HALF CARD PORT POWERED INSERTION READER
TECHNICAL REFERENCE MANUAL

Manual Part Number 99875234-6

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REGISTERED TO ISO 9001:2000
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REVISIONS

Rev Number	Date	Notes
1	21 Jun 02	Initial Release
2	09 Sep 02	Editorial comments throughout. Sec 1: Buffered Mode, clarified data and error status, clarified output when sensor is blocked or card withdrawn, Related Documents, added source of ISO specs, Specs: added cmps for card speed, added 6' cable, corrected storage temp to 176 degrees, modified Related Documents to qualify characters in Tk 1 and Tk 2, corrected Fig 1-2 side view dimension. Sec 2: corrected Table 2-1 and added Molex connectors, corrected Table 2-2 by adding P designations. Sec 3: Table 3-2: added red and green LED status and to note "LED controlled by Host", added Watchdog LED paragraph, added optional statement to card insertion block, clarified Tables 3-3 and 3-4.
3	13 Jun 03	Front Matter: added ISO line to logo, changed Tech Support phone number, added new warranty statement.
4	26 Jun 03	Sec 1: added part number to Table 1-1; Specifications: changed operating temperature to before (32 ^{o}F) and after (-4 ^{o}F) 1 Nov 03 shipping date.
5	30 Aug 04	Sec 3, Table 3-2: changed To Set Option L(0x52) to L(0x4C); Table 3-3: added Card Inserted line and Card Removed line at the end of the table, added "data buffer is cleared" to "Sends card data…" line.
6	15 Nov 04	Sec 1, Table 1-1: Added P/N 21066020, 215232 Insertion Reader TK1,2 1Head Right, Half Card Port Powered, Black.

Limited Warranty

MagTek, Inc. warrants that the Product described in this document is free of defects in materials and workmanship for a period of one year from the date of purchase where the date of purchase is defined as the date of shipment from MagTek. During this warranty period, MagTek shall, at their option, repair or replace without charge for either parts or labor, any failure, malfunction, defect or nonconformity which prevents the product from performing in accordance with MagTek's published technical specifications and manuals.

This warranty does not apply to wear of the magnetic read head. This warranty shall not apply if the product is modified, tampered with, or subject to abnormal working conditions. This warranty does not apply when the malfunction results from the use of the Product in conjunction with ancillary or peripheral equipment where it is determined by MagTek that there is no fault in the Product itself.

Notification by the Customer to MagTek of any condition described above should be directed to the Customer's MagTek Sales Representative or to MagTek's Help Desk at (651) 415-6800. If the Product is to be returned from the Customer to MagTek, a returned material authorization (RMA) will be issued by MagTek. The Customer shall be responsible for shipping charges to MagTek, (20801 S. Annalee Ave., Carson, CA 90746). MagTek shall be responsible for shipping charges back to the Customer.

Repair or replacement as provided under this warranty is the exclusive remedy. This warranty is in lieu of all other warranties, express or implied.

FCC WARNING STATEMENT

This equipment has been tested and found to comply with the limits for Class B digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

FCC COMPLIANCE STATEMENT

This device complies with Part 15 of the FCC Rules. Operation of this device is subject to the following two conditions: (1) This device may not cause harmful interference. And (2) This device must accept any interference received, including interference that may cause undesired operation.

CANADIAN DOC STATEMENT

This digital apparatus does not exceed the Class B limits for radio noise for digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de las classe B prescrites dans le Réglement sur le brouillage radioélectrique édicté par les ministère des Communications du Canada.

CE STANDARDS

Testing for compliance to CE requirements was performed by an independent laboratory. The unit under test was found compliant to Class B.

UL/CUL

This product is recognized per Underwriter Laboratories and Canadian Underwriter Laboratories 1950.

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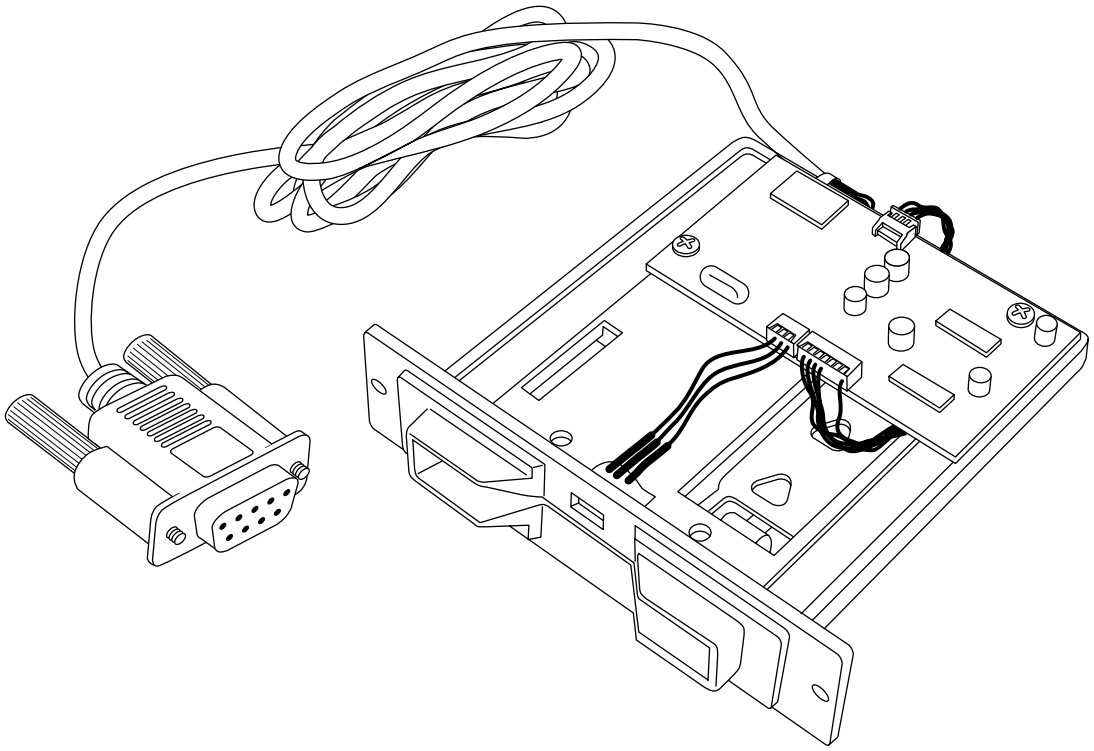


Figure 1-1. Half Card Port Powered Insertion Reader

SECTION 1. FEATURES AND SPECIFICATIONS

The Half Card Port Powered Insertion Reader is a single-head, dual-track configuration (Tracks 1 and 2). The magnetic stripe is down and to the right as viewed from the front of the Reader. The single head configuration can read the card on insertion and removal.

FEATURES

Features of the Reader are as follows:

- Port Powered RS-232 Interface – No power pack required, powered from PC port with computers having an RS-232 interface
- Card Present Opto-sensor – Detects if card is fully inserted in Reader
- Dual-Color LED – Red/Green colors provide visual cues to the card holder
- Watchdog LED – Provides visual cues to service personnel to verify Reader electronics are operational
- Open Chassis design – Provides superior debris clearing capability
- Isolated PCB – Isolates electronics from debris and liquids
- Beam-mounted Read-head – Provides superior tracking of bowed or warped cards
- Mag-Stripe reading during insertion and removal of card – For reliable card reading
- AGC F2F ASIC – Provides improved ability to read cards (Automatic Gain Control, Two Phase Frequency, and Application Specific Integrated Circuit)
- Command Selectable Buffered or Unbuffered Modes – Provides greater versatility of operating modes
- Command Selectable Framing Characters – Provides selection of STX, ETX, ESC, and CR.
- ASCII Message Format at 9600 bps

CONFIGURATIONS

Table 1-1 lists the part number, single or dual head, head positions, Tracks, and Head Connector.

Table 1-1. Configuration

Part Number	Single or Dual Head	Head Position*	Track	Comments
21066008	Single	Head Down/Right	1-2	White; 6’ Cable
21066019	Single	Head Down/Right	1-2	White; No Cable
21066020	Single	Head Down/Right	1-2	Black; 6’ Cable

*The magnetic stripe is inserted in the same orientation as the head position; for example, head down/right means magnetic stripe down or to the right.

MODES OF OPERATION

The Reader can operate in either unbuffered or buffered mode. The modes are described below. The note that follows applies to both modes.

Note

The insertion and removal of the card must be done in a continuous motion. If not, the Reader may not read the encoded data properly. In that case, the Reader responds by either transmitting the ASCII character "E" representing an error, or by not transmitting any character, which indicates that the Reader has not detected data and the card was not completely inserted.

Unbuffered Mode

When a card is inserted and removed, a read attempt is made during both insertion and removal. If the read is successful, data (including the two sentinel characters) is sent to the PC. The data is transmitted immediately after removing the card and not retained in the Reader.

When operating in the unbuffered mode, the Reader does not need to receive commands from the host in order to transmit data or status characters, and data, if available; however, the Reader does respond to an "Inquiry Command" by sending status characters. The inquiry command that requests the transmission is the ESCAPE (ESC) character followed by "I" (0x49).

In the unbuffered mode, data can be retrieved from the card after the card has been inserted and while it is blocking the rear sensor. Issuing an "Inquiry Command" (see Section 3) will retrieve data from the card.

Buffered Mode

When a card is inserted and removed, a read attempt is made during both insertion and removal. Upon removal of the card if the read is successful, data (including the two sentinel characters) is stored in a memory buffer on the Reader and is not transmitted until the Reader receives an "Inquiry Command" from the host. This command is the ESCAPE character followed by "I". The data or error status is available when the back sensor is blocked, however the Release Command will not clear the buffer. The Reader cannot read another card until the buffer is cleared. To clear the buffer, the Host must transmit the ESCAPE character followed by "R".

The unit will always output a 1 and enabled optional characters when the back sensor is first blocked. It will output a 0 and enabled optional characters when the card has been withdrawn. See Section 3, Table 3-4 for detailed examples.

RELATED DOCUMENTS

MagTek 99875125	The MagTek Device Drivers for Windows, Part Number 30037385, may be used with the Port Powered Insertion Reader. The title of the manual is *MagTek Device Drivers For Windows Programming Reference Manual*.

The Port Powered Insertion Reader will read cards that meet the standards defined by ISO (International Standards Organization) with the exception that track 1 can only contain up to 51 characters and track 2 up to 25 characters:

ISO 7811	Identification Cards - Mag-stripe Cards, Tracks 1-3
ISO 7810	Identification Cards - Physical Specifications (ID-1 Cards)
Available from ANSI	Phone 212-642-4900, www.ansi.org

SPECIFICATIONS

The Specifications are listed in Table 1-2.

Table 1-2. Specifications

OPERATING	
Reference Standards	ISO7810 and 7811; 51 Characters on Track 1, 25 on Track 2
Power Input	From RS-232 Interface
Output Cable	Should not exceed 50 ft (15 m) in length
Interface Signal	RS-232E
Message Format	ASCII (8 Data Bits, No Parity) 9600 Baud
Track Card Speed	3 to 50 IPS (7,6 to 127 cm/sec)
MTBF	Electronics: 125,000 hours Head: 500,000 Insertion Cycles (1,000,000 head passes)
ELECTRICAL	
DTR Voltage (Input)	+5 to +15 VDC
Transmit Data (TXD)	+5 to -5 VDC
Receive Data (RXD)	+15 to -15 VDC
Communication	Transfer Rate: 9600 bps, 8 data bits, no parity, 1 stop bit
Current	
Power On	12 mA Max
Transmitting	11 mA typical, 5 ms duration
Quiescent	6 mA typical, continuous
MECHANICAL	
Dimensions	
Length	3.856 in (97.942 mm) – Allow .3 in (7.62 mm) for cable thickness and tie wrap at the rear of the unit
Width	4.000 in (101.6 mm)
Height	1.000 in (25.4 mm)
Weight	4.046 oz (114.69 gr) including 6' cable
ENVIRONMENTAL	
Temperature	
Operating	Units shipped prior to November 1, 2003: 32 ^{o}F to 131 ^{o}F (0 ^{o}C to 55 ^{o}C) Units shipped after November 1, 2003: -4 ^{o}F to 158 ^{o}F (-20 ^{o}C to 70 ^{o}C)
Storage	-40 ^{o}F to 176 ^{o}F (-40 ^{o}C to 80 ^{o}C)
Humidity	
Operating	10% to 90% noncondensing
Storage	10% to 90% noncondensing
Altitude	
Operating	0-10,000 ft (0-3048 m)
Storage	0-50,000 ft (0-15,240 m)

DIMENSIONS

The dimensions and tolerances for the Reader are shown in Figure 1-2.

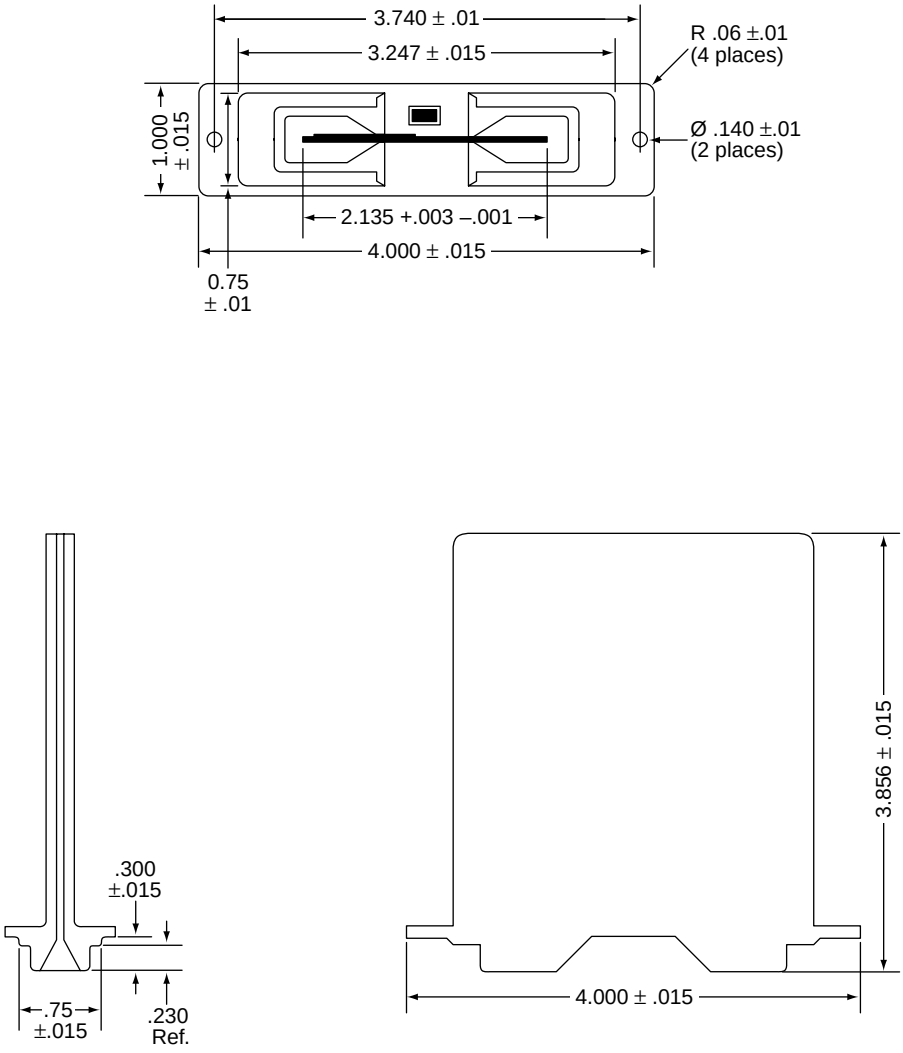


Figure 1-2. Half Card Reader Dimensions

SECTION 2. INSTALLATION

This section describes Connectors, cabling information, mounting, and card orientation.

CONNECTORS

The connector pin list is shown in Table 2-1. The mating connector manufactured by Molex is 51021-0400. The Molex Terminal is 50058-8000.

Table 2-1. J1 Connector - RS232

PIN NUMBER	SIGNAL (HOST AS REFERENCE)
J1-1	RXD (To PC)
J1-2	TXD (From PC)*
J1-3	DTR (From PC)
J1-4	GND

* Pin must be connected to TXD (or DTR if TXD not available).

PC Connector

The serial cable is shown in Figure 2-1. One end connects to J1 and the other end is a DE-9 female. The pin list for the cable connectors is shown in Table 2-2.

Table 2-2. P2 Connector and Cable

P2	SIGNAL	COLOR	P1
1	NC*	--	--
2	RXD	YELLOW	1
3	TXD	GREEN	2
4	DTR	ORANGE	3
5	GND	BROWN	4
6-9	NC*	--	--

*NC = No connection

MOUNTING

Figure 2-1 shows the board layout orientation as viewed from the top. The Reader is attached to the customer plate with two mounting screws. There are three levels on the front face: the bracket with the mounting holes; the beveled race above the mounting bracket; and the card guide brackets. The unit is mounted to the inside of the user's surface. The mounting bracket is not seen by the customer, and the beveled race and area above it and the card guide brackets are visible to the customer.

Dimensions and tolerances are shown in Section 1, Figure 1-2.

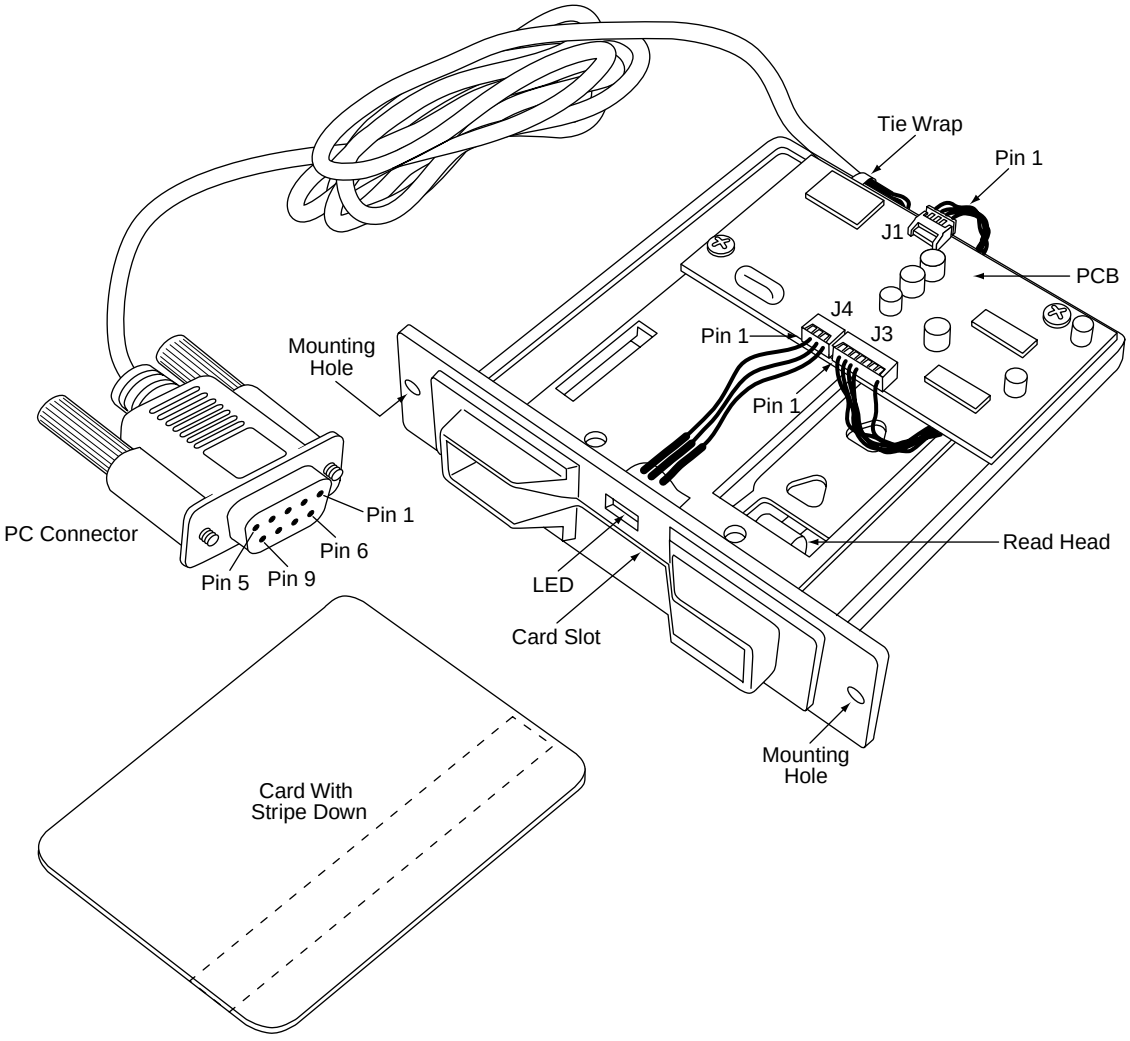


Figure 2-1. Reader Layout - Top

For the LED shown in the illustration refer to Section 3, Table 3-2, for setting the color options.

Orientation

The Reader is mounted as oriented in Figure 2-1, or it may be rotated 90^{o} counterclockwise from that orientation. In the latter position, debris and foreign objects can clear the unit without damaging head or card stop areas, shown in Figure 2-2.

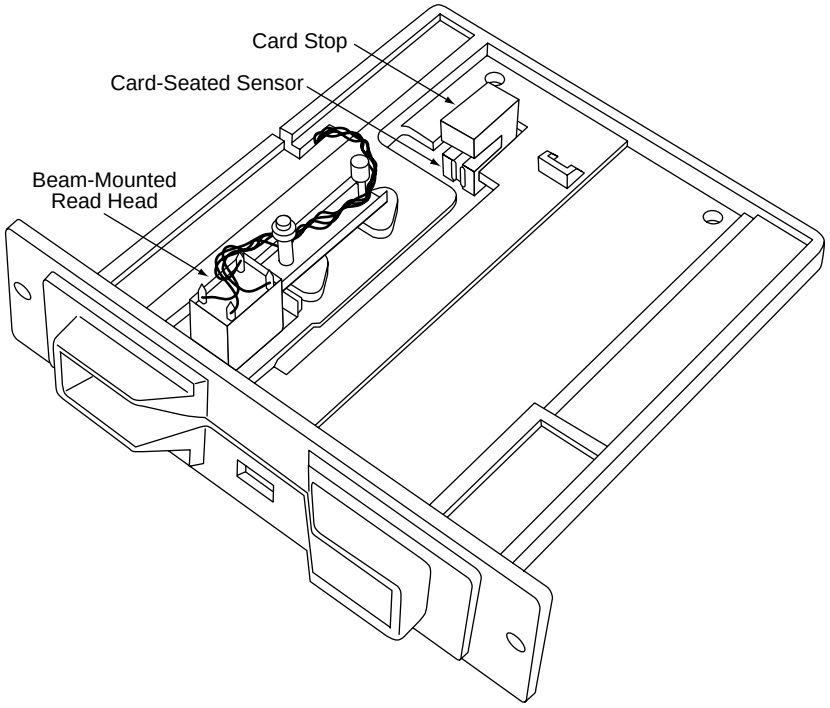


Figure 2-2. Reader Layout -Bottom

The Reader should be mounted only in the two orientations describe above, so that the magnetic stripe is facing down and to the right or up and to the right

SECTION 3. COMMANDS, FORMATS, TIMING

This section includes commands, message formats, and transmission timing.

The MagTek Device Drivers for Windows, part number 30037385, may be used with the Half Card, Port Powered Insertion Reader. When these drivers are used, refer to *MagTek Device Driver for Windows, Programming Reference Manual*, Part Number 99875125.

When power is applied, the Reader transmits a sign-on ID message. About 150 milliseconds after DTR is applied, the Reader sends the part number of the firmware in the following form: 21088828A01. The first 8 characters indicate the firmware number; the letter is the revision, which is followed by a revision sublevel of 01 to 99.

Since the input voltage is supplied by a relatively low source of power, the Reader depends on its input capacitor to maintain proper charge during all operations. In order to reduce the drain on this internal power source during data transmission, the output data is transmitted in 5 to 6 millisecond bursts with a 10-millisecond gap between bursts to allow the capacitor to recharge. The PC software should be able to tolerate this 10-millisecond space between characters.

HOST TO READER COMMANDS

All commands transmitted from the Host to the Reader must be preceded by the ASCII "ESCAPE" character (0x1B). These command messages may contain other framing characters that are ignored by the Reader. Table 3-1 describes the commands and responses. Table 3-2 lists setting and clearing options and the responses.

Table 3-1. Commands and Responses

HOST COMMANDS			READER RESPONSES
COMMAND PREFIX	**USE EITHER CHARACTER**		
<ESC> (0X1B)	I (0x49)	+ (0x2B)	Inquiry command causes the Reader to transmit data, error, or status message. This command works in both the buffered and unbuffered modes.
<ESC> (0X1B)	R (0x52)	- (0x2D)	Release command causes the Reader to clear its memory buffer of any data present. This command works only in the Buffered mode.

The Inquiry command (I/+) will transmit data after the card has been inserted even if not in the buffered mode. This allows a card to remain in the slot during the transaction. If not in the buffered mode, the card data will also be transmitted when the card is removed. (Refer to Tables 3-3 and 3-4 for examples.)

Table 3-2. Options and Reader Responses

COMMAND PREFIX	TO SET OPTION	TO CLEAR OPTION (DEFAULT)	READER FUNCTION
<ESC> (0x1B)	S (0x53)	s (0x73)	Send STX
<ESC> (0x1B)	E (0x45)	e (0x65)	Send ETX
<ESC> (0x1B)	C (0x43)	c (0x63)	Send CR
<ESC> (0x1B)	P (0x50)	p (0x70)	Send ESC
<ESC> (0x1B)	B (0x42)	b (0x62)	Buffered Mode
<ESC> (0x1B)	G (0x47)	-	Green LED On, Red LED off
<ESC> (0x1B)	L (0x4C)	-	Red LED On, Green LED off
<ESC> (0x1B)		O (0x4F)	Both LEDs Off (default)
<ESC> (0x1B)	Q (0x51)	q (0x71)	Quiet Mode; Buffered Mode (reader does not send status)

Note

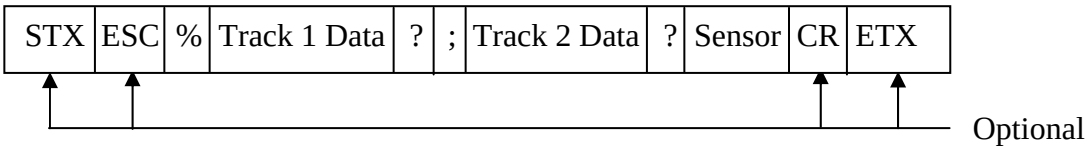
If DTR is dropped and restored, the setup options are returned to the default state. The LED is controlled by the Host.

WATCHDOG LED

A watchdog LED provides a visual clue to service personnel that the Reader electronics are operational. This LED is located on the PCB next to J4 (LED connector) and is designated D1. If power is applied and the CPU is in its normal idle loop, the LED will continually blink green, **on** for approximately one second, **off** for one second. If an encoded card is withdrawn from the Reader at the beginning of the **on** cycle, the LED should give an extra short blink.

READER TO HOST FORMATS

The following diagram represents the format of the data transmitted to the Host:



Where optional characters

STX (0x02) = Start of text character
ESC (0x1B) = Escape character
CR (0x0D) = Carriage return character
ETX (0x03) = End of Text

are used to frame data.

%	=	Start Sentinel Track 1
;	=	Start Sentinel Track 2
?	=	End Sentinel

The LRC character is not transmitted.

Track data may be represented as follows:

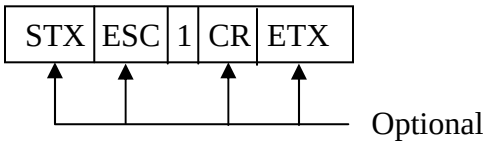
SS	Track Data	ES	Card Sensor Status

Where

SS	=	Start Sentinel: "%" for Track 1; ";" for Track 2
Data	=	Track Data in track order that is, Track 1 then Track 2
ES	=	End Sentinel: "?"
Sensor	=	"0" no card in reader
		"1" card present in reader (rear sensor blocked)

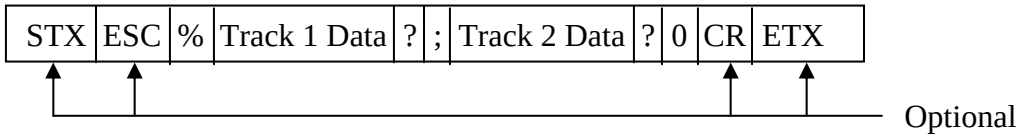
If there is an error in one of the tracks, the "Track Data" field will be replaced with "E" (0x45).

An example of a card insertion or removal is as follows when the Back Sensor is first blocked by the card:



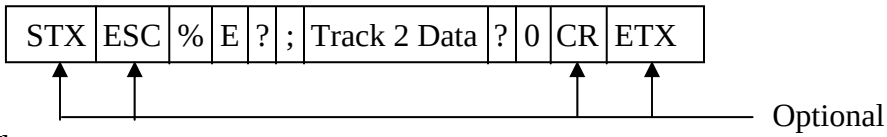
Where 1 indicates Sensor blocked; 0 indicates the sensor became unblocked.

The following is an example of a good read on withdrawal of a card:



Where 0 indicates the sensor unblocked.

The following is an example of a bad read on Track 1 and a good read on Track 2 on withdrawal of a card:



Where

E (0x45)	=	Error
Track 2 Data	=	Good read Track 2 Data
0	=	Sensor unblocked

TIMING FOR ID SIGN-ON AND TRANSMISSION BURSTS

Timing for the ID Sign-on and transmission bursts (5 ms with 10 ms between bursts) is shown in Figure 3-1.

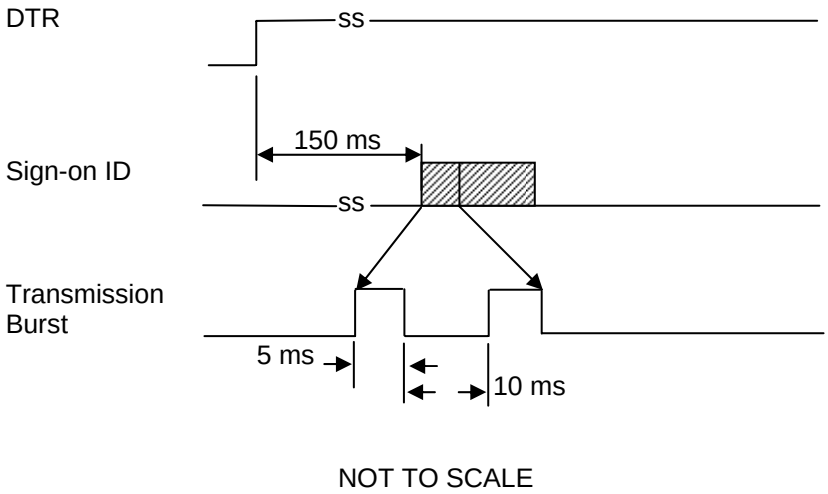


Figure 3-1. Timing For ID Sign-on and Transmission Bursts.

The firmware controls the operation of ID Sign-on and Transmission bursts. The ID sign-on is

21088828A04

Where:

21088828 is the firmware part number,

A is the alpha revision, and

04 is the number sub-revision.

TRANSMISSIONS EXAMPLES

Table 3-3 shows transmission examples not in the buffered mode:

Table 3-3. Transmission Data Examples Not in Buffered Mode

Action	Port Powered Insert Reader Data	PC Data
Card Inserted	1 (0x31)	
PC Sends Inquiry (if the application needs data before card removed)		<ESC> I (0x1B, 0x49)
Bad read on insert so reader sends error plus card status	%E?;E?1 (0x25, 0x45, 0x3F, 0x3B, 0x45, 0x3F, 0x31)	
Card removed	%<track 1 data>?;<track 2 data>?0	
Card Inserted	1 (0x31)	
PC Sends Inquiry (if the application needs data before card removed)		<ESC> I (0x1B, 0x49)
Sends card data plus card status; data buffer is cleared	%<track 1 data>?;<track 2 data>?1	
Card removed (card data is always transmitted when the card is removed if not in buffered mode)	%<track 1 data>?;<track 2 data>?0	
Card Inserted	1 (0x31)	
Card removed (card data is always transmitted when the card is removed if not in buffered mode)	%<track 1 data>?;<track 2 data>?0	

Table 3-4 shows transmission examples in the buffered mode with STX and ETX included:

Table 3-4. Transmission Data Examples in Buffered Mode With STX and ETX Included

Action	Port Powered Insert Reader Data	PC Data
PC Sets Buffered Mode		<ESC>B (0x1B, 0x42)
PC Sets STX		<ESC>S (0x1B, 0x53)
PC Sets ETX		<ESC>E (0x1B, 0x45)
Card Inserted	<STX>1<ETX> (0x02, 0x31, 0x03)	
PC Sends Inquiry		<ESC>I (0x1B, 0x49)
If bad read on insert, reader sends error status	<STX>%E?;E?1<ETX>(0x02,0x25, 0x45,0x3F,0x3D,0x45,0x3F,0x31,0x03)	
If good read on insert, sends card data	<STX>%<track 1 data>?;<track 2 data>?1<ETX>	
Card removed	<STX>0<ETX> (0x02, 0x30, 0x03)	
PC Sends Inquiry		<ESC>I (0x1B, 0x49)
Sends card data	<STX>%<track 1 data>?;<track 2 data>?0<ETX>	
PC Sends Inquiry		<ESC>I (0x1B, 0x49)
Sends card data (data remains in buffer until a release command has been received)	<STX>%<track 1 data>?;<track 2 data>?0<ETX>	
Buffer cleared (released)		<ESC>R (0x1B, 0x52)
PC Sends Inquiry		<ESC>I (0x1B, 0x49)
Sends status	<STX>0<ETX> (0x02, 0x30, 0x03)	