

MSR206-7HL

Magnetic Stripe Card Reader/Writer
(High & Low Coercivity)

Programmer's Manual

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NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/ TV technician for help.

You are cautioned that any change or modifications to the equipment not expressly approve by the party responsible for compliance could void your authority to operate such equipment.

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WARRANTY

This product is served under one-year warranty to the original purchaser. Within the warranty period, merchandise found to be defective would be repaired or replaced. This warranty applies to the products only under the normal use of the original purchaser, and in no circumstances covers incidental or consequential damages through consumers' misuse or modification of the products.

PREFACE

This manual provides detailed information relating to the overall operational, electrical, mechanical, environmental and functional aspects of the MSR206-7HL. This document should be read and understood prior to initial operation of the product. For ease of installation and programming use, we have addressed everything from its attractive features to its various configurations. When designing the MSR206-7HL, we selected what we feel are the most useful features and functions. If in some cases you find that your specific needs differ from our existing products, we welcome your comments and suggestions. Custom-designed models are also available. If further questions do arise, please call for technical support, our FAE will assist you in any way we can.

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Section 1: Introduction

Thank you for purchasing the MSR206-7HL Manual Swipe Magnetic Card Reader/Writer. It is ideal for access control, time keeping, banking, ID recognition & credit verification and related applications. In fact, wherever a magnetic stripe ID or transaction card is used, one can find a related use for the versatile, user-friendly MSR206-7HL reader/writer.

The MSR206-7HL is designed to offer a reading and writing solution of high and/or low coercivity cards that will attractively complement an existing system.

1.1 Accessories of MSR206-7HL

Make sure all the following accessories are contained in your package:

- Switch power Supply, AC 110~240V in / DC 24V, 2.2A out.
- Power cord.
- Signal cable (DB9 to RJ45, 1.5m).
- Utility disk (A/P S/W).
- Blank Hi-Co test card.(or and Low-Co test card)
- Programmer's manual.

1.2 Features

- Can encode cards with media coercivities from 250 through 4000+ Oersted.
- Can read and write up to three tracks of Magstripe data simultaneously. (ISO, AAMVA and Custom)
- Read after write verification for single pass encoding.
- Any ISO standard track format can be read to, or written from, any track location (1, 2 or 3).
- All tracks have independent, selectable write densities (75 / 210 bpi) that can be controlled via host software.
- Three LED that is host controlled.
- RS232 compatible serial interface.
- Firmware speed governor to help prevent encoding cards with higher than allowed jitter.
- Rugged, die cast steel enclosure.

Section 2: General Description

The MSR206-7HL series is designed to read and/or write high or low coercivity magnetic cards. It can encode and verify up to 3 tracks of data simultaneously. It communicates with a host computer or other terminal using a standard RS-232 interface.

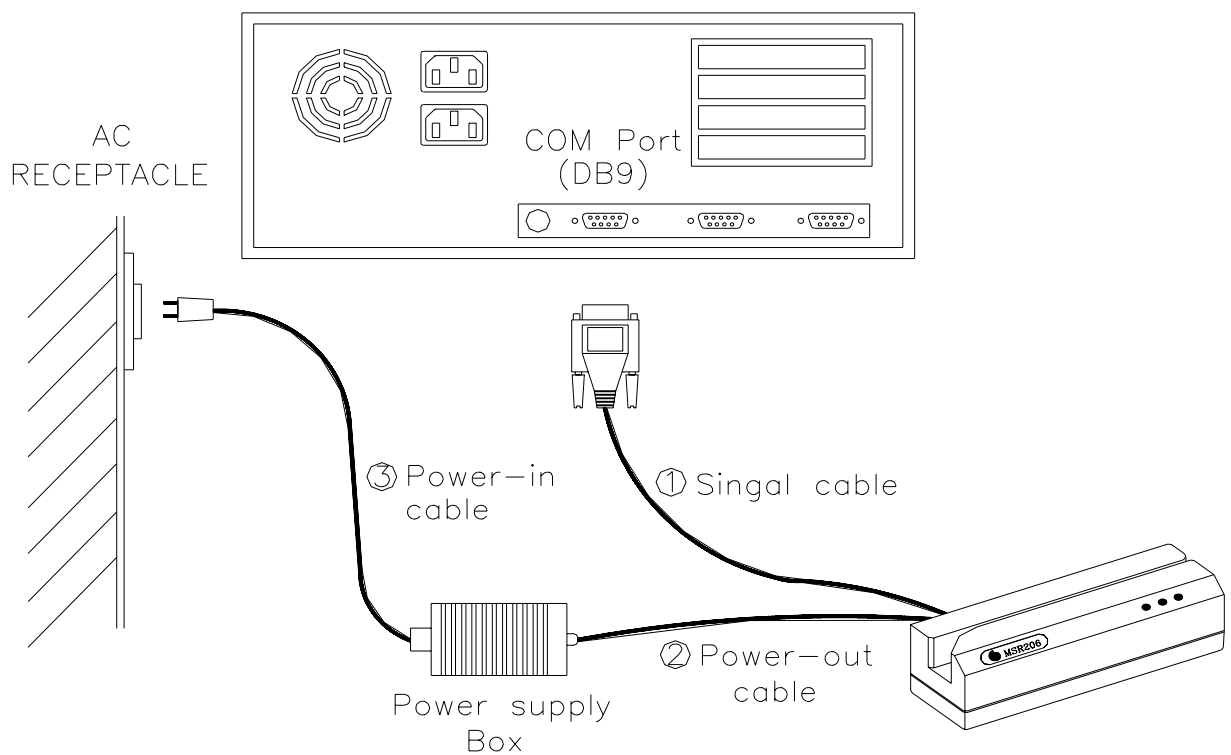
Section 3: Technical Specifications

ITEM	SPECIFICATION
Standard	ISO7811
Electrical	
Consumption	Current/operating Typical 350mA Max
	600mA plus for each writing track
Communication	Standard RS232 signal voltage levels. Default, 9600 Baud, Odd Parity, 7 bits
Power supply	External switching Power 24V/2.2A regulated
Interconnection	
Cable	RJ45->DB9, 5 feet
Pin Assignment DB-9	1.shield
	2.TXD / MSR206-7HL data transmit
	3.RXD / MSR206-7HL data receive
	4,6,7,8,9, no connection
	5. circuit ground
Mechanical	
Body	ABS 94V-0
Swipe	Manual, single direction
Outline	210Lx68Wx60H mm
Weight	1.5Kg approx.
Environment	
Operation	-10°C to 60°C
	10 to 85% humidity, non condensing
Storage	-30°C to 70°C
	10 to 90% humidity, non condensing
Performance	
Read Circuit	Track 1&3 210bpi
	Track 2,75 or 210 bpi
Bit per Char	5-7 bit per char.
Media Speed	Read, 5-50 ips (read speed 5-40 ips for track 2 at 210bpi)
	Write, 5-30
Media Coercivity	Read 300-4000 Oe Mag. Card
	MSR206-7HL write 2750-4000 Oe Mag. Card
	MSR206-7HL write 300-4000 Oe Mag. Card
Media Thickness	0.76-1.2mm

Jitter Card	Read bit to bit interval $\leq \pm 15\%$ card			
	Write bit to bit interval $\leq \pm 10\%$, Sub interval $\leq \pm 12\%$ at 30ips			
Low amplitude Card	Read 60% for both 75& 210bpi			
Error Rate	Read $< 0.5\%$			
	Write $< 0.8\%$			
Media Swipe	Head life 1,000,000 passes for both read & write head			
Configuration	Model	Read/Write Track	Hi-C	Lo-C
Available Model	MSR206-7HL	1,2&3	R/W	R/W

Section 4: Setup

- (1) Power off your system (PC).
- (2) Connect PC and MSR206-7HL as below.
- (3) Connect DB9 of ① signal cable to a free serial port then connect RJ45 at the other end of the cable to MSR206-7HL.
- (4) Connect outer plug of ② Power-out cable to the power inlet of MSR206-7HL.
- (5) Connect ③ Power-in cable to Power supply and AC receptacle (110V~240V).
- (6) Power on your system (PC).



Section 5: Communications

The communications interface transmits and receives asynchronous serial data, using an industry standard UART, at voltage levels compatible with the EIA RS-232D specification.

5.1 Transmission Rates

The following baud rates are supported:

1200, 2400, 4800, 9600, 19.2K baud

Default = 9600

5.2 Transmission Format

Each character is transmitted using a ten-bit character frame in the following order:

1 Start bit

7 Data bits, lsb first

1 Parity bit, selectable: odd, even, zero or one (none when Data bits = 8)

1 Stop bit

5.3 USI Protocols

The USI protocol is used for information exchange. The user may select from 2 different variations for communicating with the unit.

USI0 (Protocol 0)

In USI0, all characters are transmitted and received using exactly the command characters listed in the section on Commands and Responses found later in this manual. There are no Headers, Trailers or Block Check Characters. Protocol 0 presumes no transmission errors. This is the default protocol after a reader reset, although the reader may be configured to respond in USI0 or USI1 for the power-on message. This protocol also enforces a five (5) second maximum timeout between characters.

USI1 (Protocol 1)

In USI1, all messages are preceded by the ASCII character STX, and followed by the ASCII character ETX and one Block Check Character (BCC). The BCC is an XOR of the data bits of the entire message including the STX and ETX characters. (It does not include the BCC itself.) The parity of the BCC is the selected parity, if any. This protocol also enforces a 65ms maximum timeout between characters.

If the Interface detects an error in an incoming transmission, it will respond with a "Retransmit". If the host detects transmission error, it may, at its option request a retransmission.

5.4 Protocol Selection

After a power-on or reset, the unit is initialized to use USI0. After the unit receives a valid USI1 message from the host, it will continue to operate in USI1 until it experiences a power reset or receives a WARM RESET command.

5.5 Flow Control

For both protocols, the host may at any time stop/start the unit transmission by using the XOFF/XON commands. After a power-on or reset, the unit is initialized to XON (communications enabled) mode.

Section 6: Commands and Responses

The following sections describe the commands that the host can send to the reader, this is followed by a section describing the reader responses to the host. There are three groups of commands that can be sent to the reader. The first is used to manipulate the reader (LED's, status, etc.). The second is used to read and process magnetic stripe data. The third group is used to write magnetic stripe data. Tables summarize the commands of each group.

The unit executes commands received from the host one at a time and cannot execute a new command until the previous command has been completed. Once the unit receives a command, it performs the requested action and reports the results back to the host.

Unless otherwise specified, the examples shown assume that the unit uses the default settings.

6.1 Reader Commands

USI Reader Command Summary				
ASCII	HEX	Name	Use	Length*
<XON>	11	Resume transmission	Resume transmission to host	1
<XOFF>	13	Pause Transmission	Pause Transmission to host	1
%	25	Reproduce	Reproduce the last Command again	1
9	39	Version Report	Transmits Version String	1
<ESC>	1B	Abort	Abort command	1
	7F	Warm Reset	Simulates power cycle	1
#	23	Configuration Request	Sends Reader Configuration Byte	1
K	4B	Yellow LED ON	Turns on Yellow LED	1
k	6B	Yellow LED OFF	Turns on Yellow LED	1
L	4C	Green LED ON	Turns on Green LED	1
l	6C	Green LED OFF	Turns off Green LED	1
M	4D	Red LED ON	Turns on Red LED	1
m	6D	Red LED OFF	Turns off Red LED	1
(	28	Green LED Flash	Start flashing Green LED	1
|	7C	Yellow LED Flash	Start flashing Yellow LED	1
)	29	Red LED Flash	Start flashing Red LED	1

*Length does not include protocol overhead characters, if any.

Reader Command Description

ASCII Char Definition of Instruction

<XON> (11H) Resume Reader Transmission

ACTION: Resume transmission of data by the unit.

<XOFF> (13H) Pause Reader Transmission

ACTION: Stops transmission of data by the unit.

% (25H) Reproduce

ACTION: Reproduce the last Command by the reader.

Use this command when you detect a communication error in a message received from the reader. The reader will re-produce the last command it transmitted before this request. The host may request reproduce as many times as needed.

9 (39H) Version Report

ACTION: Transmit version information.

Send this when you want to know the version of the Model MSR206-7HL firmware currently loaded. The response is an ASCII string giving the firmware date, reader type, the firmware version number and check sum.

Example: "206AM1XX dd-mm-yy".

<ESC> (1BH) Abort

ACTION: Abort current command and transmit an Acknowledge response ("^" 5EH) if issued:

- After a single character "Load Encode Data" command (A, B, C) has been responded to by the unit.
- After the first character of a double character "Read" or "Load Encode Data" command (q, u, a, E, ...) has been issued to the unit.
- After the first or second character of a triple character "Read Custom" or "Load Custom Encode Data" command (E_, U_, ...) has been issued to the unit.
- After a double or triple character "Load Encode Data" command (a3, E_, ...) has been responded to by the unit.
- After the download of encode data for a particular track has been responded to by the unit. (In this case only the "Load Encode Data" command associated with the last download of data will be aborted.)
- After the "Arm to Read" or "Encode data" commands have been responded to by the unit. (The unit would be waiting for a card swipe to read or encode.)

Note: This command byte is not recognized as a command within data strings. It will be processed as a data character instead.

DEL (7FH) Warm Reset

ACTION: Abort all current actions and cause the device to execute all initialization functions. The unit will respond exactly as it would for a “power up” cycle. It does not send the typical acknowledge response (“^” 5EH). See section Reader Responses for details.

Note: This command byte is not recognized as a command within data strings.

This is the command version of power cycling the reader.

(23H) Configuration Request

ACTION: Transmit a byte representing the configuration of the unit as follows:

Configuration Byte		
Bit Position*	Bit = 0	Bit = 1
0	Track 1 Read not present	Track 1 Read present
1	Track 2 Read not present	Track 2 Read present
2	Track 3 Read not present	Track 3 Read present
3	not used – should be 0	not used
4	Track 3 Write not present	Track 3 Write present
5	Track 2 Write not present	Track 2 Write present
6	Track 1 Write not present	Track 1 Write present
7	parity bit**	parity bit**

* bit 0 = lsb, bit 7 = msb

** is = 0 for units configured for 8 data bit transmission

Obtain details of the current unit configuration

EXAMPLE: The following byte (in hex) was returned: 63

It indicates a unit capable of reading magnetic data on tracks 1 and 2; and writing magnetic data on to tracks 1 and 2.

& (26H) Card Edge Detect

ACTION: The unit will perform the following sequence:

- Transmit command acknowledge (“^” 5EH). If not a reader/writer, then a Can’t Execute “~” reply will be sent from the unit.
- Wait for card swipe.
- Transmit Card Edge Acknowledge (“>” 3EH) after the unit detects the card edge at the encode head.

After a “Card Edge Detect” command is received and acknowledged the only valid commands that will be accepted for execution are the “Abort” <ESC> and “Warm Reset” commands. All other commands will result in an “Invalid Command” “!” response.

LED Commands. Use these commands to manipulate the reader’s LED.

ASCII Char	Definition of Instruction
------------	---------------------------

K (4BH)	Yellow LED ON
----------------	----------------------

k (6BH)	Yellow LED OFF
----------------	-----------------------

L (4CH)	Green LED ON
----------------	---------------------

l (6CH)	Green LED OFF
----------------	----------------------

M (4DH)	Red LED ON
----------------	-------------------

m (6DH)	Red LED OFF
----------------	--------------------

ACTION: The unit will perform the following operations:

- Turn Yellow/green/red LED colors ON or OFF, as specified.
- Transmits an acknowledge response “^” (5EH).

((28H)	Green LED flash
----------------	------------------------

) (29H)	Red LED flash
----------------	----------------------

| (7CH)	Yell LED flash
----------------	-----------------------

ACTION: The unit will perform the following operations:

- Begin flashing the specified LED color ON and OFF
- Transmits an acknowledge response “^” (5EH).

The LED flashes approximately .25 seconds ON and .25 seconds OFF. The flashing continues until changed by another LED command. A single, bicolor LED is used on the unit. If both red and green are turned ON, the LED appears amber/yellow.

6.2 Magstripe Card Read Commands

Magstripe Card Read Command Summary				
ASCII	HEX	Name	Use	Length*
P	50	Arm to Read	Clear buffers, wait for card read	1
P	70	Arm to Read with speed prompts	Same as P but send “(“ at start of Magstripe data and “)” at end. (Test Tool)	1
Q	51	Transmit ISO standard data, Track 1	Process and send track 1 data after card read using ISO track 1 decoding	
R	52	Transmit ISO standard data, Track 2	Process and send track 2 data after card read using ISO track 2 decoding	
S	53	Transmit ISO standard data, Track 3	Process and send track 3 data after card read using ISO track 3 decoding	
q	71	Transmit ISO standard data, Track 1	Process and send track 1 data after card read using selected ISO track decoding	2
r	72	Transmit ISO standard data, Track 2	Process and send track 2 data after card read using selected ISO track decoding	2
s	73	Transmit ISO standard data, Track 3	Process and send track 3 data after card read using selected ISO track decoding	2
I	49	Transmit “Error Data”	Sends data after a data error is returned 1	
U	45	Transmit custom data, forward - Track 1	Sends data with/without nulls parsed using specified bits per custom character 2,3	2 or 3
V	46	Transmit custom data, forward - Track 2	Sends data with/without nulls parsed using specified bits per custom character 2,3	2 or 3
W	47	Transmit custom data, forward - Track 3	Sends data with/without nulls parsed using specified bits per custom character 2,3	2 or 3
X	58	Transmit Passbook Data	Process and send passbook data using 0CH or 0FH as the allowed End Sentinel	1
x	78	Transmit Passbook Data	Process and send passbook data using the specified End Sentinel	2
?	3F	Write Verify	Perform a Read-After-Write check on data in the read buffers 1	1

*Length does not include protocol overhead characters, if any.

Magstripe Card Read Command Description

ASCII Char Definition of Instruction

P (50H, uppercase) Arm to Read

ACTION: The unit will perform the following sequence:

- Clear the read data buffers and Load buffers for all tracks.
- Transmit command acknowledge (“^” 5EH).
- Wait for card swipe.
- Transmit read acknowledge (“^” 5EH) after card swipe.

After an “Arm to Read” command is received and acknowledged the only valid commands that will be accepted for execution are: “Abort” <ESC>, “Warm Reset” , and LED control commands. All other commands will result in an “Invalid Command” “!” response.

p (70H, lowercase) Arm to Read with speed prompts

ACTION: The unit will perform the following sequence:

- Clear the read data buffers and Load buffers for all tracks.
- Transmit command acknowledge (“^” 5EH).
- Wait for card swipe.
- If Magstripe media is detected a “(” (28H) byte is sent, when media detect goes inactive a “)” (29H) byte is sent.

This is similar to the 'P' command, except an extra response '(' is reported when a media is detected through the read head. A ')' response is reported when media detect goes inactive. Mainly used as a tool for determining average swipe speed. Most applications should not use this command. They should use the upper case P command instead.

Q (51H) Transmit ISO standard data, track 1

R (52H) Transmit ISO standard data, track 2

S (53H) Transmit ISO standard data, track 3

ACTION: The unit will perform the following sequence:

- Process data in the read buffer for the specified track according to ISO standard.
- If error is detected in card data, transmit proper error response ('*' or '+'). (Refer to Reader Responses)
- Else, transmit data in ASCII

Note: Q, R, and S are special single byte commands for the corresponding cases of double byte commands, e.g. Q has the same effect as q1.

q (71H)	Transmit track 1 data
r (72H)	Transmit track 2 data
s (73H)	Transmit track 3 data

FORMAT: 2-byte command - Command character (q, r, s) is followed by an ASCII number (1, 2 or 3) representing the ISO track format for processing the Magstripe data.

ACTION: The unit will perform the following sequence:

- Process data in the read buffer for the specified track and format.
- If no card data errors, transmit data in ASCII.
- If error is detected in card data, transmit proper error response ('*' or '+'). Refer to Reader Responses.

These commands allow a track to be transmitted with a different track's ISO format. For example to transmit track 1's data using ISO track 2 format send "q2" (71H, 32H). The uppercase equivalents (Q, R, and S) are equivalent to q1, r2, and s3.

Note: The s1 command will decode track 3 using AAMVA format if the unit is configured for ISO and AAMVA decoding.

I (49H)	Transmit "Error Data"
----------------	------------------------------

ACTION: The unit will perform the following sequence:

- If the previous read command resulted in an error (response was '*', e.g. no end sentinel, parity or LRC error), transmit the data regardless of the error(s).
- If there was no error, transmit '+'.

The "I" command allows you to recover data even if the reader detects data errors. This command will not work for a no start sentinel '+' response.

U (55H)	Transmit Custom Data, forward swipe, track 1
V (56H)	Transmit Custom Data, forward swipe, track 2
W (57H)	Transmit Custom Data, forward swipe, track 3

FORMAT: These commands may be either 2 or 3 bytes long.

2-byte command – Used to request custom data with no internal null characters allowed. The command character is followed by an ASCII number (3,4,5,6 or 7) which specifies the number of bits per custom character.

3-byte command – Used to request custom data with internal null characters. The command character is followed by the underline character (5FH) and the ASCII number (3,4,5,6 or 7) which specifies the number of bits per custom character.

ACTION: The unit will perform the following sequence:

- Process data in the read buffer for the specified track, based upon the “number of bits” character.
- Transmits data formatted one byte per character with the unused most significant bits in each byte set to '0'.

Note: Use the appropriate 2 or 3 byte form depending on the presence or absence of null (00H) characters. Data is returned in the low order bits for 3,4,5,6, or 7 bits per character.

X (58H) Transmit passbook data

ACTION: The unit will perform the following sequence:

- Process data in the read buffer for tracks 2 and 3 using 0FHor 0CH as the end sentinel. The unit will try to decode up to four fields, two fields from each track location, one at a time. It will stop at the first field found to have no errors.
- If error is detected, transmit proper error response ('*' or '+')(Refer to Reader Responses.)
- Else, transmit data in ASCII. Only one of the redundant fields will be transmitted.

x (78H) Transmit passbook data with specified end sentinel

FORMAT: 2-byte command – The command character (x) is followed by an ASCII character representing the end sentinel used for decoding. Only the lower four bits of the ASCII character will be used for the end sentinel.

ACTION: The unit will perform the following sequence:

- Process data in the read buffer for tracks 2 and 3 using the end sentinel specified in the second character. The unit will try to decode up to four fields, two fields from each track location, one at a time. It will stop at the first field found to have no errors.
- If error is detected, transmit proper error response ('*' or '+')(Refer to Reader Responses.)
- Else, transmit data in ASCII. Only one of the redundant fields will be transmitted.

Note: Use this command when you only want to decode data with a single specific end sentinel.

? (3FH) Write verify

ACTION: The unit will perform the following sequence:

- Check that valid write data exists in Encode Data storage buffer. Send “*” error if not. Else...
- Clear the read data buffers for all tracks.
- Transmit command acknowledge (“^” 5EH).
- Wait for card swipe.

- Transmit acknowledge (“^” 5EH) after card swipe if card passes the Read After Write checks on all tracks that were previously encoded. Otherwise send the proper RAW (1, 2 and/or 3) error response in ASCII.

After a “Write Verify” command is received and acknowledged the only valid commands that will be accepted for execution are: “Abort” <ESC>, “Warm Reset” , and LED control commands. All other commands will result in an “Invalid Command” “!” response.

6.3 Magstripe Card Write Commands

Magstripe Card Write Command Summary				
ASCII	HEX	Name	Use	Length*
A	41	Load ISO Standard Data for writing Track 1	To encode cards with standard ISO format	1
B	42	Load ISO Standard Data for writing Track 2	To encode cards with standard ISO format	1
C	43	Load ISO Standard Data for writing Track 3	To encode cards with standard ISO format	1
a	61	Load ISO Data for writing Track 1	Allows for ISO track formats in nonstandard track assignments	2
b	62	Load ISO Data for writing Track 2	Allows for ISO track formats in nonstandard track assignments	2
c	63	Load ISO Data for writing Track 3	Allows for ISO track formats in nonstandard track assignments	2
j	6A	Load passbook data for writing	tracks 2 and 3 To encode passbooks with the IBM Passbook format.	2
E	45	Load Custom Data for Writing Track 1	To encode cards using a user defined data format.	2 or 3
F	46	Load Custom Data for Writing Track 2	To encode cards using a user defined data format.	2 or 3
G	47	Load Custom Data for Writing Track 3	To encode cards using a user defined data format.	2 or 3
;	3B	Set Write Density (for individual tracks)	Change the density of data that is written to the card for the specified track.	3
O	4F	Set Write density to 210 bpi on Tracks 1 and 3	Returns tracks 1 & 3 encoding density settings to ISO standard for those tracks.	1
o	6F	Set Write density to 75 bpi on Tracks 1 and 3	Change encoding density on tracks 1 & 3	1
N	4E	Set Write density to 210 bpi on Track 2	Change encoding density on track 2 .	1
n	6E	Set Write density to 75 bpi on Track 2	Returns track 2 encoding density setting to ISO standard for track 2.	1
[	5B	Set Default Write Current	Change default write current setting in EEPROM.	4
]	5D	View Default Write Current	View default write current setting in EEPROM.	1
<	3C	Set Temporary Write Current	Change setting of write current used to encode cards.	4
>	3E	View Temporary Write Current	Check setting of write current used to encode cards.	1
@	40	Arm to Write with RAW	Encode cards and perform Read After Write (RAW) verification.	1

Z	5A	Arm to Write, no RAW	Required for encoding Extended length media on VC units.	1
z	7A	Arm to Write with RAW and speed prompts	Same as @ but send “(“ at start of write and “)” at end of read. (Test tool)	1

*Length does not include protocol overhead characters, if any.

Load Data Commands Use these commands to load data into the unit's encode storage.

ASCII Char Definition of Instruction

A (41H) Load ANSI/ISO standard data for encoding track 1

B (42H) Load ANSI/ISO standard data for encoding track 2

C (43H) Load ANSI/ISO standard data for encoding track 3

ACTION: The unit will perform the following sequence:

- Clear the Encode Data storage for the specified track.
- Transmit Command acknowledge (“^” 5EH)
- Wait for download of the encode data in ASCII, terminated by the ASCII EOT character (04H).
- If data is good, transmit acknowledge (“^” 5EH).
- Else, transmit “*” error response

Note: Commands A, B and C are special cases of the two byte commands a, b, and c.

Example: A = a1, B = b2, and C = c3.

a (61H) Load ISO data for encoding track 1

b (62H) Load ISO data for encoding track 2

c (63H) Load ISO data for encoding track 3

FORMAT: 2-byte command – Command character (a, b, c) is followed by an ASCII number (1, 2 or 3) representing the ISO track format for processing the Magstripe data.

ACTION: The unit will perform the following sequence:

- Clear the Encode Data storage for the specified track.
- Transmit Command acknowledge (“^” 5EH)
- Wait for download of the encode data in ASCII, terminated by the ASCII EOT character (04H).
- If data is good, transmit acknowledge (“^” 5EH).
- Else, transmit “*” error response

j (6AH) Load Passbook data for encoding track 2/3

FORMAT: 2-byte command – The command character (j), is followed by an ASCII character representing the end sentinel used for IBM Passbook encoding. Only the lower four bits of the

ASCII character will be used for the end sentinel. If the <ESC> character is sent for the end sentinel, then the command is aborted and the unit will send an acknowledge (“^” 5EH).

ACTION: The unit will perform the following sequence:

- Clear the Encode Data storage for tracks 2 and 3.
- Transmit Command acknowledge (“^” 5EH)
- Wait for download of the encode data in ASCII, terminated by the ASCII EOT character (04H).
- If data is good, transmit acknowledge (“^” 5EH).
- Else, transmit “*” error response

Note:

(1) Use this command when you only want to write passbook formatted data to a card.

Two redundant data fields will be encoded on tracks 2 and 3.

(2) Tracks 2 and 3 write data buffers will be loaded with the passbook formatted data.

(3) The encoding density for tracks 2 and 3 will always beset to 210 bpi when this command is used and completed.

(4) After this command is completed, arming the unit to write will always write over tracks 2 and 3.

(5) Command is only supported on reader/writer units with tracks 2 and 3.

Reader/Writers that have track 1 and 2 only will respond with a Can't Execute (“~” 7EH).

E (45H) Load Custom data for encoding track 1

F (46H) Load Custom data for encoding track 2

G (47H) Load Custom data for encoding track 3

FORMAT: These commands may be either 2 or 3 bytes long.

2 byte command – Used to load custom data with no internal null characters allowed. The command character is followed by an ASCII number (3,4,5,6 or 7) which specifies the number of bits per custom character.

3 byte command – Used to load custom data with internal null characters. The command character is followed by the underline character (“_” 5FH) and the ASCII number (3,4,5,6 or 7) which specifies the number of bits per custom character.

ACTION: The unit will perform the following sequence:

- Clear the Encode Data storage for the specified track. If an invalid track number is sent the unit will send an Invalid Command (“!” 21H) response.
- Transmit Command acknowledge (“^” 5EH)

- Wait for download of the Encode Data string in ASCII, terminated by the ASCII EOT character (04H).
- If data is good, transmit Acknowledge (“^” 5EH).
- Else, transmit “*” error response

Density Commands: Use these commands to set the bit density of the encoded data

; (3BH) Set Write Density

FORMAT: 3-byte command - “;TD” where:

; = Command character (3BH)

T = ASCII character (1, 2 or 3) representing the track number being configured.

D = ASCII character (H or h) for 210bpi; ASCII character (L or l) for 75bpi

ACTION: The unit will perform the following sequence:

- Set density for the specified track. If an invalid track number or density parameter is sent the unit will send a “*” reply.
- Transmit Command acknowledge (“^” 5EH)

This command allows for full independence in setting the densities for each track. Tracks 1 and 3 are not forced to be the same as in previous models.

Notes:

On Power-up/Reset, Tracks 1 and 3 default to 210bpi and Track 2 to 75bpi.

These commands must be sent prior to any Load Data commands. Errors may occur otherwise.

O (4FH) Set Write Density to 210bpi on tracks 1 and 3

o (6FH) Set Write Density to 75bpi on tracks 1 and 3

N (4EH) Set Write Density to 210bpi on track 2

n (6EH) Set Write Density to 75bpi on track 2

ACTION: The unit will perform the following sequence:

- Set density for the specified track(s).
- Transmit Command acknowledge (“^” 5EH)

If track 1 and 3 require different density settings, use the more general Set Write Density (“;” 3BH) command.

Note:

On Power-up/Reset, Tracks 1 and 3 default to 210bpi and Track 2 to 75bpi.

These commands **must** be sent prior to any Load Data commands. Errors may occur otherwise.

Write Current Commands: Use these commands to set and review the write current used to encode data on to cards. (VC units only)

[(5BH) Set Default Write Current

FORMAT: 4-byte command – Command character ([, is followed by three ASCII number characters (0 thru 9) representing the write current used for encoding.

ACTION: The unit will perform the following sequence:

- Change the write current setting in EEPROM and RAM to the specified value. Valid values are 000 to 255 only. Any other values outside this range will get a “*” reply from the unit. If not a VC unit, then a “~” reply will be sent from the unit.
- Transmit Command acknowledge (“^” 5EH)

This command may be sent anytime prior to an “Arm to Write” command.

Notes:

- (1) In USI0 there is a 5-second inter-character timeout
- (2) On Power-up/Reset, this value will be used for encoding cards.
- (3) The previous default current value will be lost.
- (4) Recommended values:
 Typical low coercivity (~300 Oersted) setting = 036
 Typical high coercivity (4140 Oersted) setting = 255

] (5DH) Review Default Write Current

ACTION: The unit will return a 3 ASCII character response representing the default write current setting stored in EEPROM, MSD first. If not a VC unit, then a “~” reply will be sent from the unit.

Note: The value returned is **not necessarily** the value used to presently encode cards with; i.e. the temporary value could be different.

< (3CH) Set Temporary Write Current

FORMAT: 4-byte command – Command character (<, is followed by three ASCII number characters (0 thru 9) representing the write current used for encoding.

ACTION: The unit will perform the following sequence:

- Change the write current setting RAM to the specified value. Valid values are 000 to 255 only. Any other values outside this range will get a “*” reply from the unit. If not a VC unit, then a “~” reply will be sent from the unit.
- Transmit Command acknowledge (“^” 5EH)

This command may be sent anytime prior to an “Arm to Write” command.

Notes:

(1) In USI0 there is a 5-second inter-character timeout

(2) On Power-up/Reset the unit will set the write current to the default value read from the on-board EEPROM. The temporary value will be lost.

(3) Recommended values:

Typical low coercivity (~300 Oersted) setting = 036

Typical high coercivity (4140 Oersted) setting = 255

> (3EH) Review Temporary Write Current

ACTION: The unit will return a 3 ASCII character response representing the temporary write current setting stored in RAM, MSD first. If not a VC unit, then a “~” reply will be sent from the unit.

Note: The value returned is the value presently used to encode cards with. This value could be different from the default write current value stored in EEPROM.

Arm to Write Commands: Use these commands to write cards.

ASCII Char	Definition of Instruction
------------	---------------------------

@ (40H)	Arm to Write with RAW verification
----------------	---

ACTION: The unit will perform the following sequence:

- Check that valid write data exists in Encode Data storage buffer. Send “*” error if not. Else...
- Clear read buffers
- Transmit Command acknowledge (“^” 5EH)
- Wait for card swipe.
- Transmit acknowledge (“^” 5EH) after card swipe if card passes the Read After Write checks on all tracks that were encoded. Otherwise send the proper RAW (1, 2 and/or 3) error response.

After a “Arm to Write” command is received and acknowledged the only valid commands that will be accepted for execution are: “Abort” <ESC> and “Warm Reset” commands. All other commands will result in an “Invalid Command” “!” response.

Z (5AH) Arm to Write, no RAW verification

ACTION: The unit will perform the following sequence:

- Check that valid write data exists in Encode Data storage buffer. Send “*” error if not.
Else...
- Clear read buffers
- Transmit Command acknowledge (“^” 5EH)
- Wait for card swipe.
- Transmit acknowledge (“^” 5EH) after card swipe.

After a “Arm to Write” command is received and acknowledged the only valid commands that will be accepted for execution are: “Abort” <ESC> and “Warm Reset” commands. All other commands will result in an “Invalid Command” “!” response.

z (7AH) Arm to Write, with RAW and speed prompts

ACTION: The unit will perform the following sequence:

- Check that valid write data exists in Encode Data storage buffer. Send “*” error if not.
Else...
- Clear read buffers
- Transmit Command acknowledge (“^” 5EH)
- Wait for card swipe.
- A “(” (28H) byte is sent when the media is first detected at the write head. After the card passes the read head and the media detect goes inactive, a “)” (29H) byte is sent if the card passes the Read After Write checks on all tracks that were encoded.
- Transmit acknowledge (“^” 5EH) after card swipe.

After a “Arm to Write” command is received and acknowledged the only valid commands that will be accepted for execution are “Abort” <ESC> and “Warm Reset” commands. All other commands will result in an “Invalid Command” “!” response.

This is similar to the ‘@’ command, except an extra response ‘(’ is reported when a media is detected at the write head. A ‘)’ response is reported when media detect goes inactive. Mainly used as a tool for determining average swipe speed. Most applications should not use this command. They should use the ‘@’ command instead.

6.4 Reader Responses

There are two types of responses from the unit, solicited and unsolicited. The unit produces a solicited response after receiving a command from the host. This includes command acknowledgements, card data, etc. The unit produces an unsolicited response normally due to a user's action or a power on situation.

Solicited Responses

Solicited Response Summary				
ASCII	HEX	Name	Use	Length*
^	5E	Command Completed (ACK)		
!	21	Invalid Command		
*	2A	Error		
+	2B	No data found		
-	2D	Insufficient leading zeros for custom writing		
/	2F	lsb of first character not a "1" for custom writing		
?	3F	Communications error		
~	7E	Can't Execute, hardware does not support command		

*Length does not include protocol overhead characters, if any.

Unsolicited Responses

Unsolicited Response Summary				
ASCII	HEX	Name	Use	Length*
:	3A	Power On Report		1
^	5E	Card swipe occurred when armed to read or write		1
1	31	Unsuccessful read after write – Track 1		1,2 or 3**
2	32	Unsuccessful read after write – Track 2		1,2 or 3**
3	33	Unsuccessful read after write – Track 3		1,2 or 3**
(	28	Card speed measurement – start		1
)	29	Card speed measurement - end		1
>	3E	Card edge detected		1

*Length does not include protocol overhead characters, if any.

** Responses combined into one message back to the host.

Section 7: Detailed Card Operations

This section goes into the required details for reading and writing cards using the MSR206-7HL. Various examples are provided at the end of this section.

7.1 Reading Cards

As mentioned previously above, reading cards is a three-step process.

Step 1: Reader arming phase

The host starts by sending an ARM TO READ command ("P") to the unit. (A second command "p" is available but it is meant only for use as a test tool.) This command causes the unit to clear its Read buffers and to enter the Armed-to-Read state where it waits for data from the read heads. Any visual or audio cues for the user must be sent to the unit prior to this command. The unit will respond to the command with an acknowledgement. The unit will now remain in this state until a card is swiped, an ABORT command is received or the unit is reset.

Step 2: Card data collection phase

When the user swipes a card past the read head, card data is collected and stored in the unit's read buffers until the card swipe is completed or if the card stops mid-swipe. An acknowledgement is then sent to the host. This acknowledgement only implies that data is available in the read buffers. The integrity of the data has not yet been verified. The unit then exits the Armed-to-Read state. It will not accept any further data from a card.

If a card is swiped such that its magnetic stripe does not come into contact with the read head, or if there is no data on the magnetic stripe because it is blank, no response will be sent back to the host. The unit will remain in the "Armed to Read" state since it did not detect the card swipe.

Step 3: Transmit card data phase

With data now stored in the unit's Read buffers, the next phase is for the host to retrieve it from the unit one track at a time using the various Transmit Card Data commands. There are two types of Transmit Card Data commands; those that verify and decode the data according to a supported format, and the Transmit Custom Data commands that just transmit the track data with no checking.

The Transmit Card Data commands for supported formats ("Q", "R", "S", "q", "r", "s", "X", and "x") will verify integrity of the data, strip off all leading zeros, trailing zeros, parity bits and special characters. (Special characters are defined as the start sentinel, end sentinel and LRC.) The data is then converted to ASCII characters and transmitted to the host. If an error is found, the appropriate ERROR message is returned to the host instead. The host has the option of requesting the error data using the TRANSMIT ERROR DATA ("T" 49H) command. See the following sections for details on each of the supported formats.

The Transmit Custom Data commands (“U”, “V”, and “W”) gives the user the ability to read any data pattern from a card and transmit it to the host. Depending on the command used the data may or may not contain nulls. See the section Custom Data Decoding/Transmission later in this section for further details.

ISO Format Decoding/Transmission

The unit starts the decoding process by searching the read buffer for the start sentinel character for the specified decoding format. If the unit can't locate the start sentinel it ceases the decoding process and transmits the “+” ERROR response. After locating the start sentinel, all succeeding data characters are decoded and their parity checked until the end sentinel character is reached. The next character should be the LRC character. No further characters are decoded after that point. The LRC character is compared to the value that the unit has calculated. If the card data passes all of the verification checks, then the unit converts it to ASCII characters and transmits it to the host. The unit will return a “*” ERROR response for the following problems; no end sentinel found, LRC character does not match calculated value, or a parity error on any of the data or special characters.

There are two types of Transmit ISO data commands, single byte and double byte. The single byte commands (“Q”, “R”, and “S”) are used when standard ISO card data is read from the corresponding track location. (Track 1 format from track 1 on the card.) The double byte commands (“q1”, “q2”, “q3”, “r1”, “r2”, “r3”, “s1”, “s2”, and “s3”) are used for reading a particular track format from a different track location. (Track 1 format from tracks 2 or 3.) For further information on these commands, see the Magstripe Card Read Commands section of Commands and Responses.

For additional details on the ISO track formats see Appendix B: Card Formats.

AAMVA Format Decoding/Transmission

The MSR206-7HL must be configured to decode ISO and AAMVA data on track 3. Data integrity checks consist of verifying the existence or the start and end sentinels, the parity of each Magstripe character and that the calculated LRC matches the LRC read from the card. If a problem is found then the unit sends an ERROR response back to the host. If the data passes all of the verification checks then the unit then strips off the leading and trailing zero bits, the start sentinel, end sentinel and LRC characters. The unit then converts the data characters to ASCII format and transmits it back to the host.

AAMVA uses the same format as ISO for data on tracks 1 and 2. Therefore the same Transmit ISO Data commands (“Q”, “q1”, “R”, and “r2”) are used. These commands operate the same as detailed above in the ISO Format Decoding section. To decode and transmit AAMVA data from track 3, the “s1” command must be issued from the host to the unit. This command does the same checking as the ISO format commands but allows the end sentinel to be processed as a data character.

For additional details on the AAMVA track formats see Appendix B: Card Formats.

IBM-Passbook Format Decoding/Transmission

Passbook format consists of two redundant data fields that are separated by a field of zero bits. Since passbook data can span tracks 2 and 3, the unit attempts to decode the data from both tracks' read buffers. At two fields per track, the unit has up to four chances of extracting good data from the card in a single swipe. The unit starts the decoding operation by searching for the start sentinel character. If a start sentinel character can not be found in either track's read buffer, the unit ceases the decoding operation and sends a "+" ERROR response. After locating the start sentinel, all succeeding data characters are decoded and their parity checked until the end sentinel character is reached. The next character should be the LRC character that is verified against the value calculated by the unit. If the data in the field passes all of the verification checks, it is converted to ASCII and transmitted to the host. If an error is found, then the unit continues on to the next field and tries decoding the data without errors. The decoding operations ends with either good data being found in one of the fields and transmitted to the host or with an "*" ERROR response being sent.

There are two Transmit Passbook data commands, TRANSMIT PASSBOOK DATA ("X" 58H) and TRANSMIT PASSBOOK DATA USING SPECIFIED END SENTINEL ("x" 78H). The decoding operations are the same for both with the exception of the end sentinel decoding. The TRANSMIT PASSBOOK DATA command will check for an end sentinel value of either 0FH or 0CH. The TRANSMIT PASSBOOK DATA USING SPECIFIED END SENTINEL command will check for an end sentinel that matches the specified value. If that value is not found, the unit responds with a "*" ERROR. See the Reader Commands section of Commands and Responses for further information on these two commands.

For additional details on the IBM-Passbook format see Appendix B: Card Formats.

Custom Data Decoding/Transmission

The Transmit Custom Data commands ("U", "V", and "W") are used where the card data may not conform to a supported standard. Data integrity is not verified when decoding. The unit assumes that the data in the read buffer is stored lsb first. It also assumes that the lsb of the first character to be read is a "one". The decoding operation starts when the unit locates the first "one" bit in the read buffer. The unit then parses the data into characters determined by the specified number of bits. Custom data is not formatted into ASCII characters for transmission to the host. Characters are returned to the host in the least significant bits of the transmitted character frame. The unused higher order data bits (if any) are set to zero. (See Section Communications) Where the decode operation ends depends on whether a 2-byte or 3-byte command was received. If the 2-byte commands are used (for example U7, V5, W6, etc) then the unit stops decoding data when it comes across the first character that has no "ones" in it (i.e. a null character). Any data past that point in the read buffer is ignored. If the 3-byte commands are used (for example U_7, V_5, W_6, etc) then card data from the first "one" bit found to the last 10 bits from the end of the card will be processed and transmitted.

7.2 Writing Cards

This section only applies to units that are reader/writers. If a unit is a reader only, a CAN'T EXECUTE “~” error response will be returned to the host.

Step 1: Unit setup phase

This phase is not required if the default parameters for write current (card coercivity) and track density are used. Of these two parameters changing the track density if required must occur in this phase. If a change density command is sent later, errors could occur during the encode operation. Some errors that could occur are that the start sentinel is placed in the wrong position or incomplete data could be written to the card among others.

The unit supports the two standard track densities, 75bpi and 210bpi. Encoding density is a track attribute, that is different tracks can have different densities. During an encode operation the chosen density is maintained across the chosen track; i.e. it cannot be changed halfway through the card.

The host can change the encoding density using the set density commands “,”, “O”, “o”, “N”, and “n”. The unit will retain any change in densities until either another density command is sent or a reset operation is performed. Changing the track density will affect the amount of data that can be written to a card.

VC units have the capability writing to cards of different coercivities. The unit does this by adjusting the amount of write current used for encoding. For further important information on changing and viewing the write current settings see the Working with different media coercivities section later in this section.

Step 2: Data loading phase

Data is loaded into the unit on an individual track basis. Only tracks that have data loaded in this phase will be written to the card. For example, if data for track 2 is loaded into a triple track unit and a card is then encoded, only track 2 will be written to on the card. All other tracks will remain untouched.

There are two types of Load Data commands; those that load data for a supported format and those that load custom data. Using a supported format command (“A”, “B”, “C”, “a”, “b”, “c” and “j”), the host is only required to provide the unit with the data field in ASCII. The unit verifies that the downloaded data uses only the allowed characters for the specified format. It then proceeds to convert the downloaded data by converting the ASCII data to the proper character format with the correct parity and adding the start sentinel and end sentinel characters. It will calculate the value of the LRC character that is also appended to the data. The unit will also add in the required number of leading zero bits so that the start sentinel character will be properly located on the card. See the following sections for details on each of the supported formats.

The Load Custom Data commands (“E”, “F” and “G”) give the user the ability to write almost any data pattern to a card. Depending on the command used the data may or may not contain nulls.

See the section Loading Custom Data later in this section for further details.

Step 3: Card encoding phase

After the encode data is loaded into the write data buffers, the unit can now be armed to write. Any visual or audio cues for the user must be sent at this time. A flashing green LED is suggested as an indication to the user that the unit is ready to encode their card. Since the LED's are host controlled this is left to the applications software to initiate.

There are mainly two "Arm to Write" commands available. They are ARM TO WRITE WITH RAW VERIFICATION "@", and the ARM TO WRITE NO RAW VERIFICATION "Z". (A third command "z" is available but it is meant only for use as a test tool.) The card length and type of reader/writer unit being used determine which command to use. Only one of these commands may be used at a time. If a MSR206-7HL unit is being used, then the "@" command can be used all the time without regard to card length. If a MSR206-7HL unit is being used, then the length of the card determines if the "@" command can be used. If the card is ISO standard length (3.370"/ 85.60mm) or shorter, the "@" command can be used. If the card is longer than ISO standard length then the "Z" command must be used. When using the "@" command, the VC unit stops writing to a card after it has written an ISO length of data.

Upon reception of the Arm to Write command, the unit will respond with an acknowledgement. The unit will now remain in this state until a card is swiped, an ABORT command is received or the unit is reset. When the user swipes the card past the write head, the unit encodes the magnetic stripe on the card with the information stored in the write buffers. The unit will provide the necessary trailing zero bits after the last data character to complete the card. Only tracks that have data in the write buffers will be written to.

If the ARM TO WRITE WITH RAW VERIFICATION "@" command was used to arm the unit, data that is on the card will be collected as it passes the read head. This data is stored in the units read buffers for later analysis. If the "Z" command is used instead, no data is collected from the card during the encode swipe.

Step 4: Verification and acknowledgement phase

Depending on which "Arm to Write" command that was used, data verification would occur either on the same swipe as the encode operation or on a second swipe. If the ARM TO WRITE WITH RAW VERIFICATION "@" command was used to arm the unit, data that is on the card would be collected as it passed the read head and stored in the unit's read buffers. The Read After Write (RAW) function performs a 100% check on the magnetic data written on a card. Any bit errors outside the data field will be flagged as an error. If all written tracks pass the RAW verification checks, then the unit responds with an acknowledgement. If errors are found on one or more tracks, the unit sends a RAW ERROR character ("1", "2" and/or "3") for each track that contains errors.

If the ARM TO WRITE NO RAW VERIFICATION "Z" command is used instead, no data was collected from the card during the encode swipe. A second verification swipe would be necessary. The host would send the WRITE VERIFY ("?",) command to the unit. The unit would send back a command acknowledgement and wait for a card swipe. After the user swipes the card, the unit performs a Read After Write check on the data the same as for the @ command. The unit then responds back appropriately to the host.

The unit implements a speed governor to help ensure that cards are encoded within the ISO specification for allowed jitter. The unit does this by measuring the speed of the card during an encode operation. If the card exceeds the maximum specified encode speed, the unit reports a Read After Write error for all tracks that it was writing to. The unit also causes the LED to display an amber color for one second. If a card is swiped too slowly, i.e. below the minimum allowed encode speed, the unit will timeout and consider the write operation completed. This would result in a partially encoded card.

Step 5: Re-encoding phase

Loading ISO Format Data

There are two types of Load ISO data commands, single byte and double byte. The single byte commands (“A”, “B”, and “C”) are used when standard ISO card data is to be written to the corresponding track location. (Track 1 format to track 1 on the card.) The double byte commands (“a1”, “a2”, “a3”, “b1”, “b2”, “b3”, “c1”, “c2”, and “c3”) are used for writing a particular ISO track format to a different track location. (e.g. Track 1 format to tracks 2 or 3.) For further information on these commands, see the Magstripe Card Write Commands section of Commands and Responses.

Loading AAMVA Format Data

The MSR206-7HL must be configured to decode ISO and AAMVA data on track 3.

AAMVA uses the same format as ISO for data on tracks 1 and 2. Therefore the same Load ISO Data commands (“A”, “a1”, “B”, and “b2”) are used. These commands operate the same as detailed above in the Loading ISO Format Data section. To load AAMVA data to track 3, the “c1” command must be issued from the host to the unit. This command does the same data conversion as the other Load ISO Format commands but allows the end sentinel to be processed as a data character without generating an error.

Loading IBM-Passbook Format Data

In the case of passbook data the unit automatically creates the duplicate data fields.

Use the two byte Load Passbook Data command (“j”) when that format is to be written to the card. The host must supply the end sentinel to be used when issuing the command.

Loading Custom Data

Two selectable modes are available for custom writing. In Mode 1, the data string cannot include an EOT (04H) that is used as a string terminator. In Mode 2, EOT characters can be written on the card.

The following steps must be followed to write custom data:

Issue the command “CUSTOM WRITE TRK X,” followed by one ASCII character in the range of 3-7, indicating the number of bits per character to be written. If the interface is capable of executing the command, it acknowledges with an “ACK” response. If the interface is not configured to execute the command, it responds with a “CAN'T EXECUTE.”

Upon receiving the “ACK” response, the host should send the following:

Command Syntax for Mode 1 & 2	
Mode 1	Mode 2
Leading Zeros*	3 digits for character count**
Card Data	Leading Zeros*
EOT	Card Data

*Refer to “Leading Zero Bits for Custom Encoding table” for number of leading zeros

**For example: “097” is sent as <30H><39H><37H>. A Character that is not in the 0-9 range will receive an error message from the reader. The count is the sum of the number of Leading Zero characters and the number of the Card Data characters.

For Mode 2, when operating in USIO, a five-second delay between characters (before the count is satisfied) will terminate the message.

The LSB of the first data character to be written must be a “ONE.” If not, the reader will respond with a “/” (2FH) as an error message.

The reader extracts the number of LSB's from each byte downloaded, even from the leading zeros, and will place them in storage to be written on the card, LSB first. The number of characters written must not exceed what can be physically written onto the card and that enough clocking bits (zeros) must be written before and after the data. Refer to below table.

Leading Zero Bits for Custom Encoding			
Density	Leading Zero Bits	Recommended # Of Zero Bits	Data Bits Allowed
75 BPI	20 Min	24	1024 Max
210 BPI	40 Min	68	1024 Max

The reader provides the necessary trailing zeros to completely fill the card. Data characters downloaded for custom writing need not be in ASCII format.

If the reader is capable of executing the command, it acknowledges with an “ACK” response, if any error is detected, it responds with an “ERROR.” Upon receiving the “ACK” response, the host should proceed to send the command to Load Data to Write additional tracks or to “EXECUTE WRITE.”

After the card has been swiped, the read after write function verifies the successful recording of the data and notifies the host with an “ACK” or one or more errors identifying the Track(s) where the error(s) was/were found.

Proper command sequence

Since the unit enforces certain encoding rules, the sequence of the commands used

Set coercivity (for entire card, not track)

Set Track density

Load data command (format)

Encode card (Arm to Write) command

7.3 Working with different media coercivities

Reading

The MSR206-7HL, by the nature of its read electronics, can read cards of varying coercivities automatically.

Therefore no special considerations are required. See Technical Specifications for specified range.

Writing

Variable current (VC) units only

There are two types of write current values that the unit can contain, the default value and a temporary value.

The unit stores the write current values in two different locations, in the serial EEPROM and in RAM. The serial EEPROM is by its nature non-volatile storage. It is used to store the default write current value that is to be used after all reset operations. RAM is volatile storage and will lose any value stored in it due to loss of power. The RAM is loaded with the default write current value after any reset operation.

There are two commands that allow the host to change the write current value used to encode data on to the Magstripe media. These are the SET DEFAULT WRITE CURRENT “[” (5Bh) command and the SET TEMPORARY WRITE CURRENT ”<” (3Ch), command. The SET DEFAULT WRITE CURRENT command will update the stored values in both the serial EEPROM and the RAM. The unit will encode all further Magstripe media using this value for the write current until either of the “Set Write Current” commands are received from the host. The SET TEMPORARY WRITE CURRENT command will update only the value stored in RAM. The unit will use this value to encode all further Magstripe media until either a new “Set Write Current” command is received or the unit undergoes a reset operation.

There are two commands that allow the host to review the current value(s) stored by the unit. These are the REVIEW DEFAULT WRITE CURRENT, “J” (5Dh), command and the REVIEW TEMPORARY WRITE CURRENT, “>” (3Eh), command. The REVIEW DEFAULT WRITE CURRENT command returns the value stored in the serial EEPROM. This value is not necessarily the value used to encode cards. The REVIEW TEMPORARY WRITE CURRENT command returns the value stored in RAM. This is the value that is presently being used to encode cards. This value could be the same as the default value. It would be different if the unit has received a “Set Temporary Write Current” command with a non-default value specified since the last reset operation.

7.4 Working with non-ISO length media

7.5 Encoding a Series of Cards

7.6 Considerations for encoding non-ISO formats

7.7 Working with California Driver's License/Identification Cards

The DMV California Driver's License/Identification card is written on all three tracks. Track 2 is read by using the “R” (52H, read track 2, ISO standard format) command. Tracks 1 and 3 are read by using custom data read commands. However, user software is required to convert custom data into ASCII format.

Decoding DMV California Driver's License/Identification Cards – Track 1

The DMV data format in track 1 is using 6 data bits with no parity. Null characters are also part of the data field. To read this format the 3-byte command “U_6” (55H, 5FH, 36H) must be used. The user software should first check the data integrity by looking for the start sentinel (05H). Then, calculate the LRC by doing an exclusive-OR on every byte beginning with the start sentinel up to and including the end sentinel (1FH). Compare the computed LRC to the encoded LRC. The encoded LRC is the data immediately following the end sentinel. If the LRC is correct, the data read can be converted to ASCII by adding 20H to each byte.

Decoding DMV California Driver's License/Identification Cards – Track 3

DMV data format on Track 3 can be converted to ASCII format by using the same procedure as described above with one exception. The command required to get the data from the reader is “W_6” (57H, 5FH, 36H) and the start sentinel is 01H.

CDL Start/End Sentinels for Tracks 1 &3		
	Track 1	Track 3
Start Sentinel	05H	01H
End Sentinel	1FH	1FH

7.8 Data Security Considerations

In applications involving sensitive information the following factors should be taken into consideration. After a card is read, the data remains in the unit's read buffers indefinitely until it experiences a reset cycle, or either an ARM TO READ command or an ARM TO WRITE command is received and acknowledged. After a card is encoded the data remains in both the read and write buffers until the unit once again experiences a reset cycle, an ARM TO READ command or an ARM to Write command is received and acknowledged.

The suggested method for protecting data would be to issue an ARM TO READ command, wait for the command acknowledgment and then immediately issue an ABORT command and wait for its acknowledgment. This sequence will fully clear the data from the read and write buffers for all tracks.

7.9 Examples

Reading ISO cards

Writing ISO cards

Reading Custom Data

Writing Custom Data

Encoding multiple cards

Encoding extended length media

Section 8: Configuration Commands

<09><09><09>Q 00~7E ASCII address for reader

<09><09><09>A 00~7E ASCII data 00~FF ASCII address for write

00H MODEL TYP

- ✓ TK2/1 READER ONLY 01H
- ✓ TK2/3 READER ONLY 02H
- ✓ TK1/2/3 READER ONLY 03H
- ✓ TK2/1 R/W 04H
- ✓ TK2/3 R/W 05H
- ✓ TK1/2/3 R/W 06H
- ✓ TK 2/3 R/W 07H
- ✓ TK2/1 R/W VC 18H
- ✓ TK2/3 R/W VC 19H
- ✓ TK1/2/3 R/W VC 1AH

01H 75 BPI LEADING ZEROS

02H 210 BPI LEADING ZEROS

03H RS232 SETING

- ✓ 19200 7.O.1 00H
- ✓ 9600 7.O.1 01H
- ✓ 4800 7.O.1 02H
- ✓ 2400 7.O.1 03H
- ✓ 1200 7.O.1 04H
- ✓ 19200 7.E.1 08H
- ✓ 19200 7.M.1 10H
- ✓ 192007.S.1 18H
- ✓ 19200.7.O.1 00H

04H

- ✓ PROTOCOL 0 <04H> ISO 00H
- ✓ PROTOCOL 1 <04H> ISO 06H
- ✓ PROTOCOL 0 <LEN> ISO 05H
- ✓ PROTOCOL 0 <04H> AAMVA 04H
- ✓ 05H~18H reserve
- ✓ 19H~1AH WRIT CLOCK (1" 510CLOCK)
- ✓ 1BH SPEED
- ✓ 1CH WRITE CURRENT (over 170 co is Hi-Co)
- ✓ 1DH~7CH reserve
- ✓ 7EH compare with 1C

✓ **7FH CHECKSUM**

8.1 Appendix A: Card Formats

ISO

ISO Card Format							
Track	Density (bpi)	Bits/Char*	Total Characters**	Character Set	Start Sentinel	End Sentinel	Field Separator
1	210	7	79	Alphanumeric	%	?	^
2	75	5	40	Numeric only	; (1BH)	? (1FH)	= (0DH)
3	210	5	107	Numeric only	; (1BH)	? (1FH)	= (0DH)

* Includes ODD parity bit.

** Includes Start Sentinel, End Sentinel and LRC characters.

Track 1 allowed characters

Alphanumeric Character Set									
					b ₆				
					b ₅				
b ₄	b ₃	b ₂	b ₁	COL	ROW				
0	0	0	0	0		SP	0	@ ⁽¹⁾	P
0	0	0	1	1		! ⁽¹⁾	1	A	Q
0	0	1	0	2		" ⁽¹⁾	2	B	R
0	0	1	1	3		# ⁽²⁾	3	C	S
0	1	0	0	4		\$	4	D	T
0	1	0	1	5		% ⁽³⁾	5	E	U
0	1	1	0	6		& ⁽¹⁾	6	F	V
0	1	1	1	7		/ ⁽¹⁾	7	G	W
1	0	0	0	8		(	8	H	X
1	0	0	1	9		)	9	I	Y
1	0	1	0	10		* ⁽¹⁾	: ⁽¹⁾	J	Z
1	0	1	1	11		+ ⁽¹⁾	; ⁽¹⁾	K	[⁽⁴⁾
1	1	0	0	12		, ⁽¹⁾	< ⁽¹⁾	L	\ ⁽⁴⁾
1	1	0	1	13		-	= ⁽¹⁾	M] ⁽⁴⁾
1	1	1	0	14		.	> ⁽¹⁾	N	^ ⁽³⁾
1	1	1	1	15		/	? ⁽³⁾	O	DEL ⁽¹⁾

(1) These characters are for hardware control purposes only and cannot contain information characters.

(2) This character is reserved for optional additional graphic symbols.

(3) These characters have the following meanings: Position 0/5 % represents "start sentinel"

1/15 ? represents "end sentinel"

3/14 ^ represents “field separator”

(4) These characters are reserved for additional national characters when required. They are not to be used internationally.

Track 2 and 3 allowed characters

Numeric Character Set						
Bits						
P	b ₄	b ₃	b ₂	b ₁	Row	Character
1	0	0	0	0	0	0
0	0	0	0	1	1	1
0	0	0	1	0	2	2
1	0	0	1	1	3	3
0	0	1	0	0	4	4
1	0	1	0	1	5	5
1	0	1	1	0	6	6
0	0	1	1	1	7	7
0	1	0	0	0	8	8
1	1	0	0	1	9	9
1	1	0	1	0	10	: ⁽¹⁾
0	1	0	1	1	11	; ⁽²⁾
1	1	1	0	0	12	< ⁽¹⁾
0	1	1	0	1	13	= ⁽³⁾
0	1	1	1	0	14	> ⁽¹⁾
1	1	1	1	1	15	? ⁽⁴⁾

(1) These characters are for hardware control purposes only and cannot contain information characters.

(2) Start sentinel

(3) Field separator

(4) End sentinel

AAMVA

AAMVA Card Format							
Track	Density (bpi)	Bits/ Char*	Total Characters**	Character Set	Start Sentinel	End Sentinel	Field Separator
1	210	7	82	Alphanumeric	%	?	^
2	75	5	40	Numeric only	; (1BH)	? (1FH)	= (0DH)
3	210	7	82	Alphanumeric	%	?	^

* Includes ODD parity bit.

** Includes Start Sentinel, End Sentinel and LRC characters.

IBM-Passbook

IBM-Passbook Card Format							
Track	Density (bpi)	Bits/Char*	Total Characters**	Character Set	Start Sentinel	End Sentinel	Field Separator
2 & 3 Wide	210	5	48	Numeric only	; (1BH)	< (1CH) or ? (1FH)	= (0DH)

* Includes ODD parity bit.

** Includes Start Sentinel, End Sentinel and LRC characters.

8.2 Appendix B: Magstripe Fundamentals

Track locations

Related Documents

- ISO 7810:1995 Identification Cards - Physical characteristics
- ISO/IEC 7811-2:1995 Identification Cards - Recording technique - Part 2: Magnetic stripe
- ISO/IEC 7811-3:1995 Identification Cards - Recording technique - Part 3: Location of embossed characters on ID-1 cards
- ISO/IEC 7811-4:1995 Identification Cards - Recording technique - Part 4: Location of read-only magnetic tracks - Tracks 1 and 2
- ISO/IEC 7811-5:1995 Identification Cards - Recording technique - Part 5: Location of read-write magnetic track - Track 3
- ISO/IEC 7811-6:1996 Identification Cards - Recording technique - Part 6: Magnetic stripe - High coercivity

Write current setting versus media coercivity table

Write Current Settings vs. Media Coercivities		
Media Coercivity (Oersteds)	Write Current Setting*	Typical Usage
300	36	Low coercivity
600		
1800		
3600+	255	Typical high coercivity