tDynamo

Three-way Secure Card Reader Authenticator
Installation and Operation Manual

February 2025

Document Number:
D998200257-200

REGISTERED TO ISO 9001:2015

Table 0-1 - Revisions

Rev Number	Date	Notes
10	May 18, 2018	Initial Release
20	Aug 17, 2018	Add supporting information about optional docking stand; Retrofit new Sleep Mode throughout; Update **3.2 About the Status LEDs**; Remove support for Windows 10 Bluetooth LE connections; Misc. clarifications and corrections
21	Nov 8, 2018	Expand section **3.4.1 About Power**; Update **Appendix A Technical Specifications** to clarify head life, shelf life, temperatures; Misc. clarifications and corrections
22	May 22, 2019	Fix minor errors in description of Connected Mode transitions throughout, notably section **3.1**; Update connection screenshots in section **2.2.3**; Misc. clarifications and corrections.
23	Jul 10, 2019	Add cross-references to SDK part numbers in section **5**; Misc. clarifications and corrections.
24	Jan 25, 2023	Update **3.4.3 How to Charge the Battery** with Battery Charging Behavior Feature, Update **5.2 Bluetooth LE-based Custom Software and Apps** with information on dropped connections; Add section **5.3 Bluetooth Firmware Update**
200	February 24, 2025	Update section **1.8 About tDynamo Components** with reference to Appendix B**.** Add **Appendix B Optional Accessories** and **Appendix C Warranty, Standards, and Certifications,** Added figure **Figure 1-3 - MagTek Otterbox(R) uniVERSE Clip.**

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1   Introduction

1.1   About tDynamo

Point-of-service and point-of-sale needs to be fast, reliable and secure. tDynamo delivers on all three and meets the growing demand from your customers to use the latest in technology in the easiest-to-use form factor. The tDynamo reader is a simple way to take a wide variety of payment methods, in a small, versatile device. tDynamo is a three way card reader (magnetic stripe, chip card, contactless).

tDynamo product features include:

- EMV L1 and L2 Contact
- EMV Contactless (most mobile payment applications)
- Rechargeable battery with 500 cycle life
- Red/Green/Amber General Status LED
- Green Contactless Transaction LEDs
- Built-in lanyard mount point and locking mount point
- Open standards-based encryption 3DES (TDEA)
- DUKPT Key Management
- MagnePrint® Card Authentication
- Unique non-changeable device serial number
- Immediate card data tokenization
- Device/host authentication
- Time bound session IDs
- Designed for handheld, fixed with optional stand, or quick-swap solutions
- No cable to interfere with handheld reader grip
- Convenient battery charging via industry standard USB-C connector or docking stand contacts
- Allows over 200 card swipes or insertions over 8 hours between charges

1.2   Fixed or Mobile

tDynamo allows you to easily go between a fixed platform and a mobile platform, giving you the flexibility your application and environment may need. The optional docking stand can be mounted to a countertop with one screw and nut, making installation simple. tDynamo uses very little real estate, while providing an easy to use payment device that accepts multiple payment methods.

1.3   Accept Multiple Payment Methods

tDynamo is a versatile reader in a simple and easy to understand design. With all of the payment methods in the market today, tDynamo delivers magnetic stripe, chip card, and contactless in a small form factor. Now you can accept classic plastic to mobile wallets and just about everything in between.

1.4   Designed for Business

tDynamo delivers a sleek design engineered to work in today's changing retail environments. Whether you are offering concierge service, pay-at-the-table, line-busting solutions, or other retail solutions, tDynamo lets you set the trends instead of trying to keep up. Although in a small form factor, it delivers a long smooth swipe path with excellent performance and one of the highest first swipe read rates in the industry. The chip card insertion path is smooth and easy to access, and the contactless pad is sleek and simple.

1.5   Security in Mind

Data is protected and encrypted the moment the card is swiped, so clear data never enters your system. Open, 3DES end-to-end encryption and industry-standard DUKPT key management allow for greater platform flexibility. Ask a representative for more information about MagTek and Magensa's data protection and transaction services.

1.6   Simplified Integration

MagTek understands the value of easy-to-use and well documented Software Development Kits (SDKs), technical documentation, APIs, and sample code. MagTek SDKs have no royalties or maintenance fees and are free to redistribute with your application. Use MagTek's MagneFlex browser or middleware application for even easier development.

1.7   MagneSafe Security Architecture

The MagneSafe Security Architecture provides the maximum security at the minimum cost, both in total dollars and implementation effort. MagneSafe delivers a layered approach to transaction security, and combines encryption, tokenization, authentication and dynamic data to protect card data at the moment the card is swiped.

1.8 About tDynamo Components

The major components of tDynamo are shown in **Figure 1-1** below. The major components of the optional tDynamo docking stand are shown in **Figure 1-2** below. For more information on tDynamo accessories, refer to **Appendix B Optional Accessories**.
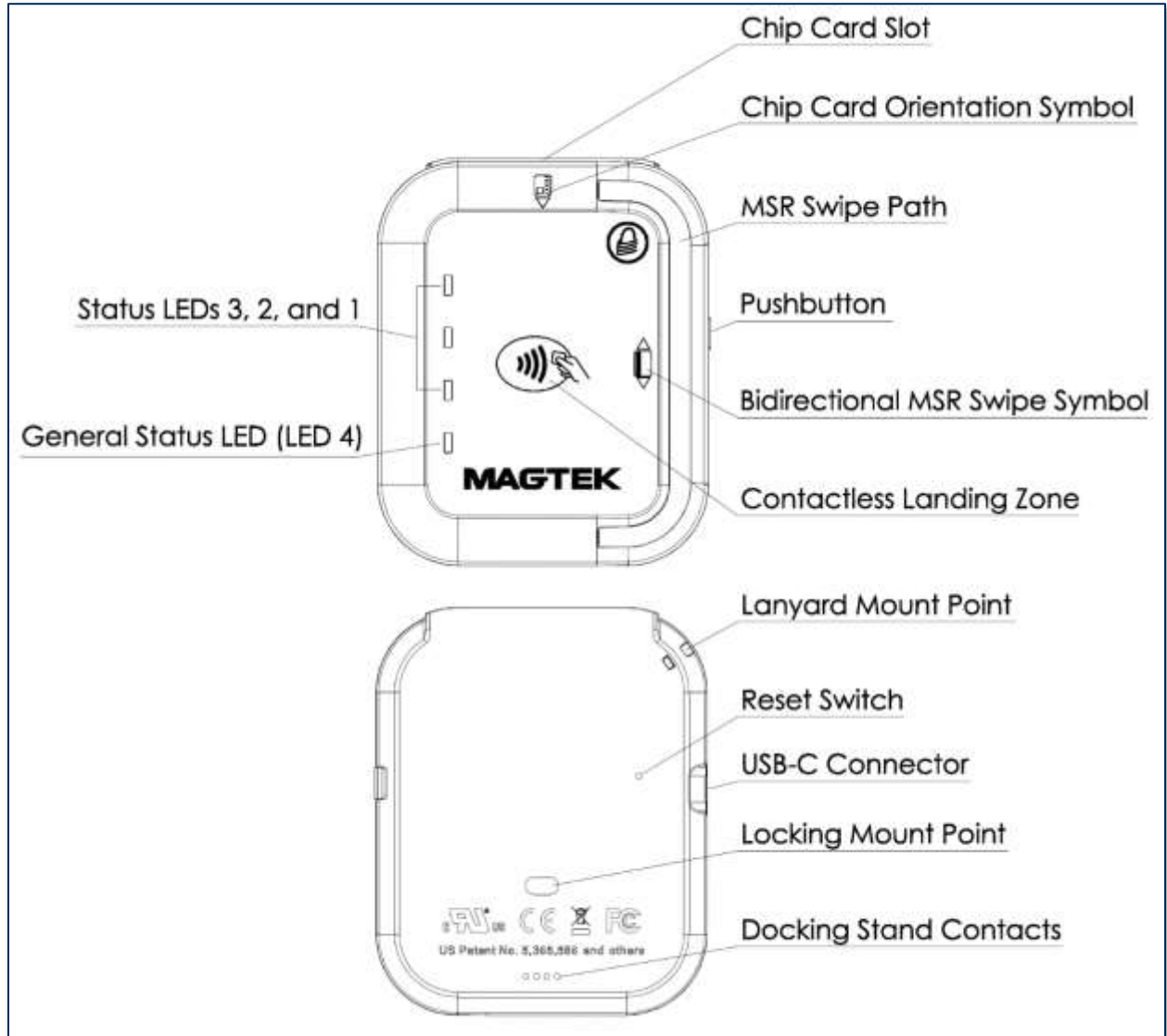
Figure 1-1 - tDynamo Major Components
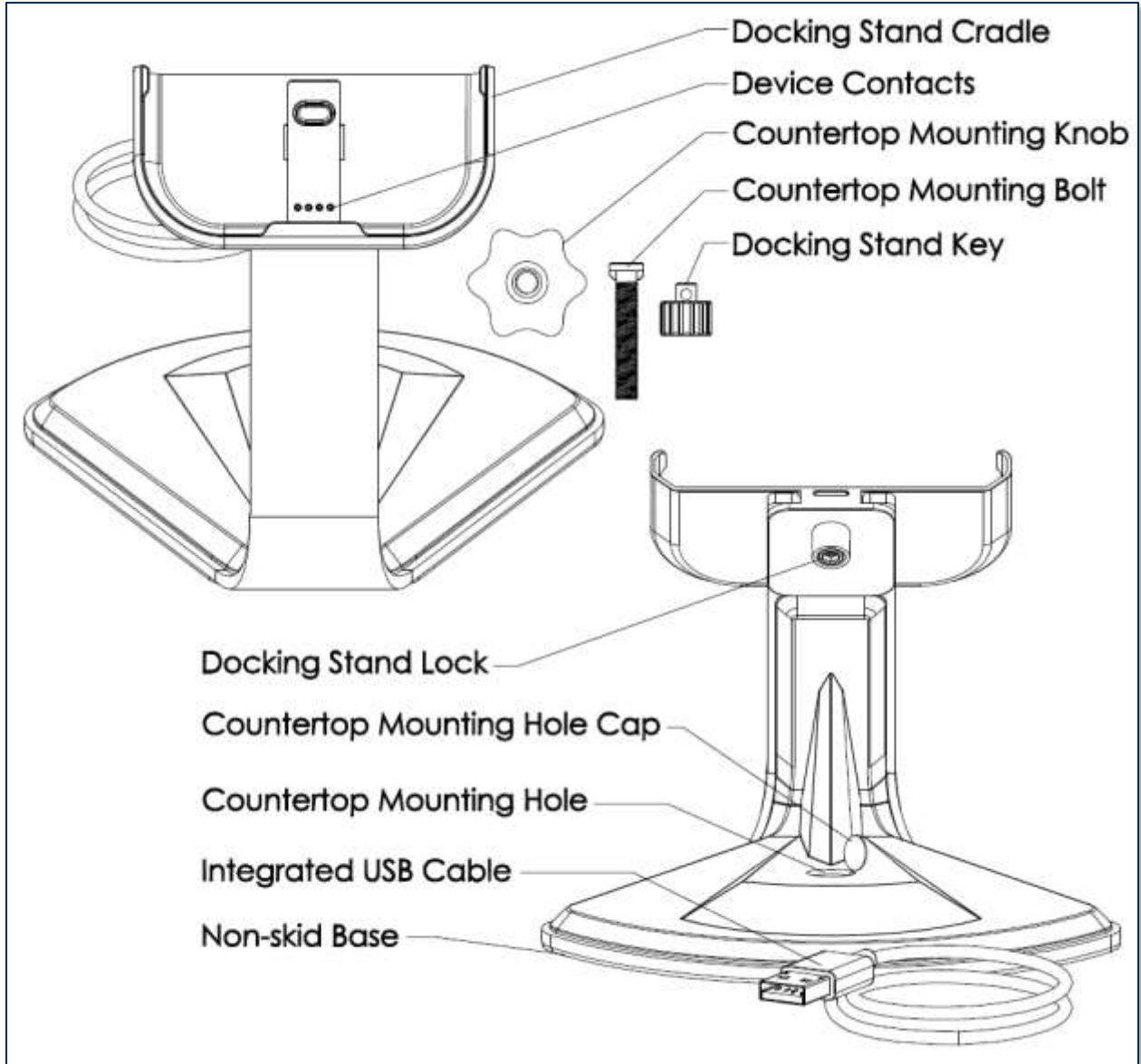
Figure 1-2 - tDynamo Stand Major Components
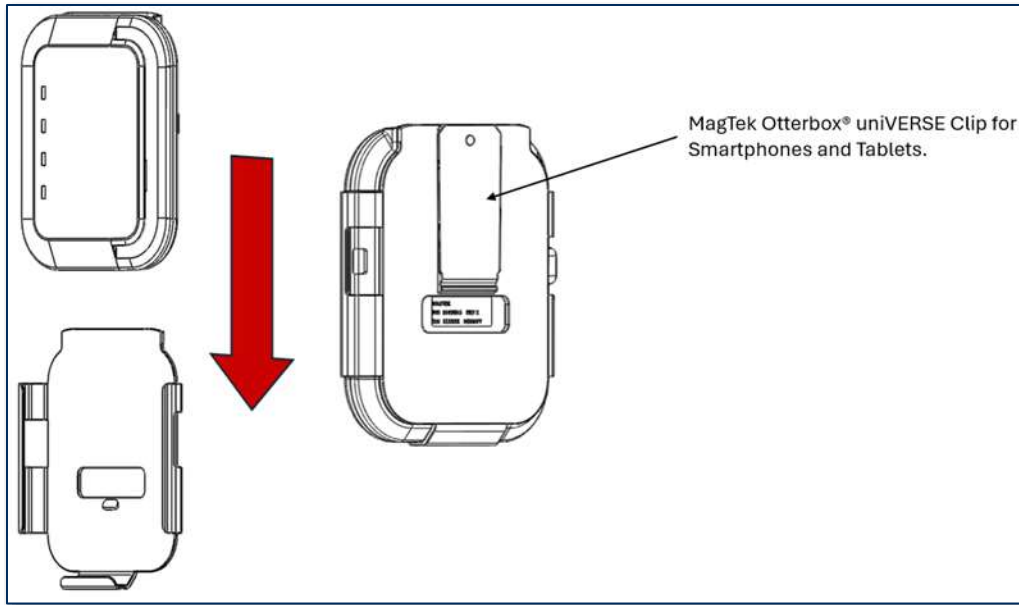
Figure 1-3 - MagTek Otterbox(R) uniVERSE Clip

1.9   About Terminology

In this document, tDynamo is referred to as the **device**. It is 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. 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 tDynamo solution requires some up-front planning and decision-making:

- Determine what type of **host** tDynamo will connect to. This can be a computer with a USB port or a host with Bluetooth 4.0 hardware that supports Bluetooth LE. When planning, include any additional support or devices required by the host, such as physical locations, mounting, and power connections.

- Determine what **software** will be installed on the host and how it will be configured. Software can include operating system, transaction processing software, security software, and so on. Include any additional support required by the software, such as network connections.

- Select which **connection type** the solution will use. tDynamo can connect physically via its USB-C connector or to the optional docking stand, or via Bluetooth LE. It connects logically as a vendor-defined HID device or GATT device, respectively. Be sure to specify the desired connection settings when ordering the device. If necessary, they can be reconfigured afterward.

- Determine how tDynamo should be **configured**, and specify that when you order devices. For example, although tDynamo comes with a factory default Bluetooth LE passkey, it is a good idea to choose and set non-default passkeys early in the planning process, or request non-default passkeys when ordering devices.

- Determine what the solution will use as a **primary power source**. tDynamo can be powered by a USB host through the USB-C connector or the optional docking stand, or can be powered by its internal rechargeable battery.

- Determine the **battery recharge schedule(s)**. For example, in high-traffic mission-critical solutions, it may be wise to keep spare devices configured and charged for fast swap-out.

- Determine how tDynamo will be physically **presented** to the cardholder. This includes whether the device will be handheld, permanently mounted to a countertop in the optional docking stand, or handheld and placed in the docking stand for easy charging. When planning placement, be sure to consider the connection type and power source. For example, if the primary data connection is USB, the mounting location should be within reasonable USB cabling distance from the host.

- Determine how tDynamo will be **branded**. In large quantities, MagTek can accommodate custom branding colors and trade dress. Contact a representative for details.

2   Installation

Installing tDynamo is a straightforward process: The acquirer configures the encryption keys and EMV terminal / payment brand settings before deployment. End users need only set up a host with appropriate software, configure the software, and connect the device to the host. This section provides general information about setting up solutions that incorporate tDynamo, including host software, connecting the device, and mounting the device.

2.1   About Host Software

In any solution, tDynamo is connected to a host, which must have software installed that knows how to communicate with the device, and which is capable of performing actions intended to be carried out when a cardholder swipes, inserts, or taps a payment method. To set up the host software to work with tDynamo, follow the installation and configuration instructions provided by the vendor of the host or the host software. For details about developing host software, see section **5 Developing Custom Software**.

Some connection types may also require installation of device drivers on the host. To set up any necessary drivers, see the connection-specific "How To" sections in section **2.2 Connecting to a Host**.

2.2   Connecting to a Host

2.2.1   About Connecting tDynamo to a Host

tDynamo can connect to a host via a variety of connections. Solution designs generally choose one connection type and do not switch between them, though the device does provide features that allow the host to actively manage its available connections and connection behaviors (see section **5 Developing Custom Software**). The following sections provide steps for connecting tDynamo to a host via each connection type.

2.2.2   How to Connect tDynamo to a Host via USB

tDynamo can connect to a USB host or charger either via its USB-C Connector or the optional docking stand. If the device is using USB as a power source but not as a host connection, also see the sections below about connecting the device using Bluetooth LE. If the device is connected to two USB connections at the same time, the docking stand connection takes precedence as a power source, and the device's configuration determines which connection it uses to send card swipe data.

To connect tDynamo to a host using the optional docking stand, see section **2.3 Mounting tDynamo**. To connect tDynamo to a host using the USB-C Connector, follow these steps:

1) Make sure tDynamo is configured to use the USB-C connector as its primary connection. If it is configured to use another connection, use that connection first to change the configuration.

2) Connect the small end of the USB cable to tDynamo's USB-C connector as shown in Error! R eference source not found..

3) Connect the large end of the USB cable to the host's USB port.

4) Power on the host.

5) On the host, install and configure the host software you intend to use with tDynamo (if you do not yet have that software, you can use *MTNETDemo.exe* included in *SOFTWARE, SDK, DYNAMAG / DYNAMAX / EDYNAMO / UDYNAMO / ADYNAMO / MDYNAMO / TDYNAMO / DYNAWAVE (WINDOWS .NET)*, available from MagTek.com, to perform simple tests):

   a) Make sure the host software is configured to look for the device on the right connection.

   b) Make sure the host software knows which device(s) it should interface with.

   c) Make sure the host software is configured to properly interpret incoming data from the device. For direct USB connections, tDynamo transmits data as a vendor-defined HID device.

6) Use the host software to connect to the device and to test swiping, inserting, and tapping a card (see section **3.5 Card Reading**).

Figure 2-1 - Connecting tDynamo to a Host via USB

2.2.3 How to Connect tDynamo to an iOS Host via Bluetooth LE

To connect tDynamo to an iOS host that supports Bluetooth LE, follow these steps:

1) Make sure tDynamo is configured to use Bluetooth LE as its primary connection. If it is configured to use another connection, use that connection first to change the configuration.

2) If any other Bluetooth LE host has an active data connection to the device, close the connection.

3) On the host, install and configure the host software you intend to use with tDynamo. If you do not yet have that software, you can download a test tool from the App Store called **MagTek Test**, published by **MagTek, Inc.**.

4) Make sure tDynamo is powered on, is not in sleep mode, and that its battery is adequately charged (see section **3.4.1 About Power** for instructions).

5) Press the pushbutton for 2 seconds until the General Status LED flashes three times, then release the pushbutton to enter Pairing Mode. The General Status LED flashes blue up to 2 minutes or until a host pairs or connects.

6) On the iOS host, launch the **Settings** app, select **Bluetooth**, and make sure the host's Bluetooth radio is turned **On**.

7) Use the host application or the **MagTek Test** app (not the device's **Settings** app) to pair with and connect to the device. If you are using the **MagTek Test** app, the steps are as follows. Other host software may be similar:

   a) Launch the host software app.

   b) Select **Bluetooth LE EMV** as the device type.

   c) Press the **Connect** button.
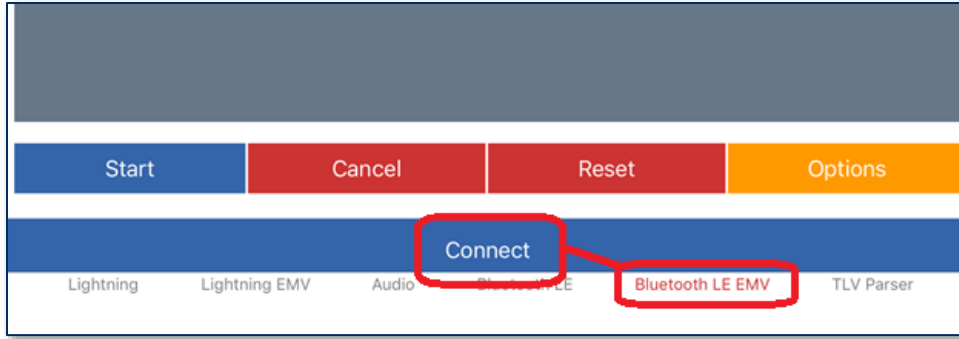
d) When the app prompts you to select a **Bluetooth LE EMV Type**, select **tDynamo**.

e) Locate the seven-digit serial number on the label on the back of the device.
f) In the list of pairable devices, select **tDynamo-xxxxxxx**, where **xxxxxxx** is the device's serial number.

8) When the host pops up a **Bluetooth Pairing Request** message asking for a code, enter the configured passkey (or the default **000000**).
9) The app reports the device is now **Connected**, and the device indicates it is in Connected mode (see section **3.2 About the Status LEDs**).

10) Use the host software or the **MagTek Test** app to test swiping, inserting, and tapping a card. For details about reading each payment type, see section **3.5 Card Reading**.

   a) Before testing a swipe, use the app to **Send** command **580101** to the device and receive response **0000** to enable the magnetic stripe read head. For convenience, the **MagTek Test** app provides an **MSR On** button that sends this command to the device with a single press.
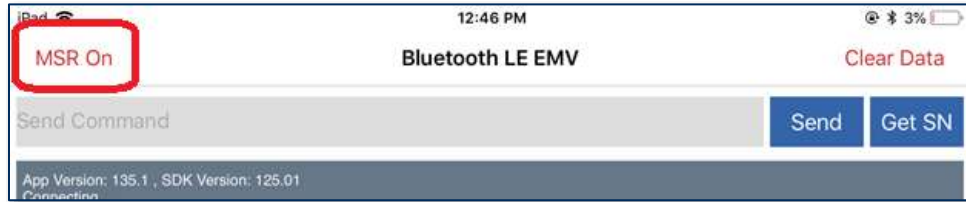
   b) After swipe testing, **Send** command **580100** to disable the magnetic stripe read head and conserve power.

11) Remember to change the default passkey. See the *tDynamo Programmer's Manual* documentation for details.

To unpair from the device, follow these steps:

1) On the iOS host, launch the **Settings** app and select **Bluetooth**.

2) Press the "i" information icon next to the device's name in the **MY DEVICES** list.

3) Select **Forget This Device** and make sure the device disappears from **MY DEVICES**.

2.2.4 How to Connect tDynamo to an Android Host via Bluetooth LE

To connect tDynamo to an Android host that supports Bluetooth LE:

1) Make sure tDynamo is configured to use Bluetooth LE as its primary connection. If it is configured to use another connection, use that connection first to change the configuration.

2) If any other Bluetooth LE host has an active data connection to the device, close the connection.

3) On the Android host, install and configure the host software you intend to use with tDynamo. If you do not yet have that software, you can download a test tool from the Google Play store called **MagTek Test**, published by **MagTek, Inc.**.

4) Make sure tDynamo is powered on, is not in sleep mode, and that its battery is adequately charged (see section **3.4.1 About Power** for instructions).

5) Press and hold the pushbutton for 2 seconds until the General Status LED flashes three times, then release the pushbutton to enter Pairing Mode. The General Status LED flashes blue up to 2 minutes or until a host pairs or connects.

6) On the Android host, launch the **Settings** application, and open the **Bluetooth** settings page or the **Connected Devices** > **Bluetooth** settings page.

7) Make sure the host has Bluetooth turned **On**.
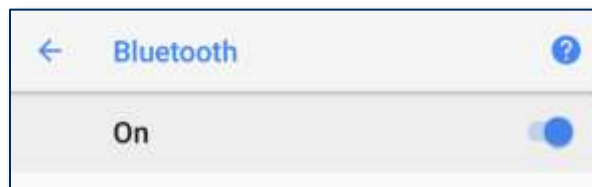
8) Press the **SEARCH FOR DEVICES** / **Scan** / **Pair new device** button to show an **Available devices** list.

9) Locate the seven-digit serial number on the label on the back of the device.

10) In the list of pairable devices, select the device called **tDynamo-xxxxxxx**, where **xxxxxxx** is the device's serial number.
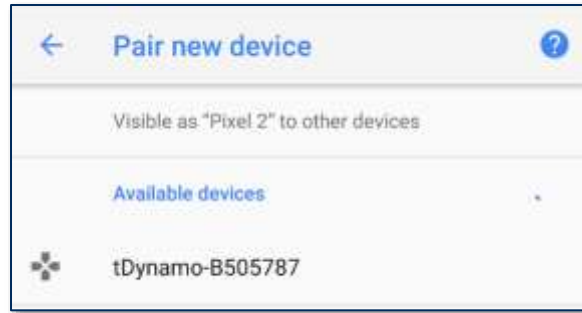
11) When the host asks for a passcode or PIN, enter tDynamo's configured passkey (or the default **000000**), then press the **OK** button. The device appears in the **Paired devices** list.
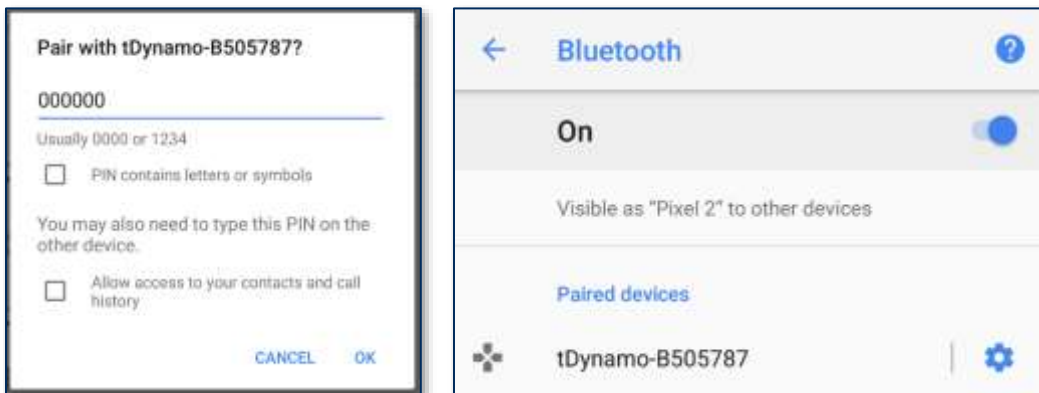
12) Use the host software or the **MagTek Test** app to connect to the device and to test swiping, inserting, and tapping a card. For details about reading each payment type, see section **3.5 Card Reading**.

   a) After connecting to the device, the app reports the device is now **Connected**, and the device indicates it is in Connected mode (see section **3.2 About the Status LEDs**).

   b) Before testing a swipe, use the app to **Send** command **580101** to the device and receive response **0000** to enable the magnetic stripe read head.

   c) After swipe testing, **Send** command **580100** to disable the magnetic stripe read head and conserve power.
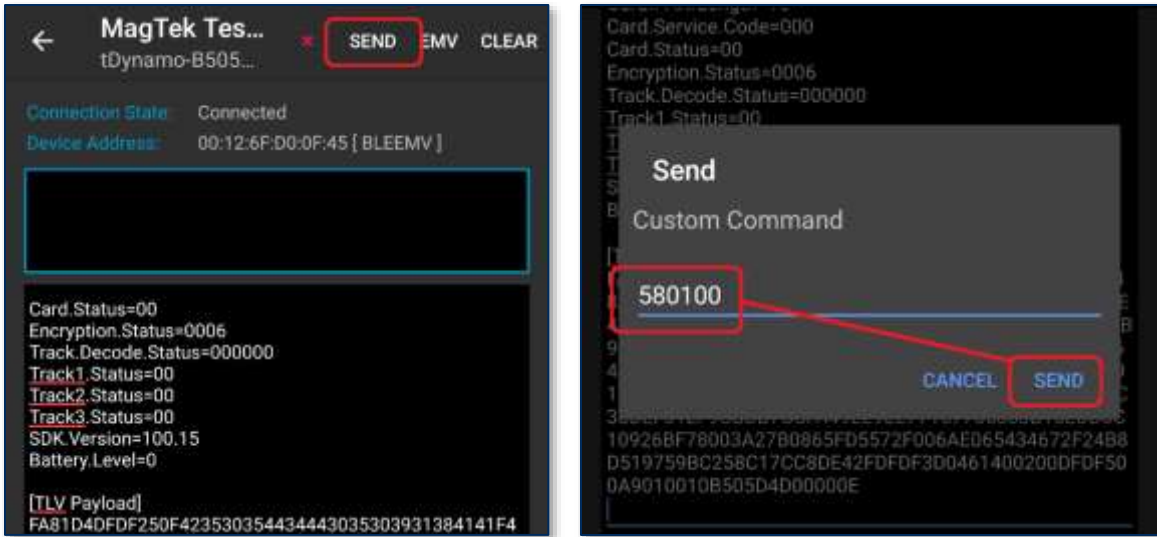
13) Remember to change the default passkey. See the *tDynamo Programmer's Manual* documents for details.

To unpair from the device, follow these steps:

1) Locate the device in the Android host's **Bluetooth** configuration page.
2) Press the settings (gear) icon.
3) Press the **Unpair** or **Forget** button and make sure the device disappears from the **Paired devices** list.

2.3   Mounting tDynamo

2.3.1   About Mounting

tDynamo's design provides two mount points: A **Lanyard Mount Point** and a **Locking Mount Point** (see section **1.8 About tDynamo Components**). The two mount points can be used in various combinations:

- The lanyard mount point can be used to hang the device for convenient storage and/or handling in handheld sales solutions.

- The locking mount point can be used with the optional docking stand (shown in **Figure 2-2**) mounted to a countertop for stability in stationary sales solutions.

- The locking mount point can also be used with custom brackets to mount to other devices or surfaces.

- The docking stand can also be used in unlocked mode, and optionally combined with the lanyard mount point, for quick grab-and-go and convenient drop-in charging between handheld sessions.

Figure 2-2 - tDynamo Installed On Optional Docking Stand

2.3.2 How to Mount the Docking Stand

To mount the docking stand to a countertop, follow these steps (see **Figure 2-3**):

1) Determine where the docking stand should be placed: Factors to consider include cable length, cardholder and operator ergonomics, and access for cleaning, maintenance, and repair.

   a) If the docking stand will be used for charging in handheld operations, unobstructed removal is also a consideration.

   b) If the device will be permanently docked for cardholder use, placing the stand so it hangs slightly over the edge of the countertop may provide the least obstructed swipe path.

2) Open the protective cap over the mounting hole on the base of the docking stand.

3) Place the docking stand at the desired location and mark the center of the mounting hole on the countertop, then set the docking stand aside.

4) Drill a ¼" hole all the way through the countertop.

5) Line up the hole in the stand over the hole in the countertop.

6) Thread the included bolt through docking stand's mounting hole and the countertop hole.

7) Fasten the included knob to the bolt and tighten it.

8) Replace the docking stand's protective cap.

9) Connect the docking stand's USB cable to the host.

Figure 2-3 - Optional Docking Stand Assembly

2.3.3 How to Temporarily Dock tDynamo

To temporarily dock the device in the docking stand for convenient charging, follow these steps:

1) If the docking stand will be mounted to a countertop, follow the steps in section **2.3.2 How to Mount the Docking Stand** to do that first.

2) Make sure the docking stand is connected to a USB power source.

3) Make sure the device's docking stand contacts are clean and unobstructed.

4) Place the device all the way into the docking stand. The device powers on automatically and begins charging.

2.3.4 How to Permanently Dock tDynamo

NOTICE
Do not leave the round key installed in the docking stand. The key is designed to be removed to deter unauthorized removal of the device.

To permanently attach the device to the docking stand, follow these steps:

1) Make sure tDynamo is configured to use the docking contacts as its primary connection. If it is configured to use another connection, use that connection first to change the configuration.

2) Follow the steps in section **2.3.3 How to Temporarily Dock tDynamo** to place the device on the docking stand.

3) Use the included round key to turn the locking screw on the back of the stand to lock the device in place.

4) Remove the key and set it aside for future use, such as for cleaning or servicing the device. It has a key ring / string hanger loop integrated into its handle for convenient storage.

5) Make sure the device is firmly locked into the stand.

3 Operation

3.1 About Operating Modes

During operation, tDynamo transitions between distinct modes, each of which implements different device behavior:

- **Reset Mode** occurs when the operator presses and the recessed reset switch or holds the pushbutton for 5 to 10 seconds. After resetting, the device progresses to Powered Off Mode. If the device is connected to USB power, it immediately progresses to Discoverable Mode.

- **Powered Off Mode** is the shipping mode of the device. The operator can power off by pressing and holding the pushbutton, and the device enters this mode automatically if it has been in Sleep Mode for a configurable timeout period. When powered off, the device consumes practically no power. To move the device from Powered Off Mode to Discoverable Mode, press the pushbutton briefly or connect the device to USB power.

- **Battery Status Mode** is a short mode that uses all four Status LEDs to report the current charge level of the device's rechargeable battery (see section **3.4.1 About Power**). The operator activates this mode by tapping the pushbutton briefly in Discoverable Mode or Connected Mode. The device automatically exits to the previous mode after a short period of time.

- **Discoverable Mode** is the device's normal waiting state. The operator activates this mode when the device is not connected to USB by briefly pressing the pushbutton once while in Powered Off Mode. In Discoverable mode, the device remains paired with any previously paired Bluetooth LE hosts, but is not connected to transmit data. Upon entering Discoverable Mode, the device advertises itself over Bluetooth LE, and any paired Bluetooth LE host may initiate a connection. To move the device from Discoverable Mode to Pairing Mode, press and hold the pushbutton for about two seconds until the General Status LED flashes, then release the pushbutton. If the device is not connected to USB power, it moves from Discoverable Mode to Sleep Mode automatically when its configurable timeout period has passed. If the device is configured to transmit data over USB and is connected to a USB host, it progresses from Discoverable Mode to Connected Mode when the host software establishes a USB connection.

- **Pairing Mode** is activated while the device is powered on by pressing the pushbutton for two seconds and waiting for the General Status LED to flash, then releasing the pushbutton. In this mode, an unpaired Bluetooth LE host may initiate pairing. Upon entering Pairing Mode, the device advertises over Bluetooth LE, and continues to be pairable until a Bluetooth LE host pairs with it or until a 2-minute timeout period expires. Upon successful pairing, the device enters Discoverable Mode.

- **Connected Mode** occurs when the host software establishes a connection either via Bluetooth LE or USB, generally in response to the host software's graphical user interface. In this mode, the host and the device can both initiate communication, and it is the Bluetooth LE host's responsibility to terminate the connection and return the device to Discoverable Mode to save power when an active data connection is no longer needed for the current transaction. If the device is not connected to USB power, it moves from Connected Mode to Sleep Mode automatically when its configurable Sleep Mode timeout period has passed. If the device is connected to a Bluetooth LE host, it does not advertise and is not discoverable by other Bluetooth LE hosts. If the device is connected to a USB host, it continues to advertise and is discoverable by Bluetooth LE hosts.

- **Sleep Mode** is a low-power standby state. The device enters this mode automatically when it is not connected to USB power and has been unused (no user input, no communication with the host) for a configurable timeout period. In this mode, the device turns off all wireless functions. To move the device from Sleep Mode to Discoverable Mode, press the pushbutton briefly or connect the device to USB power. The device moves from Sleep Mode to Powered Off Mode automatically when its configurable Power Off timeout period has passed.

3.2   About the Status LEDs

tDynamo's **General Status LED (LED 4)** and **Status LEDs 3, 2, and 1** provide feedback to the operator and cardholder about the internal state of the device (see section **1.8 About tDynamo Components**). **Table 3-1** shows how to interpret the colors and flashing patterns of the General Status LED.

Table 3-1 - tDynamo Status LED Meanings

Color	Flashing Pattern		Meaning
Off	Off		The device is powered off, or the battery is completely drained and needs to be recharged.
Green Amber Red	Flashing Periodically		The device flashes the General Status LED every 5 seconds when it is powered on and is in Connected mode, ready for the host to send it a command or for a cardholder to swipe a magnetic stripe card. The color indicates the battery charge level: • Green = Recharge if desired • Amber = Recharge soon • Red = Recharge immediately (device can not process transactions)
Green	LEDs 4, 3, 2, 1 Light **In Sequence**		The device has read a contactless tap, and the cardholder can safely remove the card or device from the contactless landing zone.
Green	LEDs 4, 3, 2, 1 Light **Simultaneously**		The device has just been powered on and is testing the four Status LEDs.
Green	LEDs 4, 3, 2, 1 Light **In Combination**		An operator has pressed the pushbutton briefly and the device is reporting battery charge level. See section **3.4.1 About Power**.
Green	Steady On		The General Status LED (LED 4) is lit green when the host has initiated an EMV transaction that allows the cardholder to present a contactless card or contactless device.
Blue	Solid On		The General Status LED (LED 4) is lit blue when the operator presses the pushbutton, to provide feedback that the pushbutton is working correctly.
Blue	Three Flashes		The operator has pressed the pushbutton for 2 seconds, and the device transitions to Pairing Mode if the operator releases the pushbutton.
Blue	Short Flashing		The device is in Pairing Mode, advertising, and ready for a Bluetooth LE host to initiate pairing.

Color	Flashing Pattern		Meaning
Red	Steady On		The device is in Sleep Mode. The General Status LED is solid red and LED 3 is solid green.
Red	Steady On		An operator is updating the firmware. On completion, the device resets and all LEDs turn off briefly.

3.3   About Sounds

tDynamo's beeper provides feedback to operators and cardholders about the internal state of the device:

- The device sounds one short beep on startup to test the beeper and indicate the device is powered on.
- The device sounds one short beep after it has successfully read a contactless tap, and the cardholder can safely remove the card or device from the contactless landing zone.
- The device sounds two beeps when an operator cancels a pending EMV transaction.
- The device sounds two short beeps when an operator successfully powers it off.

3.4   Power Management

3.4.1   About Power

This device incorporates a built-in Lithium-ion rechargeable battery, which requires very little maintenance. It is not subject to "charge memory" and therefore does not require deep discharge cycles to restore its charge capacity like many other battery technologies.

When properly powered through its USB connector or docking stand contacts, the device powers on automatically, recharges the battery, and remains powered on (see section **3.4.3 How to Charge the Battery**). While charging, the device consumes more power from the USB connection than when the battery is fully charged. The device stops charging the battery when it determines it is optimally full, to prevent overcharging.

If the device is not connected to USB power, or if the USB connection does not provide enough power, the device primarily powers itself using the rechargeable battery. In this case, after a configurable period of inactivity (no host commands and no user interaction), the device transitions to a low-power Sleep Mode, which it indicates by turning the General Status LED solid red and LED 3 solid green. After the device has been in Sleep Mode for a configurable period of continued inactivity, the device powers off completely and turns off all LEDs. The host can set the device's Sleep Mode and Power Off timeouts to values that are appropriate for the specific solution design. For details about developing host software to configure the device, see section **5 Developing Custom Software**. For details about the device's behavior in its various power modes, see section **3.1 About Operating Modes**. For instructions to check and recharge the battery, to power the device on and off, and to wake the device from Sleep Mode, see the following sections.

The device's rechargeable battery is designed to last hundreds of charging cycles, but with time and / or with use, its charge capacity will naturally degrade. To maintain the battery's charge capacity as much as possible, follow these guidelines:

- Do not discharge the battery to 0%. Full discharge shortens the battery life.

- When possible, plan to recharge the battery well before it is fully depleted.

- Store the device at the lowest reasonable temperatures within its specified storage temperature range (see **Appendix A Technical Specifications**; below 77°F / 25°C is optimal). Temperature is the most critical factor in extending battery life.

- Store the device with the battery charged to less than 100% (40% is optimal).

3.4.2 How to Check Battery Level
To check the battery charge level, make sure the device is powered on and awake, then briefly tap the pushbutton. The Status LEDs light to show the battery level as follows:

- **One** LED = Battery level is **under 50%**

- **Two** LEDs = Battery level is between **50% and 70%**

- **Three** LEDs = Battery level is between **70% and 90%**

- **Four** LEDs = Battery level is **above 90%**

Figure 3-1 - Status LEDs Showing Battery Level

When the device is in Connected mode (see section **3.1 About Operating Modes**), the General Status LED blinks periodically to indicate the device is ready for the host to send a command or for a cardholder to swipe a magnetic stripe card. The color of the blink indicates the battery level. See section **3.2 About the Status LEDs** for details.

Custom host software may also query the device and show its current charge level on the host display at all times for convenience. For details, see section **5 Developing Custom Software**.

3.4.3 How to Charge the Battery
tDynamo has an onboard rechargeable battery to supply its own power when it is not powered through its USB-C connector or docking stand connectors. The battery must be periodically recharged by connecting it to the optional docking stand, or to a USB port or stand-alone USB charger using a USB-C cable. Both the docking stand and the USB-C connector require a USB connection that can provide at least **500mA @ 5V**. A full recharge cycle for a completely drained battery takes approximately 4.5 hours.

To charge the device using a USB-C cable, connect it to a USB charger or to a USB host as shown in section **2.2.2 How to Connect tDynamo to a Host via USB**.

To charge the device in the docking stand, see section **2.3.3 How to Temporarily Dock tDynamo**.

When the battery charging behavior feature is turned on, do not use the long USB extension cable.

3.4.4 How to Power On / Wake Up from Sleep Mode / Power Off

If all LEDs are off, the device is in Powered Off mode. If the General Status LED is solid red and LED 3 is solid green, the device is in Sleep Mode. To power on the device or to wake it from Sleep Mode, tap the pushbutton. In response, the device lights all of the Status LEDs to perform a quick LED test, then transitions to either Discoverable Mode or Connected Mode. For details, see section **3.1 About Operating Modes** and section **3.2 About the Status LEDs**.

To power off the device, press and hold the pushbutton for 5 to 10 seconds until all LEDs turn off and the device beeps twice.

3.4.5 How to Force Reset

To force the device to reset, use a small tool such as a paperclip to carefully press the reset switch recessed inside the small hole on the back of the device (see Figure **1-1**).

3.5 Card Reading

3.5.1 About Reading Cards

The steps for starting a transaction and reading a card or contactless payment device are different depending on tDynamo's configuration and on the design of the host software. Host software developers should see section **5 Developing Custom Software** for implementation references. The solution developer should provide solution-specific instructions for operators to follow. A transaction generally follows this essential flow:

1) An advanced operator has already made sure tDynamo is configured properly and is connected to the host (see section **2.2 Connecting to a Host**). When the device is connected to the host via USB and powered by the USB-C connector or docking stand, the host software may always keep a connection open to the device. When connected to the host via Bluetooth LE, the device must already be paired with the host, and the host must be initiate a Bluetooth LE connection to process a transaction, then would generally disconnect after the transaction is complete to conserve power.

2) The operator makes sure tDynamo is receiving power either from its rechargeable battery or from one of the USB connections, and is awake and powered on (see section **3.4.4 How to Power On / Wake Up from Sleep Mode / Power Off** and section **3.2 About the Status LEDs**).

3) The operator uses the host user interface (for example, a point of sale) to finalize a transaction amount, then initiates a transaction.

4) The host communicates with the device, and reports to the operator when the device is ready.

5) The operator directs the cardholder in presenting payment.

6) The cardholder interacts with the device to present payment. The following sections provide additional details about presenting each of the available payment methods.

7) Because the device does not have its own display, the device may send messages to the host prompting the cardholder to perform certain actions; the host software should process these requests by displaying the requested messages, and depending on the placement of the host display(s), the operator may need to relay the messages to the cardholder. For example:

   a) If the device can not read the card, it may prompt the cardholder to swipe, insert, or tap again.

   b) If the device repeatedly can not read a chip card, it may revert to using the magnetic stripe reader instead of the chip card slot. This is known as **EMV fallback**.

8) The device reports the success or failure of the transaction to the host, which should report the results to the operator.

3.5.2   How to Swipe Magnetic Stripe Cards

Cardholders should swipe magnetic stripe cards in the MSR swipe path, indicated by the bidirectional MSR swipe symbol shown on the device's face. The magnetic stripe must face toward and into the device, as shown in **Figure 3-2**. Cardholders may swipe in either direction along the path.

Figure 3-2 - Swiping a Card Through tDynamo

3.5.3 How to Insert Contact Chip Cards

Cardholders should insert chip cards into the chip card slot, indicated by the chip card orientation symbol shown on the device's face. See **Figure 3-3**.

Figure 3-3 - Inserting a Chip Card Into tDynamo

3.5.4 How to Tap Contactless Cards / Devices

To tap a contactless card or electronic payment device, cardholders should do the following:

1) If the cardholder is using an electronic payment device, such as a smartphone, make sure the payment device has NFC turned On and has a payment app configured to process transactions. For details, see the documentation provided by the smartphone manufacturer and payment app publisher.

2) Wait until the device's General Status LED lights solid green, indicating it is ready for a tap.

3) Tap the card or electronic payment device on the contactless landing zone, indicated by the EMVCo Contactless Indicator symbol on the device's face (see **Figure 3-4**).

4) Wait for the four Status LEDs to light green and for the device to beep. Because each smartphone model may have its NFC antenna placed differently, the ideal tap position may vary by make and model. For example, Samsung users may need to center the phone on the contactless landing zone, while Apple users may need to tap the top of the phone on the contactless landing zone.

5) Remove the card or electronic payment device from the contactless landing zone.

Figure 3-4 - Tapping a Contactless Card or Smartphone On tDynamo

4 Maintenance

Periodic cleaning of tDynamo's exterior may be required. To clean the outside of tDynamo, wipe it down with a soft, damp, lint-free cloth and then wipe it dry.

MagTek's double-sided cleaning card *96700004* is designed to clean the magnetic read head in the MSR swipe path and the contact pins inside all chip card contact readers. Keeping both of these components clean is essential to the device's functioning. MagTek recommends swiping and inserting a cleaning card once per week to avoid card misreads.

⚠ CAUTION
To avoid damaging the read head, only clean the card path with approved cleaning cards. DO NOT use liquid cleaning products or insert any other objects into the device.

5   Developing Custom Software

Custom host software uses the same underlying device command set for all tDynamo connection types (USB or Bluetooth LE). The device commands are wrapped differently depending on the physical connection type and the device's configuration. The following sections provide high-level information about communicating with the device via the various physical connection types in various software development frameworks, and provide pointers to available SDKs, which include sample code. All product documentation and SDKs are available for download by searching for the product name on www.magtek.com and navigating to the **Support** tab.

5.1   USB-Based Custom Software

MagTek produces software development kits (SDKs) with API libraries that provide higher-level functions wrapped around **USB HID** communication protocols. These libraries simplify the development of custom host software that interfaces with tDynamo. See:

- *99510109 SOFTWARE, SDK, ADYNAMO, BULLET, DYNAMAG, DYNAMAX, DYNAWAVE, EDYNAMO, IDYNAMO 6, MDYNAMO, TDYNAMO, UDYNAMO (ANDROID)*

- *99510132 SOFTWARE, SDK, ADYNAMO, DYNAMAG, DYNAMAX, DYNAWAVE, EDYNAMO, IDYNAMO 6, MDYNAMO, TDYNAMO, UDYNAMO (WINDOWS .NET)*

- *99510133 SOFTWARE, SDK, DYNAMAG, DYNAMAX, DYNAWAVE, EDYNAMO, IDYNAMO 6, MDYNAMO, TDYNAMO (WINDOWS C++ / JAVA)*

In addition to MagTek's SDKs, custom software on any operating system can communicate directly with the device using the operating system's native USB libraries and protocols. For details, see *D998200226 TDYNAMO PROGRAMMER'S MANUAL (COMMANDS)*.

5.2   Bluetooth LE-based Custom Software and Apps

MagTek produces software development kits (SDKs) with API libraries that provide higher-level functions wrapped around **Bluetooth LE** communication protocols. These libraries simplify the development of custom host software that interfaces with tDynamo. See:

- *99510109 SOFTWARE, SDK, ADYNAMO, BULLET, DYNAMAG, DYNAMAX, DYNAWAVE, EDYNAMO, IDYNAMO 6, MDYNAMO, TDYNAMO, UDYNAMO (ANDROID)*

- *99510111 SOFTWARE, SDK, ADYNAMO, DYNAMAX, EDYNAMO, IDYNAMO, IDYNAMO 6, KDYNAMO, SDYNAMO, TDYNAMO, UDYNAMO (IOS)*.

In addition to MagTek's SDKs, custom software on any operating system can communicate directly with the device using the operating system's native Bluetooth LE libraries and protocols. For details, see *D998200226 TDYNAMO PROGRAMMER'S MANUAL (COMMANDS)*. In this case, the device acts as a server/peripheral, and the host acts as a client/central. The custom software wraps commands in simple Get/Set wrappers, and should use whatever Bluetooth LE library is appropriate for the chosen software development framework. For example, iOS custom apps use Apple's `CoreBluetooth` Framework, for which sample code is available in the form of Apple's Temperature Sensor app; see https://developer.apple.com/library/IOS/samplecode/TemperatureSensor/Introduction/Intro.html.

MagTek recommendation - When the customer app detects that the connection has dropped, the app should wait a minimum of 1 second before attempting to reconnect.

5.3   Bluetooth Firmware Update

After Bluetooth firmware has been updated, the user must forget the device from the available devices list on their iOS device, and pair with tDynamo again.

5.4   For More Information

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

Appendix A   Technical Specifications

tDynamo Technical Specifications	
Reference Standards and Certifications	
Identification Cards Financial Transaction Cards (ISO 7813) AAMVA EMV ICC Specifications for Payment Systems Ver 4.3, L1 Contact and L2 Contact Encryption: TDEA (3DES)-CBC using DUKPT FCC Title 47 Part 15 Class B CE Level B EMC UR/CUR UL Recognized California Proposition 65 (California) EU Directive Waste Electrical and Electronic Equipment (WEEE) EU Directive Restriction of Hazardous Substances (RoHS) Universal Serial Bus Specification 2.0, compatible with 1.1 TQM Label Certified	
Physical Characteristics	
Dimensions (L x W x H):	3.94 in. x 3.25 in. x 0.61 in. (100 mm x 82.5 mm x 15.5 mm)
Weight	Handheld: 3 oz (82 g) With docking stand: 10 oz (285 g)
Supported Mounting Options:	Handheld Lanyard Countertop with optional docking stand
Card Read Characteristics	
Magnetic Stripe Reader:	Bidirectional 3 track encrypting IntelliHead magnetic stripe reader (MSR) with MagnePrint
Magnetic Stripe Decoding:	Financial (ISO Type B), AAMVA, or Other ISO 7810, 7811
Acceptable Swipe Speeds:	4 inches per second to 60 inches per second
Chip Card Reader:	EMVCo L1 and L2 Contact Reader Terminal type 21 and 24 with ODA Terminal type 21 and 24 without ODA
Contactless Reader:	EMVCo L1 and L2 Contactless Reader D-PAS, MCL, payWave, ExpressPay, Apple Pay
User Interface Characteristics	
Status Indicators:	General Status LED (Red/Green/Blue/Amber) Contactless Status LEDs (Green)
Display Type:	Not Applicable
Display Size (viewable area):	Not Applicable
Display Resolution:	Not Applicable

tDynamo| Three-way Secure Card Reader Authenticator | Installation and Operation Manual

tDynamo Technical Specifications	
Keypad:	Not Applicable
Security Characteristics	
Ingress Protection:	Not Applicable
Tamper Protection:	Secure Cryptographic Device (SCD) with Tamper Resistant Security Module (TRSM).
Code Protection:	Signed firmware. Any attempt to install unsigned firmware on the device renders it unusable.
Eavesdrop Protection:	Tamper-evident enclosure around data signals
Electrical Characteristics	
Power Inputs:	USB-C connector Docking stand contacts
Battery Type:	Rechargeable Lithium Polymer (LiPo)
Battery Capacity:	760 mAH nominal
Battery Charge Time:	Approximately 4.5 hours to full charge
Battery Time, Powered Off:	Up to 2 years (time from 60% charge to 0% charge)
Battery Time, Idle:	Up to 10 hours
Battery Time, Sleep Mode:	Up to 60 hours / More than 2 days
Battery Time, Transactions:	Over an 8 hour shift, with all payment methods enabled per transaction, and a new battery fully charged: • Over 140 15-second transactions • Over 200 10-second transactions • Over 400 5-second transactions
Voltage Requirements:	5 VDC on USB power
Average Current Draw:	25 µA in Powered Off mode 13 mA in Sleep Mode 55 mA in Discoverable mode 110 mA in Connected mode during swipe or contact transaction 250 mA in Connected mode during contactless transaction 266 mA in Connected mode with swipe/contact/contactless enabled
Data Storage:	Not Applicable
Connection Characteristics	
Wired Connection Types:	USB-C high current, compatible with USB 2.0 Vendor-defined USB Human Interface Device (HID) data format
Wireless Connection Types:	Bluetooth Low Energy (Bluetooth LE) 4.2 GATT device / data format

tDynamo Technical Specifications	
Wireless Connection Frequency:	2.4 GHz
Software Characteristics	
Tested Operating System(s):	USB: Windows 7, Windows 8.1, Windows 10, Android 4.4.2 and above on devices with USB On-The-Go (OTG) support Bluetooth LE on hosts with Bluetooth 4.0 hardware only: iOS 9 and above, Android 5 and above
Environmental Tolerance	
Operating Temperature:	32°F to 113°F (0°C to 45°C)
Operating Relative Humidity:	10% to 90% without condensation
Storage Temperature:	32°F to 113°F (0°C to 45°C)
Storage Relative Humidity:	10% to 90% without condensation
Vibration Resistance:	Not Applicable
Shock Resistance:	No separation of covers or damage to internal components after six surface drops and four corner drops 3 feet onto concrete surface
Reliability	
Shelf Life:	Minimum 4 years
Magnetic Read Head Life:	100,000 card swipes
ICC Read Head Life:	100,000 card insertions
Battery Shelf Life:	Minimum 1 year for rechargeable battery
Battery Cycle Life:	2-3 years or 300 full discharge cycles, 500 cycles or more if device is not run to complete discharge

Appendix B   Optional Accessories

Tailored for use with mobile handsets, tablets, and desktop computers, tDynamo offers accessories designed to meet a wide range of operational needs.

Part Number	Description
21079820	TDYNAMO DOCKING STAND
21079855	TDYNAMO DOCKING STAND, BLACK
21079861	TDYNAMO (GEN II), ADAPTOR FOR OTTERBOX, MAGTEK

Appendix C   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 (562) 546-6800.

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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.

CANADIAN DECLARATION OF CONFORMITY

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 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 numérique de la classe B est conformé à la norme NMB-003 du Canada.

INDUSTRY CANADA (IC) RSS

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not cause interference, and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) L'appareil ne doit pas produire de brouillage, et (2) L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

CUR/UR

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

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.

EU STATEMENT

Hereby, MagTek Inc. declares that the radio equipment types **Wideband Transmission System** (802.11 wireless and Bluetooth® Low Energy), and **Non-Specific Short Range Device** (contactless) are in compliance with *Directive 2014/53/EU*. The full text of the EU declarations of conformity is available at the following internet addresses:

- https://www.magtek.com/Content/DocumentationFiles/D998200296.pdf

AUSTRALIA / NEW ZEALAND STATEMENT

Testing for compliance with AS/NZS standards was performed by a registered and accredited laboratory. The unit under test was found compliant with standards established under AS/NZS CISPR 32 (2013), AS/NZS 4268 Table 1, Row 59 DTS 2400-2483MHz SRD (802.11), and AS/NZS 4268 (2017) Table 1, Row 43 13.553-13.567MHz (contactless reader).

UL/CSA

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) Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU. The marking is clearly recognizable, either as written words like "Pb-free," "lead-free," or as another clear symbol (⊘).

PCI STATEMENT

PCI Security Standards Council, LLC ("PCI SSC") has approved this PIN Transaction Security Device to be in compliance with PCI SSC's PIN Security Requirements.

When granted, PCI SSC approval is provided by PCI SSC to ensure certain security and operational characteristics important to the achievement of PCI SSC's goals, but PCI SSC approval does not under any circumstances include any endorsement or warranty regarding the functionality, quality or performance of any particular product or service. PCI SSC does not warrant any products or services provided by third parties. PCI SSC approval does not under any circumstances include or imply any product warranties from PCI SSC, including, without limitation, any implied warranties of merchantability, fitness for purpose, or non-infringement, all of which are expressly disclaimed by PCI SSC. All rights and remedies regarding products and services which have received PCI SSC approval shall be provided by the party providing such products or services, and not by PCI SSC.

<div align="center">

SAFETY

</div>

This product has been tested to IEC 62368-1 -Audio/Video, information and communication technology equipment - Part 1: General Requirements and U.S. (UL 62368-1), Canadian, Australian & New Zealand National Deviations by an ISO 17025 Accredited Testing Laboratory.

This document is written specifically to work in conjunction with these safety and integrity features to protect the user and the device. It is very important to follow all steps in the product documentation carefully, in the order in which they are described, and at the recommended times. Failure to do so could result in personal injury, and / or cause damage to the device, and / or void the product warranty.

SAFETY REQUIREMENTS

⚠ CAUTION

Never do any of the following:

- DO NOT use a ground adapter plug to connect equipment to a power socket-outlet that lacks a ground connection terminal.

- DO NOT attempt any maintenance function that is not specifically described in this manual or in other ExpressCard 3000 instructional documents published by MagTek.

- DO NOT remove any of the covers or guards that are fastened with screws. There are no user-serviceable areas within these covers.

- DO NOT override or "cheat" electrical or mechanical interlock devices.

- DO NOT use EC3000 supplies or cleaning materials for other than their intended purposes.

- DO NOT operate the equipment if you or anyone else have noticed unusual noises or odors.

Consider the following before operating the ExpressCard 3000:

- Connect the EC3000 to a properly grounded AC power socket-outlet. If in doubt, have the socket-outlet checked by a qualified electrician. Improper connection of the device's grounding conductor creates a risk of electric shock.

- Place the EC3000 on a solid surface that can safely support the device's weight plus the weight of a person leaning against it (such as a service technician).

- Be careful when moving or relocating the device. Use proper lifting techniques.

- Use materials and supplies specifically designed for MagTek devices. Using unsuitable materials may result in poor performance, and in some cases may be hazardous.

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