

# mDynamo Gen I and Gen II

## EMV Contact Reader/Transaction Hub Module

### Installation and Operation Manual



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**Table 0-1 - Revisions**

Rev Number	Date	Notes
10	Dec 23, 2016	Initial Release
11	Mar 3, 2017	Add cable part numbers, connectable heads; to planning section <b>1.10</b> , add key management and encrypting options; misc. clarifications
12	Sep 7, 2017	Clarify separation of function between on-board General Status LED in section <b>4.2</b> and the <b>External LED Connector [J2]</b> , add callout of on-board general status LED in section <b>1.8</b>
13	Oct 2, 2017	Production release
14	Feb 4, 2021	Update temperature ranges in <b>Appendix A</b> to reflect latest design and tests; Update styles and doc standards.
100	Jan 2, 2024	Changes to language throughout document to accommodate <b>mDynamo Gen I</b> and <b>Gen II</b> . Update <b>Table 1-1 - Available Accessories</b> with references to new section. Add RS-232 content to section <b>1.3 Contact Chip Card</b> , <b>1.8 About mDynamo Components</b> , <b>2.1 Grounding / ESD Protection</b> , <b>2.3 About Signal Connectors</b> , <b>3.2 Cabling Design</b> Add Section <b>2.6 RS-232 Serial Port [J8]</b> , Add <b>Table 1-2 - Hardware Part Numbers</b> ; Add <b>Figure 1-2 – mDynamo Gen II Major Components (PN 21079863)</b>

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## 1 Introduction

This document provides suggestions, guidelines, and technical information for designing solutions that integrate **mDynamo Gen I and mDynamo Gen II**, MagTek's modular contact chip card reader for OEM solutions.

### 1.1 About mDynamo Gen I and Gen II

**mDynamo Gen I and Gen II** give users the flexibility to add a variety of identification and payment acceptance options from a compact, modular design. The small form-factor makes it easy to integrate into new or existing unattended locations including kiosks, vending, parking, or payment terminals; and is an ideal solution for mobile payment applications involving tablets and phones to accept payments almost anywhere. The card reading module is easy to incorporate into an enclosure. mDynamo is engineered to save the integration designer money in a single, low-cost, yet highly secure device.

### 1.2 Simple Integration

Using an updated bezel, **mDynamo Gen I and Gen II** can be added to a new design or, if only magnetic stripe is being used, retrofitted to existing insertion style magnetic stripe readers. The chip card reader and optional NFC module are certified for EMV L1 and L2. MagTek offers a variety of software developer kits (SDKs) to use with Windows, iOS, and Android operating systems.

### 1.3 Contact Chip Card

mDynamo is a cost-effective and versatile card reading module designed for ISO 7816-compliant contact chip cards. It accommodates various connection options to support additional card reading technologies, such as magnetic stripe readers/SCRAs and contactless/NFC modules. The board is compactly designed with easily accessible SPI and UART ports in Gen I (or optional RS-232 port in Gen II), featuring Molex connectors.

### 1.4 Security

mDynamo is built on the MagneSafe Security Architecture (MSA). When coupled with MagTek's Magensa services, MagnePrint magnetic stripe card authentication can be activated to stop fraud and the use of altered cards. mDynamo uses TDES encryption and DUKPT key management to protect card data.

### 1.5 Magensa Services

mDynamo is supported by the full suite of Magensa's Services: Data decryption, card and device authentication, gateway, device configuration, and key injection. MagTek provides well-defined and documented web services and several off-the-shelf applications for reader configuration on Windows, iOS, and Android platforms.

### 1.6 Fast Development

Invest in mDynamo and receive dedicated software, hardware, and payments support. Working with MagTek OEM is the fastest way to secure, compliant, flexible payment solutions for your custom device.

### 1.7 Communications Interface Options

mDynamo products offer two host communication interface types: USB and UART for **mDynamo Gen I**, and USB and RS-232 for **mDynamo Gen II**. These interface options not only facilitate communication but also serve as power sources, eliminating the need for extra cabling or external power supplies.

## 1.8 About mDynamo Components

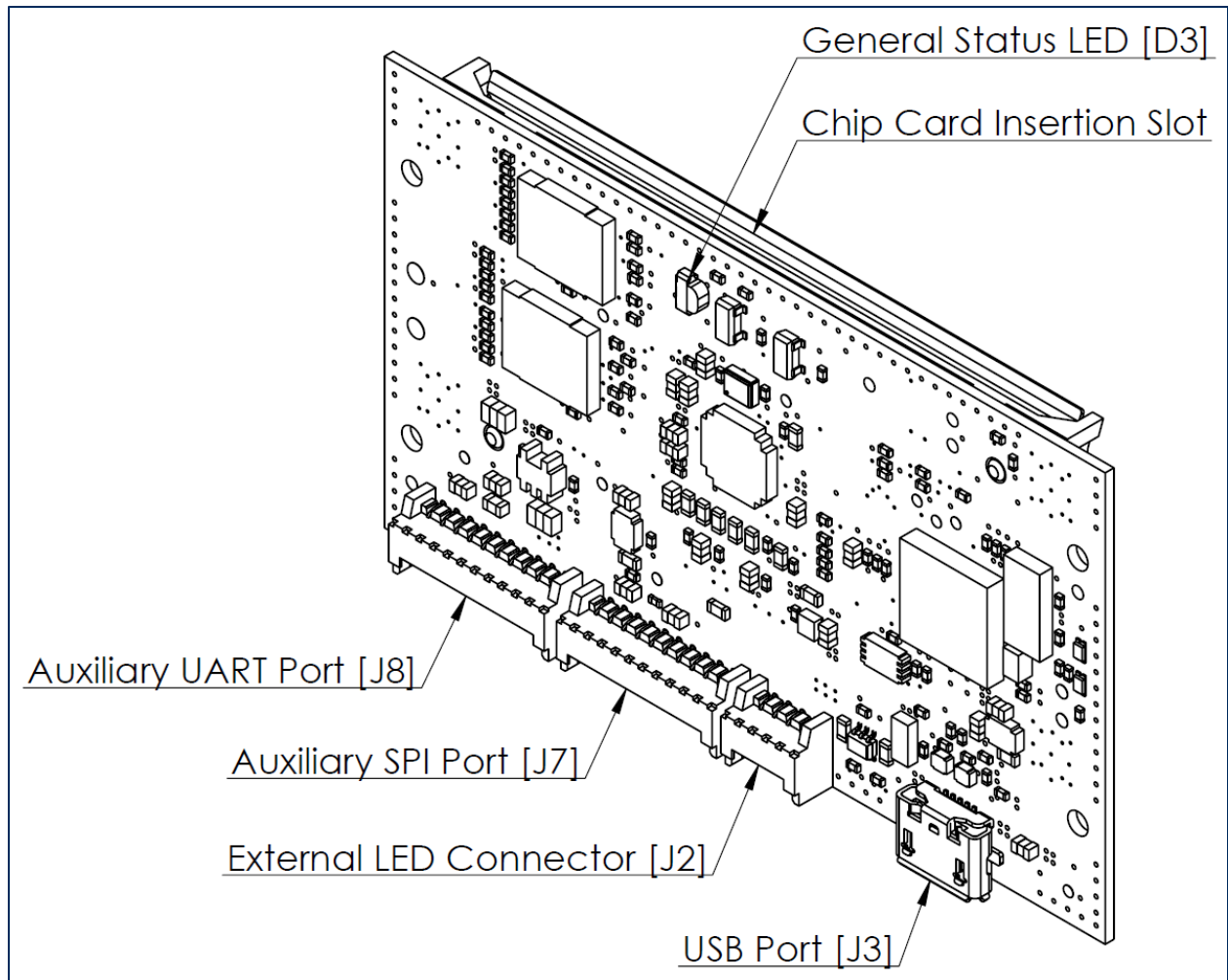


Figure 1-1 – mDynamo Gen I Major Components (PN 21079812)

mDynamo Gen I (PN 21079812) is configured with an Auxiliary UART Port at **J8**, refer to **2.5 Auxiliary UART Port [J8]**.

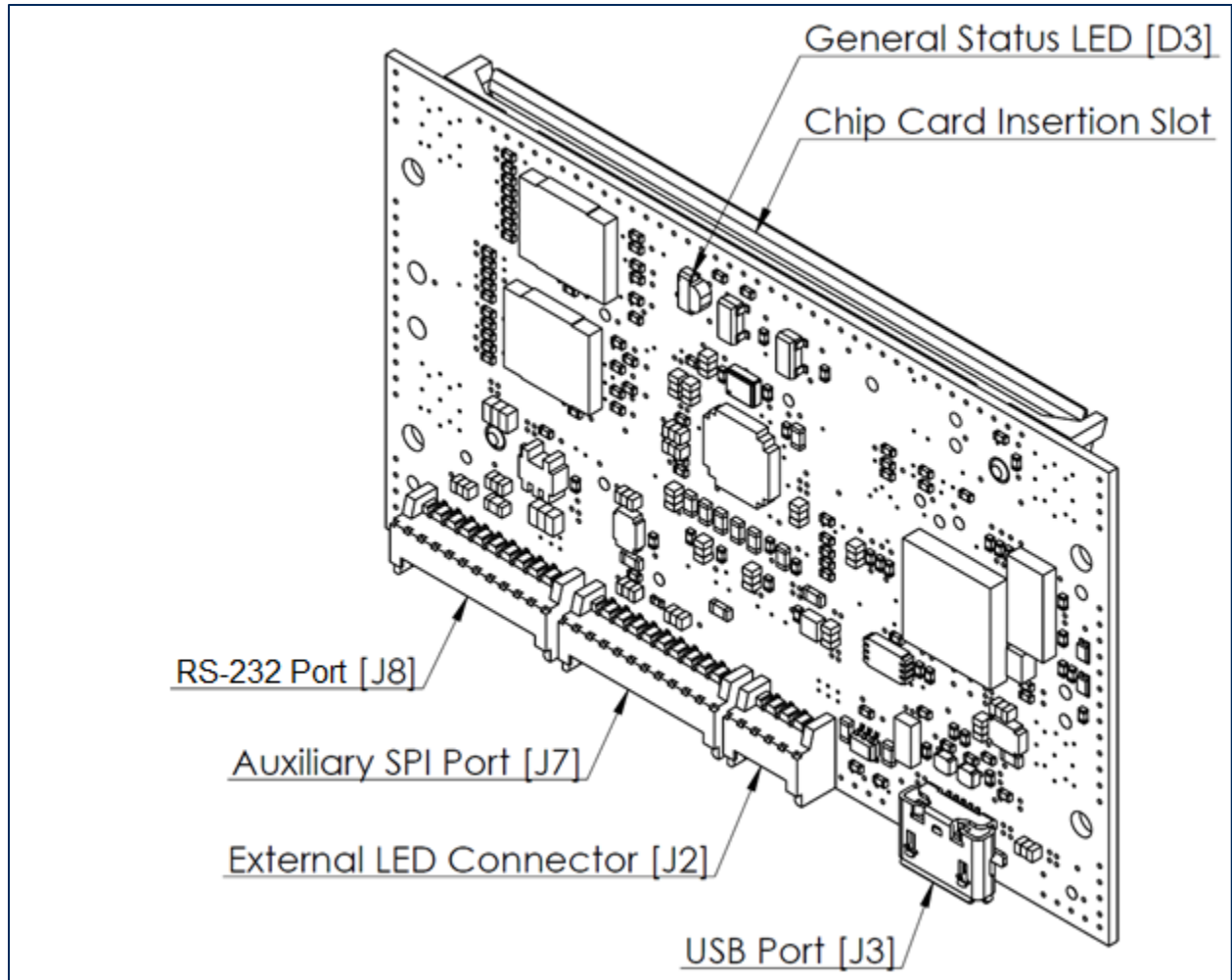


Figure 1-2 – mDynamo Gen II Major Components (PN 21079863)

mDynamo Gen II (PN 21079863) is configured with an RS-232 Port at **J8**, refer to **2.6 RS-232 Serial Port [J8]**.

## 1.9 About Terminology

In this document, mDynamo Gen I and Gen II are referred to as the **device**. They are designed to be connected to a **host**, which is a piece of general-purpose electronic equipment which can send commands and data to, and receive data from, the device. Host types include PC computers/laptops, tablets, and smartphones. Generally, the host must have **software** installed that communicates with the device and is capable of processing transactions. The combination of device(s), host(s), software, firmware, configuration settings, physical mounting and environment, user experience, and documentation is referred to as the **solution**. During a transaction, the host and its software interact with the **operator**, such as a cashier or bank teller, while the device interacts with the **cardholder**.

## 1.10 About Solution Planning

A smooth deployment of a solution that integrates mDynamo requires some up-front planning and decision-making:

- Determine the overall **functional requirements** and desired **user experience** of the solution mDynamo will be integrated into.
- Determine what **documentation** and **training** will be required from solution design to deployment.
- Determine what type of **host** mDynamo will connect to. This can be a computer with a fully-powered USB port. When planning, include any additional support or devices required by the host, such as physical locations, mounting, and power connections.
- Determine what **auxiliary devices** mDynamo will connect to. Solutions can include external magnetic stripe readers using UART or SPI protocols, or external contactless NFC readers using the UART protocol. **Table 1-1** provides a list of available auxiliary devices and accessories.
- Determine what **software** will be installed on the host and how it will be configured. Software can include the operating system, transaction processing software, security software, and so on. Include any additional support required by the software, such as network connections.
- Determine how mDynamo should be **configured** and specify when you order devices. MagTek or your reseller can advise. For further details about configuration options and how they affect device behavior, see *D998200151 mDynamo Programmer’s Reference (COMMANDS)*. For example:
  - Decide whether mDynamo should be in non-encrypting mode (“Security Level 2”) or encrypting mode (“Security Level 3” or higher).
  - Decide on the solution’s key management scheme. The device can be configured either to use DUKPT key management, or to rely on the host software to manage Fixed Keys.
- Determine how the solution design will integrate mDynamo electrically (see section **2 Electrical Integration** for details).
- Determine how the solution design will integrate mDynamo mechanically (see section **3 Mechanical Integration** for details).
- Determine how the solution design will be **tested** and, if appropriate, how it will be **certified**.

Table 1-1 - Available Accessories

Part Number	Description	Related To
21030150	MGSFCO MAGSAFE TDES DUKPT UART 63.5MMWRE/5PMLX	<b>Auxiliary UART Port [J8]</b>
1000003957	CABLE, HEAD EXTENSION, 5 PIN TO 10 PIN, MDYNAMO	<b>Auxiliary UART Port [J8]</b>
21030088	MGSFCO 3TK INTHD BF-SPR 125MM 8PMLX SPI MAGSAF V5	<b>Auxiliary SPI Port [J7]</b>



Part Number	Description	Related To
100003958	CABLE, HEAD EXTENSION, 8 PIN TO 10 PIN, MDYNAMO	Auxiliary SPI Port [J7]

Table 1-2 - Hardware Part Numbers

Part Number	Description	Related To
21079812	MDYNAMO GEN I	Auxiliary UART Port [J8]
21079863	MDYNAMO GEN II	RS-232 Serial Port [J8]

## 2 Electrical Integration

### 2.1 Grounding / ESD Protection

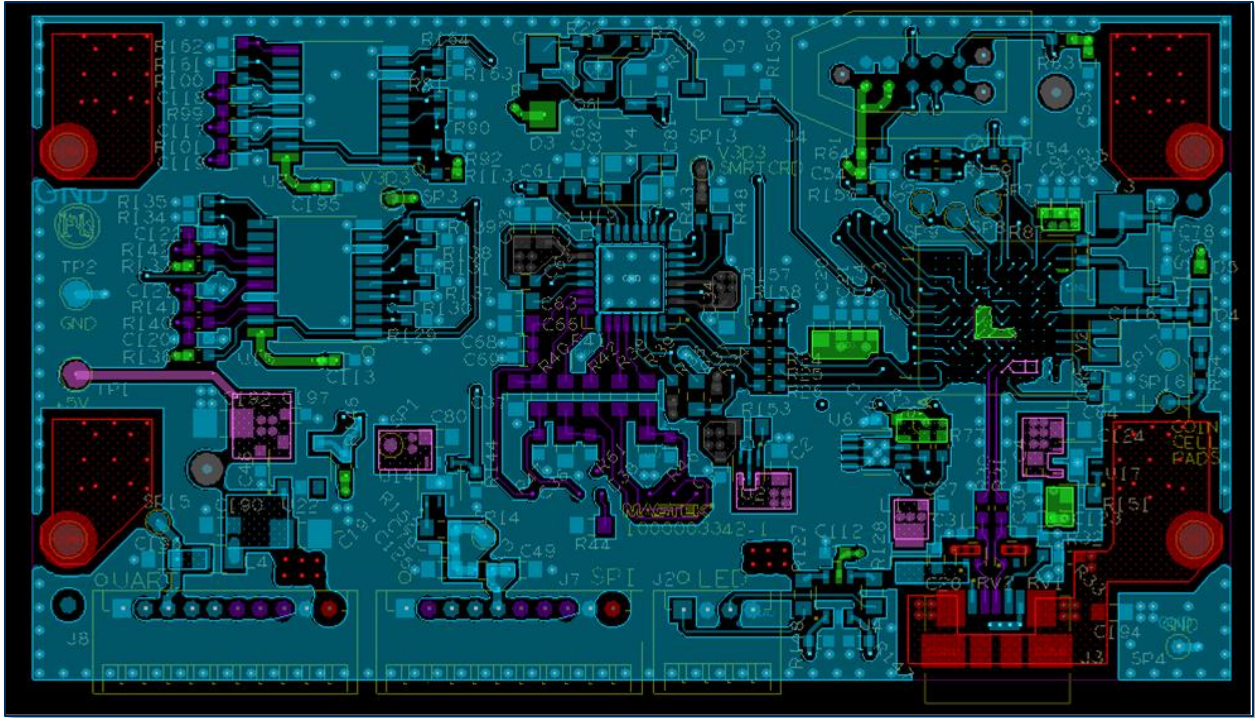


Figure 2-1 – mDynamo Chassis Ground Points

Figure 2-1 shows red highlights on all points on mDynamo that share a common earth ground plane:

- The four mounting screw pads
- The housing of **USB Port [J3]**
- Pin 10 of **Auxiliary SPI Port [J7]**
- Pin 10 of **Auxiliary UART Port [J8]** or Pin 1 and 9 of **RS-232 Serial Port [J8]**

To guard against ground loops and to protect the chip card contact block against electrostatic discharge (ESD), it is important to ground the device correctly. MagTek strongly recommends checking whether the host provides earth ground on its USB port shield, and whether the selected USB cable carries that ground all the way to the shield of **USB Port [J3]** on the board. This will help make an informed decision about proper grounding:

- If the solution design, including the host, provides earth ground to the shield of **USB Port [J3]**, no additional ground connections are necessary.
- If the solution design does not provide earth ground to the shield of **USB Port [J3]**, the solution design should connect one or more of the other points in **Figure 2-1** to a common chassis ground. Ideally the chosen ground would be earth ground, because only an earth ground connection provides ESD protection.
- After deciding which points will be grounded, make sure none of the remaining ground points in **Figure 2-1** are connected to a different ground. For example, carefully trace from Pin 10 of the auxiliary ports through any connected devices to make sure they do not lead to different grounds.

## 2.2 Shielding

MagTek recommends using earth-grounded shielded cables. The device itself has been tested by an FCC lab for Class B radiated susceptibility and has no special shielding requirements. For details, see the FCC information provided at the beginning of this document.

## 2.3 About Signal Connectors

mDynamo provides the following signal connections:

- A **USB** port, labeled **J3** on the printed circuit board, must be connected to a host's fully-powered USB port to provide power to the device and bidirectional communication with the host. For details, see section **2.4 USB Port**.
- Depending on the version, the **Auxiliary UART** port is labeled **J8** and **UART** on the printed circuit board for **mDynamo Gen I**, and **J8** and **RS-232** on the printed circuit board for **mDynamo Gen II**. **The Auxiliary UART** port can be used to connect to an optional external contactless module or UART Encrypting IntelliHead with MagneSafe V5. As an alternative to USB the R232 Serial Port can be directly connected to a host's fully-powered RS232 port to provide power to the device and bidirectional communication with the host. For details, see section **2.6 RS-232 Serial Port [J8]**. An **Auxiliary SPI** port, labeled **J7** and **SPI** on the printed circuit board, can be used to connect to an optional external SPI Encrypting IntelliHead with MagneSafe V5. For details, see section **2.7 Auxiliary SPI Port**.
- An **LED** connector, labeled **J2** and **LED** on the printed circuit board, can be used in solution designs that need to provide an external status LED. For details, see section **2.8 External LED Connector**.

## 2.4 USB Port [J3]

The USB port, labeled **J3** on the printed circuit board, must be directly connected to a host's fully-powered USB port to provide power to the device and bidirectional communication with the host. It is a Micro-USB B receptacle designed to mate with a standard Micro-USB B connector found on commercially available USB cables. Pinouts are shown in **Figure 2-2**. MagTek does not support connecting multiple mDynamo devices simultaneously to the same host.

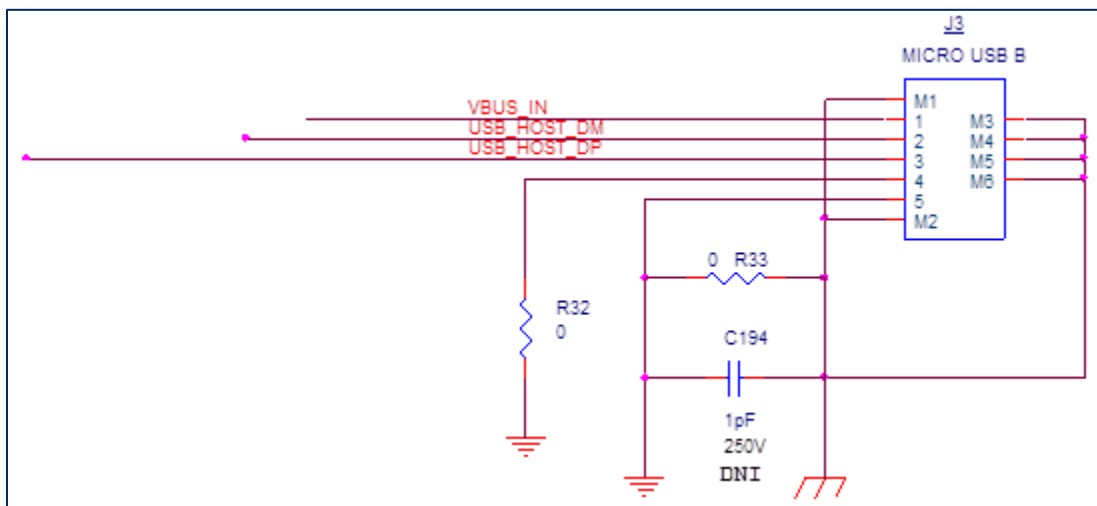
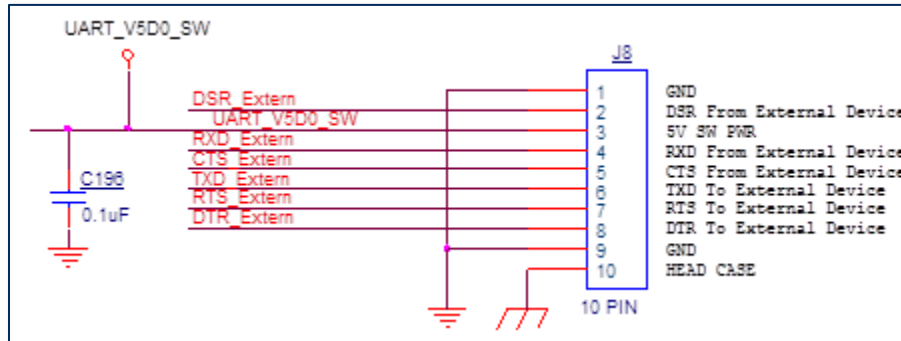


Figure 2-2 - Pinouts for mDynamo USB Port J3

Depending on usage, the device expects to draw up to 500mA at 5V from the USB port. The device itself draws a maximum of 300mA and will draw additional current to drive devices connected to the Auxiliary UART port and the Auxiliary SPI port.

## 2.5 Auxiliary UART Port [J8]

**mDynamo Gen I** is configured with an Auxiliary UART port, labeled **J8** and **UART** on the printed circuit board, which can be used to connect an optional external contactless module or UART Encrypting IntelliHead with MagneSafe V5. It is a 10-pin 1.25mm pitch Molex PicoBlade header designed to mate with Molex PicoBlade connector **51021-1000**. The dot on the printed circuit board indicates pin 1. Pinouts are shown in **Figure 2-3 - Pinouts for mDynamo Auxiliary UART Port J8**.



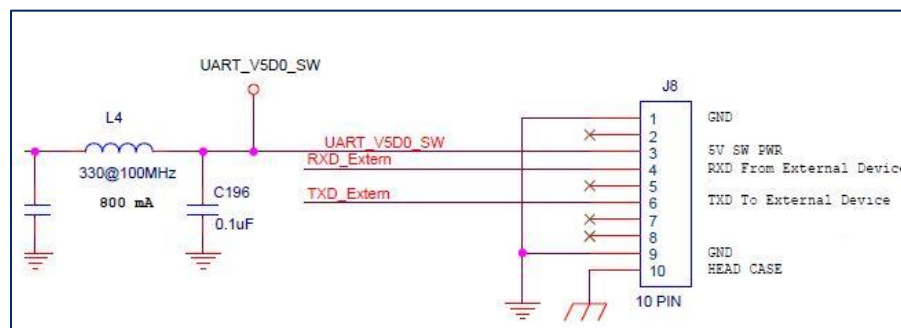
**Figure 2-3 - Pinouts for mDynamo Auxiliary UART Port J8**

Depending on usage, the Auxiliary UART port can provide up to 400mA @ 5V to power an external UART device.

For details about integrating an NFC contactless module or UART Encrypting IntelliHead with MagneSafe V5, see the *Installation and Operation Manual* or *Technical Reference Manual* for the module you plan to connect. Programmers should see section **5 Developing Custom Software** for cross-references to programming tools and documentation for communicating through the port.

## 2.6 RS-232 Serial Port [J8]

**mDynamo Gen II** is configured with an RS-232 serial port, labeled **J8** and **RS-232** on the printed circuit board. As an alternative to USB the R232 port can be directly connected to a host's fully-powered RS-232 port to provide power to the device and bidirectional communication with the host. It is a 10-pin 1.25mm pitch Molex PicoBlade header designed to mate with Molex PicoBlade connector **51021-1000**. The dot on the printed circuit board indicates pin 1. Pinouts are shown in **Figure 2-4**.

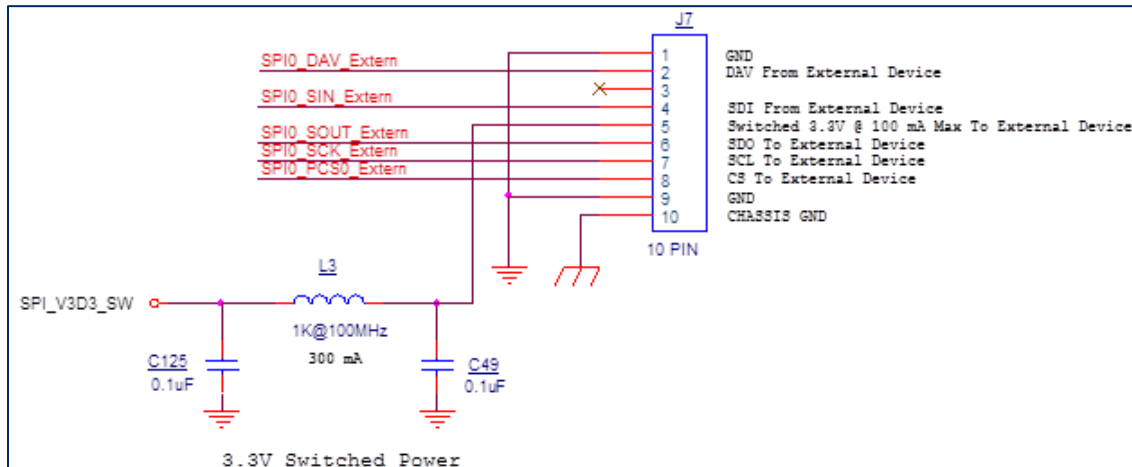


**Figure 2-4 Pinouts for mDynamo RS-232 Port J8**

Programmers should see section **5 Developing Custom Software** for cross-references to programming tools and documentation for communicating through the port

## 2.7 Auxiliary SPI Port [J7]

The Auxiliary SPI port, labeled **J7** and **SPI** on the printed circuit board, can be used for connecting to an optional external SPI Encrypting IntelliHead with MagneSafe V5. It is a 10-pin 1.25mm pitch Molex PicoBlade header designed to mate with Molex PicoBlade connector **51021-1000**. The dot on the printed circuit board indicates pin 1. Pinouts are shown in **Figure 2-5**.



**Figure 2-5 - Pinouts for mDynamo Auxiliary SPI Port J7**

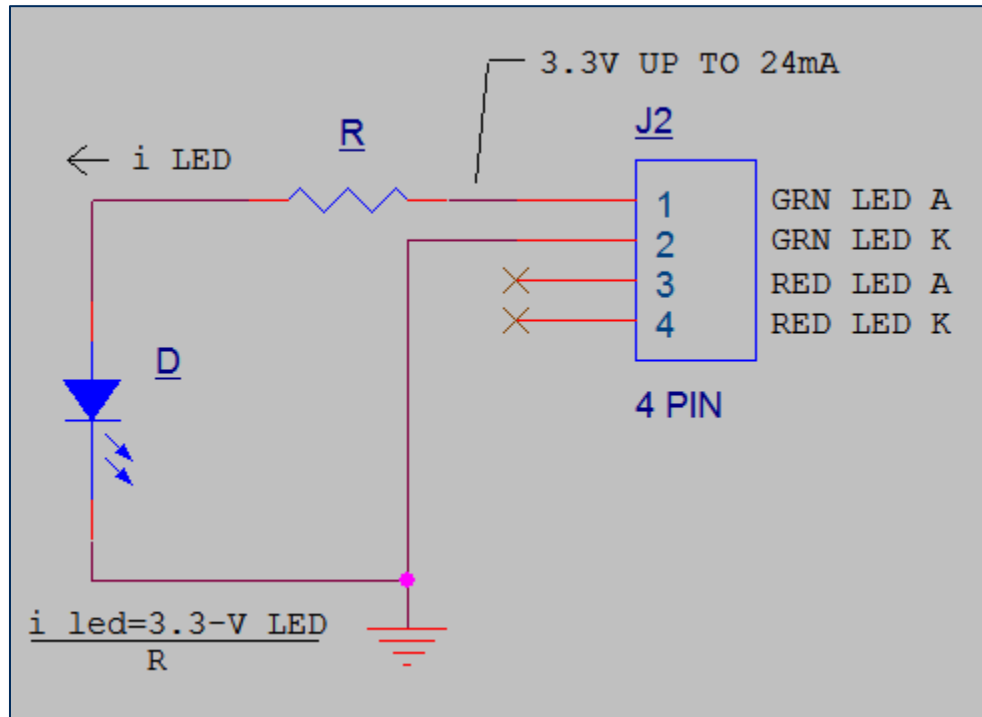
Depending on usage, the auxiliary SPI port can provide up to 100mA @ 3.3V to power an external SPI device. For details about connecting to an SPI Encrypting IntelliHead with MagneSafe V5, see the **Installation and Operation Manual** or **Technical Reference Manual** for the module you plan to connect. Wiring specifications for SPI heads are shown in **Table 2-1**. Programmers should see section **5 Developing Custom Software** for cross-references to programming tools and documentation for communicating through the port.

**Table 2-1 - Connector Pin Specifications for SPI Device Cable**

SPI Signal	Color	Connector Pin
SCL	BLUE	1
SDO	YELLOW	2
SDI	RED	3
DAV	BROWN	4
CS	GREEN	5
VIN	WHITE	6
GND	BLACK	7
CASE	VIOLET	8

## 2.8 External LED Connector [J2]

The External LED connector, labeled **J2** and **LED** on the printed circuit board, can be used to drive an external LED. It is a 4-pin 1.25mm pitch Molex PicoBlade header designed to mate with Molex PicoBlade connector **51021-0410**. The dot printed on the circuit board indicates pin 1. Pinouts of the connector, and a reference design for the green portion of the LED connector, are shown in **Figure 2-6**.



**Figure 2-6 – Pinouts and Green LED Reference Implementation for mDynamo LED Connector J2**

The connector can drive either an encapsulated red/green three-pin LED with common cathode (allowing for amber blending) or separate red and green LEDs. The connector provides 3.3V up to 24 mA. Each LED should have a current-limiting resistor connected in series, with values calculated as  $R = \frac{3.3V - V_{LED}}{I_{LED}}$  Ohms, where  $V_{LED}$  is the characteristic voltage drop across the LED (typically 2V) and  $I_{LED}$  is optimally between 10mA and 20mA. Solutions that incorporate amber should carefully select and test current limiting LED resistor values that provide a proper mix that doesn't look too green or too red.

By default, the device drives **J2** to match the General Status LED (see section **4.2 About the General Status LED**). However, custom software on the host the device is connected to may override the External LED behavior.

### 3 Mechanical Integration

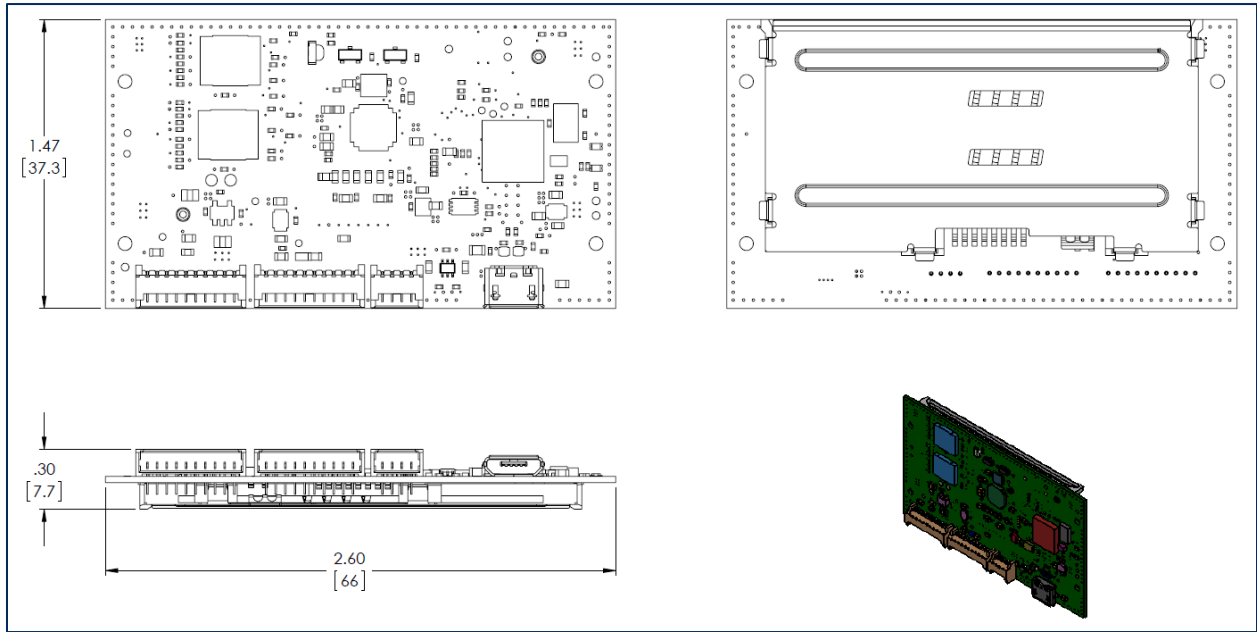


Figure 3-1 – mDynamo Gen I Overall Mechanical Dimensions in Inches [mm]

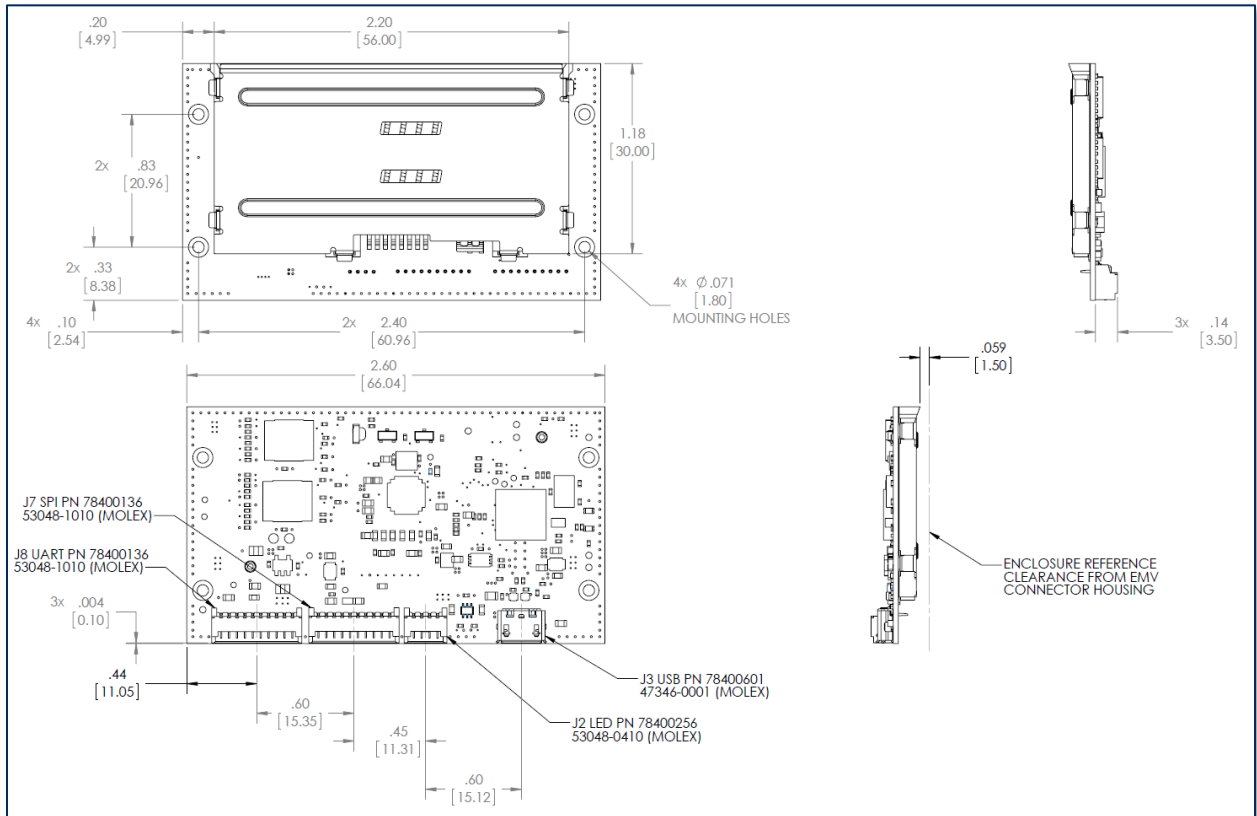


Figure 3-2 – mDynamo Gen I Detail Mechanical Dimensions in Inches [mm]



### 3 - Mechanical Integration

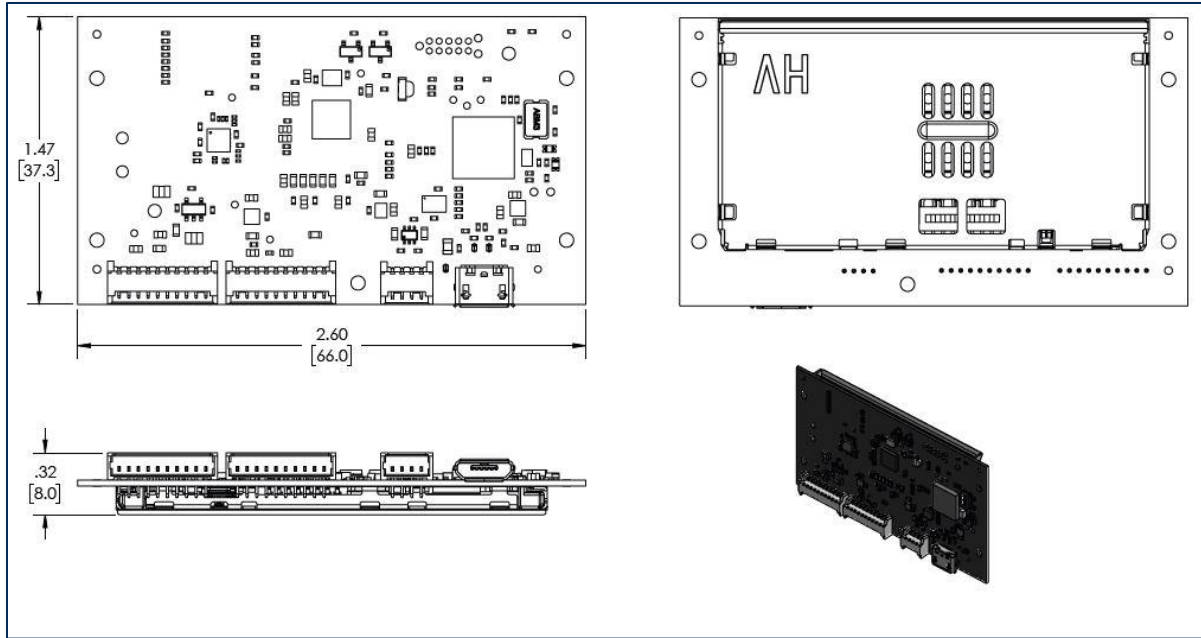


Figure 3-3 – mDynamo Gen II Overall Mechanical Dimensions in Inches [mm]

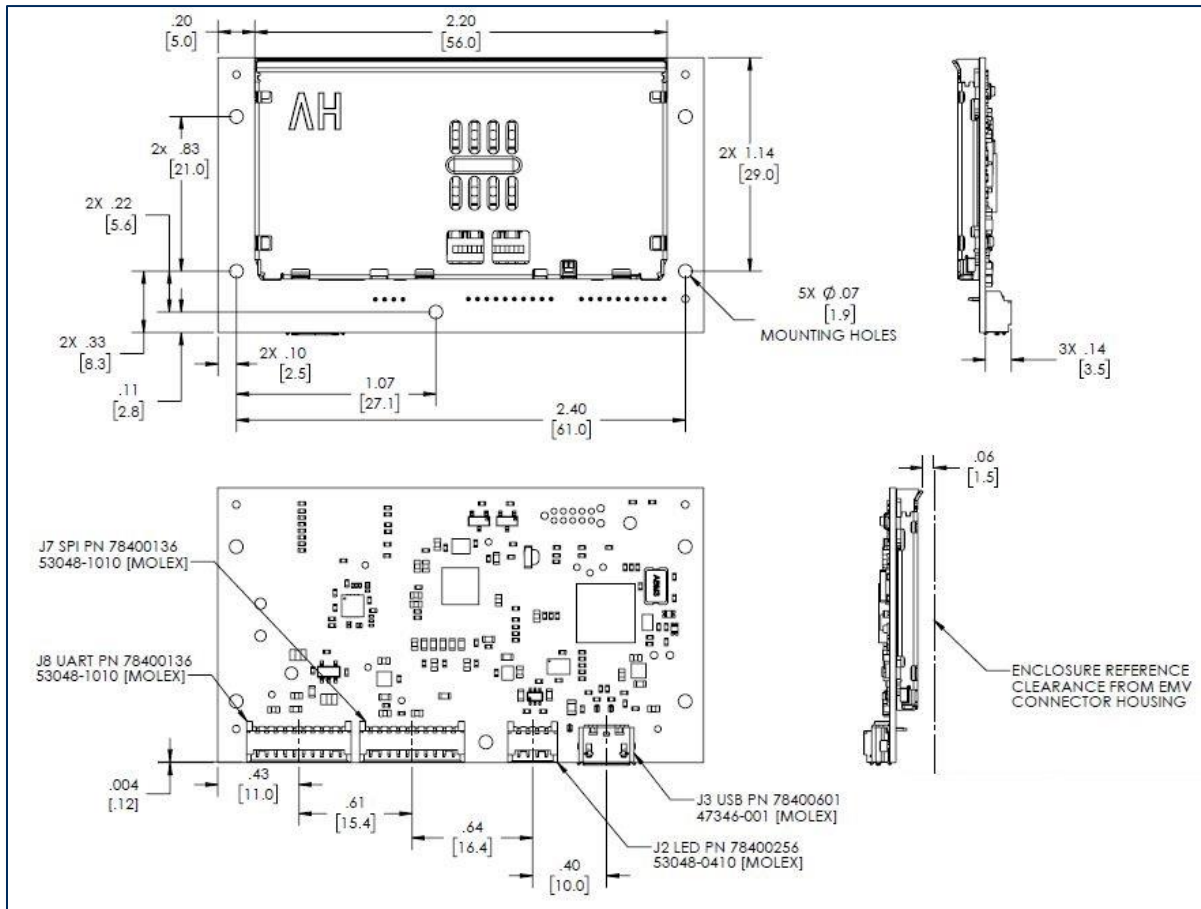


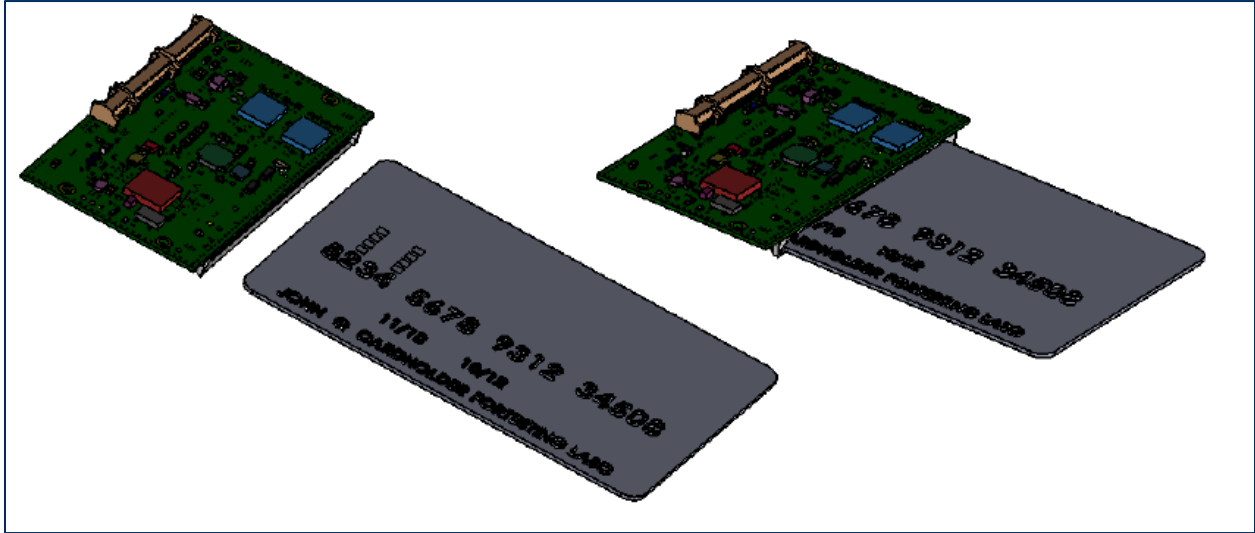
Figure 3-4 - mDynamo Gen II Detail Mechanical Dimensions in Inches [mm]



## 3.1 Enclosure Design

The device should always be placed in an enclosure to protect the device and to guide inexperienced cardholders in proper usage. Consider the following when designing the enclosure:

- **Overall dimensions** of the device are shown in **Figure 3-1** and **Figure 3-3**. The printed circuit board is 1/32” thick. **Detailed dimensions** are shown in **Figure 3-2** and **Figure 3-4**.
- The device will work in any orientation, but MagTek recommends a horizontal orientation with the large stainless steel plate facing the floor to meet cardholder expectations of inserting cards with the chip facing the ceiling (see **Figure 3-5**). Consider including visual features on the enclosure to guide cardholders to insert contact chip cards properly.



**Figure 3-5 - mDynamo Recommended Orientation**

- On request, MagTek can provide a 3D model of the device’s envelope to assist with the mechanical portion of solution design. MagTek recommends building 3D-printed prototypes with samples before finalizing the solution design.
- The mounting hole placements are provided in **Figure 3-2** and **Figure 3-4**. MagTek suggests stainless steel screws starting with sizes **0-80** or **M1.6**, mated with threaded inserts in the enclosure. Make sure mounting hardware in contact with the mounting holes conforms to grounding requirements in section **2 Electrical Integration**.
- Enclosure materials should meet UL rating 94 V-0. Examples include polycarbonate/ABS blends, ABS, polycarbonate, and polypropylene.
- The device is designed to withstand insertion forces up to 10N. To provide additional support, the enclosure may incorporate features that buttress the chip card reader housing.
- Be sure to provide at least 1/16 inch (1.5 mm) clearance from the large stainless steel plate of the chip card reader housing to any portion of the enclosure to allow for soldering variations in different boards (see reference clearance in **Figure 3-2** and **Figure 3-4**).
- The enclosure should have a card slot that aligns with the device’s chip card insertion slot. The enclosure’s card slot should accommodate cards conforming to **ISO 7816**: **Figure 3-6**, **Figure 3-7**, and **Figure 3-8** provide a reference card slot design to use as a starting point; features of the reference design include adequate clearance to avoid cards hitting the sides, top, and bottom of the mDynamo slot, and a cutout on one side of the slot to accommodate embossing on cards.

### 3 - Mechanical Integration

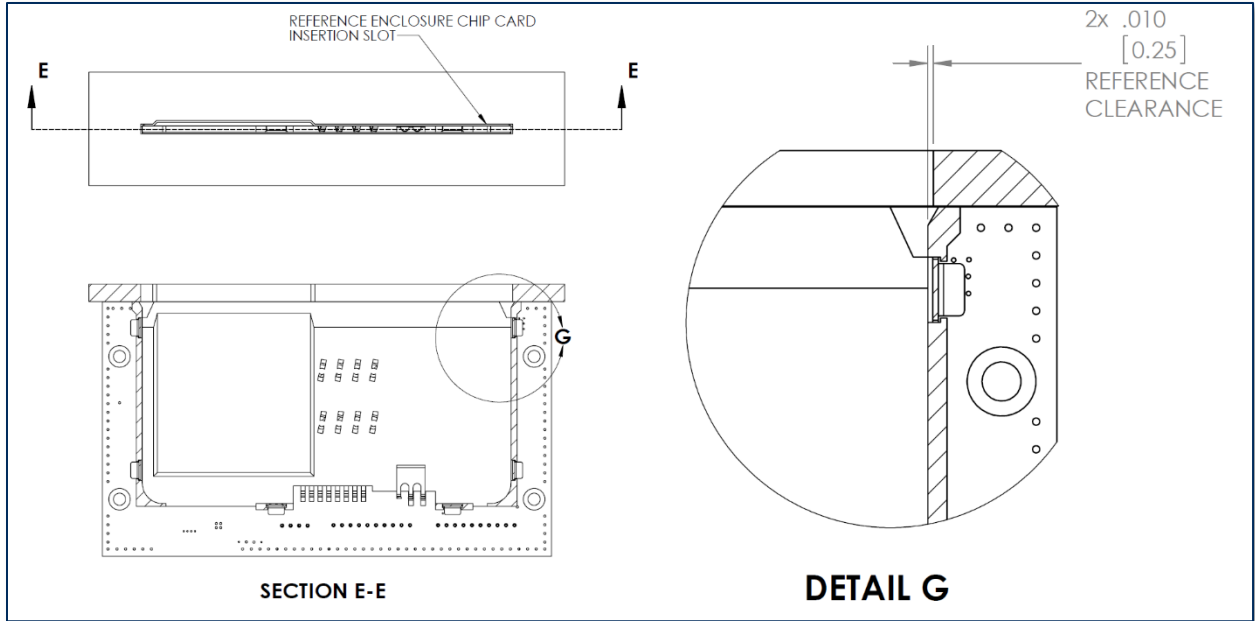


Figure 3-6 - Reference Enclosure, Card Slot Width

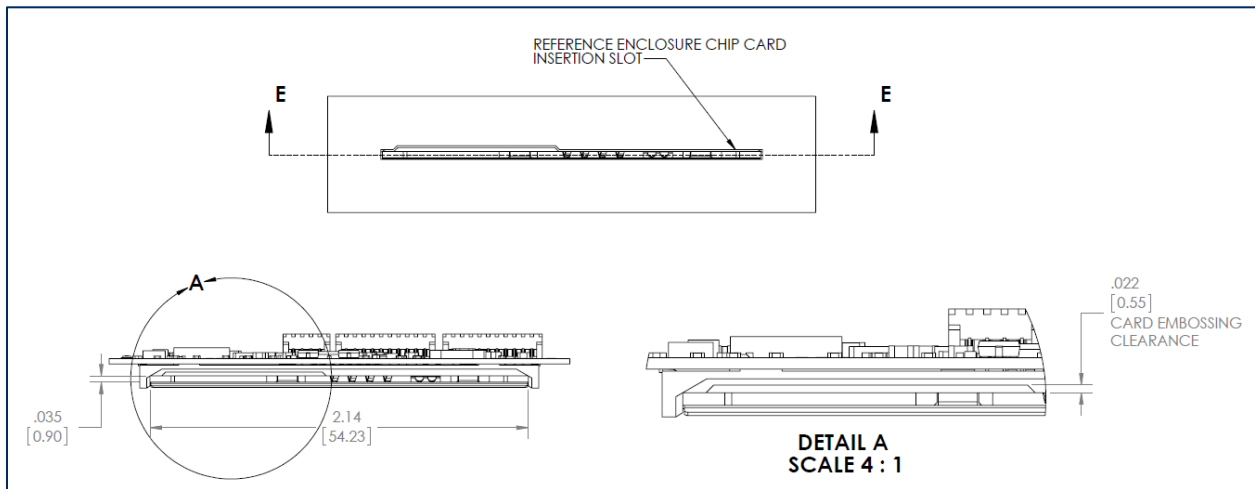


Figure 3-7 - Reference Enclosure, Card Slot Height, and Width

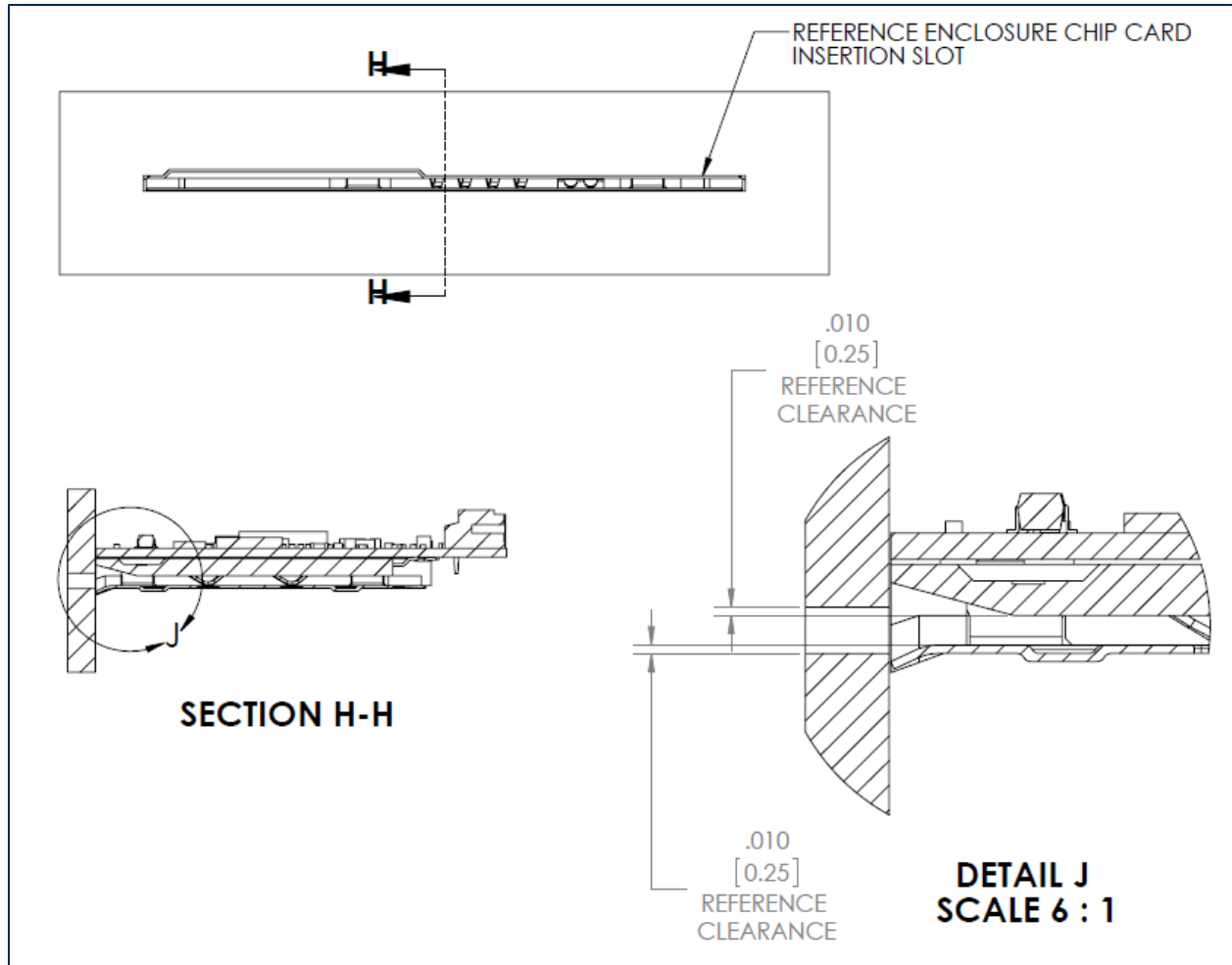


Figure 3-8 - Reference Enclosure, Card Slot Height

- If the solution will use **External LED Connector [J2]**, allow space to run the cable and to mount the LED(s) to be visible to cardholders during use. For details, see section **2.8 External LED Connector [J2]** and section **4.2 About the General Status LED**.
- If the solution will use **Auxiliary SPI Port [J7]**, to connect mDynamo to external UART or SPI modules, allow space to for the connectors and cables, and consider how the external devices will be mounted relative to the contact chip card insertion slot.
- The device operates on low power, so no special cooling should be necessary.
- mDynamo is not a PCI certified device; solutions that integrate it should consider how cardholder data will be secured and which certifications the solution will need to pass.
- MagTek strongly recommends testing solution designs before deployment, to make sure they meet all requirements (e.g., functional, legal, security, certification, safety).

### 3.2 Cabling Design

Consider the following when designing cabling:

- Make sure the enclosure provides adequate clearance for all required cables. The enclosure should also take into account the need for assembly and maintenance access and should support the device against cable connection and disconnection forces.
- Consider using a right-angle connector for **USB Port [J3]** to reduce space requirements and make strain relief easier.
- Consider cable ties or comparable strain relief for the USB cable.
- For stability, consider using locking connectors when using **Auxiliary UART Port [J8]**, **Auxiliary SPI Port [J7]**, and **External LED Connector [J2]**.

## 4 Operation

Before use, make sure mDynamo is connected to a USB host. Generally, the host software will always keep a connection open to the device via the USB port, and the device indicates it is ready for a transaction or host command by keeping the General Status LED green.

### 4.1 Card Reading / Transactions

EMV transactions begin when the host software initiates them. After the cardholder properly inserts a contact chip card into the slot, the device will communicate with the card and notify the host. The host software may choose to use these notifications to provide additional feedback (such as audible, visual, or tactile feedback) to guide the cardholder to leave the card inserted until the transaction is complete, then to remove the card. Programmers of host software should see section 5 **Developing Custom Software** for cross-references to programming tools and documentation for communicating with the device.

Cardholders will generally rely on guidance provided by the solution's enclosure (see section 0

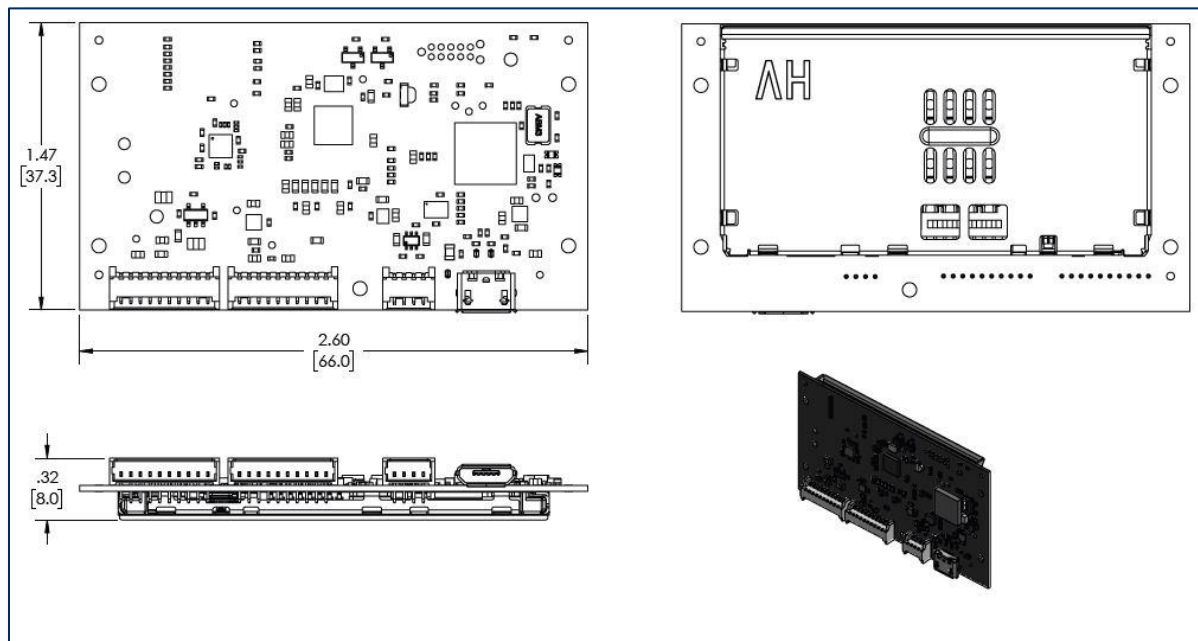


Figure 3-3 – mDynamo Gen II Overall Mechanical Dimensions in Inches [mm]

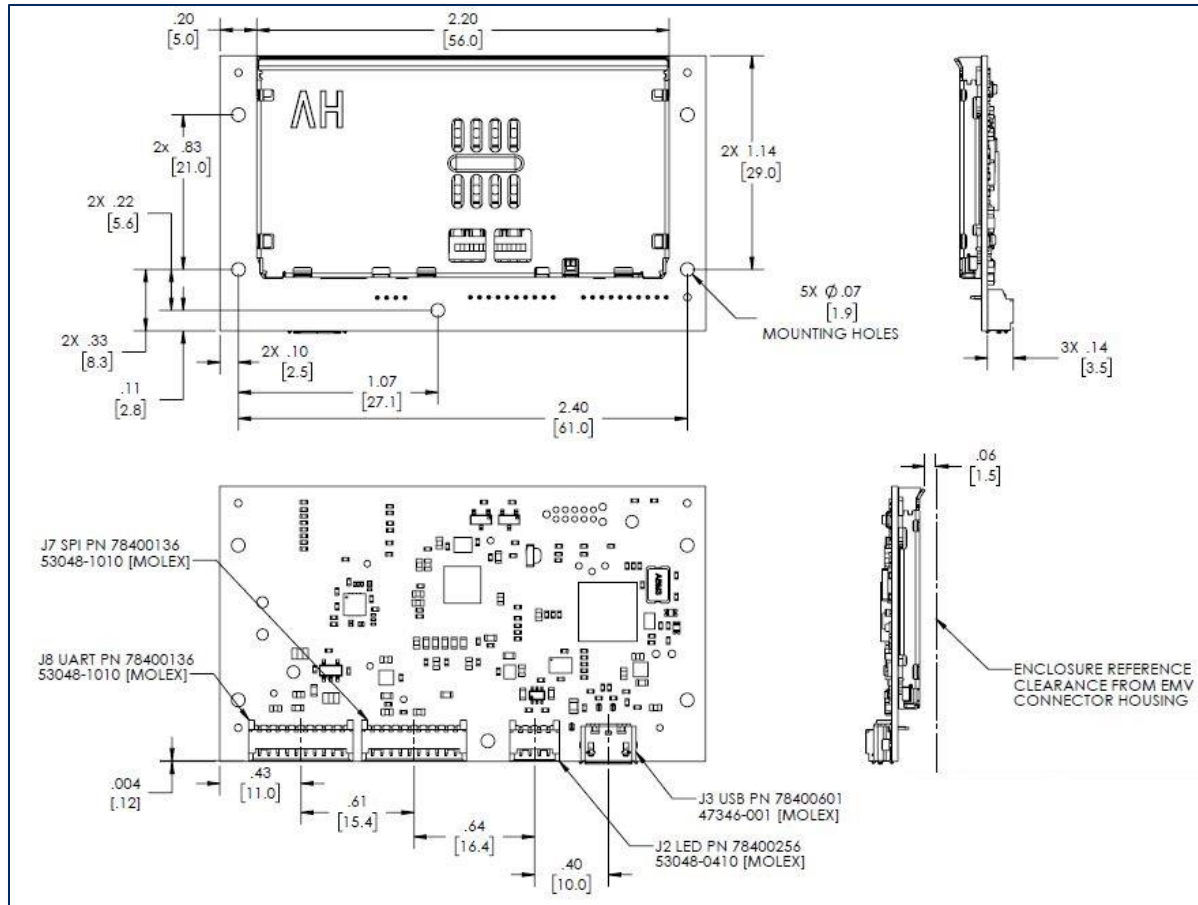


Figure 3-4 - mDynamo Gen II Detail Mechanical Dimensions in Inches [mm]

Enclosure Design) to properly orient chip cards before inserting them into the card insertion slot. The solution should guide cardholders to insert chip cards all the way into the slot until the card touches the card stop / switch. They may feel a slight click when the latch engages.




Before and during transactions, an operator may control or monitor the device using the host software and the General Status LED. See section **4.2 About the General Status LED** for assistance interpreting the device's LED patterns. Solutions that use the **External LED Connector [J2]** should provide additional supplemental documentation about how to read customized LED patterns.

## 4.2 About the General Status LED

mDynamo’s on-board General Status LED and the **External LED Connector [J2]** can be used to provide feedback to operators and cardholders about the internal state of the device (see **Figure 1-1**). By default, the device drives **J2** to match the General Status LED. However, custom software on the host the device is connected to may completely override the External LED behavior.

**Table 4-1** shows how to interpret the colors and flashing patterns of the General Status LED, and the behavior of an external LED if the host is not overriding the **J2** behavior.

**Table 4-1 – General Status LED Meaning**

Color	Flashing Pattern		Meaning
Off	Off		The device is not receiving adequate power from the host via the USB port.
Green	Steady On		The device is ready to read a contact chip card.
Red	Steady On		An operator is updating the firmware. On completion, the device will reset and the LED will turn off briefly.

## 5 Developing Custom Software

MagTek produces software development kits (SDKs) with API libraries that provide higher-level functions wrapped around **HID USB** communication protocols. These libraries simplify the development of custom applications that use mDynamo, and include:

- **99510133 DYNAMAG/DYNAMAX/EDYNAMO/MDYNAMO SDK FOR WINDOWS**, which bundles libraries for non-managed Windows executable images, such as .exe or DLL files.
- **99510132 DYNAMAG/DYNAMAX/EDYNAMO/UDYNAMO/ADYNAMO/MDYNAMO .NET SDK FOR WINDOWS**, which bundles libraries for Microsoft .NET.
- **99510109 DYNAMAG, DYNAMAX, EDYNAMO, MDYNAMO, UDYNAMO, ADYNAMO, BULLET SDK FOR ANDROID**
- **1000004036 DYNAMAG, DYNAMAX, EDYNAMO, MDYNAMO, UDYNAMO, BULLET SDK FOR MAC OSX**

In addition to the SDK API libraries, custom software on any operating system can communicate directly with the device using native USB libraries and protocols. For details, see **D998200151 MDYNAMO PROGRAMMER'S REFERENCE (COMMANDS)**.

For more information about developing custom applications that integrate with mDynamo, see the MagTek web site or contact your reseller or MagTek Support Services.



## Appendix A Technical Specifications

mDynamo Technical Specifications	
Reference Standards and Certifications	
Identification Cards Integrated Circuits with Contacts (ISO/IEC 7816-1, 2, 3, & 4) EMV ICC Specifications for Payment Systems Version 4.3, L1 Contact and L2 Contact Encryption: TDEA (3DES)-CBC using DUKPT FCC Title 47 Part 15 Class B CE Level B EMC CE Safety UR/CUR UL Recognized MasterCard TQM California Proposition 65 (California) IPC-A-610 Class II Assembly EU Directive Waste Electrical and Electronic Equipment (WEEE) EU Directive Restriction of Hazardous Substances (RoHS) Universal Serial Bus Specifications 1.1, 2.0	
Physical Characteristics	
Dimensions (L x W x H):	2.60 in. W x 1.47 in. H x 0.30 in. T (66mm x 37.3mm x 7.7mm)
Weight	0.5 oz. (14g)
Supported Mounting Options:	Solution-specific enclosure with card slot, screws, and inserts
Card Read Characteristics	
Magnetic Stripe Reader:	Optional separate module connected to Auxiliary SPI or UART port
Magnetic Stripe Decoding:	Not Applicable
Magnetic Swipe Speeds:	Not Applicable
Chip Card Reader:	EMVCo L1 and L2 Contact Reader
Contactless Reader:	Optional separate module connected to Auxiliary UART port
User Interface Characteristics	
Status Indicators:	On-board General Status LED (Red/Green/Amber) Port for External LED (Red/Green/Amber)
Display Type:	Not Applicable
Display Size (viewable area):	Not Applicable
Display Resolution:	Not Applicable
Keypad:	Not Applicable
Security Characteristics	
Tamper Protection:	Not Applicable

<b>mDynamo Technical Specifications</b>	
Code Protection:	Not Applicable
Eavesdrop Protection:	Not Applicable
<b>Electrical Characteristics</b>	
Power Inputs:	<b>mDynamo Gen I:</b> USB power via a Micro-USB B jack <b>mDynamo Gen II:</b> USB power via a Micro-USB B jack or RS-232 power via an RS-232 Serial Port
Power Outputs:	400mA @ 5.0V available on Auxiliary UART port 100mA @ 3.3V available on Auxiliary SPI port
Battery Type:	Not Applicable
Battery Capacity:	Not Applicable
Battery Charge Time:	Not Applicable
Battery Time, Standby:	Not Applicable
Battery Time, Transactions:	Not Applicable
Voltage Requirements:	5 VDC from USB port
Current Draw:	300mA from USB port when not driving auxiliary devices 500mA from USB port maximum
Data Storage:	Not Applicable
<b>Communication Characteristics</b>	
Wired Connection Types:	Micro-USB B, compatible with USB 1.1, USB 2.0 Vendor-defined USB Human Interface Device (HID) data format.
Wireless Connection Types:	Not Applicable
Wireless Range:	Not Applicable
Wireless Frequency:	Not Applicable
<b>Software Characteristics</b>	
Tested Operating System(s):	USB: Windows 7, Windows 8.1, Windows 10
<b>Environmental Tolerance</b>	
Ingress Protection:	Not Applicable
Operating Temperature:	mDynamo Gen I -4°F to 149°F (-20°C to 65°C) mDynamo Gen II -22°F to 185°F (-30°C to 85°C)
Operating Relative Humidity:	5% to 90% non-condensing
Storage Temperature:	mDynamo Gen I -4°F to 149°F (-20°C to 65°C) mDynamo Gen II -22°F to 185°F (-30°C to 85°C)

<b>mDynamo Technical Specifications</b>	
Storage Relative Humidity:	5% to 90% non-condensing
Vibration Resistance:	Not Applicable
Shock Resistance:	Not Applicable
<b>Reliability</b>	
Shelf Life:	Not Applicable
Magnetic Read Head Life:	Not Applicable
ICC Read Head Life:	500,000 card insertions
Battery Shelf Life:	Not Applicable
Battery Cycle Life:	Not Applicable

## Appendix B Warranty, Standards, and Certifications

### LIMITED WARRANTY

MagTek warrants that the products sold pursuant to this Agreement will perform in accordance with MagTek's published specifications. This warranty shall be provided only for a period of one year from the date of the shipment of the product from MagTek (the "Warranty Period"). This warranty shall apply only to the "Buyer" (the original purchaser, unless that entity resells the product as authorized by MagTek, in which event this warranty shall apply only to the first repurchaser).

During the Warranty Period, should this product fail to conform to MagTek's specifications, MagTek will, at its option, repair or replace this product at no additional charge except as set forth below. Repair parts and replacement products will be furnished on an exchange basis and will be either reconditioned or new. All replaced parts and products become the property of MagTek. This limited warranty does not include service to repair damage to the product resulting from accident, disaster, unreasonable use, misuse, abuse, negligence, or modification of the product not authorized by MagTek. MagTek reserves the right to examine the alleged defective goods to determine whether the warranty is applicable.

Without limiting the generality of the foregoing, MagTek specifically disclaims any liability or warranty for goods resold in other than MagTek's original packages, and for goods modified, altered, or treated without authorization by MagTek.

Service may be obtained by delivering the product during the warranty period to MagTek (1710 Apollo Court, Seal Beach, CA 90740). If this product is delivered by mail or by an equivalent shipping carrier, the customer agrees to insure the product or assume the risk of loss or damage in transit, to prepay shipping charges to the warranty service location, and to use the original shipping container or equivalent. MagTek will return the product, prepaid, via a three (3) day shipping service. A Return Material Authorization ("RMA") number must accompany all returns. Buyers may obtain an RMA number by contacting MagTek Support Services at (888) 624-8350.

**EACH BUYER UNDERSTANDS THAT THIS MAGTEK PRODUCT IS OFFERED AS-IS. MAGTEK MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND MAGTEK DISCLAIMS ANY WARRANTY OF ANY OTHER KIND, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

**IF THIS PRODUCT DOES NOT CONFORM TO MAGTEK'S SPECIFICATIONS, THE SOLE REMEDY SHALL BE REPAIR OR REPLACEMENT AS PROVIDED ABOVE. MAGTEK'S LIABILITY, IF ANY, SHALL IN NO EVENT EXCEED THE TOTAL AMOUNT PAID TO MAGTEK UNDER THIS AGREEMENT. IN NO EVENT WILL MAGTEK BE LIABLE TO THE BUYER FOR ANY DAMAGES, INCLUDING ANY LOST PROFITS, LOST SAVINGS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF, OR INABILITY TO USE, SUCH PRODUCT, EVEN IF MAGTEK HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY OTHER PARTY.**

- **LIMITATION ON LIABILITY**

EXCEPT AS PROVIDED IN THE SECTIONS RELATING TO MAGTEK'S LIMITED WARRANTY, MAGTEK'S LIABILITY UNDER THIS AGREEMENT IS LIMITED TO THE CONTRACT PRICE OF THIS PRODUCT.

MAGTEK MAKES NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCT, EXPRESSED OR IMPLIED, EXCEPT AS MAY BE STATED IN THIS AGREEMENT, AND MAGTEK DISCLAIMS ANY IMPLIED WARRANTY, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

MAGTEK SHALL NOT BE LIABLE FOR CONTINGENT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES TO PERSONS OR PROPERTY. MAGTEK FURTHER LIMITS ITS LIABILITY OF ANY KIND WITH RESPECT TO THE PRODUCT, INCLUDING NEGLIGENCE ON ITS PART, TO THE CONTRACT PRICE FOR THE GOODS.

MAGTEK'S SOLE LIABILITY AND BUYER'S EXCLUSIVE REMEDIES ARE STATED IN THIS SECTION AND IN THE SECTION RELATING TO MAGTEK'S LIMITED WARRANTY.

## FCC INFORMATION

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

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:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- 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.

**Caution: Changes or modifications not expressly approved by MagTek could void the user's authority to operate this equipment.**

## CE STANDARDS

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

## UL/CSA/CUR/UR

This product is recognized per *UL 60950-1, 2nd Edition, 2011-12-19* (Information Technology Equipment - Safety - Part 1: General Requirements), *CSA C22.2 No. 60950-1-07, 2nd Edition, 2011-12* (Information Technology Equipment - Safety - Part 1: General Requirements).

## ROHS STATEMENT

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