P-SERIES, PORT POWERED
INSERTION READER
TECHNICAL REFERENCE MANUAL

Manual Part Number 99875158 Rev 12

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REVISIONS

Rev Number	Date	Notes
1	04 Feb 00	Initial Release
2	01 Mar 00	Removed all references to unreleased P/N 21065098
3	07 Aug 00	Sec 1, Specs, Mechanical, Length changed to (without bezel) 4.08" (103.6 mm); (with extended bezel) 4.82" (122.4 mm). Added weight of 3.5 oz to (100 grms ±20%). Converted symbols to Metric System [SI].
4	01 Jan 00	Front Matter: Changed copyright date; Changed warranty from 90 days to one year.
5	15 Feb 01	Sec 1: to Configuration Table added P/N 21065098, Single head with head opposite PCB side. Sec 2 Mechanical Installation: head on opposite side described
6	19 Jul 01	Front Matter: Agency Approvals: FCC updated to Class B. Removed CE Approval
7	10 Jul 02	Sec 2: Specs, changed weight from 3.2 oz. to 3.8 oz. Sec 3: added statement for ICs 21088819 and 21088823 relevant to card insertion; added transmission examples and note about Optional J5 Connector.
8	21 May 03	Front Matter: added ISO line to logo, changed Tech Support phone number, added new warranty statement.
9	26 Jun 03	Changed operating temperature to before (32 ^{O}F) and after (-4 ^{O}F) 1 Nov 03 shipping date.
10	8 May 06	Added support brackets
11	23 Mar 07	Added 21065144, added new FCC Line.
12	19 Sept 09	Replaced mounting brackets with angle bracket kit (21064519); updated Limited Warranty & Agency Approvals

LIMITED WARRANTY

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FCC WARNING STATEMENT

This equipment has been tested and was found to comply with the limits for a 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 with 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 from 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 la classe B prescrites dans le Réglement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numériqué de la classe B est conformé à la norme NMB-003 du Canada.

CE STANDARDS

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

UL/CSA

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

RoHS STATEMENT

When ordered as RoHS compliant, this product meets the Electrical and Electronic Equipment (EEE) Reduction of Hazardous Substances (RoHS) European Directive 2002/95/EC. The marking is clearly recognizable, either as written words like "Pb-free", "lead-free", or as another clear symbol ( ).

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FIGURES and TABLES

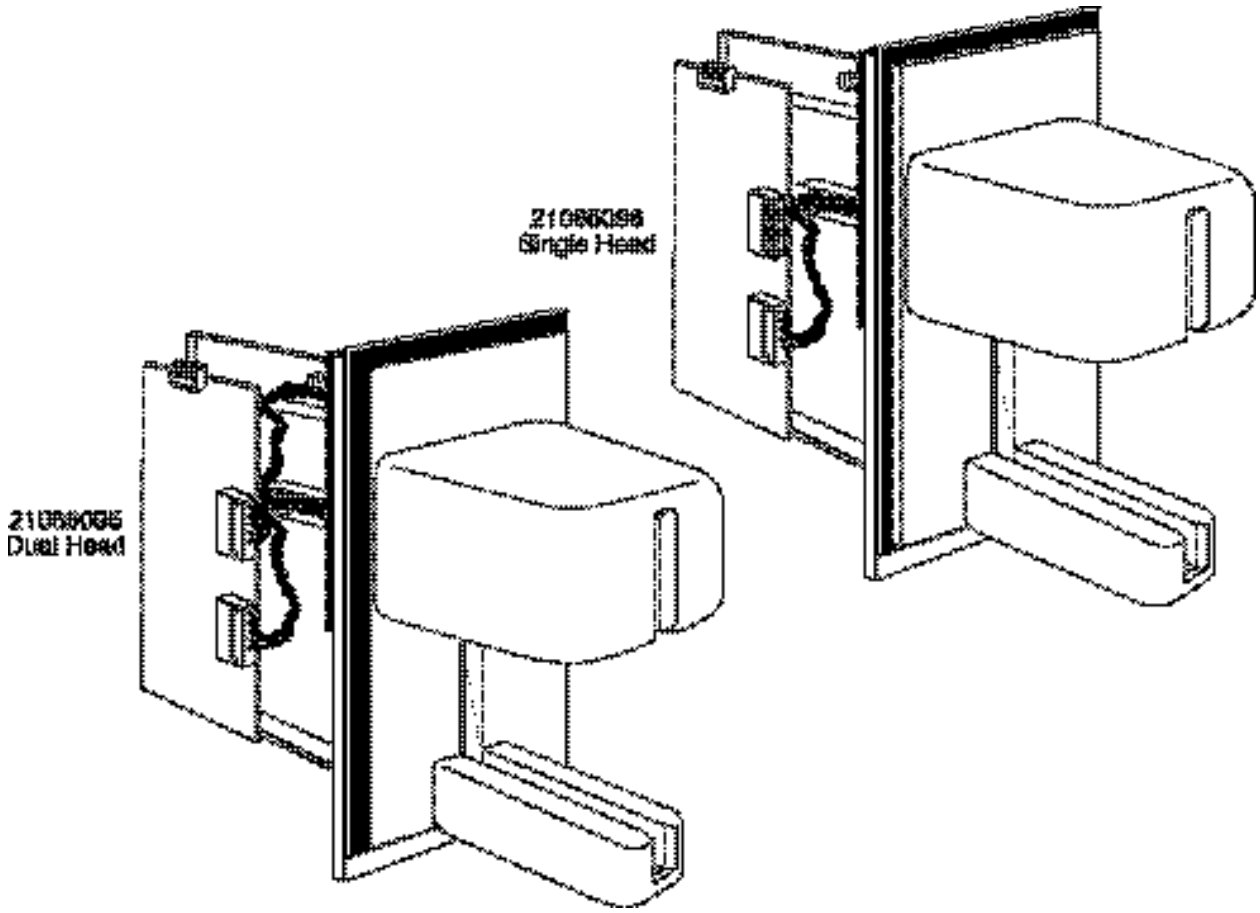


Figure 1-1. P-Series Port Powered Insertion Reader Configurations

SECTION 1. FEATURES AND SPECIFICATIONS

The P-Series Port Powered Insertion Reader can be single or dual head configuration. Figure 1-1 shows the Readers, cabling configurations, and bezel configuration. The dual head configuration can read the card on insertion and removal with the magnetic stripe facing left or right. The single head configuration can read the card on insertion and removal if the stripe is oriented to match the position of the head.

The Reader also has circuitry that automatically ensures that the ISO magnetic stripe is read in the case where a dual-stripe JIS (Japanese) credit card is inserted on the dual head unit. (The JIS stripe is ignored.)

The Reader conforms to the following specifications: ISO (International Standards Organization) and ANSI (American National Standards Institute). The Reader conforms to specifications for Tracks 1 and 2 of the following 3-Track formats: AAMVA (American Association of Motor Vehicle Administrators) and CDL (California Drivers License).

FEATURES

Features of the Reader are as follows:

- Port Powered RS-232 Interface - powered from PC port with computers having an RS-232 interface.
- Single or Dual Read Head - Configuration can be Single or Dual Read Head.
- JIS Discrimination circuitry - automatically detects if a dual-stripe JIS (Japanese Industrial Standard) card is inserted, and auto-routes the ISO data signals to microcontroller. This ensures that dual-head features still work for Japanese card holders.
- Mag-Stripe reading during insertion and removal of card - for reliable card reading.
- Sealed Chassis design - provides superior protection from moisture.
- Isolated PCB - isolates electronics from debris and liquids.
- AGC (Automatic Gain Control) in MagTek's latest read IC - enhances read performance with less susceptibility to RF interference.
- Beam-mounted Read-heads - improves card tracking capabilities.
- Ruggedized Chassis and Bezel Material - improves temperature and impact performance.
- 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 numbers, single or dual head, and head positions.

Table 1-1. Configurations

Part Number	Single or Dual Head	Track	RS-232 I/O Connector
21065095	Dual head	1-2	53048-0410
21065096	Single head (head left)	1-2	53048-0410
21065098	Single head (head right) with head opposite PCB side	1-2	53048-0410
21065144	Dual head	1, 2, 3	53048-0410

ACCESSORIES

The accessories are as follows:

Part Number	Description
21041469	4-Pin Molex Cable to DE-9, Pearl White, 6 ft.
21051499	4-Pin Molex Cable, Black to DE-9, 6 ft.
21064519	Angle Bracket Mounting Kit

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; however, the Reader does respond to an

"Inquiry Command" by sending status characters. The inquiry command that requests the transmission of status characters is the ESCAPE (ESC - 0x1B) character followed by "I" (0x49).

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 "I". The data is not available until the rear sensor is unblocked. 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".

RELATED DOCUMENTS

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

The P-Series Port Powered Insertion Reader will read cards that meet the standards defined by ISO (International Standards Organization):

ISO 7811	Identification Cards - Mag-stripe Cards, Tracks 1-3
ISO 7810	Identification Cards - Physical Specifications (ID-1 Cards)

Available from ANSI: 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; JIS B9561	
Power Input	From RS-232 Interface	
Interface Signal	RS-232E	
Message Format	ASCII (8 Data Bits, No Parity) 9600 Baud	
Tracks (tracks 1-2 versions)	Reads ISO Tk1 and Tk2 data locations	
Track Card Speed	3 to 50 IPS (7,6 to 127 cm/sec)	
MTBF	Electronics: 125,000 hours Head: 500,000 Insertion Cycles	
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 Peak	10 to 12 mA	
Transmitting	8 to 11 mA typical (5 ms duration)	
Quiescent	4 to 6 mA typical (continuous)	
MECHANICAL		
Dimensions:	Without Bezel	With Extended Arm Bezel
Length:	4.08" (103.6 mm)	4.82" (122.4 mm)
Width:	3.15" (80.0 mm)	3.54" (90.0 mm)
Height:	1.29" (32.8 mm)	1.81" (46.0 mm)
Weight:	3.8 oz (108g) ±20%	
ENVIRONMENTAL		
Temperature Operating Storage	 Units shipped prior to November 1, 2003: 32 °F to 131 °F (0 °C to 55 °C) Units shipped after November 1, 2003: -4 °F to 158 °F (-20 °C to 70 °C) -40 °F to 176 °F (-40 °C to 80 °C)	
Humidity Operating Storage	 10% to 90% noncondensing 10% to 90% noncondensing	
Altitude Operating Storage	 0-10,000 ft. (0-3048 m.) 0-50,000 ft. (0-15240 m.)	

SECTION 2. INSTALLATION

This section describes cabling information, mounting, and PCB layout.

The installation consists of mounting the Reader and connecting the cable. The head, or heads, are installed in the factory to customer specifications.

CONNECTORS

The connector pin list is shown in Table 2-1. The mating connector for J4 is Molex 51021-0400. The terminals are Molex 50058-8000.

Connector J5 is an optional, 3-pin, auxiliary power connector that is supplied upon request. (See Optional J5 Connector in Section 3).

Table 2-1. J4 Connector - RS232

PIN NUMBER	SIGNAL (HOST AS REFERENCE)
J4-1	RXD (To PC)
J4-2	TXD (From PC)*
J4-3	DTR (From PC)
J4-4	GND

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

OPTIONAL RS-232 CABLE

Optional serial cables, part numbers 21051499 (black) or 21041469 (white), are available. Both cables are 6 feet in length. One end connects to J4 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. Pin List for Cables 21051499 and 21041469

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

*NC = No connection

MECHANICAL INSTALLATION

The standard orientation of the Reader is with the larger guide up as shown in Figure 2-1. The position shown offers the best protection for the heads from moisture, dust, or foreign particles.

In a dual head configuration, connector J3 is wired to the head that is on the same side as the PCB. Connector J2 is wired to the head that is opposite the PCB. The magnetic stripe must be inserted in the Large Guide but may be facing in either direction.

In a single head configuration, the head may be mounted on either side. As shown in Figures 2-1 and 2-2, connector J3 is wired with the head on the same side as the PCB. Connector J2 is wired when the head is on the opposite side of the PCB. The magnetic stripe must be inserted in the Large Guide and must be facing the head.

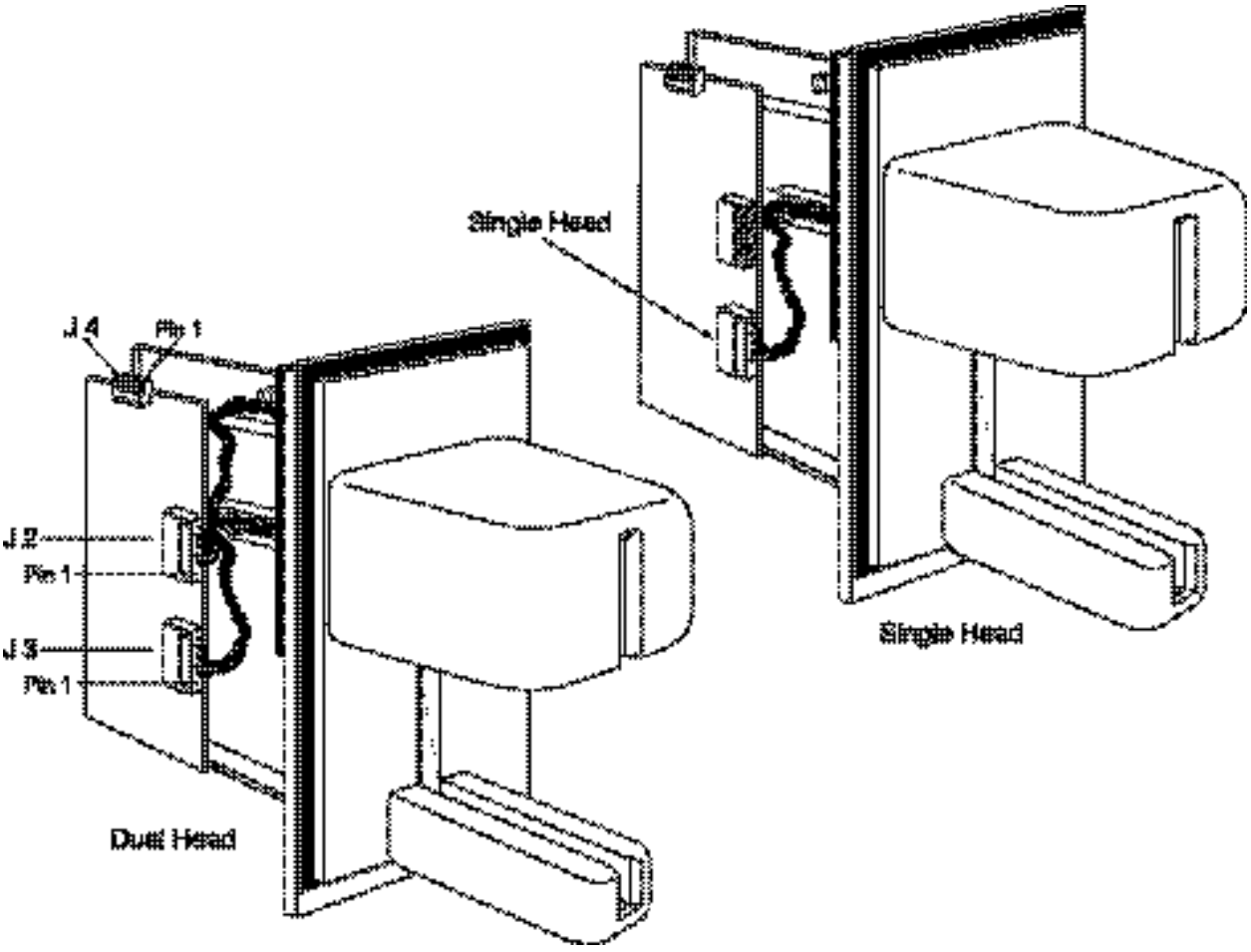


Figure 2-1. MagTek Bezel Mounting Position

The unit is supplied with a cable tie so that a user-supplied cable (or optional MagTek cable) can be securely attached.

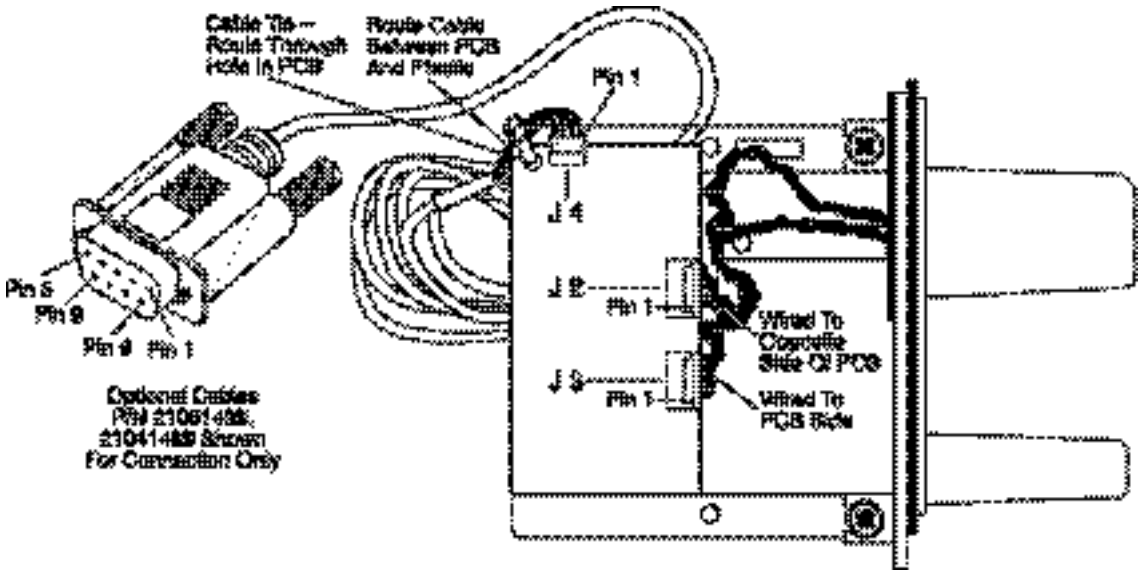


Figure 2-2. Board Layout and Cable Connections

The recommended method of installation is to position the Reader between two brackets from the inside of a mounting panel, as indicated in Figure 2-3. The large gasket on the bezel presses against the bracket to prevent moisture from entering. Another bracket is positioned and secured over the bezel to hold the Reader firmly against the first bracket.

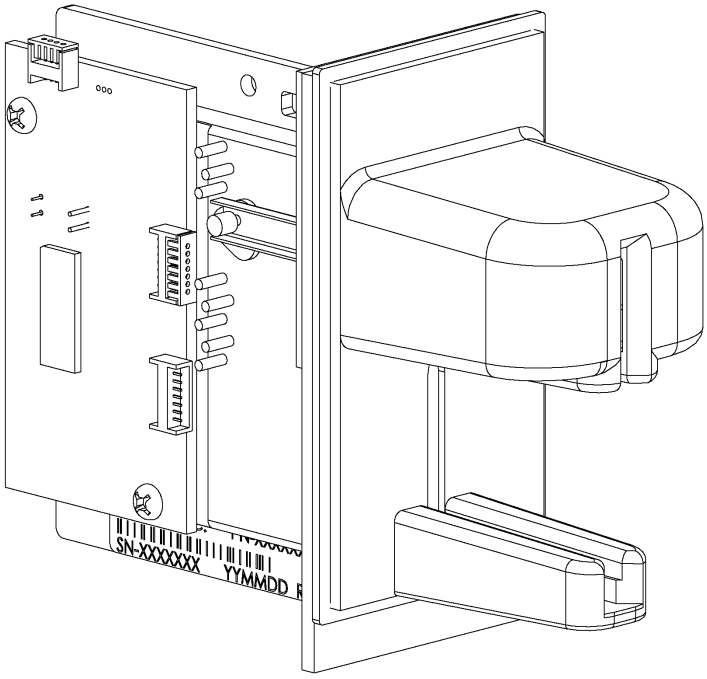


Figure 2-3. MagTek Bezel Mounting Position

OPTIONAL MOUNTING BRACKET

In applications where moisture-intrusion is a concern, it is recommended that the reader be mounted with a 4^{o} - 5^{o} *downward* angle with respect to the horizontal plane. This will allow gravity to drain away any excess moisture that may have entered into the Card Reader slot.

For more information about the mounting bracket kit (21064519) that can be used to tip the reader forward, contact your MagTek salesperson.

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 P-Series 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: 21088819A01. 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
ASCII "ESCAPE" CHARACTER	**USE EITHER CHARACTER**		
<ESC> (0x1B)	I (0x49)	+ (0x2B)	Inquiry command causes the Reader to transmit data, error, or status message.
<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.

With IC U10, part number 21088819 Revision D or above, or IC part number 21088823 Revision B or above, 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.

Table 3-2. Options and Reader Responses

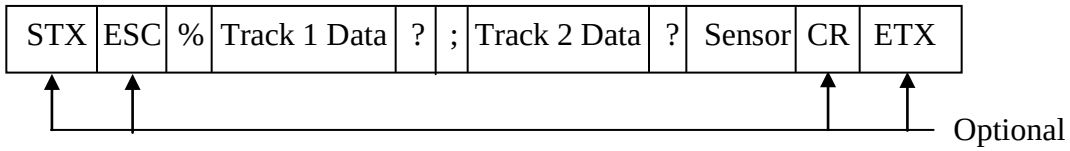
ASCII "ESCAPE" CHARACTER	TO SET OPTION	TO CLEAR OPTION (DEFAULT)	READER RESPONSES
<ESC> (0x1B)	S (0x53)	s (0x73)	Send STX
<ESC> (0x1B)	E (0x45)	e (0x65)	Send ETX
<ESC> (0x1B)	C (0x43)	c (0x63)	Send CR
<ESC> (0x1B)	P (0x50)	p (0x70)	Send ESC
<ESC> (0x1B)	B (0x42)	b (0x62)	Buffered Mode

Note

If DTR is dropped and restored, the setup options are returned to the default state.

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 2 data may be represented as follows:

SS	Track 2 Data	ES	Card Sensor

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)

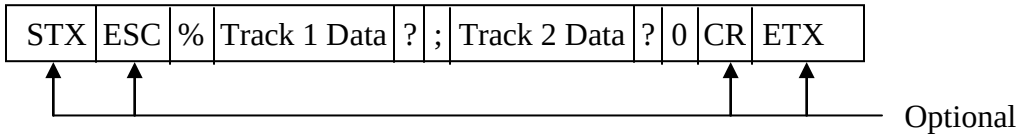
An example of a card insertion or removal is as follows:

STX	ESC	1	CR	ETX

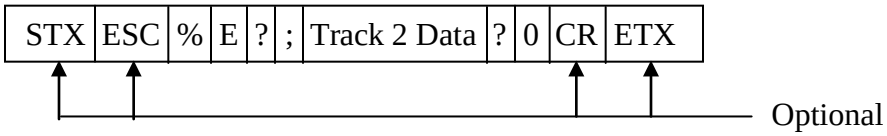
Where

1 = Sensor blocked
0 = Sensor unblocked

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



Where 0 represents 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) are shown in Figure 3-1.

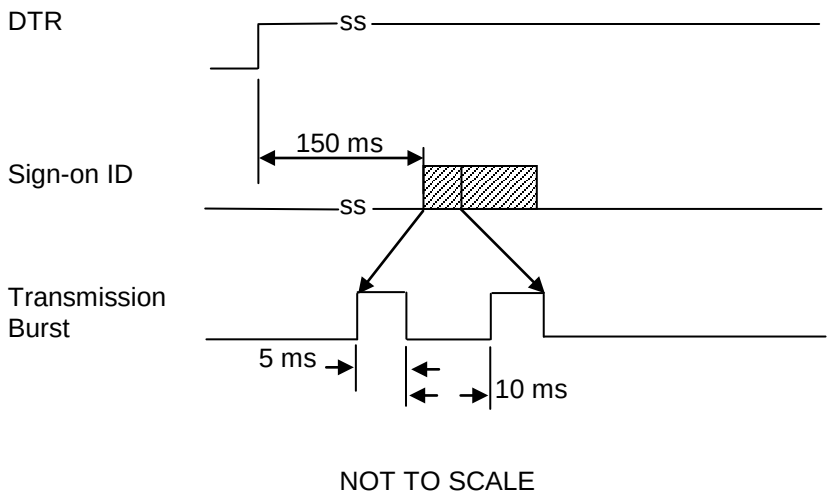


Figure 3-1. Timing For ID Sign-on and Transmission Bursts.

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

21088819Lnn (Track 1-2)

Where:

21088819 is the firmware part number,

L or A is the alpha revision, and

nn is the number sub-revision

TRANSMISSIONS EXAMPLES

The following tables show transmission examples:

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?11 (0x25, 0x45, 0x3F, 0x3B, 0x45, 0x3F, 0x31, 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	%<track 1 data>?;<track 2 data>?11	
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. 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 just sends status	<Stx>1<Etx> (0x02, 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)	

OPTIONAL J5 CONNECTOR

The following note only applies if the optional connector J5 has been installed, and it is desired to operate the unit with an external power supply, instead of Port Power.

The mating connector for J5 is Molex 51021-0300.

J5-1 is connected to the positive terminal of a filtered DC external power supply (often marked + or Pos. The voltage should be between +5 VDC and +15 VDC. If J4-3 is still connected to the port and it is desired that the power come from the external power supply, the voltage at J5-1 must exceed the voltage at J4-3, or the Reader will continue to take power from the port.

J5-2 should be connected to the Power Supply Ground Return (often marked – or Neg).

J5-3 is not connected.

APPENDIX A. MECHANICAL DRAWING FOR MOUNTING

The engineering drawing shows dimensions for mounting:

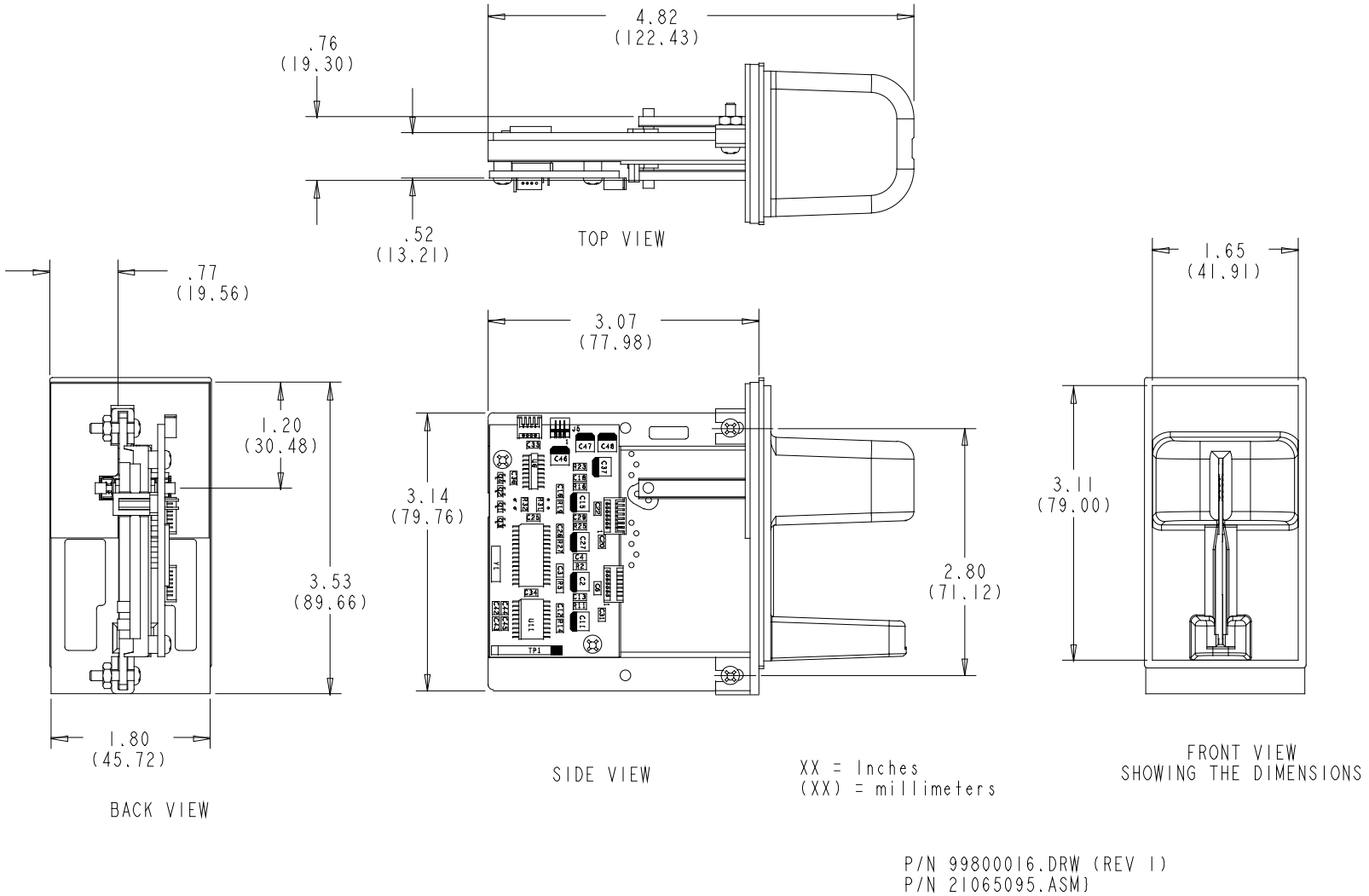


Figure A-1. Dimensions for Mounting