User Manual

MOIR Insert Readers

USB HID
Interface Reference

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MOIR Insert Reader USB HID Reader Interface Reference

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1 Introduction

The MOIR USB HID Reader is a magnetic stripe card insert reader. The Reader is compatible with the PC series of personal computers or any device with a USB interface. To read a card on withdrawal (recommend) or insertion with the magnetic stripe facing the magnetic head.

The reader conforms to the USB Human Interface Device (HID) Class specification Version 2.0. Host applications designed for the Second Edition of Windows 98, Me, 2000 and XP can be easily communicate with the MOIR USB HID reader using standard Windows API calls that communicate to the device through the HID driver that comes with Windows.

Unlike USB HID keyboard readers, this reader does not do keyboard emulation. It behaves as a vendor defined HID device so that a direct communication path can be established between the Host application and the device.

A Visual Basic demo program with its source code is available.

2 INSTALLATION

On hosts with the Windows operating system, the first time the device is plugged into a specific USB port; Windows will pop up a dialog box, which will guide you through the process of installing a device driver for the device. After this process is completed once, Windows will no longer request this process as long as the device is plugged into the same USB port. The device driver that Windows will install for this device is the driver used for HID devices and it is part of the Windows operating system. Most Windows will find all the files it needs on its own without giving you any prompts. Other times Windows will need to know the location of the files it needs.

3 USB COMMUNICATIONS

This device conforms to the USB specification revision 2.0. This device also conforms with the Human Interface Device (HID) class specification version 1.1. The device communicates to the host as a vendor defined HID device. The details about how the card data and commands are structured into HID reports follow later in this section. The latest versions of the Windows operating systems, Windows 98, Me, and 2000, all come with a standard Windows USB HID driver. Windows applications that communicate to this device can be easily developed. These applications can communicate to the device using standard windows API calls that communicate to the device using the standard Windows USB HID driver. These applications can be easily developed using compilers such as Microsoft's Visual Basic or Visual C++. A demonstration program and its source code, written in Visual Basic, that communicates with this device is available. This demo program can be used to test the device and it can be used as a guide for developing other applications. More details about the demo program follow later in this document.

It is strongly recommended that application software developers become familiar with the HID specification the USB specification before attempting to communicate with this device. This document assumes that the reader is familiar with these specifications. These specifications can be downloaded free from www. usb. org.

This is a full speed USB device. This device has a number of programmable configuration properties. These properties are stored in non-volatile EEPROM memory. These properties can be configured at the factory or by the end user. The device has an adjustable endpoint descriptor polling interval value that can be set to any value in the range of 1ms to 255ms. This property can be used to speed up or slow down the card data transfer rate. The device will go into suspend mode when directed to do so by the host. The device will wakeup from suspend mode when directed to do so by the host.

4 MOIR Data Structure

MOIR USB HID Reader supports both ID TECH and Mag-Tek data Structure with an EEPRom setting.
Vender ID: 0ACD
USB HID Data Format Setting:

Setting A: ID TECH Data Format (Default setting)	Product ID: 0640
Setting B: MagTek Data Format	Product ID: 0650

During first plug in, the Firmware will read the "Data Format Setting" from EEPROM and send current Product ID in enumeration. Each time after change the "Data Format Setting", the firmware will save the setting to EEPROM then re-do the enumeration process.

Command requests and responses are sent to and received from the device using feature reports. Command is send to the device using HID class specific request Set_Report (21 09 …). The response to a command is retrieved from the device using HID class specific request Get_Report (A1 01 …). These requests are sent over the default control pipe.

4.1 ID TECH Format Data Structure

Offset	Usage Name
0	T1 decode status
1	T2 decode status
2	T3 decode status
3	T1 data length
4	T2 data length
5	T3 data length
6	Card encode type
7,8	Total Output Length
9-508	Output Data

In this approach, the reader will keep all of the ID TECH data editing and other features like preamble, postamble, etc. The output data is always 509 bytes; the "Total Output Length" field indicates the valid data length in the output data.

4.2 Mag-Tek Format Data Structure

Offset	Usage Name
0	T1 decode status
1	T2 decode status
2	T3 decode status
3	T1 data length
4	T2 data length
5	T3 data length
6	Card encode type
7-116	T1 data
117-226	T2 data
227-336	T3 data

4.3 Notes (for both IDTECH format and MagTek format):

T1, T2 or T3 decode status: 0 for no error, 1 for error
T1, T2 or T3 Data Length: Each byte value indicates how many bytes of decoded card data are in the track data field. This value will be zero if there was no data on the track or if there was an error decoding the track. The track data includes all data string starting with the start sentinel and ending with the end sentinel.

Card Encode Type:

Value	Encode Type	Description
0	ISO/ABA	ISO/ABA encode format
1	AAMVA	AAMVA encode format
2	CADL	California Driver License
3	Blank	The card is blank
4	Other	The card has a non-standard format. For example, ISO/ABA track 1 format on track 2

5 Descriptor Tables:

5.1 Device Descriptor:

Field	Value	Description
Length	12	
Des type	01	
bcd USB	10 01	
Device Class	03	
Sub Class	00	Unused
Device Protocol	00	Unused
Max Packet Size	20	
VID	CD 0A	
PID	40 06 / 50 06	With ID TECH Structure With MagTech Structure
BCD Device Release	00 01	
i-Manufacture	01	
i-Product	02	
i-Serial-Number	00	
# Configuration	01	

5.2 Configuration Descriptor:

Field	Value	Description
Length	09	
Des type	02	
Total Length	22 00	
No. Interface	01	
Configuration Value	01	
iConfiguration	00	
Attributes	80	Bus power, no remove wakeup
Power	32	100 mA

5.3 Interface Descriptor:

Field	Value	Description
Length	09	
Des type	04	
Interface No.	00	
Alternator Setting	00	
# EP	01	
Interface Class	03	HID
Sub Class	00	
Interface Protocol	00	
iInterface	00	

5.4 HID Descriptor:

Field	Value	Description
Length	09	
Des type	21	HID
bcdHID	11 01	
Control Code	00	
numDescriptors	01	Number of Class Descriptors to follow
DescriptorType	22	Report Descriptor
Descriptor Length	37 00 3D 00	With ID TECH format With MagTek format

5.5 End Pointer Descriptor:

Field	Value	Description
Length	07	
Des Type	05	End Point
EP Addr	81	EP1 - In
Attributes	03	Interrupt
MaxPacketSize	20 00	
bInterval	0A	

5.6 Report Descriptor: (ID TECH Setting)

Field	Value	Description
	06 00 FF	Usage Page (MSR)
	09 01	Usage(Decoding Reader Device)
	A1 01	Collection (Application)
	15 00	Logical Minimum
	26 FF 00	Logical Maximum
	75 08	Report Size
	09 20	Usage (Tk1 Decode Status)
	09 21	Usage (Tk2 Decode Status)
	09 22	Usage (Tk3 Decode Status)
	09 28	Usage (Tk1 Data Length)
	09 29	Usage (Tk2 Data Length)
	09 2A	Usage (Tk3 Data Length)
	09 38	Usage (Card Encode Type)
	95 07	Report Count
	81 02	Input (Data,Var,Abs,Bit Field)
	09 30	Usage (Total Sending Length)
	95 02	Report Count (2)
	82 02 01	Input (Data, Var, Abs, Bit Field)
	09 31	Usage (Output Data)
	96 F4 01	Report Count (500)
	82 02 01	Input (Data, Var, Abs, Bit Field)
	09 20	Usage (Command Message)
	95 08	Report Count
	B2 02 01	Feature (Data,Var, Abs, Buffered Bytes)
	C0	End Collection

5.7 Report Descriptor: (MagTek Setting)

Field	Value	Description
	06 00 FF	Usage Page (MSR)
	09 01	Usage(Decoding Reader Device)
	A1 01	Collection (Application)
	15 00	Logical Minimum
	26 FF 00	Logical Maximum
	75 08	Report Size
	09 20	Usage (Tk1 Decode Status)
	09 21	Usage (Tk2 Decode Status)
	09 22	Usage (Tk3 Decode Status)
	09 28	Usage (Tk1 Data Length)
	09 29	Usage (Tk2 Data Length)
	09 2A	Usage (Tk3 Data Length)
	09 38	Usage (Card Encode Type)
	95 07	Report Count
	81 02	Input (Data,Var,Abs,Bit Field)
	09 30	Usage (Tk1 Data)
	95 6E	Report Count (110)
	82 02 01	Input (Data, Var, Abs, Bit Field)
	09 31	Usage (Tk2 Data)
	95 6E	Report Count (110)
	82 02 01	Input (Data, Var, Abs, Bit Field)
	09 32	Usage (Tk3 Data)
	95 6E	Report Count (110)
	82 02 01	Input (Data, Var, Abs, Bit Field)
	09 20	Usage (Command Message)
	95 08	Report Count
	B2 02 01	Feature (Data,Var, Abs, Buffered Bytes)
	C0	End Collection

6 HID USAGES:

HID devices send data in reports. Elements of data in a report are identified by unique identifiers called usages. The structure of the device's reports and the device's capabilities are reported to the host in a report descriptor. The host usually gets the report descriptor only once (after the device is plugged powered up). The report descriptor usages identify the devices capabilities and report structures. For example, a device could be identified as a keyboard by analyzing the device's report descriptor. Usages are four byte integers. The most significant two bytes are called the usage page and the least significant two bytes are called usage IDs. Usages that are related can share a common usage page. Usages can be standardized or they can be vendor defined. Vendor defined usages must have a usage page in the range 0xff00 – 0xffff. All usages for this device are vendor defined magnetic stripe reader usage page 0xff00. The usage IDs for this device are defined in the following table. The usage types are also listed.

6.1 IDTECH format reader usage page 0xff00:

1	Decoding reader device	Collection	None
20	Track 1 decode status	Data	Input
21	Track 2 decode status	Data	Input
22	Track 3 decode status	Data	Input
28	Track 1 data length	Data	Input
29	Track 2 data length	Data	Input
2A	Track 3 data length	Data	Input
38	Card encode type	Data	Input
30	Total Data Length	Data	Input
31	Output Data	Data	Input
20	Command message	Data	Feature

6.2 Mag-Tek format reader usage page 0xff00:

Usage ID (Hex)	Usage Name	Usage Type	Report Type
1	Decoding reader device	Collection	None
20	Track 1 decode status	Data	Input
21	Track 2 decode status	Data	Input
22	Track 3 decode status	Data	Input
28	Track 1 data length	Data	Input
29	Track 2 data length	Data	Input
2A	Track 3 data length	Data	Input
30	Track 1 data	Data	Input
31	Track 2 data	Data	Input
32	Track 3 data	Data	Input
38	Card encode type	Data	Input
20	Command message	Data	Feature

7 Command requests and responses:

Command requests and responses are sent to and received from the device using feature reports. Command is send to the device using HID class specific request Set_Report (21 09 …). The response to a command is retrieved from the device using HID class specific request Get_Report (A1 01 …). These requests are sent over the default control pipe.

7.1 Commands

A simple Turbo TLP-224 protocol with one byte check sum is used when host communicates with reader.

Command is in format of <ACK> <Length> <Command> <LRC> <ETX>
Positive response of reader will be in format of <ACK> <Length> <Data> <LRC> <ETX>
Negative response from a reader will be in format of <NAK> <Length> <Status> <LRC> <ETX>

Where:
<ACK> is 60h.
<NACK> is E0h.
<Length> is a two-byte counter of length of <Command>.
<Status> is a two-byte error code.
<ETX> is 03h.
The overall <LRC> (Modulus 2 = Exclusive OR) checksum (from <60> to <LRC>) should be zero.

The following table is a summary of error code.
<29> <00> Unknown Function ID (or Function Value) in setting command
<2A> <00> Command received correctly, but could not complete
<69> <00> Command not supported
<81> <00> Time out

The response for Unknown function ID or Function Value will be in format of <NAK> <Length> <29> <00> <Unknown ID Num> <Unknown ID 1> . . . <LRC> <ETX>
Firmware will still do all the setting for known setting unless communication protocol is wrong.

The following table is a summary of the general commands.

Command	Name	Usage
24	Get Reader Status	To get reader status in form of a single byte
39	Get Firmware Version	To get the version of the reader's firmware
49	Reader Reset	Reset the reader
50 01 30	Arm to Read	Buffer mode set
50 01 32	MSR Reset	Buffer mode reset
51 01 <Track Selection Option>	Read MSR Data	Read stored MSR data
52 <FunctionID>	Get Setting	Getting various reader optional settings
52 1F	Get All Settings	Getting all current settings of the reader
53 18	Default all	Setting reader optional functions to default
53 [<FuncID> <Len> <FuncData>]. . .	Send Setting	Setting various reader optional functions
<6C> <LED Status>	LED Control	Turning on/off bicolor LED

7.2 Function ID

Function ID used in command/response are same as MiniMag I ID and they defined as follows:

Function ID	Hex Value	Function Description	Default	Function Value
HTypeID	10	Terminal Type	'0'	'0','5','6'
ReaderOptID	11	Reader Option	8Fh (RS232) /03h (KB)	Any
CharDelayID	12	Character Delay	'0'	'0' - '5'
TrackSelectID	13	Track Selection	'0'	'0' - '7'
PollingIntervalID	14	USB HID Polling Interval	1	1 ~ 255 ms
TrackSepID	17	Track Separator	\CR	Any ASCII Code
DefaultAllID	18	Default All		
SendOptionID	19	Send Option	'1' (RS232) / ‘5’ (KB)	'0' - '7'
MSRReadingID	1A	MSR Reading	'1'	'0' - '2'
DecodingMethodID	1D	MSR Decode Method	'3'	'1' - '3'

ReviewID	1F	Review All		
TerminatorID	21	Terminator	\CR	Any ASCII Code
USBHIDFmtID	23	USB HID Format	'0' for USB HID '8' for USB HID KB	'0' ID TECH HID '1' MagTek HID '8' HID KB
CardSeatedStrID	26	Card Seated String	[tab]Card Seated[tab]	Any String (<= 23 characters)
CardRemovedStrID	27	Card Removed String	[tab]Card Removed[tab]	Any String (< = 23 characters)
CardInStrID	28	Card Present String	[tab]Card Present[tab]	Any String (<= 23 characters)
CardOutStrID	29	Card Out String	[tab]Card Out[tab]	Any String (<= 23 characters)
NoDataStrID	2A	No Data String	[tab]No Data[tab]	Any String (<= 23 characters)
MediaDetectedStrID	2B	MediaDetected String	[tab]Media Detected[tab]	Any String (<= 23 characters)
MagDataStrID	2C	Magnetic Data String	[tab]Magnetic Data[tab]	Any String (<= 23 characters)
CardInSlotStr	2D	Card In Slot String	[tab]Card In Slot[tab]	Any String (<= 23 characters)
PartialInStr	2E	Incomplete Insertion String	[tab]Incomplete Insertion[tab]	Any String (<= 23 characters)
ReaderOpt2ID	2F	Reader Option 2	00h(RS232)/03h (KB)	Any Character
Track1ID	31	Track 1 ID	NULL	Any ASCII Code
Track2ID	32	Track 2 ID	NULL	Any ASCII Code
Track3ID	33	Track 3 ID	NULL	Any ASCII Code
LZ1ID	3C	T1 Lead zero adjustment	0Dh	Any Character
LZ2ID	3D	T2 Lead zero	0Dh	Any

		adjustment		Character
LZ3ID	3E	T3 Lead zero adjustment	0Dh	Any Character
BaudID	41	Baud Rate	'7'	'0' - '7'
DataID	42	Data Bit	'0'	'0' - '1'
ParityID	43	Data Parity	'0'	'0' ~ '4'
HandShakeID	44	Handshake mode	'0'	'0' - '2'
StopID	45	Stop Bit	'0'	'0' - '1'
XOnID	47	X-On Character	11h	Any ASCII Code
XOffID	48	X-Off Character	13h	Any ASCII Code
LRCID	60	LRC Character	'0'	'0' ~ '1'
T17BStartID	61	Track 1 7 Bit Start Sentinel	'%'	Any Character
T16BStartID	62	Track 1 6 Bit Start Sentinel	'%'	Any Character
T15BStartID	63	Track 1 5 Bit Start Sentinel	';'	Any Character
T27BStartID	64	Track 2 7 Bit Start Sentinel	'%'	Any Character
T25BStartID	65	Track 2 5 Bit Start Sentinel	';'	Any Character
T37BStartID	66	Track 3 7 Bit Start Sentinel	'%'	Any Character
T36BStartID	67	Track 3 6 Bit Start Sentinel	'!'	Any Character
T35BStartID	68	Track 3 5 Bit Start Sentinel	';'	Any Character
TEndID	69	End Sentinel	'?'	Any Character
BTModeID	70	Boot loader Mode	00h	FFh
PrefixID	D2	Prefix Setting	NULL	String
PostfixID	D3	Postfix Setting	NULL	String

7.3 Default and Available Setting

Following is a table of default setting and available setting (value within parentheses) for each function ID.

Function ID	Default Setting	Description
Terminal Type	'0' (‘0’~’2’,'4'~'6')	PC/AT, Scan Code Set 2, 1, 3, PC/AT with external Keyboard and PC/AT without External Keyboard
Beep Setting	‘2’ (‘0’~’2’)	Beep volume High
Character Delay	‘0’ (‘0’~’5’)	2 ms inter-character delay
Track Selection	‘0’ (‘0’~’9’)	Any Track
Polling Interval	1 (1 ~ 255)	USB HID Polling Interval
Data Output Format	‘0’ (‘0’~’2’)	ID TECH Format
Format Option (UIC/Mag-Tek)	H’59’	Refer MiniMag RS232 User’s Manual
Track Separator	CR/Enter	CR for RS232, Enter for KB
SendOptionID	‘1’ (‘0’~’F’)	Sentinel and Account number control
MSRReadingID	‘1’ (‘0’~’2’)	Enable MSR Reading
DTEnableSendID	‘0’(‘0’,’1’,’3’)	Data Editing Control
DecodingMethodID	‘1’ (‘0’~’3’)	Decoding in both direction
TerminatorID	CR/Enter	CR for RS232, Enter for KB
USBHIDFmtID	‘0’ (‘0’~’1’)	ID TECH Format
ForeignKBID	'0' ('0' ~ '9')	Foreign Keyboard
Track1PrefixID	NULL	No prefix for track 1
Track2PrefixID	NULL	No prefix for track 2
Track3PrefixID	NULL	No prefix for track 3
Track1SuffixID	NULL	No suffix for track 1
Track2SuffixID	NULL	No suffix for track 2
Track3SuffixID	NULL	No suffix for track 3
Baud Rate	‘5’ (‘3’~’7’)	9600 bps, ‘7’ is 38,400 bps
Data Bit	‘0’ (‘0’~’1’)	8 Bits
Data Parity	‘0’ (‘0’~’4’)	None
Hand Shake	‘0’ (‘0’~’1’)	Software (Xon/Xoff) hand shake
Stop Bit	‘0’ (‘0’~’1’)	1 Bit
XOn Character	DC1	0x11 as XOn
XOff Character	DC3	0x13 as XOff
OutputModeID	'0' ('0' ~ '1')	Standard mode
LRC character	‘0’ (‘0’~’1’)	Without LRC in output

Track 1 7 Bit Start Char	'%'	'%' as Track 1 7 Bit Start Sentinel
T16BStartID	'%'	'%' as Track 1 6 Bit Start Sentinel
T15BStartID	';'	';' as Track 1 5 Bit Start Sentinel
Track 2 7 Bit Start Char	'%'	'%' as Track 2 7 Bit Start Sentinel
T25BStartID	';'	';' as Track 2 5 Bit Start Sentinel
Track 3 7 Bit Start Char	'%'	'%' as Track 3 7 Bit Start Sentinel
T36BStartID	'!'	'!' as Track 3 6 Bit Start Sentinel
T35BStartID	';'	';' as Track 3 5 Bit Start Sentinel
Track 1 End Sentinel	'?'	'?' as End Sentinel
Track 2 End Sentinel	'?'	'?' as End Sentinel
Track 3 End Sentinel	'?'	'?' as End Sentinel
PrefixID	NULL	No Prefix
PostfixID	NULL	No Postfix
AddedFieldID	NULL	No Added Field
SearchCmdID	NULL	No Search Command
SendCmdID	NULL	No Send Command

7.4 Notification Setting

Setting for ReaderOptID is defined as following:

Bit Position	'0'	'1'
0	Card Seated Off	**Card Seated On**
1	Card Removed Off	**Card Removed On**
2	Card In Off	**Card In On**
3	MSR Data Envelope Off	**MSR Data Envelope On**
4	**LED Controlled by Reader**	LED Controlled by Host
5	**Magnetic Data Present Off**	Magnetic Data Present On
6	**Standard Decoder**	Raw Data Decoder
7	Card Out Off	**Card Out On**

Setting for ReaderOpt2ID is defined as following:

Bit Position	'0'	'1'
0	Media Detected Off	Media Detected On
1	No Data Off	No Data On
2	No Card in Slot	Card in Slot On
3	No Imcomplete Insertion	Incomplete Insertion is On
4-7	Reserved	

"Card Seated" and "Card Removed" is changes on "Card Seated" switch, "Card In" and "Card Out" is changes on "Card Present" switch.

A single byte reader status is defined as following:

Bit Position	'0'	'1'
0	Others	No data in a read
1	Card not Seated	Card Seated
2	Others	Media Detected
3	Card not Present	Card Present
4	No Magnetic Data	Magnetic Data Present
5	All other conditions	Card in Slot
6	All other conditions	Incomplete Insertion
7	Unused	

Card present bit is meaningful only when reader has card present switch.

7.5 Notifications explain:

7.5.1 Card Seated Change Notification

Switch change notification on card seated switch will be issued if its setting is on. "Card Seated On and Off" and "Card Removed On and Off" in ReaderOptID is used to enable or disable notification about card seated switch change.

7.5.2 Card Present Change Notification

Switch change notification on card present switch will be issued if its setting is on. "Card In On and Off" and "Card Out On and Off" in ReaderOptID is used to enable or disable notification about card present switch change.

7.5.3 No Data Notification

No data after an insertion or withdrawal will be issued if its setting is on. They are mismatch of data edit formula, no data on selected tracks if read direction is enabled and magnetic data envelop is off, no magnetic data after an insertion or withdraw time out.

7.5.4 Media Detected Notification

Media Detected Notification after an insertion or withdrawal will be issued if its setting is on and magnetic data in current read direction disabled by reader.

7.5.5 Magnetic Data Present Notification

Magnetic Data Present Notification after an insertion or withdrawal will be issued if in buffer mode; its setting is on and magnetic data in current read direction enabled by reader.

7.5.6 Card in Slot Notification

Card in Slot notification after a withdrawal will be issued if card present still on after 2 second of withdrawal.

7.5.7 Incomplete Insertion Notification

Incomplete Insertion notification after an insertion will be issued if card seated still off after 2 second of insertion.

7.6 Commands example:

7.6.1 Get Firmware Version

This command will respond a firmware version to application.
Command: <ACK> <Length> <R> <FmVerID> <LRC 1> <ETX>
Response: <STX> <Firmware Version String> <LRC 2> <ETX>

Version String will be in format of “ID TECH Magnetic Stripe Insert zzz Reader Vxx. yy. xx. yy is the major and minor version number; zzz is the interface, it can be “RS232”, “Keyboard”, “USB HID KB”, “USB HID” or “USB CDC”.

7.6.2 Setting Command

The setting data command is a collection of many function setting blocks and its format is as follows.
Command: <ACK> <Length> <S> <FuncSETBLOCK1>…<FuncBLOCKn> < LRC> <ETX>
Response: <ACK> or <NAK> for wrong command (invalid funcID, length and value)

Each function-setting block <FuncSETBLOCK> has following format:

<FuncID><Len><FuncData>

Where:
<FuncID> is one byte identifying the setting(s) for the function.
<Len> is a one byte length count for the following function-setting block <FuncData>.
<FuncData> is the current setting for this function. It has the same format as in the sending command for this function.

7.6.3 Get Setting

This command will send current setting to application.
Command: <ACK> <Length> <R> <FuncID > <LRC 1> <ETX>
Response: <STX> <Current Setting> <LRC 2> <ETX>

<FuncID>, <Len> and <FuncData> definition are same as described above.