HALF CARD PORT POWERED INSERTION READER
TECHNICAL REFERENCE MANUAL

Manual Part Number 99875234-7

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MAGTEK®
REGISTERED TO ISO 9001:2000
1710 Apollo Court
Seal Beach, CA 90740
Phone: (562) 546-6400
FAX: (562) 546-6301
Technical Support: (651) 415-6800
www.magtek.com

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 Sec 1: Buffered Mode, clarified data and error status, clarified output when sensor is blocked or card withdrawn, Related Documents, added source of ISO specs, Specs: added cmps for card speed, added 6' cable, corrected storage temp to 176 degrees, modified Related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.
7	9 Feb 07	Added new model 21066000; updated throughout to include printed circuit board 21067505; added ability to configure the communication parameters; added configuration commands

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, (1710 Apollo Court, Seal Beach, CA 90740). 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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FIGURES and TABLES

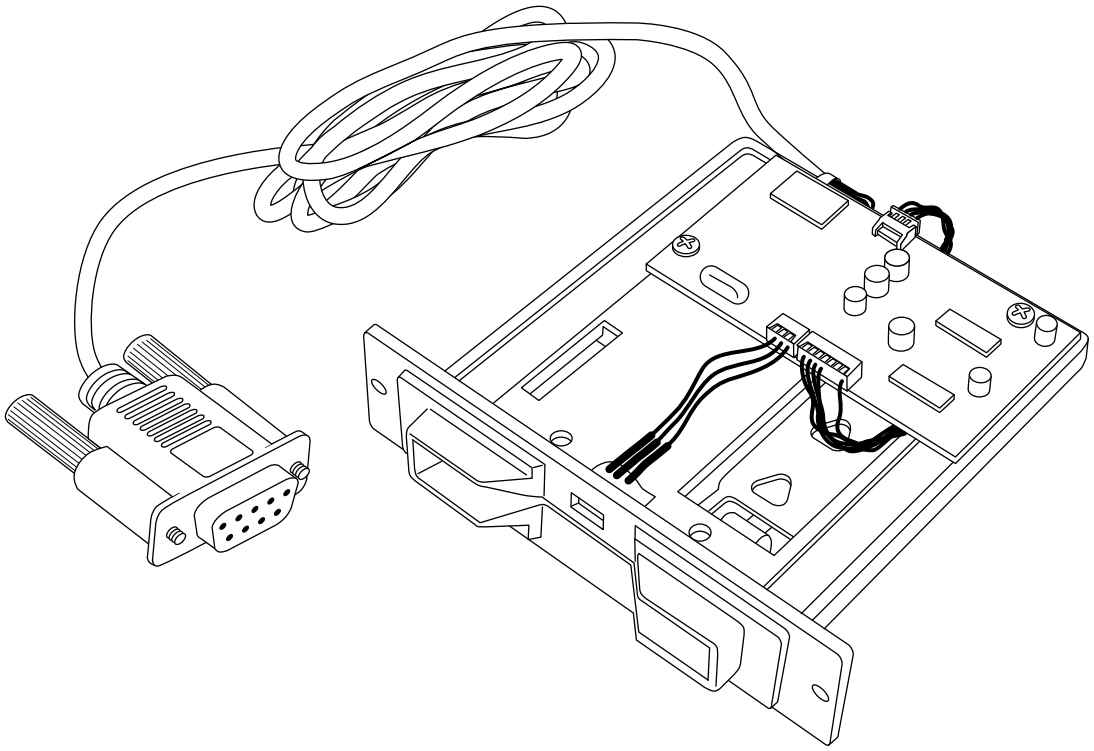


Figure 1-1. Half Card Port Powered Insertion Reader

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, also 19.2k, 38.4k, 57.6k, or 115.2k bps for ***new*** reader (33% duty cycle)

CONFIGURATIONS

Table 1-1 lists the part number, single or dual head, head positions, tracks, and cable type.

Note

*Additional features have been incorporated into the new version of the Half Card Insert Reader (generally available after December 2006). In the new version, the firmware part number will be reported as 21088842. This new reader was designed to be a drop in replacement for the old reader. However, there are some slight behavior differences mentioned throughout this manual. This new reader also added a number of features that are mentioned throughout this manual. The part number of the readers did not change for the new readers, however the revisions did change. The enhancements included in this new version are identified within this document with the word "**new**".*

Table 1-1. Configuration

Part Number	Heads	Head Position*	Track	Bezel	Cable Type
21066000	Single	Head Down/Right	1-2	Black	No Cable
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
21166021	Single	Head Down/Right	1-2	White	No electronics, no 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 or Auxiliary Power Input (some units)
Interface Signal	RS-232 compatible
Message Format	ASCII
Track Card Speed	3 to 50 IPS (7,6 to 127 cm/sec)
Head Life	500,000 Insertion Cycles (1,000,000 head passes)

ELECTRICAL

	Printed Circuit Assembly 21067502 (discontinued)	**Printed Circuit Assembly 21067505 (*new* unit)**
DTR Voltage (Input) V_{DTR}	+5 to +15 VDC operating +16 VDC absolute maximum -25 VDC absolute maximum	+5 to +15 VDC operating +/-20 VDC absolute maximum
Transmit Data (TXD)	+/-5 VDC minimum	+/-(V_{DTR} – 0.4 V) VDC minimum
Receive Data (RXD)	+/-15 VDC operating +/-25 VDC absolute maximum	+/-15 VDC operating +/-20 VDC absolute maximum
Communication (bursts of 5 ms transmit with 10 ms idle between bursts)	Transfer Rate: 9600 bps, 33% duty cycle; 8 data bits, no parity, 1 stop bit	Transfer Rate: Selectable 9600, 19.2k, 38.4k, 57.6k, 115.2k bps, all at 33% duty cycle; 8 data bits, no parity, 1 stop bit or configurable
DTR Current Or Auxiliary Supply Current (Positive supply to unit)	See below	* 2.7 mA minimum required under all operating conditions with cable capacitance limited to 1000pF (and practically unlimited inrush current)
Power On	12 mA Max (and practically unlimited inrush current)	See above.
Transmitting	11 mA typical, 5 ms duration	See above.
Quiescent	6 mA typical, continuous	See above.
RXD Current	Within RS-232 specified limits (does not function as a negative supply to unit)	Average current approximates that of a normal RS-232 load. (Negative supply to unit)
Output Cable	Not Specified	See note "*" below.

MECHANICAL

Dimensions	
Length	3.86 in (98.0 mm) – Allow 0.30 in (7.6 mm) for cable thickness and tie wrap at the rear of the unit
Width	4.00 in (101.6 mm)
Height	1.00 in (25.4 mm)
Weight	4.1 oz (115 g) including 6' cable

ENVIRONMENTAL		
	Printed Circuit Assembly 21067502 (discontinued)	**Printed Circuit Assembly 21067505 (*new* unit)**
Temperature		
Operating	4°F to 158°F (-20°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Storage	-40°F to 176°F (-40°C to 80°C)	-40°F to 176°F (-40°C to 80°C)
Humidity		
Operating	10% to 90% noncondensing	
Storage	10% to 90% noncondensing	

* The 2.7 mA figure is for continuous data transmission at 33% duty cycle while reading a card. Typical capacitance from TXD is about 1000 pF for our standard 2 m cable. Minimum DTR current 'I_T' required for continuous transmission at 33% duty cycle, while reading a card, with cable capacitance 'C' and arbitrary baud rate is approximately:

I_T = (2.5 mA) + (10 V) * 33% *(baud rate in Hz) / 2 * C.

Maximum transmission burst time 'T' at 33% duty cycle for RS-232 compatibility is approximately:

T = (64 μF) * (5 V - 3.4 V) / (I_T - I_S), where I_S is the current supplied by the DTR line (T is unlimited for $I_S > I_T$)

A note about "port-powered" readers: These readers operate off some combination of otherwise unused RS-232 lines, DTR and TXD from the host in this case. Per the RS-232 specification, these lines are only required to drive a 3 kΩ load at +/-5 V. This is a current of merely 5 V / 3 kΩ=1.67 mA per line. All "port-powered" readers fundamentally require more current than 1.67 mA (consider that at least 1.67 mA must be supplied to a 3 kΩ load, and some extra current is needed for the circuit that does so). Thus these readers are not technically guaranteed to work unless multiple unused lines are used for power and/or some duty cycle limit is imposed on transmitting while employing an energy storage device (a capacitor). In practice, however most ports can easily supply the 2.7 mA at +5 V required by this ***new*** reader on DTR and the near-specification average TXD (from host) current at -5 V. This ***new*** reader is MagTek's lowest current "port-powered" reader to date. Strictly speaking, some RS-232 ports may not supply the required current, and this is the reason for including a current consumption specification for a "port-powered" device. The current drive capability of an RS-232 port is not typically specified, so experimentation may be required in a particular application. If more current is needed for the positive supply, RTS may be paralleled with DTR (both host-referenced) in the cabling to the unit. If this is done, the host must of course hold RTS high.

DIMENSIONS

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

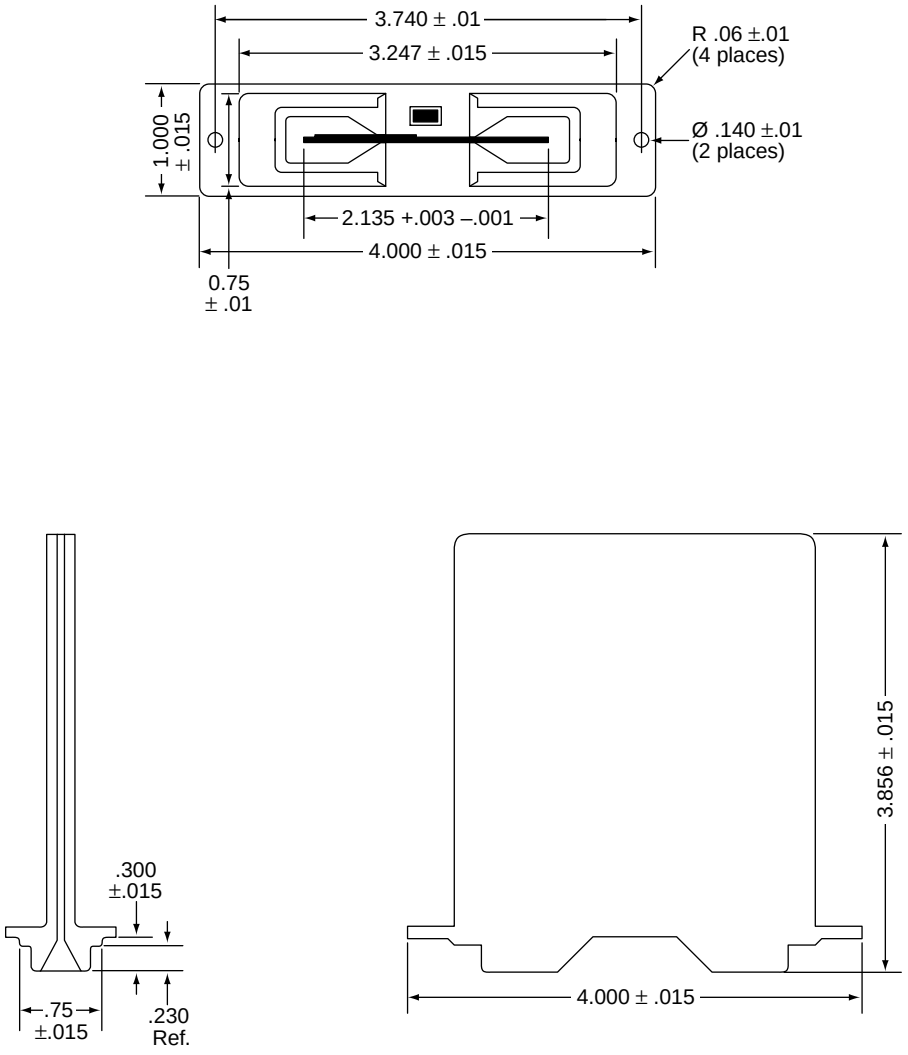


Figure 1-2. Half Card Reader Dimensions

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

All pins must be connected as shown.

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

All pins (except NC) must be connected as shown.

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.

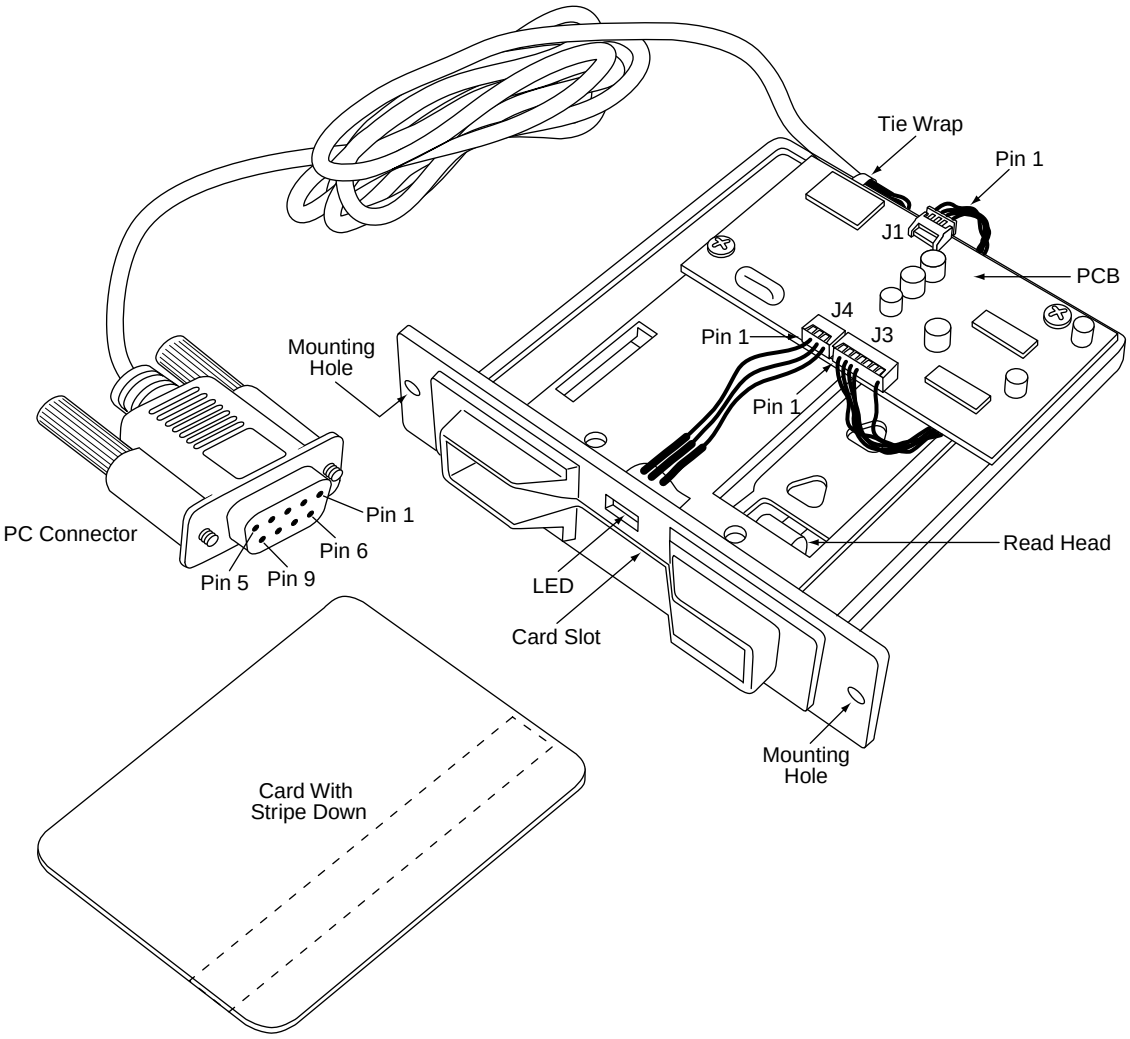


Figure 2-1. Reader Layout - Top

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.

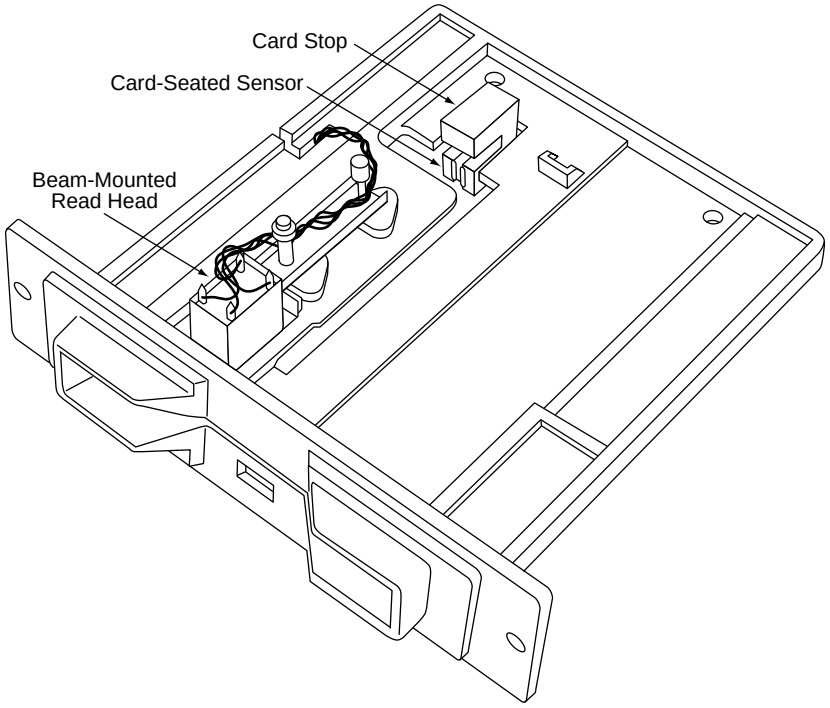


Figure 2-2. Reader Layout -Bottom

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 (500 for the ***new*** reader) milliseconds after DTR is applied, the Reader sends the part number of the firmware in the following form: 21088828A01 (21088842A01 for the ***new*** reader). 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[1] 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.)

[1] For the 21067505 printed circuit assembly, the transmission is strictly in 5 ms bursts with 10 ms between.

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)
<ESC> (0x1B)	V (0x56) ***New*** reader only	-	Version request. Same as the program mode version request command except the reader does not send an ACK character in the response.
<ESC> (0x1B)	X (0x58) ***New*** reader only	*See the exit program mode command in the program mode command set section.*	Enter program mode. See program mode section for a full description. The device will only respond to the program mode command set when in program mode.

Note

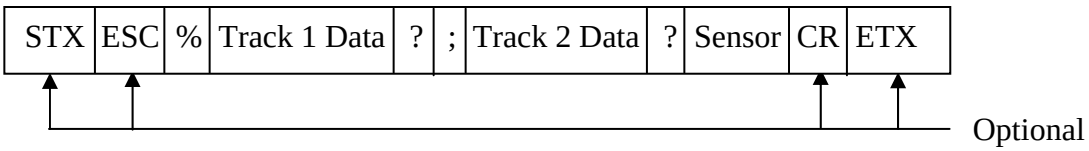
*If DTR is dropped and restored, the setup options are returned to the default state. Some default states can be modified by the program mode command set in the **new** reader. The LED is controlled by the Host.*

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 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. For the ***new*** reader, the watchdog LED remains off when the dual color LED is on.

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.

These sentinel characters can be changed in the ***new*** reader by using the program mode command set.

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

The LRC character is not transmitted.

Track data may be represented as follows:

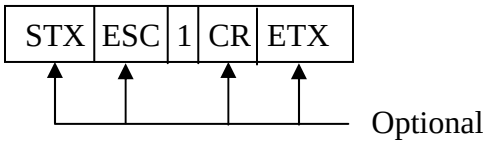
SS	Track Data	ES	Card Sensor Status

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)

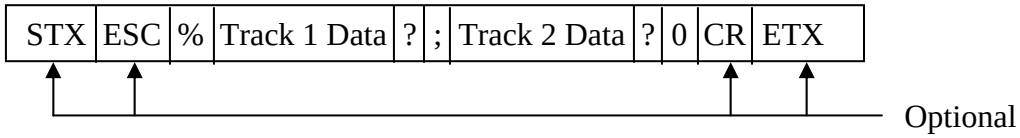
If there is an error in one of the tracks, the "Track Data" field will be replaced with "E" (0x45).

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



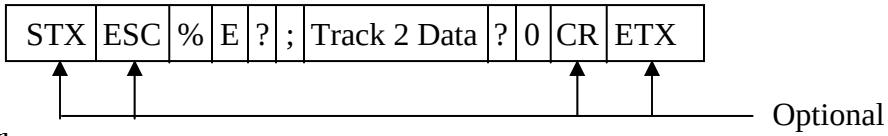
Where 1 indicates Sensor blocked; 0 indicates the sensor became unblocked.

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:

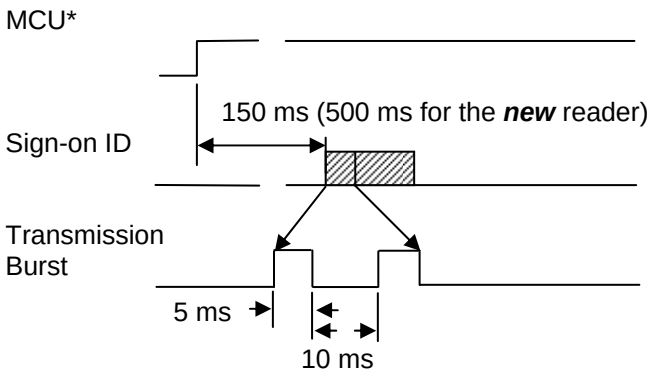


Where

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.



* Up to 1.5 seconds are required from DTR rising until the MCU comes out of reset.

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 (21088842A01 in the ***new*** reader)

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)	

PROGRAM MODE

The ***new*** reader has a number of non-volatile properties. Once these properties are changed and saved in non-volatile memory, the changes will take affect after a power cycle or reset. These properties are usually only modified once prior to installing the device. These properties can only be modified when in program mode. See the **enter program mode** command in the regular command set for a description of how to enter program mode. Once in program mode, the reader will only respond to the program mode command set until the device is power cycled, reset or the **exit program mode** command is received. This section describes the program mode commands set.

Sending Program Mode Commands

The Reader will operate from 2400 to 115200 bps but each command sent to the Reader must match the communication parameters of the Reader. The default communication parameters are 9600 bps with 8 bits, no parity and 1 stop bit (8N1). If the Reader fails to respond after a command has been transmitted, the application should modify the transmission parameters until a response is received.

Commands, as described below, must be preceded by an Escape (<ESC> – 0x1B) character and be terminated by a Carriage Return (<CR> – 0x0D). All commands are case sensitive—that is, they must all use upper case characters.

After a valid command has been received, the Reader will respond with an Acknowledge (<ACK> – 0x06) within one character time. If a message is started but not completed within 2 seconds, a No-acknowledge (<NAK> – 0x15) will be transmitted; also, if the baud rate or other communication settings are incorrect, the Reader will transmit a NAK using its current communication parameters. An unrecognized command will also return a NAK.

PROGRAM MODE COMMAND SET

The reader must be in program mode for the device to respond to this command set.

Exit Program Mode

This command can be used to exit program mode; however changes made while in program mode will not take affect unit the device is reset or power cycled:

<ESC>x<CR>

Once program mode is exited, the device will only respond to the regular command set and not the program mode command set.

Reset Device

The Reader will always be reset when power (DTR) is applied (hardware reset). It can also be reset programmatically with a Reset (RS) command. This command can be used after changing the setting to activate the new values:

<ESC>RS<CR>

After sending the <ACK>, the Reader will perform a soft reset and, if the function is enabled (SA-6), will transmit the sign-on ID message:

<ACK>21088842A01<CR>

Version Request

In order to determine which device is connected, the application can send a Version Request (VR) command to the Reader:

<ESC>VR<CR>

The Reader will respond with an ACK and then will transmit the firmware part number and the corresponding version in a format like this:

<ACK>21088838A00<CR> or
<ACK>21088842A01<CR> for the ***new*** reader

Upload Command

The Upload (UP) command is used to move any modified properties from temporary storage into the flash memory. This only needs to be done once after all changes have been made.

This method of updating the programmable settings allows all parameters to be modified in anticipation of the next reset. Thus, a series of switch commands (including the sentinel values described below) can be sent to the Reader without affecting any operation. The set of configuration commands should be followed by an Upload (UP) command to transfer all settings

into flash. Finally, the Reset (RS) command can be sent to validate that all changes have taken place. After the RS command, any changes to communication parameters will be effective.

Configuration Commands

The configuration properties are stored in three separate bytes (referred to as switches). The switch settings are modified with three separate commands, one for each switch. The switch names, bits and corresponding properties are shown in the tables below.

The command to interrogate or modify a switch is of the form:

<ESC>Sn<CR>

where “n” is “A”, “B” or “C”.

For example, to interrogate the values of switch B, send the command:

<ESC>SB<CR>

The response will look like this:

<ACK><ESC>SB00000001<CR>

Note that changes made to the switch settings with the switch commands can not be read back until they are activated. Also note that certain volatile commands from the regular command set affect the active switch settings. For example, the <ESC> S and <ESC> s commands affect the value read back from the <ESC>SB<CR> command in byte position 1.

In order to change any switch settings, send a command like this:

<ESC>SA11100010<CR>

which will set switch A to the default value. The Reader will respond with an ACK if the command is formatted properly. The change in settings will NOT take place until after the Upload and Reset commands have been sent:

<ESC>UP<CR>
<ESC>RS<CR>

The Upload (UP) command moves the new setting(s) into flash memory. The new setting(s), however, will not be used until the device has been reset—either with a power reset or with the soft Reset (RS) command.

Switch A

Switch A, Table 3-5, is primarily used to define the communication settings. The default for Switch A is:

11100010 9600, no parity, 8 bits, send ID at power on, transmit SS & ES

Table 3-5. Switch A

Command position	1	2	3	4	5	6	7	8	
Byte Position	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**Description**
						0	0	0	Baud rate 2400 (This setting may draw too much power from the host so it should be avoided if possible.)
						0	0	1	Baud rate 4800 (This setting may draw too much power from the host so it should be avoided if possible.)
						0	1	0	Baud rate 9600
						0	1	1	Baud rate 14400
						1	0	0	Baud rate 19200
						1	0	1	Baud rate 38400
						1	1	0	Baud rate 57600
						1	1	1	Baud rate 115200 (If the device is put into this setting, it will no longer be able to receive commands unless the characters sent to the device are spaced apart such that there is at least 100μs of idle time between each character. For this reason, this setting should be avoided if possible.)
				0	0				No parity
				0	1				Even parity
				1	0				Odd parity
				1	1				Mark (Parity = 1 all the time)
			0						7 bits data length
			1						8 bits data length
		0							Send ID at power on: No
		1							Send ID at power on: Yes
	0								Transmit SS and ES: No
	1								Transmit SS and ES: Yes

Switch B

Switch B, Table 3-6, is used to define the bracketing characters that are used in the messages. The default for Switch B is:

00000000 Don't send CR, STX, ETX, ESC, LRC

Table 3-6. Switch B

Command position	1	2	3	4	5	6	7	8	
Byte Position	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**Description**
								0	Send CR after messages: No
								1	Send CR after messages : Yes
							0		Send STX before data: No
							1		Send STX before data: Yes
						0			Send ETX before data: No
						1			Send ETX before data: Yes
					0				Send ESC before data: No
					1				Send ESC before data: Yes
				0					Send LRC with track data: No
				1					Send LRC with track data: Yes
			X						Reserved
		X							Reserved
	X								Reserved

Switch C

Switch C, Table 3-7, is used to define the way a card is read. The default for Switch C is:

00010101 Enable (but don't require) tracks 1, 2 & 3; decode ISO/ABA tracks only

Table 3-7. Switch C

Command position	1	2	3	4	5	6	7	8	
Byte Position	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**Description**
							0	0	Track 1 Disabled
							0	1	Track 1 Enabled
							1	1	Track 1 is required*
					0	0			Track 2 Disabled
					0	1			Track 2 Enabled
					1	1			Track 2 is required*
			0	0					Track 3 Disabled
			0	1					Track 3 Enabled
			1	1					Track 3 is required*
		0							Decode ISO/ABA tracks only
		1							Decode ISO/ABA & custom tracks
	X								Reserved

* If a track is required but does not exist, the Reader will indicate an error for that track.

Sentinel Definitions

The start and end sentinels values can individually be specified by commands. The default settings are shown in the Table 3-8.

Note

Changing the value of any of the sentinels does not actually change the encoded value on the magnetic track; it merely represents the sentinel in a unique way to help distinguish differently formatted tracks.

Table 3-8. Start and End Sentinels

Value Name	Default (hex)	Default (ASCII)	Definition
S1	25	%	Start Sentinel ISO/ABA Track 1
S2	3B	;	Start Sentinel ISO/ABA Track 2
S3	2B	+	Start Sentinel ISO/ABA Track 3
S4	40	@	SS Non-standard (7bits) Track 2
S5	26	&	SS Non-standard (7bits) Track 3
S6	23	#	SS AAMVA track 3
SE	3F	?	End Sentinel for all tracks all type

As with the switch settings, the sentinel parameters can be discovered by sending the corresponding command for that value immediately followed by a CR. For instance, in order to determine the present setting of the 7-bit track 3 start sentinel, send the following command:

<ESC>S5<CR>

The Reader will respond with the value, in nibbles:

<ACK><ESC>S526<CR>

Any ASCII character from 0x00 to 0x7F can be used as a sentinel. To change the value of the 7-bit track 3 start sentinel to "!" (0x21), send the following command:

<ESC>S521<CR>

Again, as with the switch commands described above, send the Upload (UP) command followed by the Reset (RS) command to complete the transaction.