indicate orange LED and finishes the RAS mode.

2). The ICRW executes the card entry motion. When the ICRW detects the card transport error, the ICRW stop the RAS operation, indicate orange LED and finishes the RAS mode.

3). While the ICRW executes the card entry, the ICRW read the magnetic stripe data on the card. After finishing the card entry, the ICRW activate the contact IC card and execute the request B command for contactless IC card. Each functions are executed only when the functions are implemented on the ICRW.

4). After the ICRW checks the results of the executions, the ICRW ejects the card. When the ICRW detects the card transport error, the ICRW stop the RAS operation, indicate orange LED and finishes the RAS mode.

5). The ICRW indicates the check results by LED blinking three times after ejecting the card properly.

6). The RAS operations are repeatable. If the card turn on the card width sensor or PD1 after LED indicating the result of previous checking, the ICRW executes the card entry again.

7). If the card is pulled out after LED indicating the result of previous checking, the ICRW finishes the RAS mode and starts the standard mode.

9.6 The check items and the error indications of RAS

check items	check function	LED indications	LED indication color		
			normal	abnormal	not implemented
basic functions	power supply , sensor, motor	light 1sec. and turn off		orange	
card transport	card jam or abnormal card length are detected	light 1sec. and turn off		orange	
magnetic stripe data read	read error (except for not encoded)	1st blink	green	orange	green
contact IC card activation	receive ATR properly	2nd blink	green	orange	green
contactless IC card activation	receive activation properly	3rd blink	green	orange	green

9.7 The not checked functions by RAS

1). CPU functions

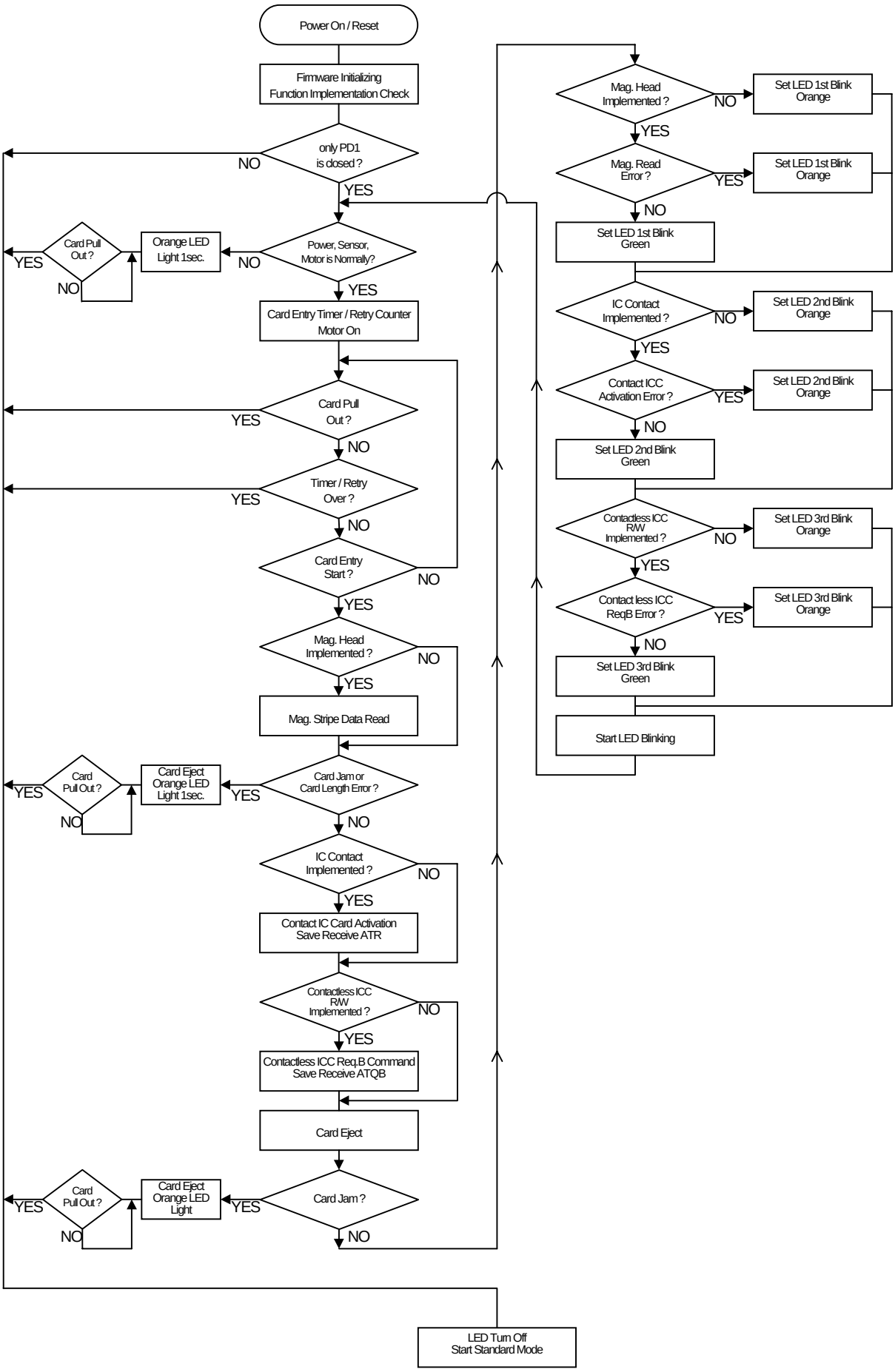
2). LED lighting

3). Very low power supply voltage

4). Shutter solenoid

5). Interface to the HOST (While the RAS operation, the interface is not available)

9.8 The flow chart of RAS operation



ANNEX 1 Calculation method of CRCC

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

```
/*
        [data]
        hex     0xF2, 0x00, 0x08, 0x43, 0x30, 0x30, 0x33, 0x32, 0x34, 0x30, 0x30
        CRC     0xFACE
*/
#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 08H
        TEXT: Initialize command ("C0032400")
    */
    unsigned char TransCommand[13] ={0xF2,0x00,0x08,0x43,0x30,0x30,0x33,0x32,0x34,0x30, 0x30,0x00,0x00};

    unsigned short TextLength = 11;         /*lengthof(STX+LEN+TEXT) */
    unsigned short crc;                     /* CRC */

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

    return 0;
}
```

ANNEX 2 TA1 values supported in specific mode.

The value of TA1 currently supported in communication with ICC is as follows.

TA1 values that ICRW is supporting with activation of EMV'96
30H
TA1='11' and TA2=none : D=1 F=372
TA1<>'11' and TA2=none : Not Supported
TA1='any' and TA2.b5=0 : Supported TA1 of Table1
TA1='any' and TA2.b5=1 : Not Supported

TA1 values that ICRW is supporting with activation of ISO/IEC7816-3
33H,35H,36H
TA1='any' and TA2=none : D=1 F=372
TA1='any' and TA2.b5=0 : Supported TA1 of Table1
TA1='any' and TA2.b5=1 : D=1 F=372

Table1: Supported TA1 values in specific mode.

D= / F=	1	2	4	8	16	Clock Frequency
372	01,11	02,12	03,13	-	-	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

ANNEX 3 Parameters values for ATR

Table2: Supported values of ATR

Vcc / ATR	30H	31H	32H	33H
	Supported values			
TS	'3F', '3B'			
TA1	See ANNEX 2			
TB1	'00' (cold reset) any value(*1) (warm reset)	Any value (*2)		
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 ANNEX 2			
TB2	None (prohibit)	Any value(*2)		
TC2	'01'... '0A'	'01' ... 'FF'		
TD2	m.s. nibble : any value l.s. nibble : '1' or 'E'	m.s. nibble : any value l.s. nibble : any value		
NOT T=15 (I=3 or 4) TA3,TA4	'10'...'FE'	'01' ... 'FE'		
TB3,TB4	m.s. nibble : '0'...'4' and l.s. nibble : '0'...'5' and $2^{CWI} \geq (N+1)$	m.s. nibble : '0'...'9' and l.s. nibble : '0'...'15' and $2^{CWI} \geq (N+1)$		
TC3,TC4	'00'	Any value		
T=15 (i=3) TA3	(*2)	b1=1	b2=1 or b1=1	
TB3,TC3, TD3	(*3)	Any value		
T=15 (i=4) TA4	b1=1	b1=1	b2=1 or b1=1	
TB4,TC4, TD4	Any value			

"Vcc" shows the data part of an activation command

*1) It becomes an error when there is a VPP activation demand at the time of communication with ICC.

*2) When both TB1 and TB2 are specified, the value of TB2 becomes effective.

*3) 'F'(T=15) is prohibited under TD2 l.s.nibble.

ANNEX 4 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 bytes 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

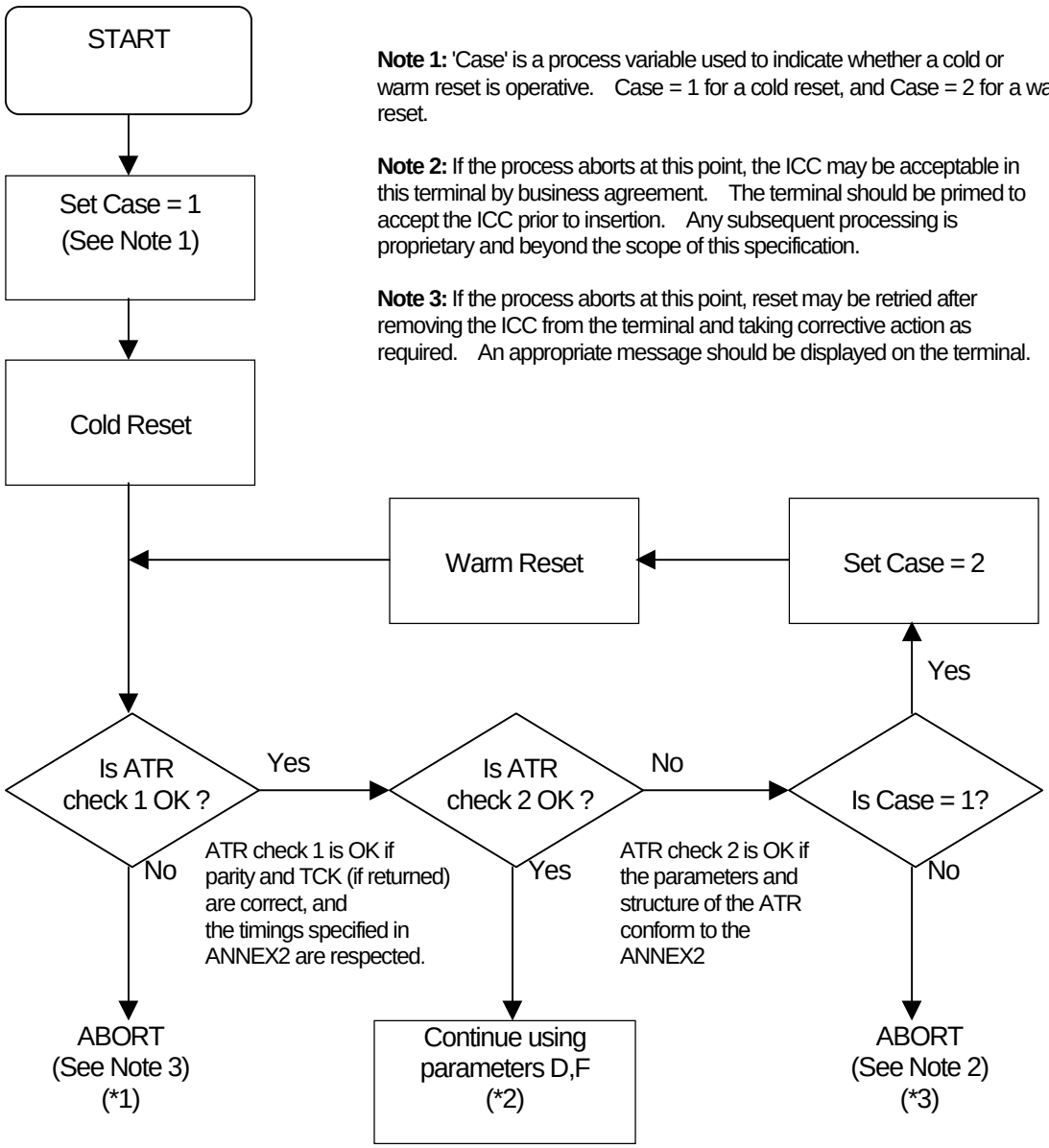
About the details of each bytes, refer to specifications of every card's standard.

The C-APDU structure have 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 ICC.

ANNEX 5 ICC power on command(CI0, CI00,CI01) sequence (Active command 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.

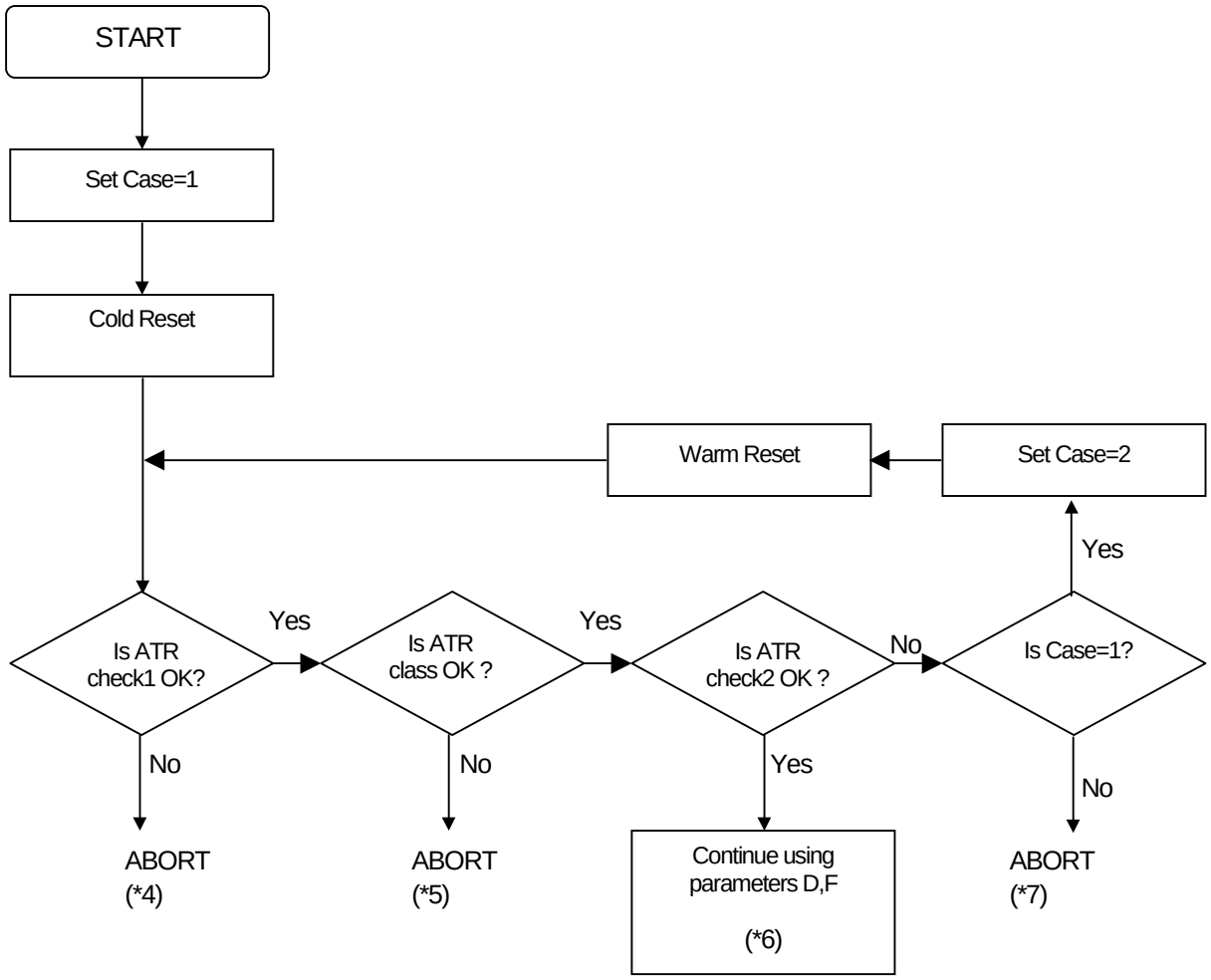
Note 2: If the process aborts at this point, the ICC may be acceptable in this terminal by business agreement. The terminal should be primed to accept the ICC prior to insertion. Any subsequent processing is proprietary and beyond the scope of this specification.

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 " 61".
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)

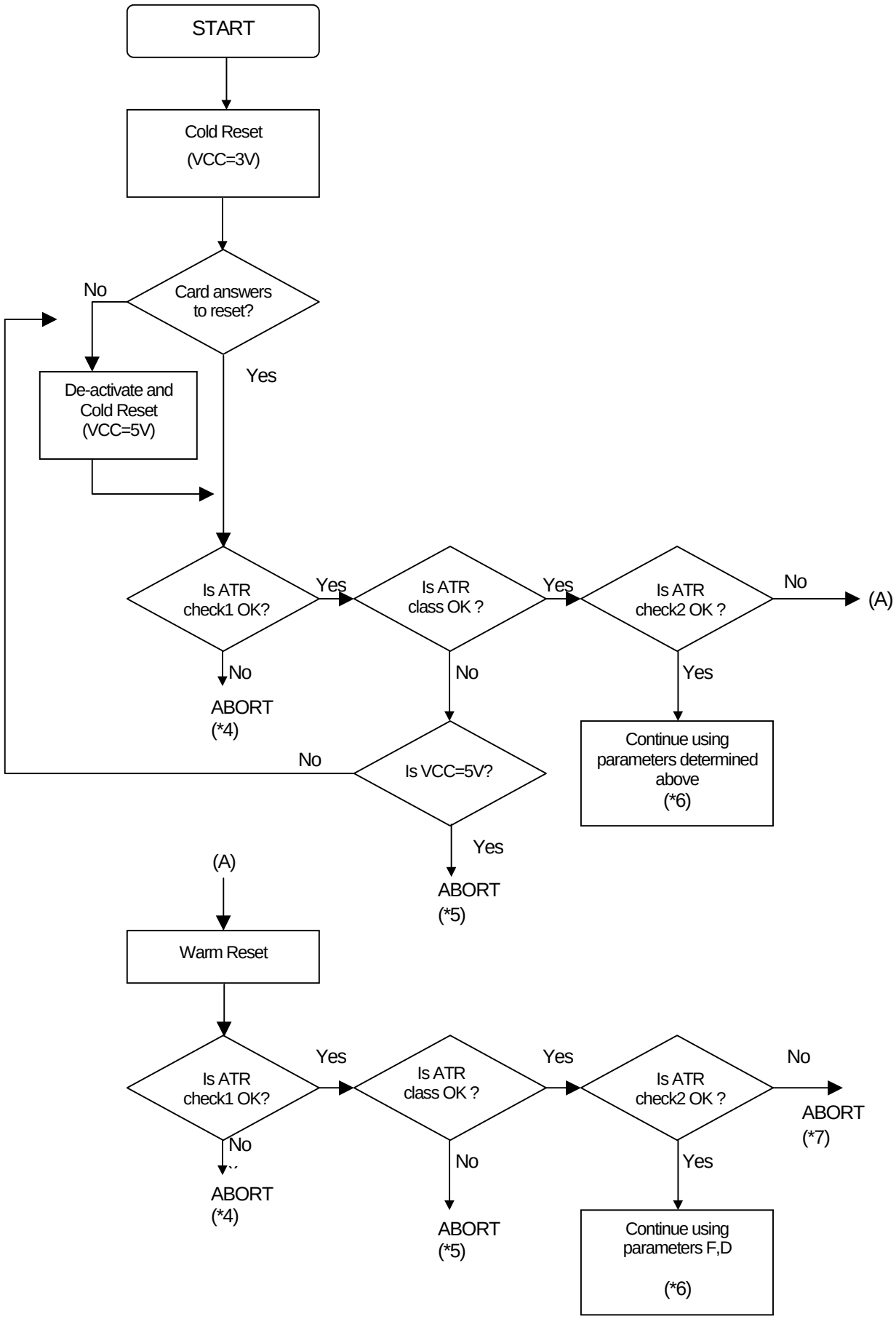
ANNEX 6 ICC power on command(CI03, CI04) sequence (Active command Vcc=33H)



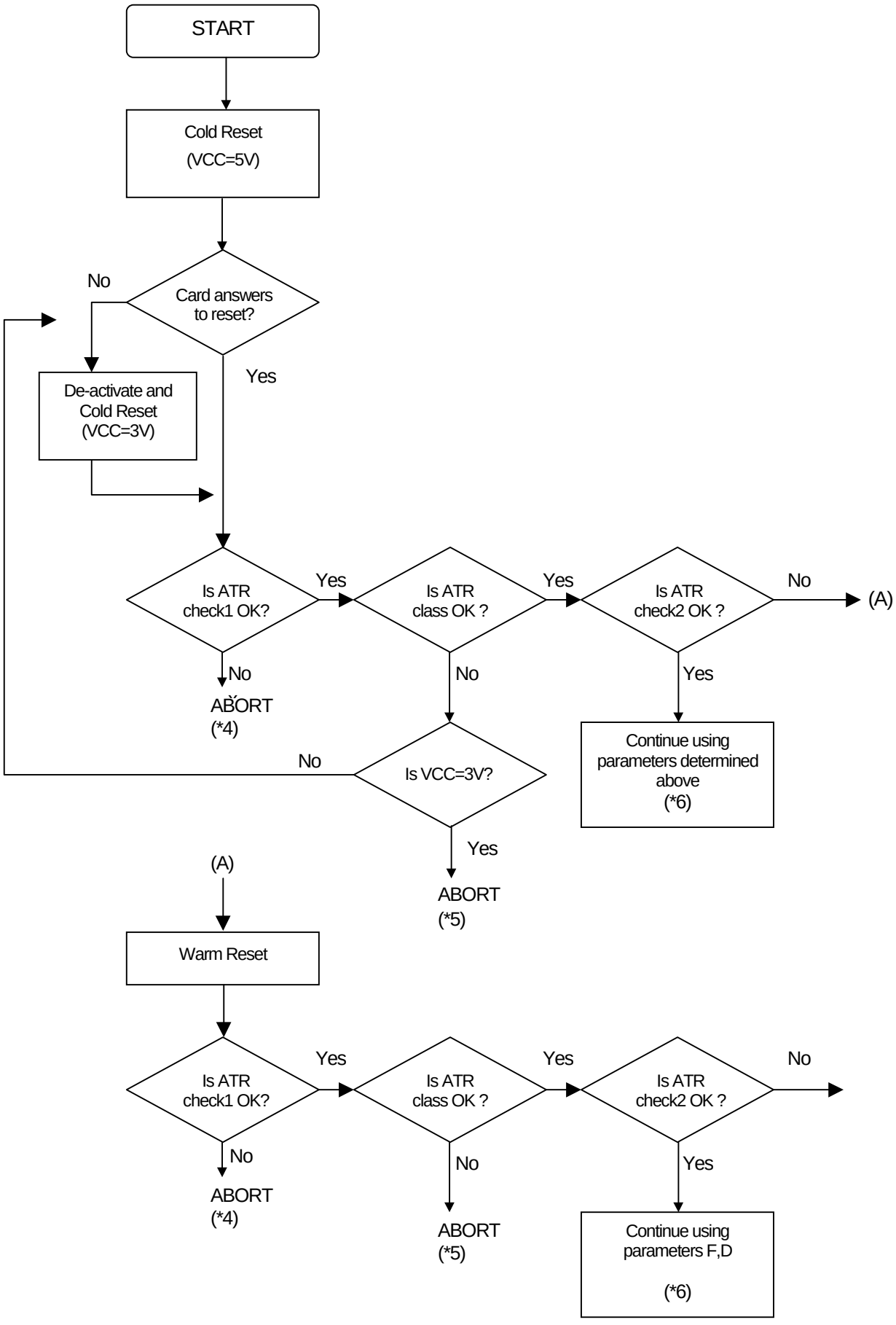
(*4)ICRW initiates the deactivation of ICC, and sends back error code " 61".
(*5)ICRW checks IC-card's class indicator, which is not supported by ICRW,
error code "66" with ATR data will be sent back and ICRW will deactivate the IC card.
(*6) After ICRW received ATR which shows T=1 protocol, ICRW transmits 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 " 61".
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 7816-3:97)

ANNEX 7 ICC power on command(CI05) sequence (Active command Vcc=35H)



ANNEX 8 ICC power on command(CI06) sequence (Active command Vcc=36H)



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