USB MagneSafe V5
Swipe and Insert Reader

TECHNICAL REFERENCE MANUAL

PART NUMBER 99875388-9

JUNE 2012

REVISIONS

Rev Number	Date	Notes
1.01	08 Jul 08	Initial Release
2.01	17 Oct 08	Added OEM and 3-track reader models. Added insert reader.
3.01	4 Feb 09	Update Card Data (HID) table. Updated Privileged Commands section. Added 210630XX models.
4.01	8 Jun 09	Added HID SureSwipe Flag property; updated Limited Warranty & Agency Approvals; added wireless reader support
5.01	2 Feb 2010	Moved Communication section to 99875475.
6.01	27 Apr 2010	Updated Appendix A drawings to show mounting drawings
7.01	13 Jul 2010	Removed 21073055, 21073058 and 21073059; added 21063022 & 21063023
8.01	31 Oct 2011	Changed temp range to -30 °C to +70 °C
9.01	15 Jun 2012	Corrected reference to Appendix A

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

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

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

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

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

RoHS STATEMENT

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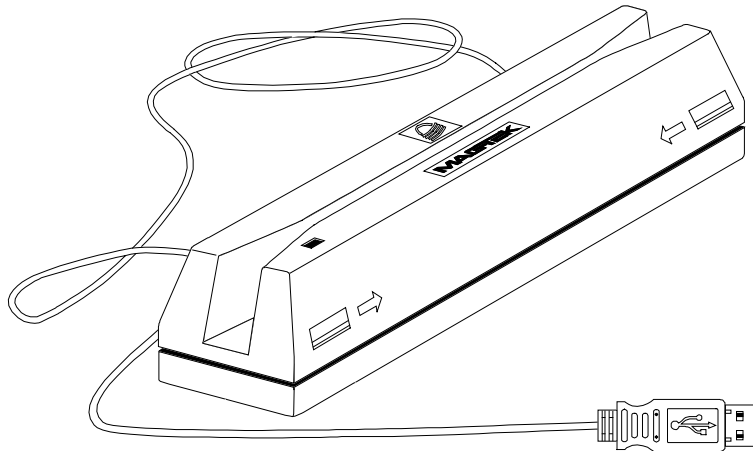
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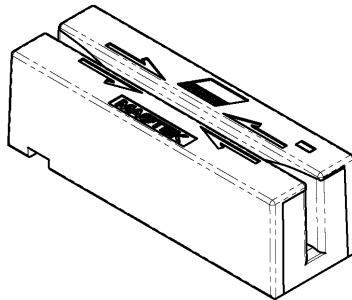

Figure 1-2. USB MagneSafe Swipe Reader – Mini

Figure 1-3. USB MagneSafe Swipe Readers – P55 and P90
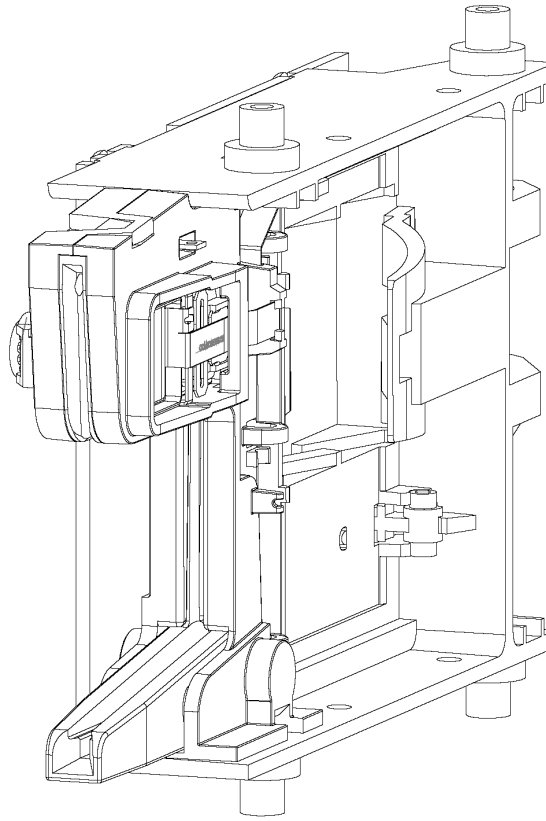
Figure 1-4. USB MagneSafe Insert Reader without bezel
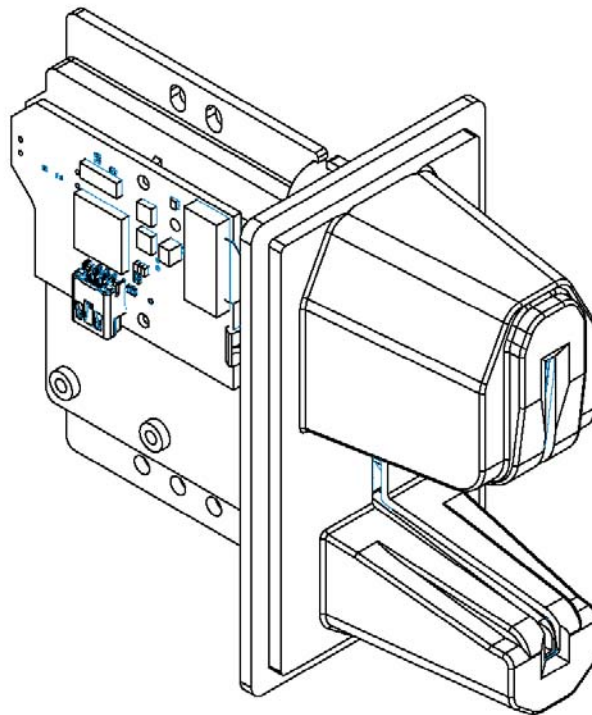

Figure 1-5. USB MagneSafe P-Series Insert Reader with Extended bezel

SECTION 1. FEATURES AND SPECIFICATIONS

The USB (Universal Serial Bus) Readers are compact magnetic stripe card readers that conform to ISO standards. In addition to reading multiple tracks of data from a card, the Readers also include MagnePrint technology. The MagnePrint data will be included with the track data on each transaction. In order to maximize card security, the Readers incorporate data encryption to protect the card contents and MagnePrint information. The Readers are compatible with any device having a host USB interface. A card is read in the swipe readers by sliding it, stripe down, through the slot either forward or backward; in the insert reader, it is read by inserting with the stripe to the right or left depending on the head orientation.

An LED (Light Emitting Diode) indicator on the Reader panel provides the operator with continuous status of the Reader operations.

The readers conform to the USB HID (Human Interface Device) Class specification Version 1.1. This allows host applications designed for most versions of Windows to easily communicate to the readers using standard Windows API calls that communicate to the reader through the HID driver that comes with Windows.

The Readers can be operated in two different modes:
- HID (herein referred to as "*HID* mode") and
- HID with Keyboard Emulation (herein referred to as "*KB* mode")

When operating in the HID mode, a reader will not use keyboard emulation. It behaves like a vendor defined HID device so that a direct communication path can be established between the host application and the reader, without interference from other HID devices.

When configured for the Keyboard Emulation (KB) mode, a Reader emulates a USB HID United States keyboard or, optionally, any international keyboard using ALT ASCII code keypad key combinations or customizable key maps. This allows host applications designed to acquire card data from keyboard input to seamlessly acquire the card data from the USB swipe reader.

<div align="center">

Caution
</div>

> *When in Keyboard Emulation mode, if another keyboard is connected to the same host as the reader and a key is pressed on the other keyboard while the reader is transmitting, then the data transmitted by the reader may get corrupted.*

When a card is swiped through the Reader, the track data and MagnePrint information will be TDEA (Triple Data Encryption Algorithm, aka, Triple DES) encrypted using DUKPT (Derived Unique Key Per Transaction) key management. This method of key management uses a base derivation key to encrypt a key serial number that produces an initial encryption key which is injected into the Reader prior to deployment. After each transaction, the encryption key is modified per the DUKPT algorithm so that each transaction uses a unique key. Thus, the data will be encrypted with a different encryption key for each transaction.

FEATURES

Major features of the Readers are as follows:

- Wired model and wireless model dongle powered through the USB – no external power supply required
- Wireless model reader is powered by a rechargeable battery; recharging can be provided via a standard USB cable (for recharging only)
- Hardware Compatible with a PC or any computer or terminal having a USB interface
- Bi-directional card reading
- Reads encoded data that meets ANSI/ISO/AAMVA standards and some custom formats such as ISO track 1 format on track 2 or 3
- Reads up to three tracks of card data
- Secure Red/Green/Amber LED for status
- Compatible with USB specification Revision 1.1
- Compatible with HID specification Version 1.1
- Can use standard Windows HID driver for communications; no third party device driver is required
- Programmable USB serial number descriptor
- Programmable USB Interrupt In Endpoint polling interval
- Programmable Keyboard Table to support alternate languages
- Non-volatile memory for property storage
- Built-in 6 foot USB cable on some models; other models include USB 5-pin mini-B connector
- Supplies 54 byte MagnePrint™ value
- Contains a unique, non-changeable serial number which allows tracking each reader
- Encrypts all track data and the MagnePrint value
- Provides clear text confirmation data including card holder's name, expiration date, and a portion of the PAN as part of the Masked Track Data
- Mutual Authentication Mode for use with Magensa.net

HARDWARE CONFIGURATION

The hardware configuration is as follows:

Part Number	Tracks	Style	Connector	Cable
21063015	1, 2, 3	Insert (IntelliStripe 65 style) No Bezel, Head Right	USB mini-B	Optional
21063016	1, 2, 3	Insert (IntelliStripe 65 style) International Bezel, Head Right	USB mini-B	Optional
21063018	1, 2, 3	P-Series Insert Extended Bezel, Head Right	USB mini-B	Optional
21063019	1, 2, 3	P-Series Insert Extended Bezel, Head Left	USB mini-B	Optional
21063020	1, 2, 3	P-Series Insert Flat Bezel, Head Right	USB mini-B	Optional
21063021	1, 2, 3	P-Series Insert Flat Bezel, Head Left	USB mini-B	Optional
21063022	1, 2, 3	IntelliStripe 65-Style MT-215 Bezel	USB mini-B	Optional
21063023	1, 2, 3	IntelliStripe 65-Style Metal Bezel	USB mini-B	Optional
21073016	1, 2	Gray Full Size	n/a	6' USB-A
21073018	1, 2	Black P55	USB mini-B	Optional
21073019	1, 2	Black P90	USB mini-B	Optional
21073022	1, 2	Black Mini	n/a	6' USB-A
21073025	1, 2	Blue P55	USB mini-B	Optional
21073026	1, 2	Pink P55	USB mini-B	Optional
21073027	1, 2	Orange P55	USB mini-B	Optional
21073028	1, 2	Purple P55	USB mini-B	Optional
21073029	1, 2	Blue P90	USB mini-B	Optional
21073030	1, 2	Gray P90	USB mini-B	Optional
21073031	1, 2	Pink P90	USB mini-B	Optional
21073032	1, 2	Orange P90	USB mini-B	Optional
21073033	1, 2	Purple P90	USB mini-B	Optional
21073035	1, 2	White P55	USB mini-B	Optional
21073036	1, 2	White P90	USB mini-B	Optional
21073037	1, 2	Gray P55	USB mini-B	Optional
21073039	1, 2, 3	Black P55	USB mini-B	Optional
21073040	1, 2, 3	Blue P55	USB mini-B	Optional
21073041	1, 2, 3	Pink P55	USB mini-B	Optional
21073042	1, 2, 3	Orange P55	USB mini-B	Optional
21073043	1, 2, 3	Purple P55	USB mini-B	Optional
21073044	1, 2, 3	White P55	USB mini-B	Optional
21073045	1, 2, 3	Gray P55	USB mini-B	Optional
21073046	1, 2, 3	Black P90	USB mini-B	Optional
21073047	1, 2, 3	Blue P90	USB mini-B	Optional
21073048	1, 2, 3	Pink P90	USB mini-B	Optional
21073049	1, 2, 3	Orange P90	USB mini-B	Optional
21073050	1, 2, 3	Purple P90	USB mini-B	Optional
21073051	1, 2, 3	White P90	USB mini-B	Optional
21073052	1, 2, 3	Gray P90	USB mini-B	Optional

Part Number	Tracks	Style	Connector	Cable
21073054	1, 2, 3	Black 6' Mini	n/a	6' USB-A
21073057	1,2	Black 6' Mini	n/a	6' USB-A
21073063	1, 2, 3	Gray 6' Full	n/a	6' USB-A

ACCESSORIES

The accessories are as follows:

Part Number	Description
21041495	USB-A to 5-pin Molex, 6' black
21042806	USB MSR Demo Program with Source Code (CD)
21051514	USB-A TO USB-Mini-B Gray, 700mm Retractable Cable
21051515	USB-A TO USB-Mini-B Gray, 750mm Cable
21051516	USB-A TO USB-Mini-B Gray, 1200mm Coiled Cable
21051517	USB-A TO USB-Mini-B Black, 700mm Retractable Cable
21051518	USB-A TO USB-Mini-B Black, 750mm Cable
21051519	USB-A TO USB-Mini-B Black, 1200mm Coiled Cable
99510026	USB MSR Demo Program with Source Code (WEB)

REFERENCE DOCUMENTS

MagTek Communication Reference Manual for USB MagneSafe V5 Readers (99875475)

Axelson, Jan. *USB Complete, Everything You Need to Develop Custom USB Peripherals*, 1999. Lakeview Research, 2209 Winnebago St., Madison WI 53704, 396pp., *http://www.lvr.com*.

ANS X9.24-2004 Retail Financial Services Symmetric Key Management Part 1: Using Symmetric Techniques

USB Human Interface Device (HID) Class Specification Version 1.1.

Universal Serial Bus (USB): HID Usage Tables Version 1.12 (1/21/2005)

USB (Universal Serial Bus) Specification, Version 1.1, Copyright© 1998 by Compaq Computer Corporation, Intel Corporation, Microsoft Corporation, NEC Corporation.

USB Implementers Forum, Inc.*, www.usb.org*.

SPECIFICATIONS

Table 1-2 lists the specifications for the USB MagneSafe Readers.

Table 1-2. Specifications

Reference Standards	ISO 7810 and ISO 7811/ AAMVA*
Power Input	5V from USB bus
Recording Method	Two-frequency coherent phase (F2F)
Message Format	ASCII
Card Speed	4 to 60 ips (10.1 to 152.4 cm/s)
ELECTRICAL	

Current
    Normal Mode
    Suspend Mode
	
	100mA maximum
	500uA maximum

MECHANICAL - FULL SIZE	
Dimensions	Length 6.50" (165.1mm) Width 1.74" (44.2mm) Height 1.50" (38.1mm)
Weight	6.8 oz. (192.7 gr)
Cable length	6 ft.
Connector	USB Type A plug
MECHANICAL – Mini	
Dimensions	Length 3.94" (100.0mm) Width 1.28" (32.5mm) Height 1.23" (31.3mm)
Weight	4.7 oz. (133.2 gr)
Cable length	6 ft.
Connector	USB Type A plug
MECHANICAL – P55	
Dimensions	Length 2.08" (52.83mm) Width 1.13" (28.70mm) Height 1.21" (30.73mm)
Weight	1.3 oz. (36.9 gr)
Connector	USB Mini B 5-pin
MECHANICAL – P90	
Dimensions	Length 3.49" (88.5mm) Width 1.02" (25.91mm) Height 1.00" (25.4mm)
Weight	1.2 oz. (34.0 gr)
Connector	USB Mini B 5-pin
MECHANICAL – Insert	
Dimensions	Length 4.66" (118.4mm) Width 2.56" (65.02mm) Height 1.01" (25.65mm)
Weight	1.2 oz. (34.0 gr)
Connector	USB Mini B 5-pin
ENVIRONMENTAL	
Temperature	
Operating	-30 °C to 70 °C (-22 °F to 158 °F)
Storage	-40 °C to 70 °C (-40 °F to 158 °F)
Humidity	
Operating	10% to 90% noncondensing
Storage	10% to 90% noncondensing

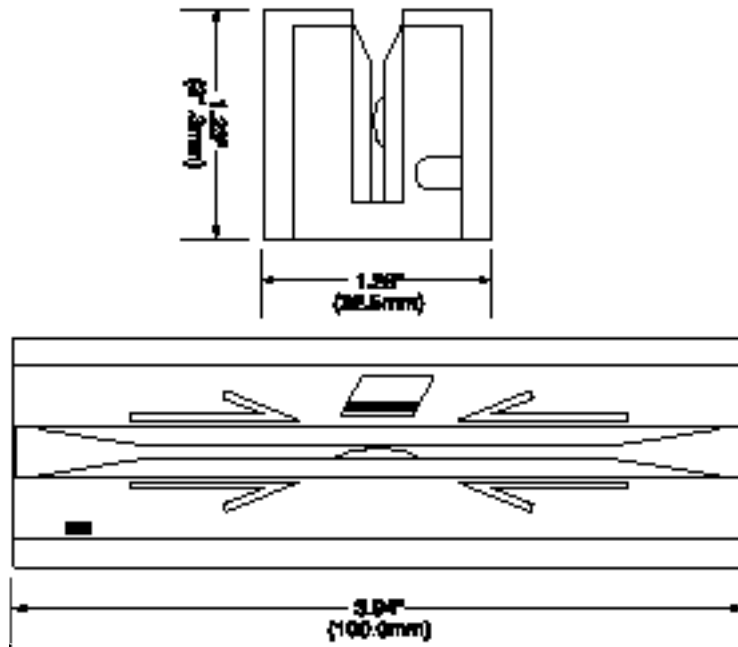* ISO (International Standards Organization) and AAMVA (American Association of Motor Vehicle Administrators).
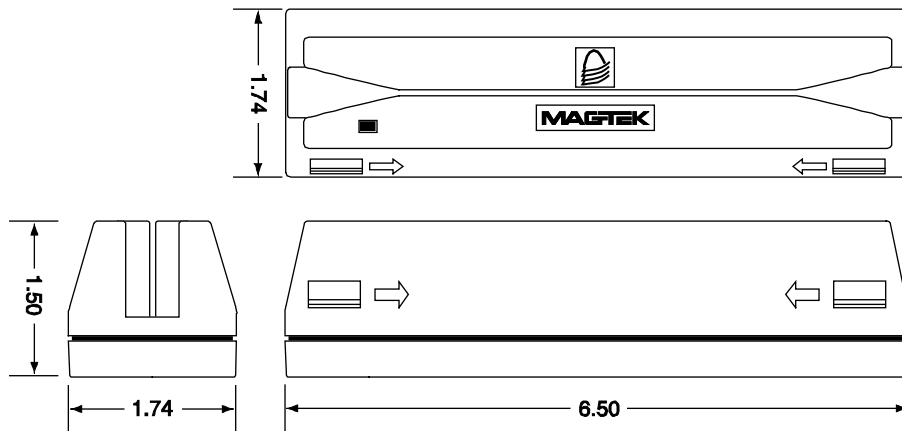
Figure 1-2. Dimensions for Mini Reader

Figure 1-3. Dimensions for Full Size Reader

SECTION 2. INSTALLATION

This section describes the cable connection, the Windows Plug and Play Setup, and the physical mounting of the unit.

USB CONNECTION

Connect the USB cable or dongle for the wireless model to a USB port on the host. The Reader, LED Indicator, and pin numbers for the 4-pin connector are shown in Figure 2-1.
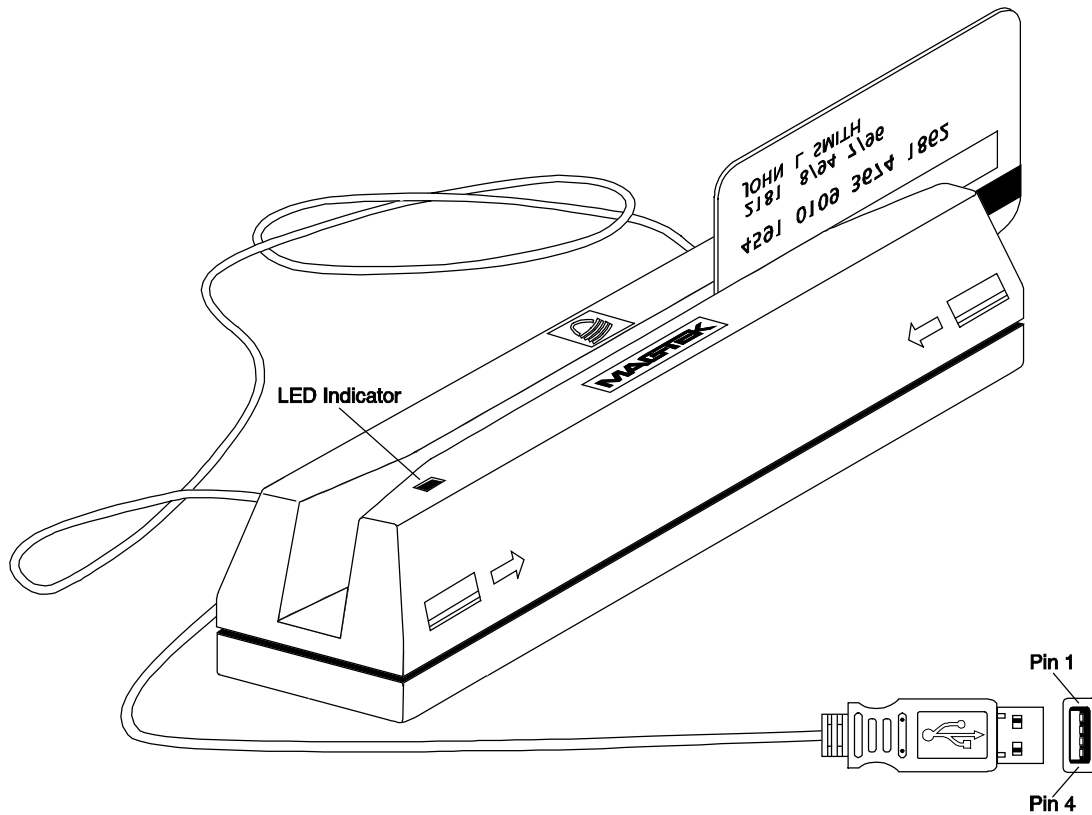

Figure 2-1. Reader Cable and Connector

Pin numbers and signal descriptions for the cable shown in the illustration are listed in Table 2-1.

Table 2-1. 4-Pin Connector

Pin Number	Signal	Cable Color
1	VBUS	Red
2	- Data	White
3	+Data	Green
4	Ground	Black

WINDOWS PLUG AND PLAY SETUP

On hosts with the Windows operating system, the first time the reader 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 reader. After this process is completed once, Windows will no longer request this process as long as the reader is plugged into the same USB port. The device driver that Windows will install for this reader is the driver used for HID devices and it is part of the Windows operating system. When the dialog box pops up, follow the instructions given. Sometimes Windows will find all the files it needs on its own without giving any prompts. Other times Windows will need to know the location of the files it needs. If Windows prompts for the file locations, insert the CD that was used to install Windows on your PC and point Windows to the root directory of the CD. Windows should find all the files it needs there.

MOUNTING

The Reader may be mounted with screws or fastening tape as described below.

1.   The Reader can be mounted on a surface in various ways:

- By two screws through the surface attached to the bottom of the unit and running the cable on the top of the surface

- By two screws through the surface attached to the bottom of the unit and by drilling a hole in the surface for the cable and running the cable through the hole

- By attaching the unit to the surface with fastening tape and running the cable on the top of the surface

Note
The two mounting inserts are 3mm diameter, 0.5mm pitch, 6.4mm deep. The length of the screws used depends on the mounting surface thickness and the thickness of washers (if used).

The mounting dimensions for the full size reader are shown in Figure 2-2; the mini size is shown in Figure 2.3. Determine the method of mounting required.

Note
Installation for insert reader models (210630XX) can be found in Appendix A.
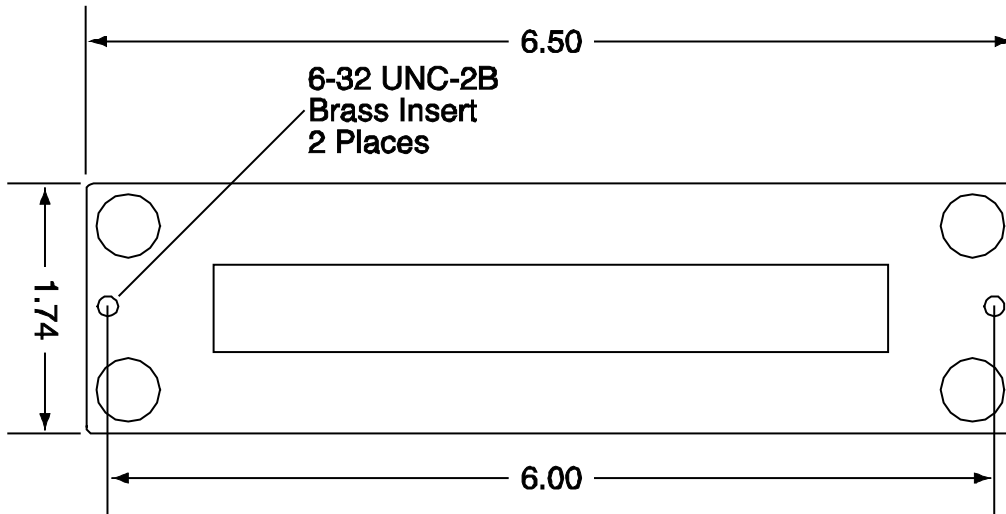
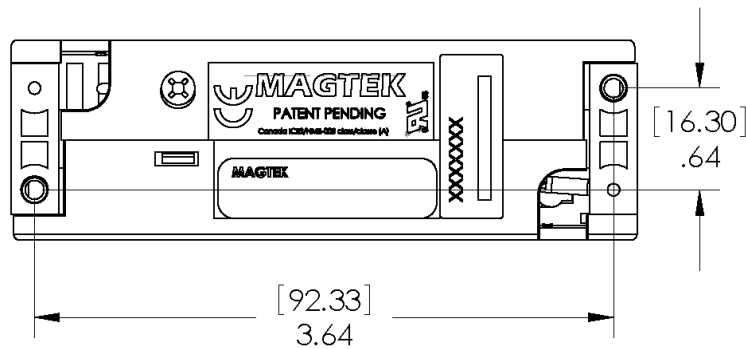**Figure 2-2. Mounting Hole Dimensions for Full Size Reader**

Figure 2-3. Mounting Hole Dimensions for Mini Reader

2.   Ensure the Reader is positioned on a flat, accessible surface with at least 4 inches clearance on either end for room to swipe a card.

If fastening tape is to be used, clean the area that the Reader will be mounted on with isopropyl alcohol. Remove the adhesive protective cover on the fastening tape, then position the Reader and push down firmly.

3.   Mount the Reader.

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SECTION 3. OPERATION

USER SWITCH

Only the wireless reader model includes a user switch. This section only applies to the wireless model. The User Switch, or Power Switch, is located on the side of the reader. Pressing the User Switch when the reader is off will turn the reader on. The reader will stay on for a predetermined amount of time (the default is 120 seconds) or until the completion of a card read transaction. Pressing the User Switch briefly when the reader is on will extend the Activity Timer to its full period avoiding having the reader turn off due to inactivity.

If the power is already on, pressing the User Switch and holding it for three seconds will turn the reader off.

LED INDICATOR

The wired reader has one LED on the reader body. The wireless reader model has one LED on the USB dongle and another LED is on the wireless reader body.

The LED indicator will be either off, red, green, or amber. When the reader or dongle is not powered, the LED will be off.

When the wired reader or dongle is first plugged in, the LED will be solid amber. After the reader is plugged in, the host will try to enumerate the reader. Once the reader is enumerated the LED will turn solid green.

On the wired reader, solid green indicates that the reader is either awaiting Authentication (if configured to require Authentication), or armed to read (if configured to NOT require Authentication).

When the wireless reader is first turned on, the LED will flash amber and then go to solid green unless the battery power is too low, in which case it will be red for two seconds then turn solid green. When the reader shows a solid green, the reader is either awaiting Authentication (if configured to require Authentication), or armed to read (if configured to NOT require Authentication). When the wireless reader is attached to a USB cable or other 5-volt power source, the battery will begin charging. The LED will *slowly* blink amber while the battery is charging and then turn solid amber when the battery is fully charged.

If enabled to operate with authentication (Security Level 4) and when the host completes Authentication successfully, the reader's LED will blink green; the reader is now armed to read a card. If the host fails an Authentication sequence, the LED will turn solid red and stay red until either the host completes Authentication successfully or the reader is powered down.

When a card is being swiped, the LED will turn off temporarily until the swipe is completed. If there are no errors after decoding the card data, then the LED will turn green for approximately two seconds to indicate a successful read. On the wired reader, the LED will remain solid green to indicate waiting for the next operation; on the wireless readers LED will turn off as the reader powers down. If there are any errors after decoding the card data, the LED will turn red for approximately two seconds to indicate that an error occurred and then turn solid green to indicate waiting for the next card swipe. The retries can go on indefinitely until a good read or until power goes off.

For the wireless reader, after a card swipe but prior to indicating the status of decoding the card data when data should be transmitted wirelessly, if the the reader is out of range the green LED will blink rapidly (~10 times a second) until the reader is back in range (when data is transmitted). The LED will go off if the user holds the user switch down for three seconds, if the reader times out, or if the battery power is too low. If the reader is within range, it attempts to transmit the data during which time the LED goes off. If the transmit attempt fails, the reader will blink the red LED rapidly (~10 times a second) for two seconds. After which, regardless of the outcome of the transmit attempt, the LED goes green or red to indicate the status of decoding the card data.

Anytime the host puts the wired reader or dongle into suspend mode, the LED will turn off. Once the host takes the reader or dongle out of suspend mode, the respective LED will return to solid green. For the wired reader, authenticated mode is always ended by a USB suspend. For the wireless reader it is not.

CARD READ

A card may be swiped through the reader slot when the LED is solid green or flashing green. The magnetic stripe must face toward the head (as indicated by a line on the top of the reader) and may be swiped in either direction. If there is data encoded on the card, the reader will attempt to read the data, encrypt it, and then send the results to the host via a USB HID input report or, if in Keyboard Emulation mode, as if the data was being typed on a keyboard. After the results are sent to the host, the reader will be ready to read the next card. For the wireless reader, if no errors were found while decoding the card data, the reader will automatically turn off after attempting to transmit the data to the host.

READER STATES

This reader may be operated so that it *requires* Mutual Authentication with a Host in order to transmit card data to the Host. When this mode of operation is required, the application (not necessarily the Authenticating Host) may need to know the state of the reader at any given moment. This can be done using the Get Reader State Command. The application may retrieve this state at any time to get a clear definition of where the reader is any given moment.

For convenience, this manual refers to states with the notation State:Antecedent (e.g., WaitActAuth:BadSwipe). State definitions can be found at the definition of the **Get Reader State Command**.

In most cases, the application could also track the state by inference. As the application interacts with a reader, most state transitions are marked by the commands and responses exchanged with the reader. The exception to this concept is the transition from WaitActRply:x to WaitActAuth:TOAuth. This state transition occurs as the result of a timeout and the transition is not reported to the Host. As the reader was waiting for the Host to send the Activation Challenge Reply command and the Host set the time limit the reader should wait, the Host should be aware that a timeout *could* occur. If the reader does time out and the Host sends the Activation Challenge Reply command, the reader will return RC = 07 (Sequence error).

Examples of Host/Application/Reader interaction and state transitions:

Example 1 – Power Up followed by Authentication and good swipe:
1. Reader Powers Up (State = WaitActAuth:PU). This is typically right after the USB connection becomes available to the application. Application should send the Get Reader State Command to discover the current state of the reader.
2. Host sends valid Activate Authenticated Mode command (State => WaitActRply:PU). Reader responds with RC = 0x00 inferring the transition to the WaitActRply:PU state.
3. Host sends valid Activation Challenge Reply command (State => WaitSwipe:PU). Reader responds with RC = 0x00 inferring the transition to the WaitSwipe:PU state.
4. User Swipes a card correctly (State => WaitActAuth:GoodSwipe). Reader sends the card data to the Host inferring the transition to the WaitActAuth:GoodSwipe state.

Example 2 – Reader times out waiting for swipe:
1. Reader waiting (State = WaitActAuth:GoodSwipe). This is after a good swipe. Application may send the Get Reader State Command to discover the current state of the reader.
2. Host sends valid Activate Authenticated Mode command (State => WaitActRply:GoodSwipe). Reader responds with RC = 0x00 inferring the transition to the WaitActRply:GoodSwipe state.
3. Host sends valid Activation Challenge Reply command (State => WaitSwipe:GoodSwipe). Reader responds with RC = 0x00 inferring the transition to the WaitSwipe:GoodSwipe state.
4. Timer expires (State => WaitActAuth:TOSwipe). Reader sends "card data" to the Host with no data, just a report about the Time Out (see ***Reader Encryption Status***), the Host infers the transition to WaitActAuth:TOSwipe state.

Example 3 – Host sends invalid Activation Challenge Reply command:
1. Reader Waiting (State = WaitActAuth:GoodSwipe). This is after a good swipe. Application may send the Get Reader State Command to discover the current state of the reader.
2. Host sends valid Activate Authenticated Mode command (State => WaitActRply:GoodSwipe). Reader responds with RC=0x00 inferring the transition to the WaitActRply:GoodSwipe state.
3. Host sends invalid Activation Challenge Reply command (State => WaitActAuth:FailAuth). Reader responds with RC = 0x02 or 0x04 inferring the transition to the WaitActAuth:FailAuth state.

Example 4 – Host waits too long sending the Activation Challenge Reply command:
1. Reader Waiting (State = WaitActAuth:GoodSwipe). This is after a good swipe. Application may send the Get Reader State Command to discover the current state of the reader.
2. Host sends valid Activate Authenticated Mode command (State => WaitActRply:GoodSwipe). Reader responds with RC=0x00 inferring the transition to the WaitActRply:GoodSwipe state.
3. Reader times out waiting for Host to send Activation Challenge Reply

command (State => WaitActAuth:TOAuth). Host doesn't know because the reader can/does not send any message.
4. Host finally sends Activation Challenge Reply command (State remains WaitActAuth:TOAuth). Reader responds with RC=0x07 inferring the previous transition to WaitActAuth:TOAuth state.

CHARGING THE WIRELESS READER BATTERY

As mentioned above (LED Indicator), the wireless reader may indicate low battery at power up by showing red for two seconds then turn solid green. The first time this happens, there will probably be sufficient battery available for several more card swipes, but the battery should be charged soon. If the low battery warning is ignored and the battery gets too low, the reader will refuse to power up until it has been charged.

Charge the reader by connecting it to any USB port on a running system or a compatible 5VDC source. For best results, allow the battery to charge fully (until the LED goes to steady amber) before using the reader again. In the worst case, it may take 3 or 4 hours to fully charge the battery.

APPENDIX A. INSERT READER DRAWINGS

This section contains the drawings showing the mounting dimensions for the Insert Reader models.

The following drawings are included:

21063015   Mounting Specifications for 21063015
21063018   Mounting Specifications for 21063018 and 21063019
21063020   Mounting Specifications for 21063020 and 21063021
21063022   Specifications for 21063022
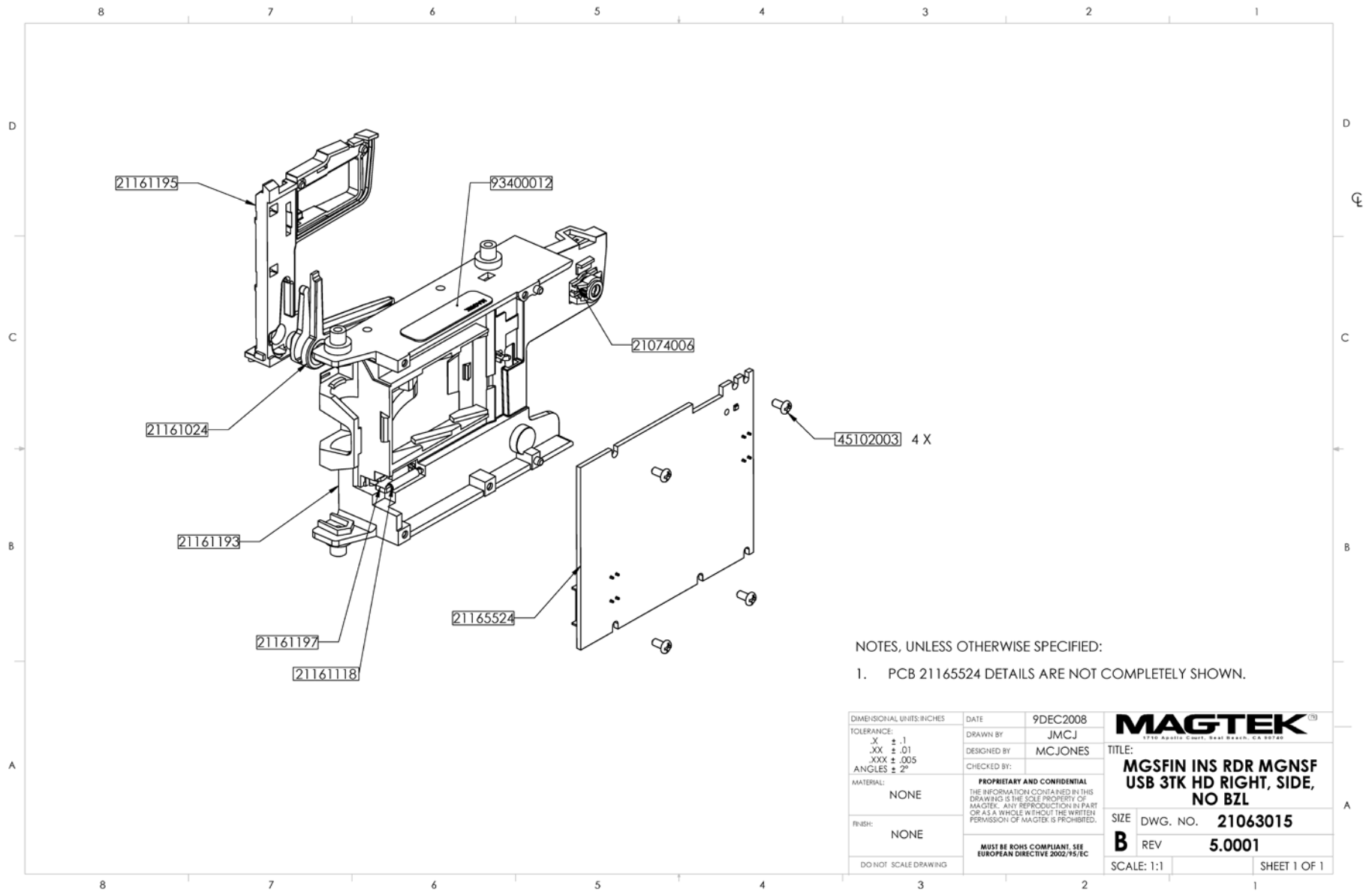21063023   Specifications for 21063023
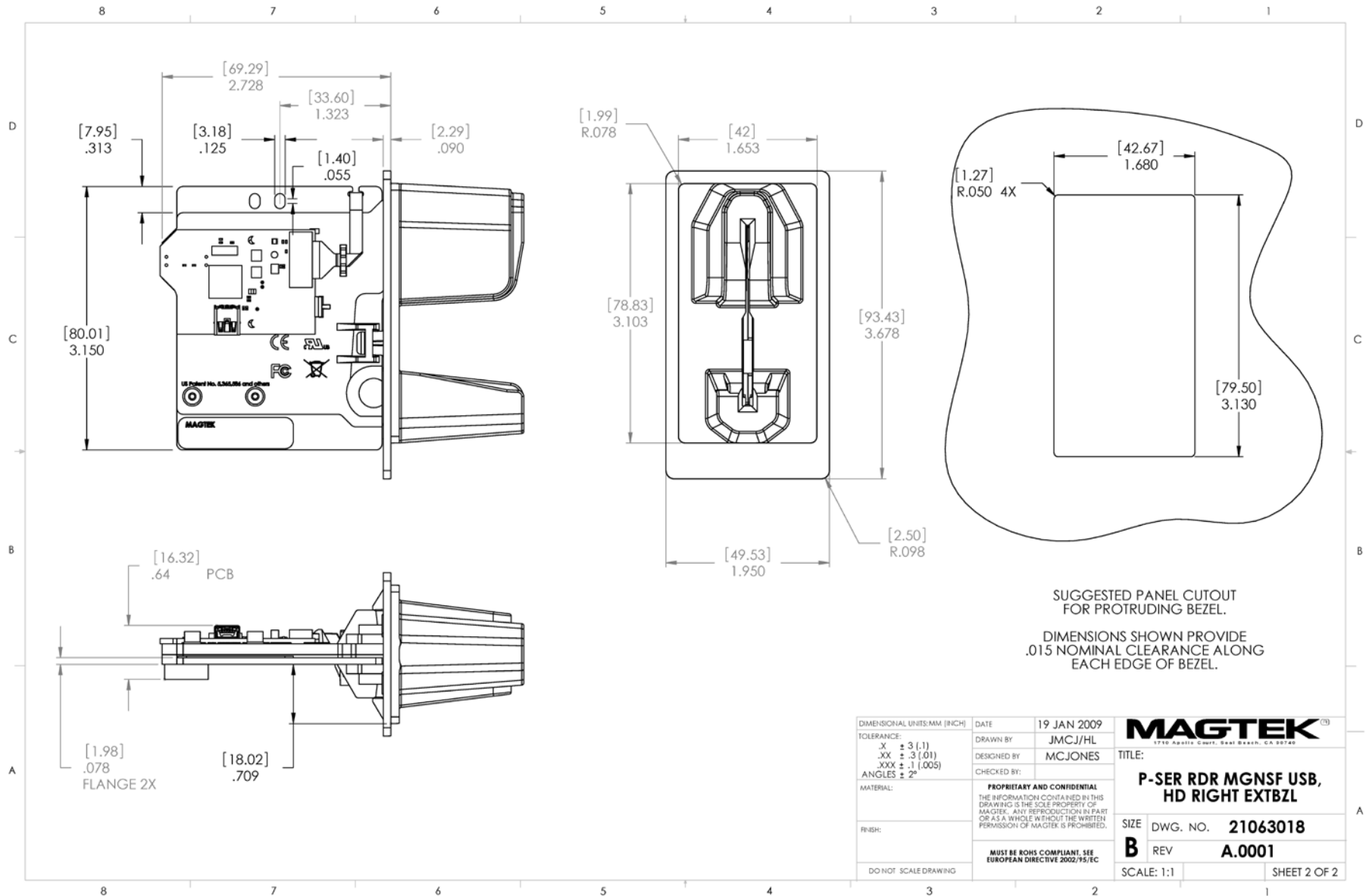
Figure A-1. Mounting Specification for 21063015

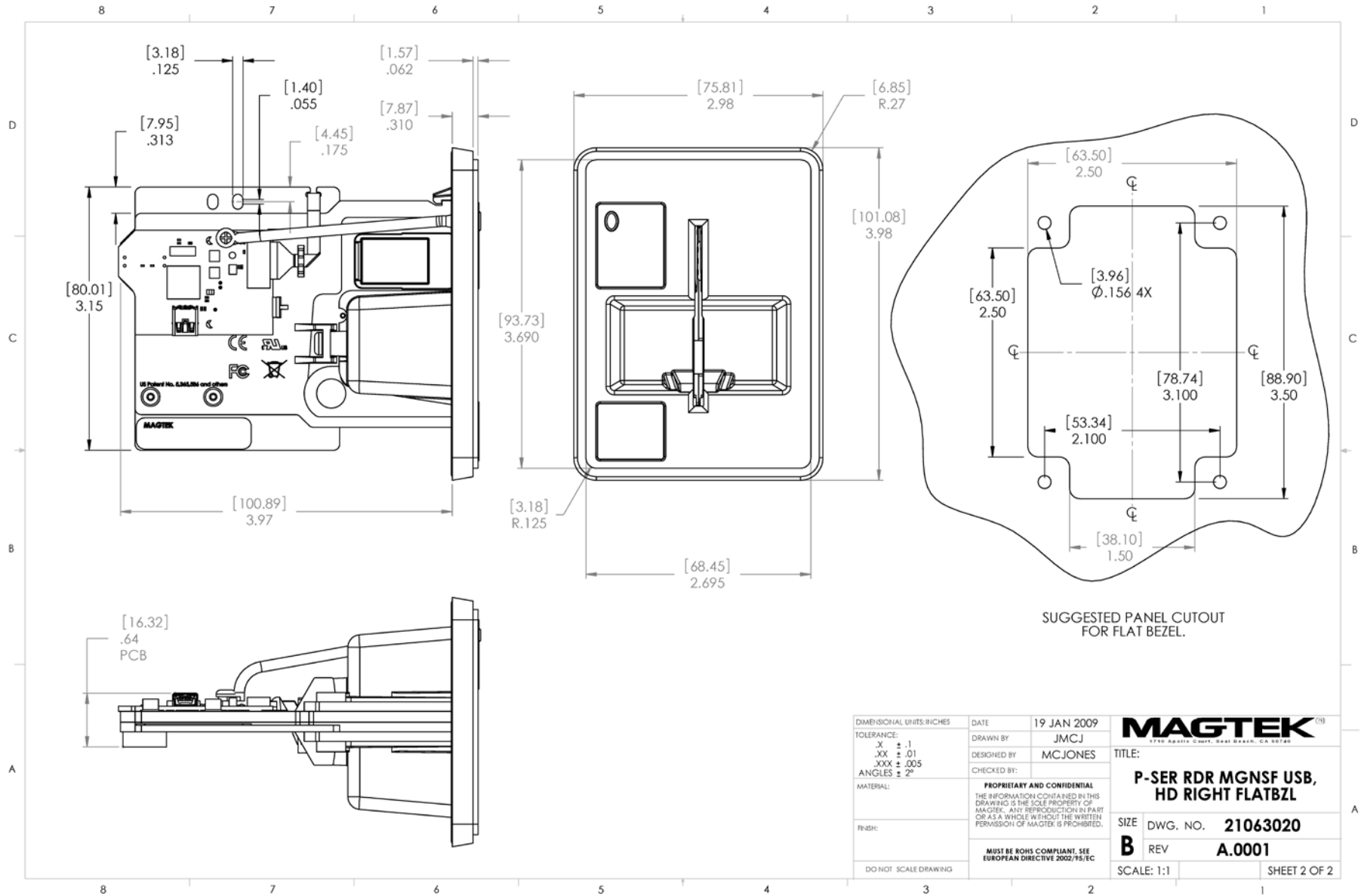**Figure A-2. Mounting Specification for 21063018 and 21063019**

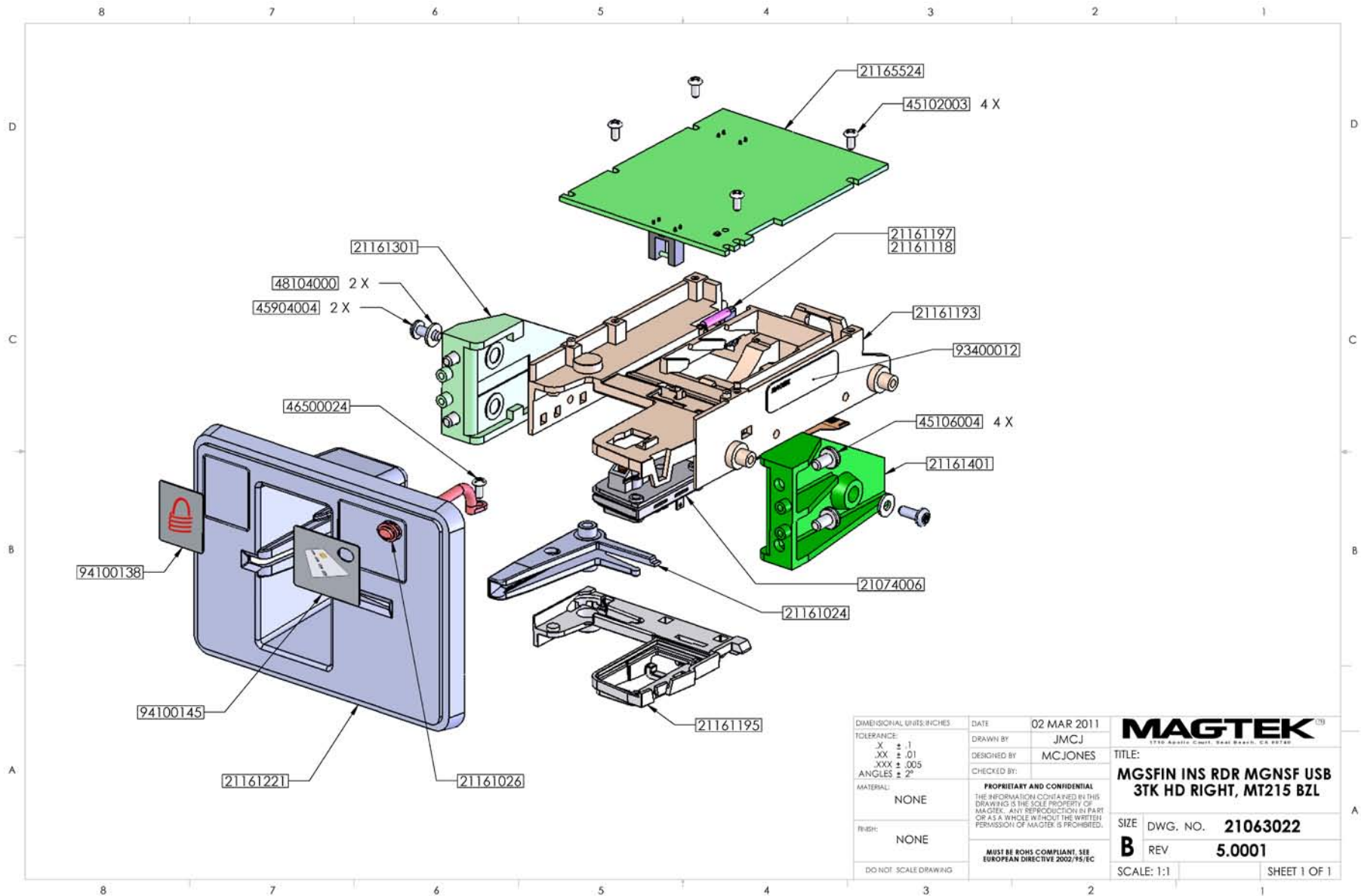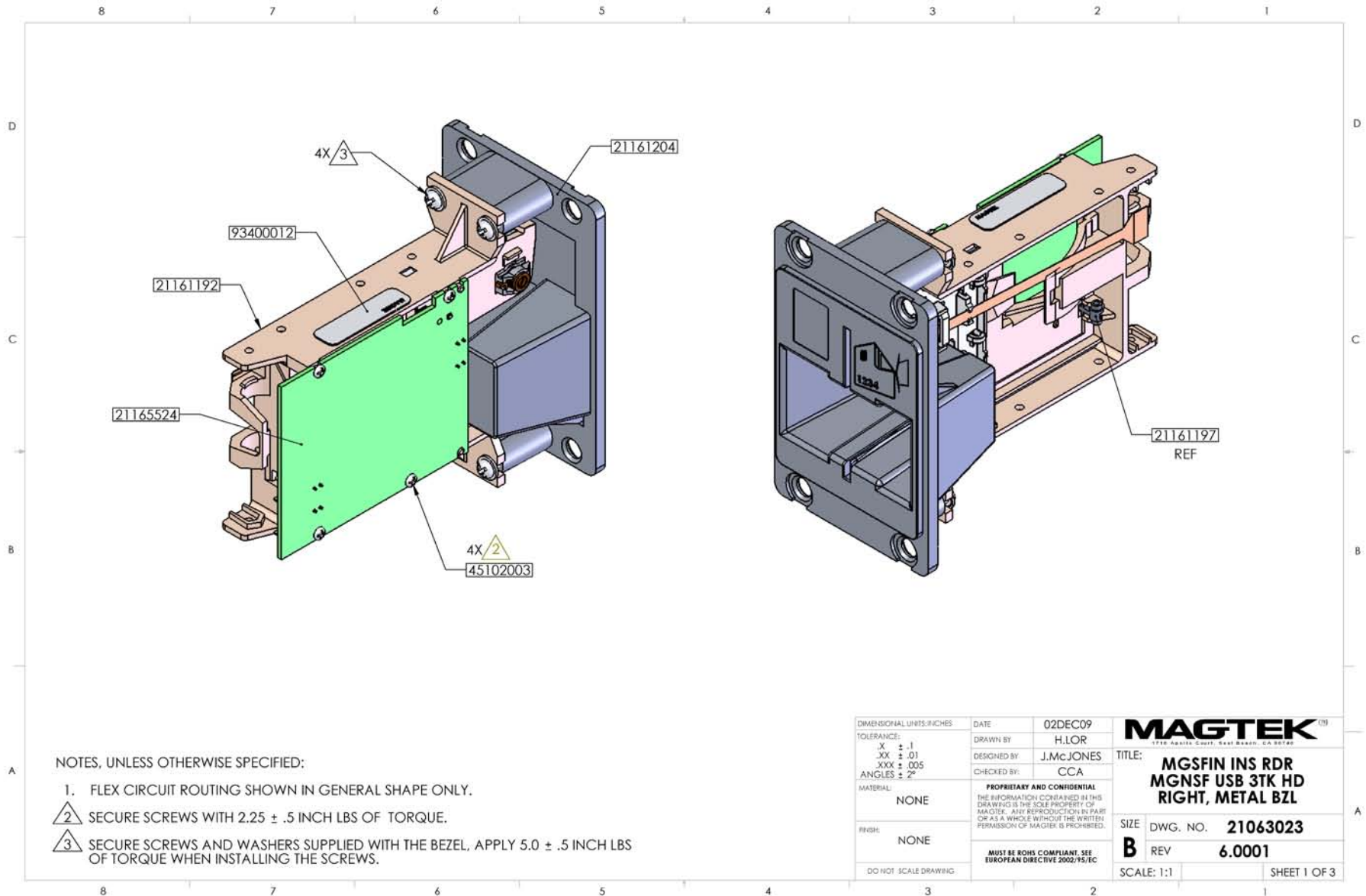**Figure A-3. Mounting Specification for 21063020 and 21063021**

Figure A-4. Specification for 21063022

Figure A-5. Specification for 21063023