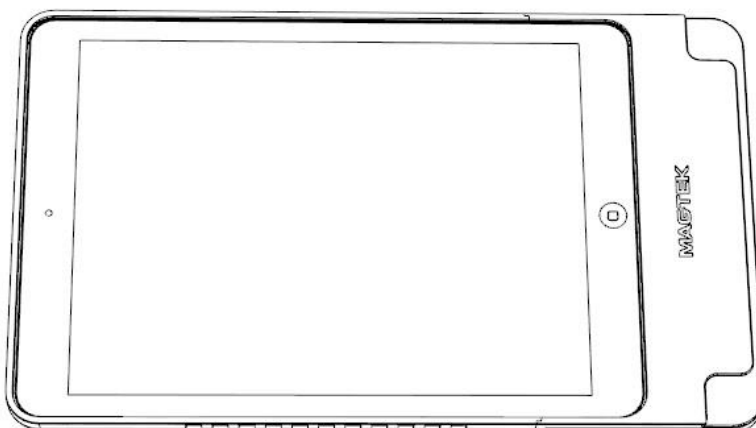


cDynamo

MagneSafe Secure Card Reader Authenticator Installation and Operation Manual



May 2016

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Table 0-1 - Revisions

Rev Number	Date	Notes
10	Sep 22, 2015	Initial Release

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This equipment has been tested and was found to comply with the limits for a Class B digital device pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference with radio communications. However, there is no guarantee that interference will not occur in a particular installation.

FCC COMPLIANCE STATEMENT

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

CANADIAN DOC STATEMENT

This digital apparatus does not exceed the Class B limits for radio noise from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

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

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

Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.


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

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

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 ()

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1 - Introduction

1 Introduction

1.1 About cDynamo

cDynamo is an iPad enclosure/case and secure card reader authenticator (SCRA) that reads magnetic stripes and conforms to ISO standards. cDynamo is compatible with the iPad Air 2, iPad Air and iPad mini, iPad mini 2 and iPad mini 3.

In addition to reading multiple tracks of data from a card, the reader incorporates MagnePrint® technology, so a card's unique MagnePrint fingerprint is included with the track data in each transaction.

To maximize card security, when a user swipes a card through the reader, the device encrypts card data and MagnePrint data before they leave the encapsulated magstripe reading head using the Triple Data Encryption Algorithm (TDEA, also known as Triple DES).

cDynamo manages encryption keys using DUKPT (Derived Unique Key Per Transaction) key management. DUKPT 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 each transaction uses a unique key. Thus, the data will be encrypted with a different encryption key for each transaction.

1.2 Product Features

- cDynamo is compatible with iPad Air 2, iPad Air, iPad Mini 3, iPad Mini 2 and iPad Mini
- Pass-through Micro-USB port allows the iPad device to charge without disconnecting cDynamo [Lightning connector supports charge ONLY; iTunes synchronization is not available]*
- cDynamo uses Apple Lightning connector
- Bi-directional card reading
- Reads encoded data that meets ANSI/ISO/AAMVA/JIS Type 2 standards
- Reads up to three tracks of card data
- Non-volatile memory for storage of protected and settable properties (such as unit serial number)
- Provides 54 byte MagnePrint™ value
- Contains a unique, permanent serial number for tracking
- Encrypts track data MagnePrint values before they leave the reader head
- Provides clear text confirmation data, including cardholder's name, expiration date, and a portion of the PAN as part of the masked track data
- Supports mutual authentication mode for use with Magensa.net

* iPad charging may require using the Apple supplied 10 Watt (2A @ 5V) iPad charger or equivalent. Computer USB ports may not supply enough power to charge the device.

2 Planning

When planning an integrated solution that includes cDynamo, there are important questions which will help determine which device and infrastructure you choose:

- Which iPad device will cDynamo be attached to? This informs which cDynamo model you need.
- What application(s) will you use to test the device? What application(s) will you use to process transactions? This informs what additional software infrastructure you will need to put in place.

Use **Table 2-1** to determine which model of cDynamo is appropriate for your solution:

Table 2-1 - cDynamo Model Selection

Model	Part #	Tracks	Interface	Compatible With
cDynamo-2	21087006	1,2,3	Lightning	iPad mini 3, iPad mini 2 and iPad mini
cDynamo-1	21087005	1,2,3	Lightning	iPad Air
cDynamo-3	21087007	1,2,3	Lightning	iPad Air 2

3 - Installation

3 Installation

3.1 How to Install cDynamo and Software the First Time

To connect cDynamo to your selected iPad device for the first time, follow these steps:

- 1) Power on the iPad device.
- 2) If you are connecting cDynamo 21087007 to an iPad Air 2, attach the four included spacers to the inside of the top enclosure as shown in the figure below.
- 3) Place the iPad device inside the top enclosure. Be sure the iPad slides to the top and snaps in place.
- 4) Slide the bottom enclosure into place by lining up the Lightning connector on the cDynamo and the lightning port of your iPad device.
- 5) Sections 1 and 3 shown in the diagram should snap in place to the inside of the enclosure and section 2 should snap to the outside of the enclosure.

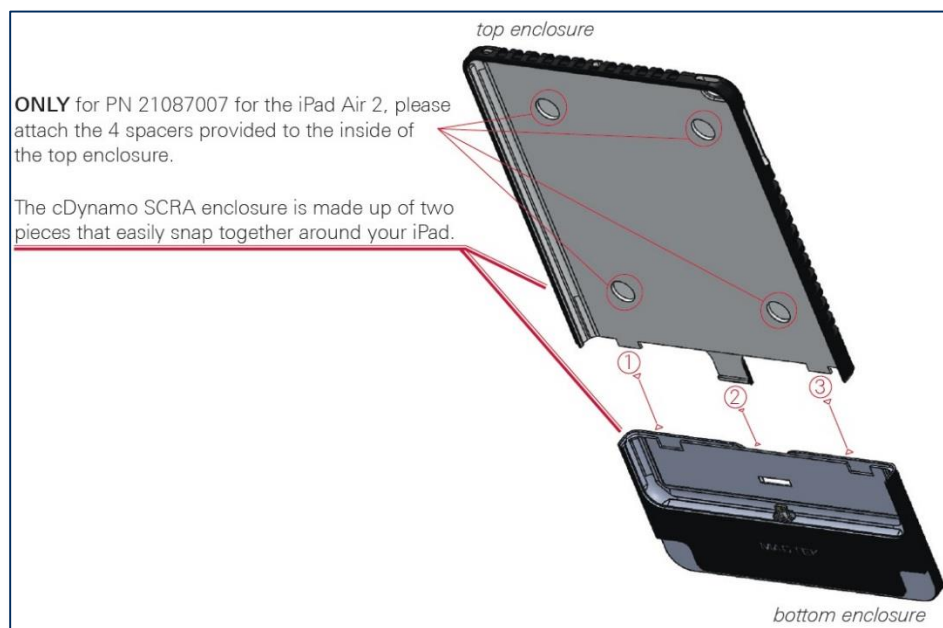
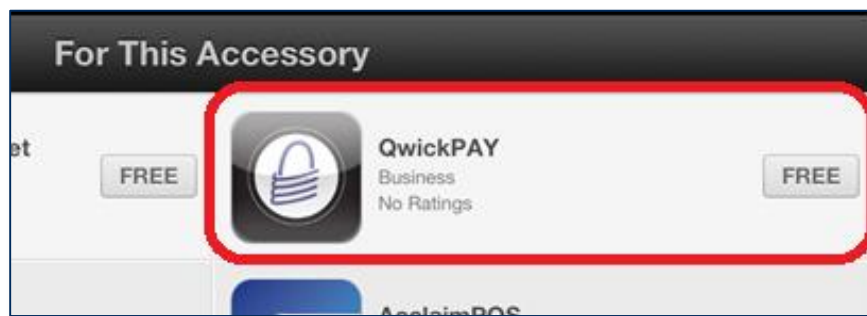


Figure 3-1 - Installing cDynamo

- 6) After a few seconds, the iPad device will pop up an **App Not Installed** window. Press the **App Store** button to open the App Store and browse all compatible applications.
- 7) Select and install **QwickPAY** as you would any iOS app.



- 8) Run **QwickPAY** and follow the instructions found in the QwickPAY documentation.

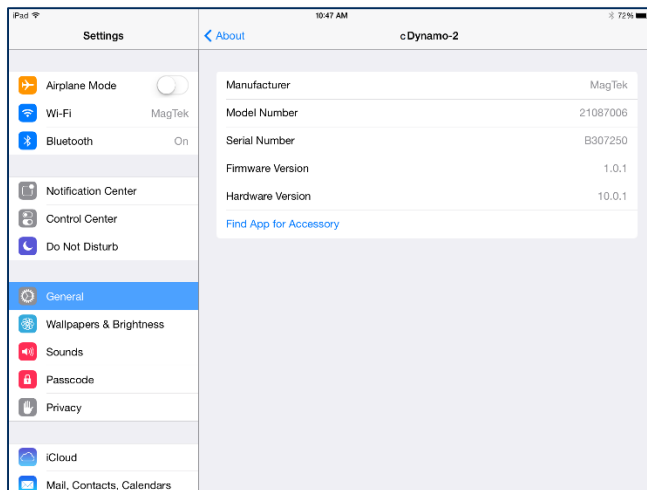
4 - Operation

- 9) When removing the iPad from the top enclosure, pull both sides out so the case is pushed past the buttons on your iPad device.

3.2 How to Re-Install Software

If cDynamo has been installed on the device previously, but you want to trigger the process of re-installing software, follow these steps:

- 1) Follow the steps in section **4.1 How to Check Device Status**.
- 2) On the **Settings** > **General** > **About** > **cDynamo** page, select **Find App for Accessory**.
- 3) Select and install **QwickPAY** as you would any iOS app.



- 4) Run **QwickPAY** and follow the instructions found in the QwickPAY documentation.

4 Operation

4.1 How to Check Device Status

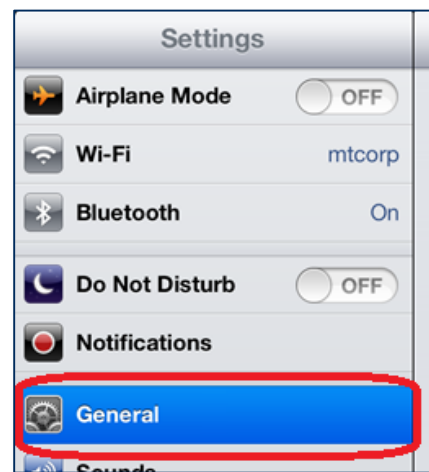
To check the status of a cDynamo connected to an iPad device, follow these steps:

- 1) From the iPad device's main screen, select **Settings** to open the **Settings** page.

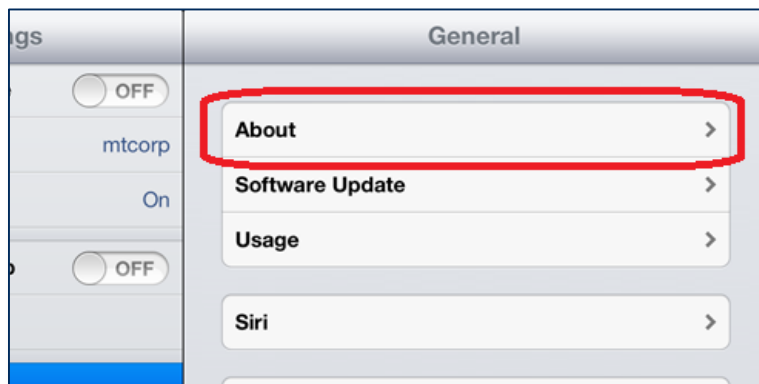
4 - Operation



- 2) In the left-side navigator (on iPad) or the main pane (on iPhone or iPod Touch), select **General** to open the **General** page.



- 3) Select **About>** to open the **About** page.



- 4) Make sure there is a **cDynamo** entry in the list on the **About** page.
- 5) Select the device's entry on the **About** page to show the device's properties page. It should be similar to **Figure 4-1**.

4 - Operation

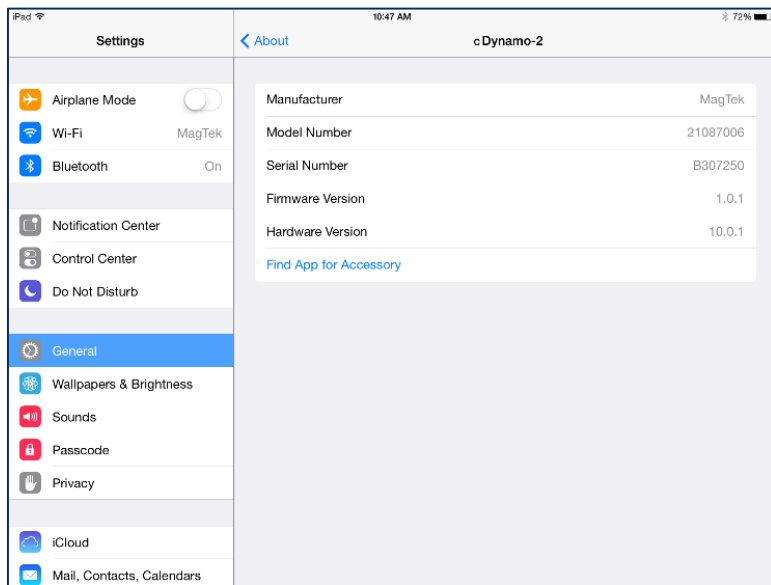
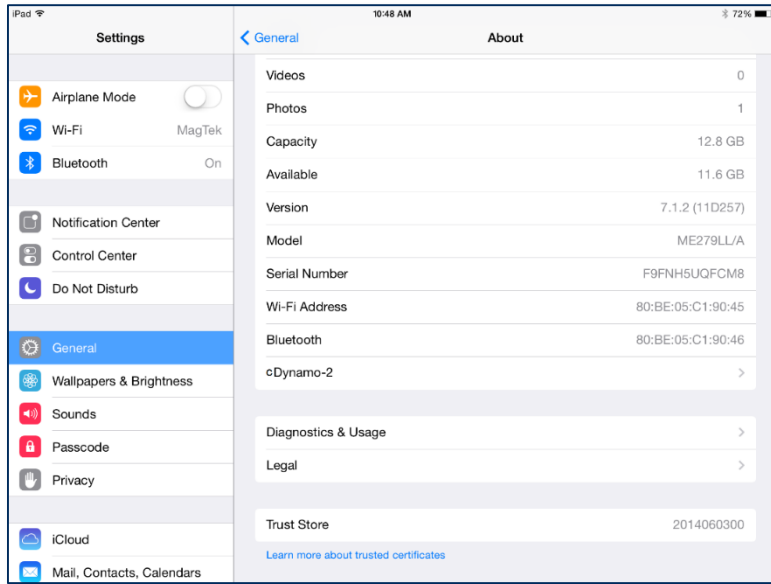


Figure 4-1 - cDynamo Properties Page

4 - Operation

4.2 How to Set Up Charging

cDynamo is equipped with a pass-through Micro-USB port which allows the connected iPad device to charge while cDynamo is connected.

To set up pass-through charging, follow these steps:

- 1) Disconnect cDynamo from the iPad device.
- 2) If charging using a computer: Connect the iPad device directly to the computer's high-power USB port (2A @ 5V) using the iPad device's original cable, and test to make sure the iPad device charges correctly.
- 1) If charging using an Apple-supplied or third-party charger designed for the device: Connect the iPad device directly to the charger using iPad device's original cable, and test to make sure the iPad device charges correctly.
- 3) Disconnect the charging cable from the iPad device.
- 4) Connect cDynamo to the iPad device as described in section **3 Installation**.
- 5) Connect the charging cable to cDynamo's pass-through Micro-USB port.

4.3 About Power Saving Mode

When an app closes a session with a reader, the reader will go to low power mode until the app restarts or re-initiates a session.

5 Developing Custom Apps

cDynamo supports development of custom third-party apps. This section provides some information pertinent to developing apps that are compatible with cDynamo. For further information, see these reference documents, which are available from the MagTek documentation web site found at <https://www.magtek.com/support/idynamo> :

- *iDynamo MagneSafe V5 Communication Reference Manual* (D99875483)
- *Communication with iDynamo (a Made for iPhone External Accessory)* (D99875555)

For more information about key management, see *ANS X9.24-2004 Retail Financial Services Symmetric Key Management Part 1: Using Symmetric Techniques*

5.1 About Device Detection

The cDynamo reader goes through an identification and authentication process each time it is attached to an iPad device. After the process is successful, the reader becomes available to the operating system. Apps can then open a communication channel to the reader and send commands to / receive responses from the reader.

To set up a communications channel, the app will need the following two pieces of information:

- SDK Protocol / Bundle Identifier = `com.magtek.iDynamo`
- Bundle Seed ID = a 10 character string assigned by Apple Inc. to the developer

For details about iOS app development, see <https://developer.apple.com/devcenter/ios>.

5.2 About Security

cDynamo can be configured to require mutual authentication with an authentication / cryptographic host before it will transmit card data. This functionality can be activated by the app.

5.3 About Card Reads

After the iPad device identifies and authenticates the cDynamo, apps may open a session with it. A card may be swiped through the reader slot. Encrypted data will be sent through the connector to the app, which will then transmit it to a cryptographic host for decryption. Data may be sent in 2 blocks. cDynamo is ready to read the next card immediately.

5.4 About States

Apps can determine the state of the reader at any time using the `Get Reader State` command. As a convention, this document refers to device states with the notation `State:Antecedent` (for example, `WaitActAuth:BadSwipe`). State definitions can be found at the definition of the `Get Reader State` command in the *iDynamo MagneSafe Communication Reference Manual*.

In most cases, the app can also infer a reader's state. As the app interacts with a reader, most state transitions are indicated by commands and responses. The one exception is the transition from `WaitActRply:x` to `WaitActAuth:TOAuth`. This state transition occurs as the result of a timeout, so it is not reported to the app. If the app sets a limited period of time for the reader to wait for the next command, it should anticipate that a timeout could occur before it sends the `Activation Challenge Reply` command. If the app sends the `Activation Challenge Reply` command after the reader timeout occurs, the reader will return response code 07 (sequence error).

5 - Developing Custom Apps

5.4.1 State Transitions Example: Power Up, Authentication, Good Swipe

- 1) Reader Powers Up (State = WaitActAuth:PU). App should send the `Get Reader State` command to discover the current state of the reader.
- 2) App sends valid `Activate Authenticated Mode` command (State→WaitActRply:PU). Reader returns response code 00 inferring the transition to the `WaitActRply:PU` state.
- 3) App sends valid `Activation Challenge Reply` command (State→WaitSwipe:PU). Reader returns response code 00 inferring the transition to the `WaitSwipe:PU` state.
- 4) User swipes a card correctly (State→WaitActAuth:GoodSwipe). Reader sends encrypted card data to the app inferring the transition to the `WaitActAuth:GoodSwipe` state.

5.4.2 State Transitions Example: Reader Timeout Waiting for Swipe

- 1) Reader waiting (State = WaitActAuth:GoodSwipe). This is after a good swipe. App may send the `Get Reader State` command to discover the current state of the reader.
- 2) App sends valid `Activate Authenticated Mode` command (State→WaitActRply:GoodSwipe). Reader returns response code 00 inferring the transition to the `WaitActRply:GoodSwipe` state.
- 3) App sends valid `Activation Challenge Reply` command (State→WaitSwipe:GoodSwipe). Reader returns response code 00 inferring the transition to the `WaitSwipe:GoodSwipe` state.
- 4) Timer expires (State→WaitActAuth:TOSwipe). Reader returns empty card data to the app to report the timeout (see `Reader Encryption Status` in *iDynamo MagneSafe Communication Reference Manual*). App infers a transition to `WaitActAuth:TOSwipe` state.

5.4.3 State Transitions Example: App Sends Invalid Activation Challenge Reply Command

- 1) Reader Waiting (State = WaitActAuth:GoodSwipe). This is after a good swipe. App may send the `Get Reader State` command to discover the current state of the reader.
- 2) App sends valid `Activate Authenticated Mode` command (State→WaitActRply:GoodSwipe). Reader returns response code 00, inferring the transition to the `WaitActRply:GoodSwipe` state.
- 3) App sends invalid `Activation Challenge Reply` command (State→WaitActAuth:FailAuth). Reader returns response code 02 or 04 inferring the transition to the `WaitActAuth:FailAuth` state.

5.4.4 State Transitions Example: Timeout Waiting for App's Activation Challenge Reply

- 1) Reader Waiting (State = WaitActAuth:GoodSwipe). This is after a good swipe. App may send the `Get Reader State` command to discover the current state of the reader.
- 2) App sends valid `Activate Authenticated Mode` command (State→WaitActRply:GoodSwipe). Reader returns response code 00 inferring the transition to the `WaitActRply:GoodSwipe` state.
- 3) Reader times out waiting for app to send `Activation Challenge Reply` command (State→WaitActAuth:TOAuth). App doesn't know because the reader can/does not send any message.
- 4) App eventually sends `Activation Challenge Reply` command (state remains `WaitActAuth:TOAuth`). Reader returns response code 07 inferring the previous transition to `WaitActAuth:TOAuth` state.

Appendix A - Technical Specifications

Appendix A Technical Specifications

Reference Standards	
ISO 7810 and ISO 7811, AAMVA	
Physical Characteristics	
Dimensions (L x W x H) without adapters:	iPad mini W 5.3" x L 9.6" x D 0.47" (W 139mm x L 244mm x D 12mm) iPad Air/2 W 6.8" x L 11.2" x D 0.47" (W 173mm x L 285mm x D 12mm)
Weight without iPad device:	WT: 5.0 oz - iPad mini WT: 7.0 oz - iPad Air/2
Operational Characteristics	
Acceptable Swipe Speeds:	6 in./s to 60 in./s (15 cm/s to 152 cm/s)
Electrical Characteristics	
Voltage Requirements:	2.85 to 3.47 VDC from the attached device
Maximum Current Draw:	50 mA from the attached device
Data Ports:	Apple Lightning Micro-USB (for pass-through charging)
Software Characteristics	
Tested Operating System(s):	iOS 6.0.0 or newer
Message Format:	ASCII
Message Protocol:	MagneSafe
Environmental Tolerance	
Operating temperature:	0°C to 35°C (32°F to 95°F)
Operating relative humidity:	5% to 90% without condensation
Storage temperature:	-20°C to 45°C (-4°F to 113°F)
Storage relative humidity:	5% to 90% without condensation
Maximum operating altitude:	3000 m (10,000 ft.)

Appendix B Troubleshooting

B.1 cDynamo Not Detected By App

If the app you are using won't detect or connect to the device, check the following:

- Check the electromechanical connection:
 - Make sure the cDynamo is fully installed and both the upper and lower assemblies have snapped together.
 - Make sure the reader's connector is not damaged or dirty.
 - Connect another device to the iPad device's connector to make sure it is functioning correctly.
- For an app to interface with the cDynamo, it must use the same Bundle Identifier as the device (by default, `com.magtek.iDynamo`). cDynamo can also be configured with a different Bundle Identifier, in which case the app must use that Bundle Identifier instead.

B.2 Bad Reads / Swipe Not Detected

If card swipes are not being registered correctly, check the following:

- **Card orientation.** Make sure the card is oriented so the magstripe is inside cDynamo and facing toward the thicker side of the cDynamo (away from the lock logo). A card swiped backwards or upside down will not produce data from a swipe event.
- **Damaged card.** The magstripe on the card may be damaged. Try another card.
- **Excessive buildup on the read head.** Clean the read head by swiping a cleaning card through the cDynamo several times in different orientations until the card comes out clean. Cleaning cards are available from MagTek as part number 96700025. If the operation environment is dusty, use compressed air to blow residue out of the cDynamo.
- **Swipe mechanics.** A good read depends on the magstripe moving straight over the read head and above a certain speed. Try swiping more quickly and straight through the guide path of the cDynamo. The range of working swipe speeds is listed in **Appendix A Technical Specifications**.
- **Ergonomics.** Ergonomics can play a critical role in device performance. Make sure nothing is impeding the end of the swipe path and the reader is not being placed/held at an awkward angle; these may cause the cardholder to swipe slowly, curve the swipe path, or stop short, and the device may report an unusually high number of bad read events.

If cDynamo is still not registering swipes after following these steps, contact your supplier for assistance. The typical symptom for a broken read head or circuit is a lack of any data from a swipe event.

B.3 iOS Device Not Charging

If the connected iPad device is not charging through the pass-through Micro-USB port, check the following:

- **Incorrect power supply / not enough power:** Swap out components in the chain, such as the power supply itself and the cable connecting the power supply to cDynamo. Remove cDynamo and connect the power supply directly to the iPad device to make sure the device charges.
- Check the connectors on cDynamo, the iPad device, and cable to make sure they are not dirty or damaged.

B.4 iOS Device Not Synchronizing

cDynamo does not support synchronizing through the pass-through Micro-USB port; only charging is supported.