Hardware Specifications of V2AF Series Hybrid Card Reader

Rev. A	Sep. 28, 1999
Rev. B	Feb. 22, 2000

Card Business Promotion Division

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1. Introduction

This document provides the hardware specifications of the V2AF series card reader that supports magnetic stripe cards and/or IC cards.

1.1 Reference standards:

(1) ISO/IEC 7810 , ISO/IEC 7811-1,2,3,4,5: 1995-08-15
Identification cards -- Recording technique

(2) JIS X6301,X6302, JIS X6303

(3) ISO 7816-1:1987
Identification cards -- Integrated circuit(s) cards with contacts
Part 1: Physical characteristics

(4) ISO 7816-2:1988
Identification cards -- Integrated circuit(s) cards with contacts
Part 2: Dimensions and location of contacts

(5) ISO/IEC 7816-3:1997
Identification cards -- Integrated circuit(s) cards with contacts
Part 3: Electronic signals and transmission protocols

(6) ISO/IEC 7816-4: 1995
Identification cards -- Integrated circuit(s) cards with contacts
Part 4: Inter-industry commands for interchange

(7) EMV '96 Integrated Circuit Card
Specification for Payment Systems
Version 3.1.1 May 31, 1998
Part I - Electromechanical Characteristics, Logical Interface, and Transmission Protocols

2. Applicable cards

2.1 Applicable magnetic cards

Magnetic cards conform to ISO/IEC 7810 , ISO/IEC 7811-1,2,3,4,5 and JIS X6301,X6302

2.2 Number and location of contacts on IC card

Eight contacts for C1 to C8 are provided.(ISO middle position)
Number and location of contacts on IC card are specified in ISO 7816-2 figure 2(see appendix A).

2.3 Applicable IC card specifications

(1) Protocol	T=0 and/or T=1
(2) Data byte reading/writing	Both inverse convention (MSB first, negative logic) and direct convention (LSB first, positive logic) are available.
(3) Clock during/after ATR*1	Conform to ISO / IEC 7816-3 (3.5795 MHz).
(4) Communication speed*2	T=0: 1etu = 372/ (3.5795×10^6) sec (Constant Value) T=1: 1etu = $(372/D) \times 1/(3.5795 \times 10^6)$ sec D=1(Default) =2, 4 (T=1:changeable by PPS)
(5) Vpp	Not used
(6) Vcc	5V

*1 ATR : Answer To Reset
*2 Communication speed of T=1 protocol can be changed by PPS procedure.
(PPS stands for Protocol and Parameter Selection)

2.4 Notice for IC card

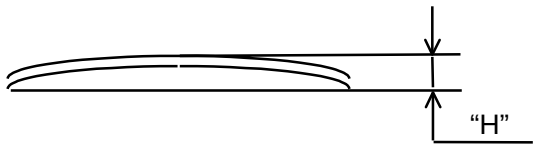
OMRON standard IC card readers cannot support every conceivable type of IC card, because the ISO standards as well as the IC cards themselves are frequently modified. OMRON will try to obtain your customers' IC cards if necessary.

2.5 Applicable memory cards

Memory cards which use SIEMENS 4442, 4428 and 4432 chip are supported.
For other memory cards, please contact us.

2.6 Warped cards

(1) "H" is less than 2.5mm :Possible to read the magnetic data and read/write IC data
(2) "H" is less than 3.5mm :Possible to feed the card
("H" means the height of warped card for all directions: lengthwise, widthwise, diagonal)



3. Module Variations

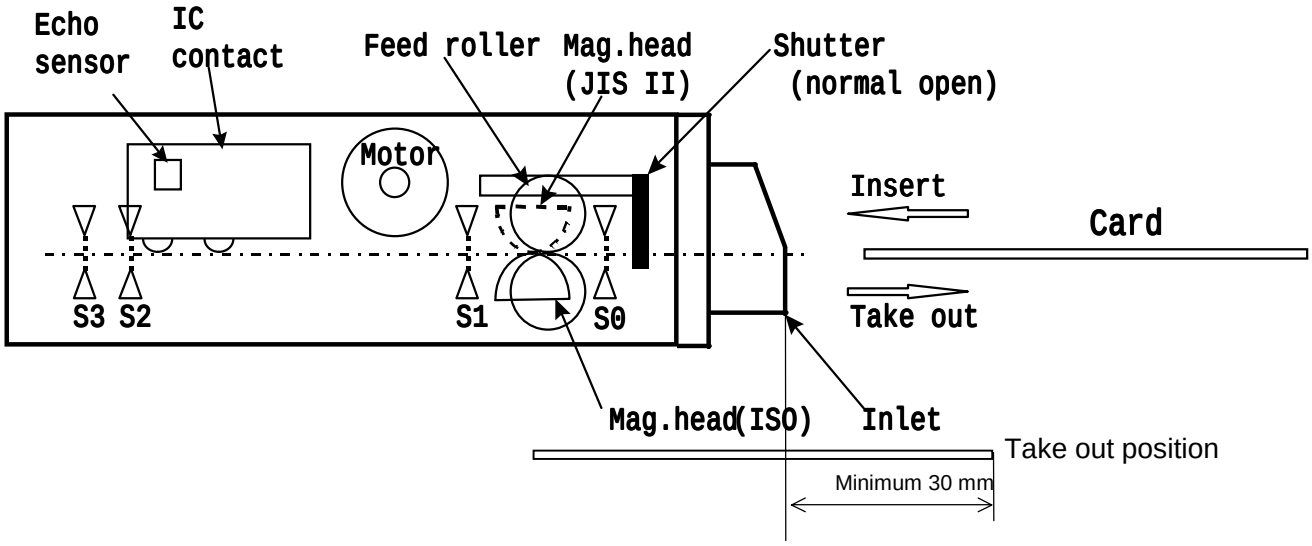
3.1 Module variations

Module name	Specifications						
	Magnetic tracks				IC contact (8pins)	Shutter	Notes
	ISO			JIS II			
	Tr.1	Tr. 2	Tr. 3				
V2AF-01	R	R	R		N	N	
V2AF-02				R	N	N	
V2AF-04		R			N	N	
V2AF-0D		R		R	N	N	
V2AF-0F	R	R		R	N	N	
V2AF-00JP					Y	Y	
V2AF-01JP	R	R	R		Y	Y	
V2AF-02JP				R	Y	Y	
V2AF-04JP		R			Y	Y	
V2AF-0DJP		R		R	Y	Y	
V2AF-0FJP	R	R		R	Y	Y	
V2AF-00JP-01N					Y	Y	Non intelligent type *1

R : Magnetic reading function
Y : Provided
N : Not provided
Notes: *1. For non intelligent type, IC card signals are directly connected to IC card interface connector.

3.2 Definitions of terminology:

S0: sensor 0 (front)
S1: sensor 1 (second)
S2: sensor 2 (third)
S3: sensor 3 (rear)
Echo sensor: IC card contact echo sensor



IC card read position/
Mag. card park position

4. General Specifications

4.1 External dimensions

Width: 70 mm +/- 1mm
Height: 36 mm +/- 1mm
Length: 145 mm +/- 1mm

4.2 Installation Card reader should be secured by four screws as illustrated in Chapter 12.

4.3 Weight Approx. 400g

4.4 Card transport method Motor driven

4.5 Card ejection direction Front

4.6 Card transport speed 250 mm/s ± 20% in normal operation
Approx. 50 mm/s (to move IC card from S2 to contact station)

4.7 Location of magnetic stripe ISO stripe at bottom

4.8 Card position detection Photo Sensors at four locations
The state of all sensors can be checked by a command.
See *Data Transmission Specifications V2AF Series Hybrid Card Reader(GB-H-99005).*

5. Detailed specifications

5.1 Magnetic Reading Specifications

(1) Reading tracks	ISO 1,2 and 3 track, JIS II track (see module variations)
(2) Reading function	Read specified tracks simultaneously.
(3) Read direction	One way from the front to the rear
(4) Magnetic reading method	Two-Frequency Method (F2F)

5.2 IC card handling specifications

(1) The contact mechanism is pushed onto the IC card's contacts when a card is transported to the proper position.
(2) The state of the IC contact echo sensor can be checked by a command.
(3) The resistance between two adjacent contacts is 500 milli ohm or less. The resistance is measured at the end of cable to the PCB.

5.3 Program downloading

The V2AF card reader has downloadable firm ware.
All firm ware can be downloaded from the Host to the reader via RS232 interface.
For detail, see *Data Transmission Specifications V2AF Series Hybrid Card Reader(GB-H-99005).*

5.4 Shutter

5.4.1 configuration

1) Shutter is normally open and closed by the solenoid.
2) Shutter is not under user control.
   Shutter is automatically closed when a card is moved to the rear end position regardless of the magnetic card or IC card.
   Shutter is automatically open when the reader receives a card return command.

5.4.2 Outer length of card

The length is a minimum of 30 mm from the slot end when a card is returned.
See 3.2 Definitions of terminology.

5.4.3 Retrieval

A card is retrieved into the reader inside by a command when the card is not pulled out within a certain time.

5.5 “Power failure” during operation

5.5.1 Power failure detection voltage level

Power failure detection activates when the +12V supply voltage falls to the range between +9.3V and +10.1V. An external capacitor connected to the C/R automatically supplies the power to the 12V line if the supply voltage drops to that level.
This power from the external capacitor will be supplied to the C/R for approx. 3 seconds.

5.5.2 Procedure in the event of power failure

If a card is inside the transport during a power failure, the following operations are performed in sequence:

1. Processing in the event of power failure(see *Data Transmission Specifications V2AF Series Hybrid Card Reader(GB-H-99005))*
2. Any of the following handling: transporting the card to the take-out position or keeping it in the transport .
   The above procedure can be performed only when an external capacitor is attached.

5.5.3 Reqired external capacitor

Capacitance: 100 mF or more

6. Required power supply

6.1 Power supply voltage 12 V DC +/- 10%

6.2 Ripple of power supply 200 mV p-p or less

6.3 Power consumption

(1) Maximum 2.0 A

(2) In operation 1.0 A or less (read operation)

(3) In standby 500 mA or less

6.4 Power supply line

There are two options powering the card reader.

(1) via interface connector

(2) via power receptacle using AC adopter

7. Environmental Conditions

7.1 Temperature

(1) In operation +5 to 50 degree (Celsius)

(2) In storage -20 to 70 degree (Celsius)

7.2 Humidity

(1) In operation 5 to 85% RH, no condensation and absolute air humidity of 23 g/m^3 or less

(2) In storage 5 to 90% RH, no condensation and absolute air humidity of 40 g/m^3 or less

8. General Performance

8.1 Vibration resistance

Test at 10-150 Hz and a single vibration width of 0.1 mm or an acceleration of 15 m/s^2, whichever is smallest

8.2 Shock resistance

Test at a peak acceleration of 150 m/s^2 three times in six directions (up & down, right & left and back & forth) respectively

8.3 Dielectric strength

250 V AC for 1 minute

8.4 Insulation resistance

10 meg-ohm or more at normal temperature and 250 V DC.

9. Life and Reliability

9.1 Life (test condition: with OMRON test card conforms to ISO standard, in laboratory, at room temperature and humidity)

(1) C/R life : 600,000 passes or 5 years, whichever comes first (one pass means forward and reverse feed)

(2) IC contact life : 300,000 operations

(3) Downloading cycles : minimum100,000 times

Note: Life will be affected by environmental conditions and cards used.

9.2 Reliability

9.2.1 Error rate

(1) Magnetic card read :Less than one error per 1,000 cycles.
(test condition: with OMRON test card conforms to ISO standard, in laboratory, at room temperature and humidity, excepting operational error)

(2) IC card read/write :Less than one error per 1,000 cycles.
(test condition: with OMRON test card conforms to ISO standard, in laboratory, at room temperature and humidity, excepting operational error)

9.2.2 MCBF :More than 300,000 cycles

Definition of failure

1) When five or more sequential errors are detected.
(e.g. magnetic card read errors, card jams)
2) Mechanical problems (e.g. deformation of frame)
3) When C/R does not work even if power is supplied.
4) When transaction is not completed properly,
except the following cases.
- Read/write errors and card jams with abnormal cards.
- Read/write errors caused by improper maintenances.
- Errors caused by HOST systems.
- Errors caused by intentional manipulation.

9.2.3 MTBF :More than 10 X10^4 hrs (Electric parts only)

9.2.4 MTTR :30 minutes (Unit replacement)

10. Interface Specifications

10.1 Electronic interface

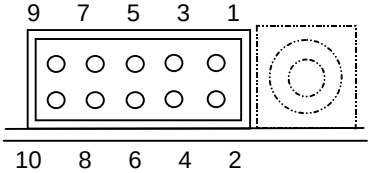
(1) Electronic interface RS232 Interface
(2) Transmission speed 1200, 2400, 4800, 9600, 19200, 38400 bps
(3) Synchronous method Start-Stop Synchronization Method
(4) Communication method Half-duplex Method

For details, see *Data Transmission Specifications V2AF Series Hybrid Card Reader(GB-H-99005)*.

10.2 Signal explanation and pin layout

(1) Interface connector HIF3FC-10PA-2.54DS (2.54mm pitch HIROSE Japan) or equivalent. (MIL-C-83503)
(in/out direction view from the reader)

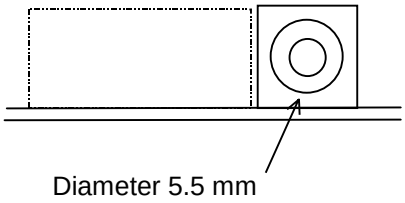
Pin No.	Assigned signal	IN/OUT	Function
1	TXD	OUT	Transmit data
2	RXD	IN	Receive data
3	DTR	OUT	Data Terminal Ready
4	CTS	IN	Clear to Send
5	SG	IN	0V
6	12V	IN	Power
7	GND	IN	Ground
8	EXPW	IN	External Power
9	EXGND	IN	External capacitor GND
10	FG	IN	Frame ground



(Interface cable is not included with the reader itself)

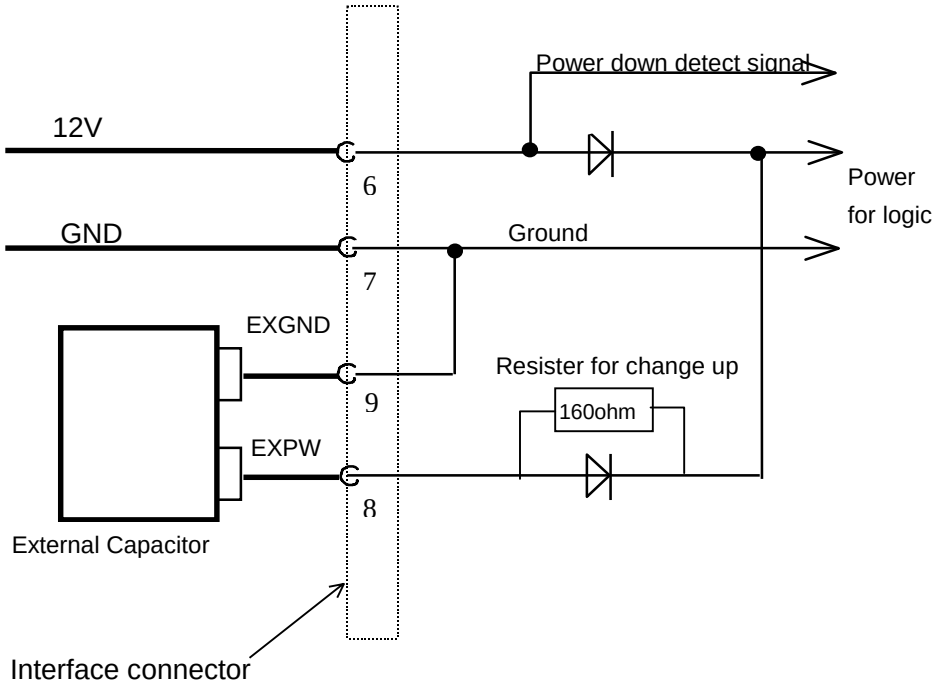
(2) Power receptacle (AC adapter connector) LGP-3831-0200(EIAJ standard RC-5320A Voltage Classification 4 SMK Japan)

Pin No.	Assigned signal	Function
1	N.C	
2	12V	power (inside)
3	GND	GND (outside)
4	N.C	



CAUTION: Do not connect both AC adapter and interface connector power line at the same time.

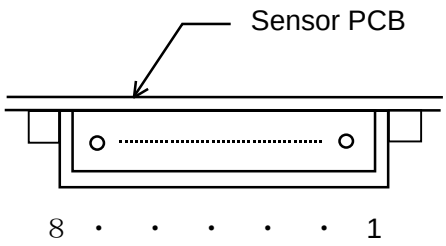
(3) Power supply circuit diagram (e.g. external capacitor)



(4) IC card interface connector (only for non intelligent type)

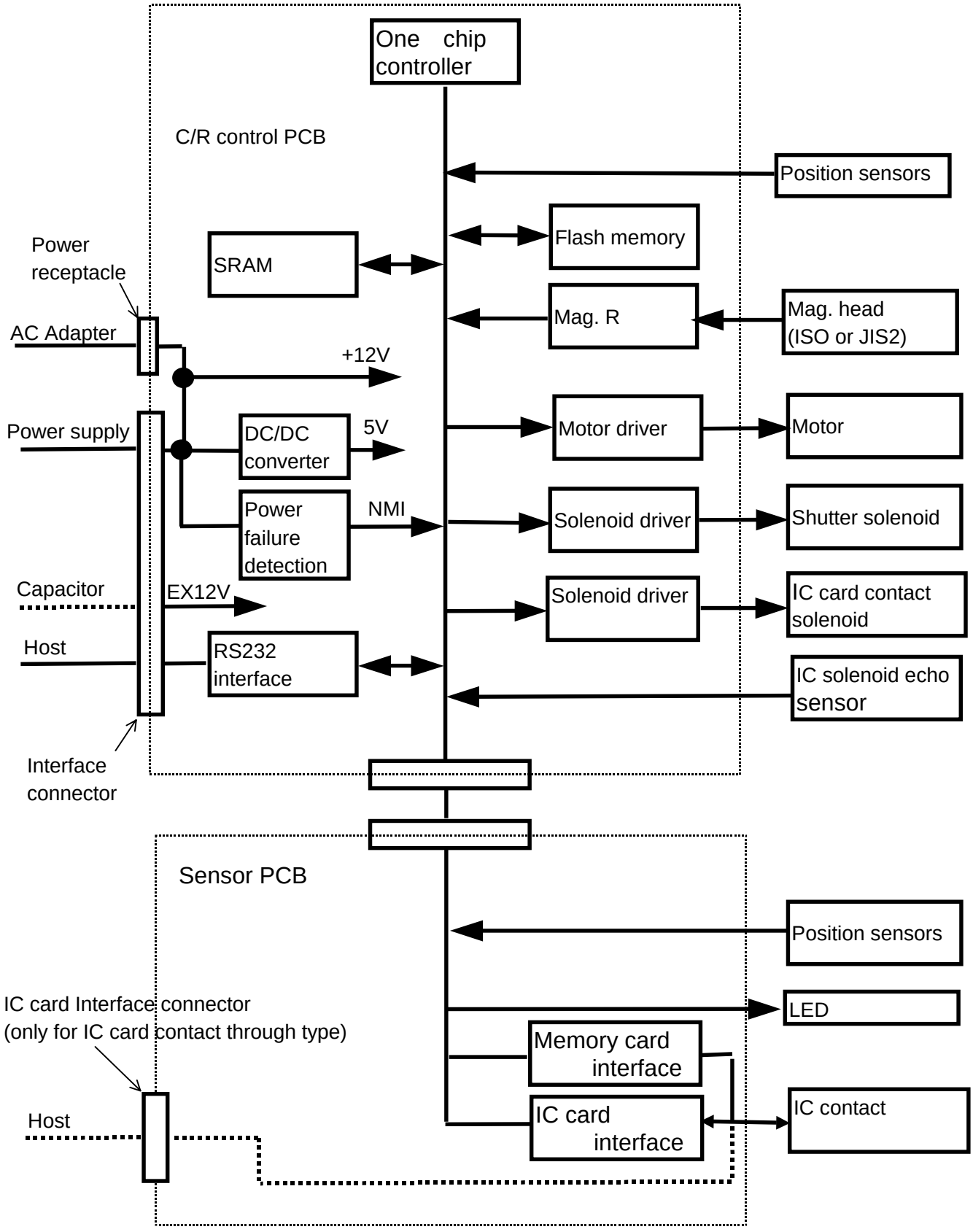
Pin No.	Assigned signal	Function
1	VCC	C1
2	RST	C2
3	CLK	C3
4	RFU	C4
5	GND	C5
6	Vpp	C6
7	I/O	C7
8	RFU	C8

Connector: 53261-0890(MOLEX)

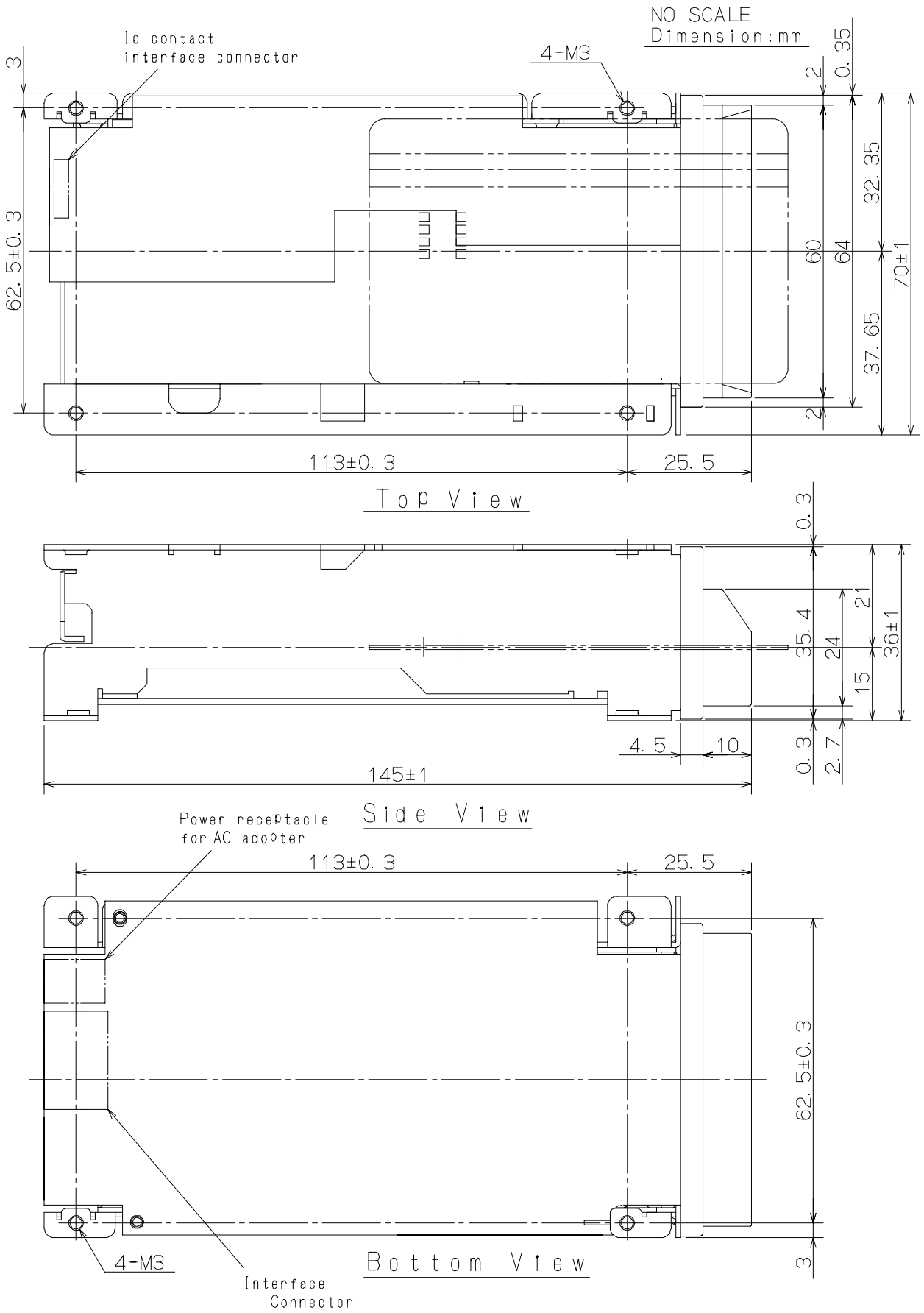


11. Hardware Overview

An overview of the hardware is given by the following block diagram.



12. Schematic Diagram



13. Notice

(1) Do not touch the card during the magnetic data read procedure.
It will cause a read error.
(2) Do not use the power supply which exceeds the limit described in the “Required power supply”.
There is no over voltage protection in the card read reader.
(3) Be sure to turn off the power when the connectors are connected or disconnected.

14. Appendix A

Abstract from ISO 7816-2: 1988 (E)

4. Number and locations of the contacts

This part of ISO 7816 defines eight contacts referred to as C1 to C8.
The contacts are located as shown in figures 2.
The contacts may be located on either the front or the back of the card, but in either case the dimensions are referenced to the left and upper edges of the corresponding surface of the card.

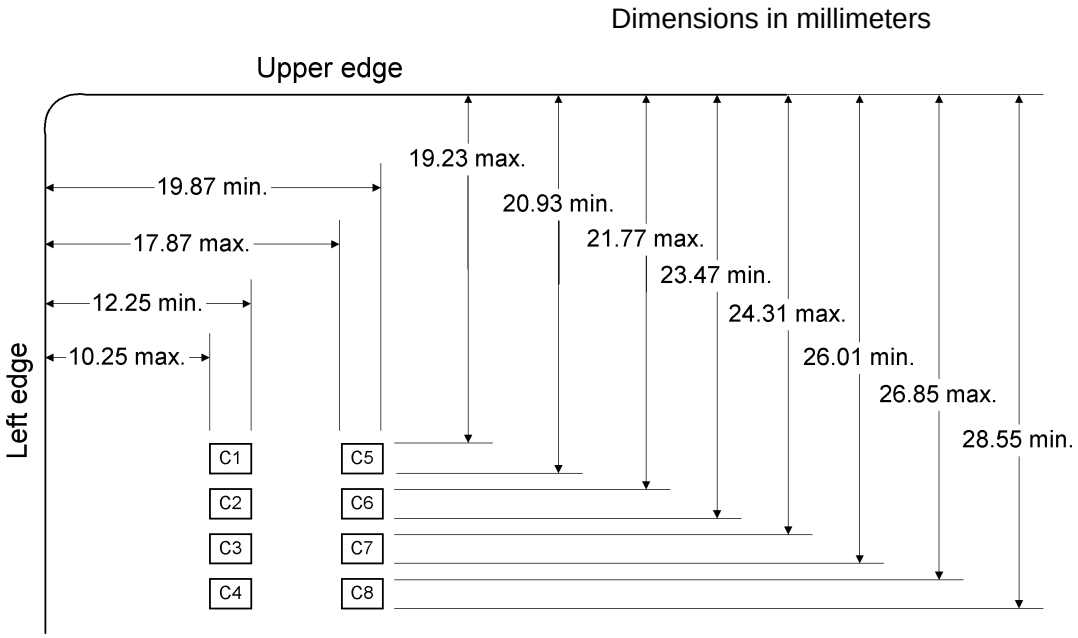


Figure 2 . Contacts location