



KVL 5000

User Guide

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Document History

Version	Description	Date
MN005113A01-A	Original release of the <i>KVL 5000 User Guide</i>	January 2019
MN005113A01-B	FIPS-related enhancements	April 2019
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MN005113A01-J	New section: Setting the KVL Screen Timeout on page 88 Minor update about USB use in Tactical OTAR Groups on page 130	March 2022
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About KVL 5000 User Guide

This manual provides step-by-step instructions for using the Key Variable Loader (KVL) to create and store encryption keys, and then load them into Motorola Solutions secure equipment.

The KVL can be used in ASTRO® 25 systems. Depending on the options ordered, the KVL can operate in ASTRO® 25, and/or Radio Authentication mode.

This manual is intended for use by experienced technicians familiar with similar types of equipment. Technicians should understand encryption concepts and be familiar with other types of Motorola Solutions encryption equipment.



WARNING: This equipment is compliant with Class A of EN55032. In a residential environment this equipment may cause radio interference.

Related Information

Related Information	Purpose
<i>Standards and Guidelines for Communication Sites</i>	Provides standards and guidelines that should be followed when setting up a Motorola Solutions communications site. Also known as R56 manual.
<i>Key Management Facility User Guide</i>	Provides descriptive and procedural information about the Key Management Facility (KMF) including a description of where the KMF can be found, a description of KMF encryption key management, as well as procedures on installation, configuration, operation, upgrade, troubleshooting, and FRU/FRE replacement.
<i>KVL 4000 Key Variable Loader ASTRO 25 User Guide</i>	Provides instructions for using the Key Variable Loader (KVL) to create and store encryption keys, and then load them into other Motorola Solutions secure equipment, such as radios, fixed encryption units and others, in ASTRO® 25 operating mode.
<i>KVL 5000 Quick Start Guide</i>	Provides basic information for the KVL 5000.

Chapter 1

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Chapter 2

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2.1

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Name	ntfs-3g
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Version 2.1, February 1999

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Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

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Modified	No

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Chapter 3

Commercial Warranty and Service Limited Warranty

I. WHAT THIS WARRANTY COVERS AND FOR HOW LONG

MOTOROLA SOLUTIONS, INC. (“MOTOROLA”) warrants the MOTOROLA manufactured Communication Products listed below (“Product”) against defects in material and workmanship under normal use and service for a period of time from the date of purchase as scheduled below:

KVL 5000 Key Variable Loader	One (1) Year
Product Accessories	One (1) Year

MOTOROLA, at its option, will at no charge either repair the Product (with new or reconditioned parts), replace it (with a new or reconditioned Product), or refund the purchase price of the Product during the warranty period provided it is returned in accordance with the terms of this warranty. Replaced parts or boards are warranted for the balance of the original applicable warranty period. All replaced parts of Product shall become the property of MOTOROLA.

This express limited warranty is extended by MOTOROLA to the original end user purchaser only and is not assignable or transferable to any other party. This is the complete warranty for the Product manufactured by MOTOROLA. MOTOROLA assumes no obligations or liability for additions or modifications to this warranty unless made in writing and signed by an officer of MOTOROLA. Unless made in a separate agreement between MOTOROLA and the original end user purchaser, MOTOROLA does not warrant the installation, maintenance or service of the Product.

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II. GENERAL PROVISIONS:

This warranty sets forth the full extent of MOTOROLA's responsibilities regarding the Product. Repair, replacement or refund of the purchase price, at MOTOROLA's option, is the exclusive remedy.

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SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION OR EXCLUSIONS MAY NOT APPLY.

This warranty gives specific legal rights, and there may be other rights which may vary from state to state.

IV. HOW TO GET WARRANTY SERVICE:

You must provide proof of purchase (bearing the date of purchase and Product item serial number) in order to receive warranty service and, also, deliver or send the Product item, transportation and insurance prepaid, to an authorized warranty service location. Warranty service will be provided by MOTOROLA through one of its authorized warranty service locations. If you first contact the company which sold you the Product (e.g., dealer or communication service provider), it can facilitate your obtaining warranty service. You can also call MOTOROLA at 1-800-927-2744 in the US/Canada.

V. WHAT THIS WARRANTY DOES NOT COVER:

- 1 Defects or damage resulting from use of the Product in other than its normal, customary or authorized manner.
- 2 Defects or damage from misuse, accident, water, neglect or act of God.
- 3 Defects or damage from improper testing, operation, maintenance, installation, alteration, modification, or adjustment not provided or authorized in writing by MOTOROLA.
- 4 Breakage or damage to antennas unless caused directly by defects in material workmanship.
- 5 A Product subjected to unauthorized Product modifications, disassembles or repairs (including, without limitation, the addition to the Product of non-MOTOROLA supplied equipment) which adversely affect performance of the Product or interfere with MOTOROLA's normal warranty inspection and testing of the Product to verify any warranty claim.
- 6 Product which has had the serial number removed or made illegible.
- 7 Rechargeable batteries if:
 - any of the seals on the battery enclosure of cells are broken or show evidence of tampering.
 - the damage or defect is caused by charging or using the battery in equipment or service other than the Product for which it is specified.
- 8 Freight costs to the repair depot.
- 9 A Product which, due to illegal or unauthorized alteration of the software/firmware in the Product, does not function in accordance with MOTOROLA's published specifications or the FCC type acceptance labeling in effect for the Product at the time the Product was initially distributed from MOTOROLA.
- 10 Scratches or other cosmetic damage to Product surfaces that does not affect the operation of the Product.
- 11 Normal and customary wear and tear.

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- 2 that MOTOROLA will have sole control of the defense of such suit and all negotiations for its settlement or compromise; and
- 3 should the Product or parts become, or in MOTOROLA's opinion be likely to become, the subject of a claim of infringement of a United States patent, that such purchaser will permit MOTOROLA, at its

option and expense, either to procure for such purchaser the right to continue using the Product or parts or to replace or modify the same so that it becomes non-infringing or to grant such purchaser a credit for the Product or parts as depreciated and accept its return. The depreciation will be an equal amount per year over the lifetime of the Product or parts as established by MOTOROLA.

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VII. GOVERNING LAW:

This Warranty is governed by the laws of the State of Illinois, U.S.A.

SERVICE

Proper repair and maintenance procedures will assure efficient operation and long life for this product. A Motorola maintenance agreement will provide expert service to keep this and all other communication equipment in perfect operating condition. A nationwide service organization is provided by Motorola to support maintenance services. Through its maintenance and installation program, Motorola makes available the finest service to those desiring reliable, continuous communications on a contract basis. For a contract service agreement, please contact your nearest Motorola service or sales representative, or an authorized Motorola dealer.

Repair Service Advantage (RSA) Service Agreements is a post-warranty service offering that provides for the repair of this product. The service agreement is renewable annually for as long as Motorola supports the equipment. For more information about RSA Service Agreements, contact the Motorola Radio Support Center at 800-247-2346 or your Customer Support Manager.

Chapter 4

KVL 5000 Description






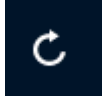


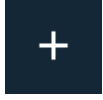
This chapter provides a general overview of KVL 5000 user interface and features.


4.1

KVL 5000 User Interface

KVL 5000 uses a touch screen. You push buttons, select items and enter data using your finger. The KVL uses on-screen keyboard to enter data (such as key names or passwords). To enlarge the on-screen keyboard, rotate the KVL horizontally. See [Enabling and Disabling KVL Screen Rotation on page 89](#)

Table 1: KVL 5000 Buttons

User Interface Button	Action
	See additional options for the current menu
	Accept the changes you made
	Cancel
	Go back to the previous menu
	Load/share keys
	Retry operation
	Delete item/items
	Sort items
	Add a VPN connection

User Interface Button	Action
	Edit a VPN connection

Using Keyboard with KVL 5000

Instead of on-screen keyboard, you can use micro USB micro keyboard or USB keyboard with USB micro adapter to enter data.

If you plug in the keyboard, the on-screen keyboard is disabled.

4.2

KVL 5000 Ports and Hardware Buttons

Figure 1: KVL 5000 Ports and Hardware Buttons

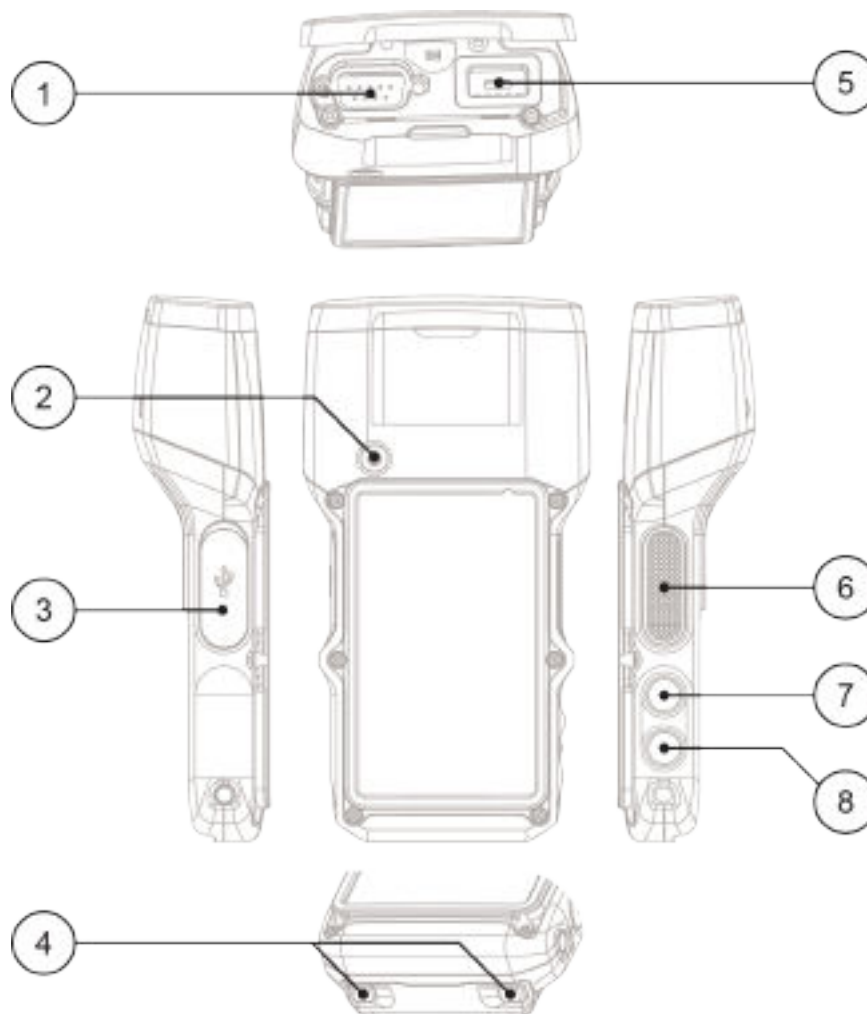


Table 2: KVL 5000 Ports and Hardware Buttons

Number	Item	Description
1	DB9 Port	Connect the Key Variable Loader (KVL) directly to Key Management Facility (KMF).
2	Power button	Push and hold the button for 3 seconds to turn the KVL on/off. Push it briefly to turn the screen on/off.
3	Rubber cover/ micro USB port	Open the cover to access micro USB port. Micro USB port is used for: <ul style="list-style-type: none">• Charging the KVL• Connecting to KMF• Connecting to a PC• Connecting to target device
4	Battery release buttons	Push both buttons to remove the KVL battery
5	Key load port	Connect the KVL to target devices or to another KVL
6	Push to Load (PTL) button	Press briefly to perform the last key loading operation for a connected radio. If KVL display is turned off: Turn on the display Press and hold the button for 5 seconds to provision a connected radio with autogenerated Radio Authentication key.
7	Go to Main Menu button	Instantly go back to main menu. If KVL display is turned off: Press briefly to turn on the display
8	System Reset button	Press and hold the button for 5 seconds to perform a system reset. (You are prompted to confirm your choice.) If KVL display is turned off: Press briefly to turn on the display

4.3

KVL 5000 Main Features

- Manual and automatic generation of encryption keys
- Password protection (Administrator and Operator security levels)
- Secure storage of encryption keys
- Configuration of system- and user-specific settings
- Support of the KVL and Crypto Module upgrades
- Key Management Support for 9.6 kbps Secure APCO Project 25
- Support of the following encryption standards:
 - FIPS 140-2
 - FIPS 197
- Loading keys through micro USB, DB9 (RS-232), and key load ports
- Support of modem connectivity
- Sharing encryption keys between two KVLs
- Maintenance of log records of KVL activities
- Exporting keys and/or key groups to an .xml file and transferring them to a target device
- Transferring keys from a Key Management Facility (KMF) using the Store and Forward feature
- Wirelessly managing TEK for a small group of radios, with one radio serving as an RF modem using Tactical OTAR feature
- Provisioning radio authentication keys into a target radio and transferring radio-key pairs to the Authentication Center (AuC)
- Keyset changeover on a target radio
- Support of the following encryption algorithms in any combination:

Table 3: Supported Algorithms

Algorithm	ASTRO 25	KMF in ASTRO 25	Radio Authentication
DES-XL	✓	✓	✗
DES-OFB	✓	✓	✗
DVI-XL (requires a System Key)	✓	✓	✗
DVP-XL	✓	✓	✗
CFX-256 (requires a System Key)	✓	✓	✗
AES-128	✗	✗	✓
AES-256	✓	✓	✗

Algorithm	ASTRO 25	KMF in ASTRO 25	Radio Authentication
ADP	✓	✗	✗



NOTE: ADP does not support the following features related to OTAR:

- Store & Forward
- KEK Key loading
- Tactical OTAR

Chapter 5

Launching KVL for the First Time

When you launch the Key Variable Loader (KVL) for the first time, you need to configure passwords and set time and date.

Procedure:

- 1 Turn on the KVL by pressing the KVL power button for a few seconds.
- 2 Read the contents of the logon banner and tap **OK**.
- 3 Read the contents of the **EULA** screen and tap **Accept**.
If you decline, the KVL will switch off.
- 4 When prompted to set the date and time, make appropriate selections in the **Date**, **Time** and **Time zone** fields and tap **OK**.
You can change those settings later.
- 5 On the **Define passwords** screen, set passwords for both Operator and Administrator:
 - a Tap **Administrator**.
 - b In the **New password** field, enter the new password.
 - c In the **Repeat password** field, repeat the password.
If the passwords match, and meet the necessary requirements, **OK** button appears at the bottom of the screen.
 - d Tap **OK**.
 - e Perform the same actions for **Operator**.
 - f After you set both Operator and Administrator passwords, tap **OK**.
KVL Logon screen appears.

Chapter 6

KVL 5000 Initial Configuration

Before using your Key Variable Loader (KVL) to enter and load encryption keys, set several parameters that determine how the KVL operates.



CAUTION:

Maintain the values of Master Key and System Key and store them in a secure location.

Maintain Master Key (or Keys) for each KMF that the KVL communicates with.

Only one algorithm at a time can use the system key (either DVI-XL or CFX-256).

6.1

Turning KVL 5000 On and Off

Pushing the power button for a few seconds turns the KVL on or off. Pushing it briefly only turns the display on or off.

Procedure:

- 1 Press the Key Variable Loader (KVL) power button for a few seconds.
- 2 If you have the logon banner turned on, tap **OK** when the logon banner appears.
- 3 On the **Login** screen, perform the following actions:
 - a Tap **Account** and select the user role: **Operator** or **Administrator**.
Operator does not have access to all KVL functionalities.
 - b In the **Password** field, enter the password for the user.
 - c Tap **Login**.
The KVL main menu appears. If you enter an incorrect password, a warning appears. By default, you can attempt to enter a password maximum 3 times before KVL gets locked out. You can change the number of maximum attempts and the result (lockout or system reset). See [Setting Password Security Options on page 77](#).
- 4 To turn the KVL off, press the power button for a few seconds.
The KVL vibrates and turns off.

6.2

Setting Password Security Options

You can set a maximum number of unsuccessful password attempts and define an action (account lockout or system reset) to be performed when you exceed this number. This applies to any situation when you enter a password.

Procedure:

- 1 Launch the KVL as Administrator.
- 2 From the KVL main menu, go to **Settings**→**Security**→**Passwords**→**Passwords options**.
- 3 Tap **Administrator** or **Operator** depending on the user type you want to configure security settings for.

- a** In the **Action** field, choose what happens when the user exceeds the number of unsuccessful password attempts:

If you want the KVL to lock out the account, choose **Lockout**.

If you want the KVL to perform a system reset, choose **System Reset**.

Resetting causes the KVL to erase the UKEKs, all stored keys, key groups, log records, and passwords, and reset the configuration settings to the factory defaults.

- b** From the **Max tries** list, choose the maximum number of unsuccessful login attempts after which the lockout or system reset is performed.

The default number is 3.



- c** To return to the main password options screen, tap

- 4** If you set KVL to lock out, from the **Lockout time** list, choose the duration of the lockout.
The lockout duration applies for both Administrator and Operator. The default is 15 minutes.

6.3

Password Management

You cannot access KVL 5000 without logging on using a password.

The Key Variable Loader (KVL) provides two levels of security access:

- *Administrator*
- *Operator*

6.3.1

Changing the Password

After passwords for both the Administrator and Operator.

Procedure:

- 1** Launch KVL as an Administrator or Operator, depending on which password you want to manage.

The Administrator can manage both the Administrator and Operator password.

The Operator can only manage the Operator password.



NOTE: If the Operator password type is set to **PIN**, you can only change the Operator password to PIN of the same length as the current PIN. See [Changing the Operator Password Type on page 78](#)

- 2** On the KVL main menu, perform one of the following actions:
- For Administrator account, go to **Settings**→**Security**→**Passwords**→**Update passwords**.
 - For Operator account, go to **Settings**→**Security**→**Update password**.
- 3** To change the password, enter you current password in the **Current password** field.
- 4** In the **New password** entry field, enter the new password of your choice.

- 5 In the **Repeat password** entry field, enter the new password again.



If the passwords match, and meet the necessary requirements, a button appears in the upper-right corner of the screen.



- 6 Tap .

If an Operator forgets the Operator password, the Administrator can assign a new Operator password.

6.3.2

Changing the Operator Password Type

You can set the Operator password type to strong password or PIN.
You cannot change the password type for Administrator.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**Security**→**Passwords**→**Password options**→**Operator**.
- 3 Tap **Operator password type**.

- 4 Choose the password type.

The available values are **Strong password** and **PIN**

You cannot select **PIN** if Federal Information Processing Standard (FIPS) is set to **Legacy level 3 (High)**. See [Changing the FIPS Mode on page 90](#)

- 5 In the **Administrator password** field, enter the Administrator password.
- 6 In the **New password** field, enter the new password or PIN.

A PIN must contain 5 to 10 digits. It cannot consist of:

- Identical digits (like 11111)
- Consecutive numbers (like 12345)
- Arithmetic sequence (like 13579 or 02468)

If you choose PIN, you are not able to change FIPS mode to level 3.

A strong password must contain between 15 and 30 characters, including at least one special character, one numeric character, and one uppercase character. The following special characters are acceptable: ! " # \$ % & ' () * + , - . / : ; < = > ? @ [\] ^ _ ` { | } ~

- 7 In the **Repeat password** field, repeat the new password or PIN.



If the passwords match, and meet the necessary requirements, a button appears in the upper-right corner of the screen.



- 8 Tap .

The Operator password type is changed.

Once you change the Operator password type to PIN, you will only be able to change it to a different PIN when logged as an Operator. The new PIN must be the same length as the original one.

6.3.3

Changing the FIPS Mode



CAUTION: Changing the FIPS mode erases all keys, passwords, Store and Forward messages, target devices to update, and sets the System Key to its default value.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings→Security→FIPS→FIPS mode**.
The list of available values appears, with the currently selected value highlighted.
- 3 Select the preferred value.

The available values are:

- **Legacy level 3 (High)**
- **Level 2 (Standard)**

FIPS Legacy Level 3 mode is the same functionality that was used in the KVL 4000 under FIPS level 3 mode. It is not certified, but it was validated to work the same as on 4000.

- 4 When prompted, confirm your choice by entering the Administrator password.



NOTE: Setting FIPS Level 3 has the following effects:

- The following features are disabled:
 - Key Sharing
 - Radio Authentication
 - USB key loading
 - Key file export
- Password masking mode is changed to **All characters masked** and cannot be changed.
- You cannot preview a key value while entering a key (**Show** button does not appear).
- You cannot set the Operator password to PIN.

- 5 Set new passwords for Operator and Administrator.

FIPS mode is changed. You are moved to **FIPS mode** screen.

6.3.4

Setting Password Security Options

You can set a maximum number of unsuccessful password attempts and define an action (account lockout or system reset) to be performed when you exceed this number. This applies to any situation when you enter a password.

Procedure:

- 1 Launch the KVL as Administrator.
- 2 From the KVL main menu, go to **Settings→Security→Passwords→Passwords options**.
- 3 Tap **Administrator** or **Operator** depending on the user type you want to configure security settings for.

- a** In the **Action** field, choose what happens when the user exceeds the number of unsuccessful password attempts:

If you want the KVL to lock out the account, choose **Lockout**.

If you want the KVL to perform a system reset, choose **System Reset**.

Resetting causes the KVL to erase the UKEKs, all stored keys, key groups, log records, and passwords, and reset the configuration settings to the factory defaults.

- b** From the **Max tries** list, choose the maximum number of unsuccessful login attempts after which the lockout or system reset is performed.

The default number is 3.



- c** To return to the main password options screen, tap

- 4** If you set KVL to lock out, from the **Lockout time** list, choose the duration of the lockout.

The lockout duration applies for both Administrator and Operator. The default is 15 minutes.

6.3.5

Changing the Operator Password Type

You can set the Operator password type to strong password or PIN.

You cannot change the password type for Administrator.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**Security**→**Passwords**→**Password options**→**Operator**.
- 3 Tap **Operator password type**.
- 4 Choose the password type.

The available values are **Strong password** and **PIN**

You cannot select **PIN** if Federal Information Processing Standard (FIPS) is set to **Legacy level 3 (High)**. See [Changing the FIPS Mode on page 90](#)

- 5 In the **Administrator password** field, enter the Administrator password.
- 6 In the **New password** field, enter the new password or PIN.

A PIN must contain 5 to 10 digits. It cannot consist of:

- Identical digits (like 11111)
- Consecutive numbers (like 12345)
- Arithmetic sequence (like 13579 or 02468)

If you choose PIN, you are not able to change FIPS mode to level 3.

A strong password must contain between 15 and 30 characters, including at least one special character, one numeric character, and one uppercase character. The following special characters are acceptable: ! " # \$ % & ' () * + , - . / : ; < = > ? @ [\] ^ _ ` { | } ~

- 7 In the **Repeat password** field, repeat the new password or PIN.



If the passwords match, and meet the necessary requirements, a button appears in the upper-right corner of the screen.

8 Tap



The Operator password type is changed.

Once you change the Operator password type to PIN, you will only be able to change it to a different PIN when logged as an Operator. The new PIN must be the same length as the original one.

6.3.6

Setting the KVL Password Masking Mode

Procedure:

- 1 Launch the KVL as Administrator.
- 2 From the KVL main menu, go to **Settings**→**Security**.
- 3 Tap **Masking Mode**.

The current masking mode is displayed.

The available options are:

- **All characters masked**
- **Last character unmasked**: the last character remains unmasked until the user types a new character or taps outside the entry field.

6.4

Granting Additional Operator Permissions

Procedure:

- 1 From the KVL main menu, go to **Settings**→**Security**→**Operator permissions**.

- 2 Select Operator permissions (policies) and tap



The following policies are available:

- **Keys and groups**
- **OTAR groups**
- **AuC**
- **KMF**
- **Control head**

If you do not enable **Keys and Groups**, the Operator will not be able to create keys even if you enable other policies. The Operator will still be able to create UKEs, but only if KMF or AuC settings are enabled for them.

6.5

Switching Between KVL Operator and Administrator Account

You can quickly switch between account types (Administrator or Operator) by logging off the current account.

The Administrator has access to all functions and features. Initially, The Operator does **not** have access to the following functions and features. It is possible to grant Operator additional permissions.

- Upgrading Crypto Module of the KVL and radio
- Adding, deleting, and editing keys and groups of keys
- Adding, deleting, and editing Tactical OTAR groups (ASTRO® 25 systems only)
- Changing SEK and KEK, entering and changing Message Number Period (MNP) for Remote Control Head Operations
- Entering and changing KVL Radio Set Identifier (RSI)
- Setting and changing the KVL inactivity timeout
- Changing Federal Information Processing Standard (FIPS) mode
- Changing the System Key
- Changing the Sharing mode
- Changing the Administrator password
- Changing the certain KMF parameters: port value, IP address, phone number
- Entering and changing KMF RSI
- Entering and changing KMF Message Number Period (MNP)
- Changing UKEK for KMF operation
- Setting Radio Authentication parameters
- Clearing the list of received jobs
- Clearing audit log records
- Setting password security options

Procedure:

- 1 From the KVL main menu, tap **Logout**.
- 2 When prompted, confirm your choice.
You are informed about successful logout.
- 3 On the **Login** screen, perform the following actions:
 - a Tap **Account** and select the user role: **Operator** or **Administrator**.
Operator does not have access to all KVL functionalities.
 - b In the **Password** field, enter the password for the user.
 - c Tap **Login**.

6.6

Checking KVL Battery Status

Procedure:

- 1 To see the battery status, go to main menu. You can quickly go to main menu using the hardware button (middle small button on the right side of the KVL).
Battery status is displayed in the upper-right corner of the main menu.
- 2 Alternatively, go to **Settings**→**General**→**Hardware**→**Device**.

6.7

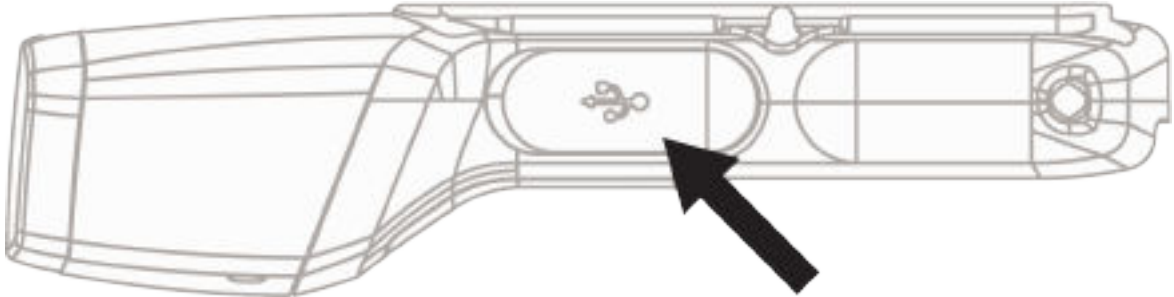
Charging the KVL 5000

Prerequisites: Obtain the KVL charging cable.

Procedure:

- 1 Open the rubber cap on the left side of the KVL.

Figure 2: KVL Rubber Cap



- 2 Connect the charger to the AC power source.
- 3 Connect the micro USB end of the charger to the KVL.

The KVL starts charging. A lightning bolt symbol appears next to the battery icon on the main menu.

6.8

Connecting Two KVL Units

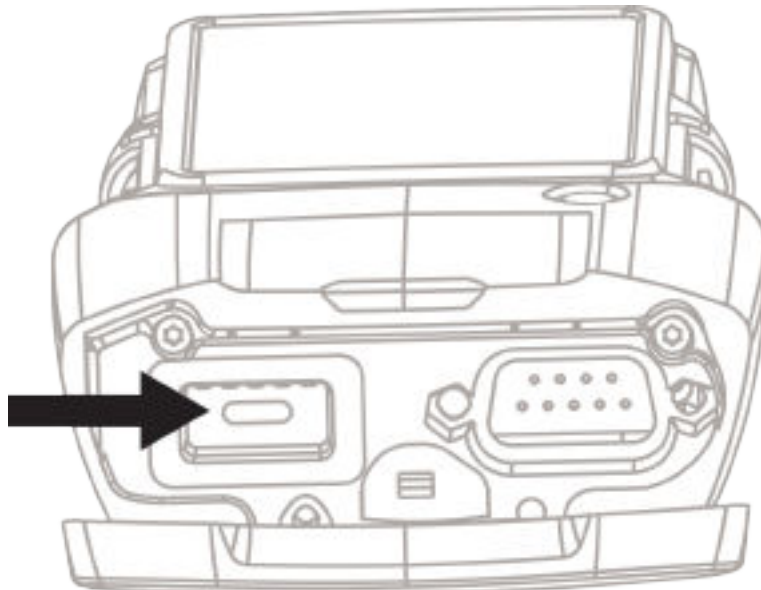
Prerequisites:

Obtain the KVL to KVL cable (TKN8209).

Procedure:

Connect two KVLs through their key load ports.

Figure 3: KVL 5000 Key Load Port



KVL 5000 is compatible with the previous models of the KVL.

6.9

Connecting KVL to a Target Radio for End to End Key Loading

Prerequisites:

For target radios using the DB9 Port, obtain an appropriate data cable, and a DB9 Gender Changer.

For target radios that support only USB key loading:

- Ensure that USB key loading is enabled and the UDP port number is set correctly. See [Managing USB Key Loading Settings on page 106](#)
- Obtain Micro USB adapter

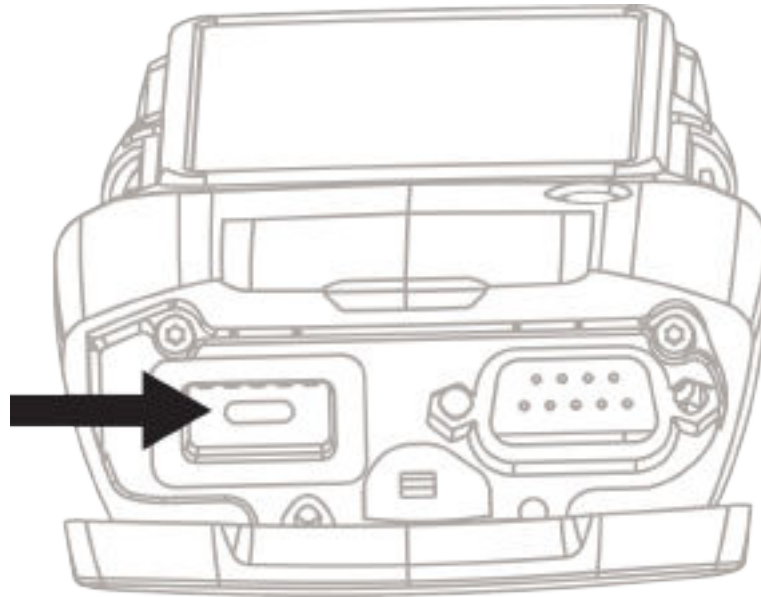
For information on appropriate device cables, see [KVL 5000 Orderable Parts on page 170](#)

Procedure:

Connect the target device to the Key Variable Loader (KVL) using an appropriate key load cable.

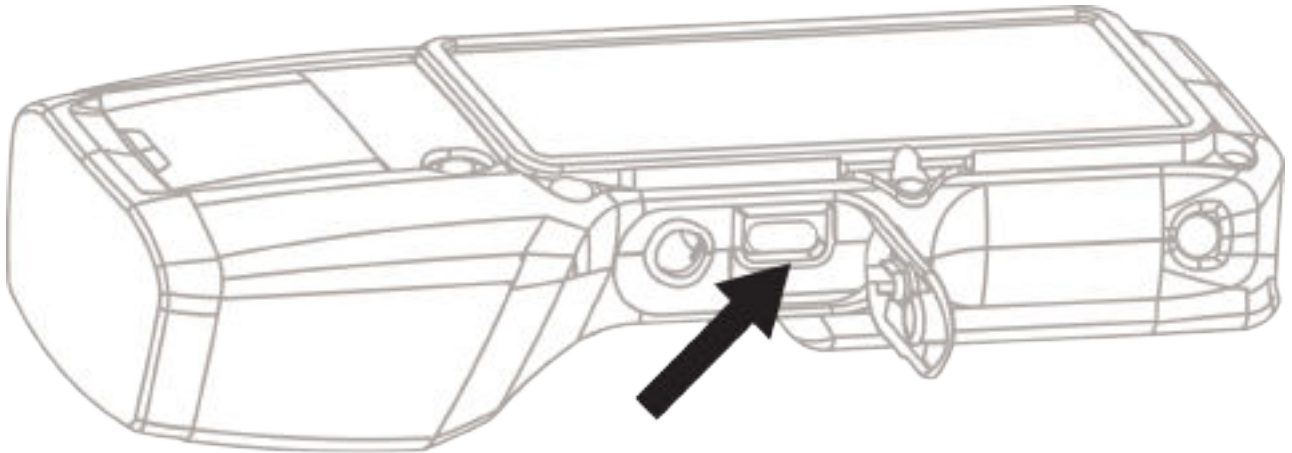
- Connect the KVL to the radio through the key load port.

Figure 4: KVL 5000 Key Load Port



- For target radio that supports only USB key loading, connect the KVL to the radio through the micro USB adapter

Figure 5: KVL Micro USB Port



6.10

Connecting KVL to a Target Radio for Provisioning with Radio Authentication Key

Prerequisites:

For target radios using the DB9 Port, obtain an appropriate data cable, and a DB9 Gender Changer.

For target radios that support only USB key loading:

- Ensure that USB key loading is enabled and the UDP port number is set correctly. See [Managing USB Key Loading Settings on page 106](#)
- Obtain Micro USB adapter

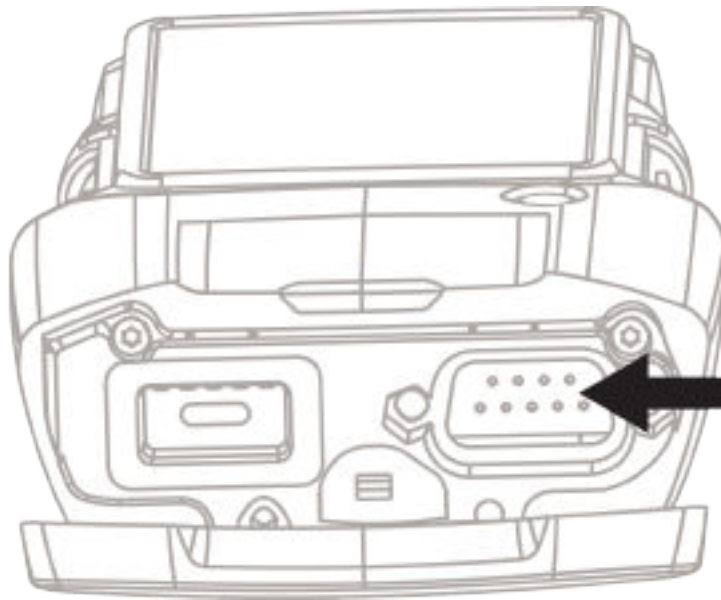
For information on appropriate device cables, see [KVL 5000 Orderable Parts on page 170](#).

Procedure:

Choose how you connect the KVL to the target device:

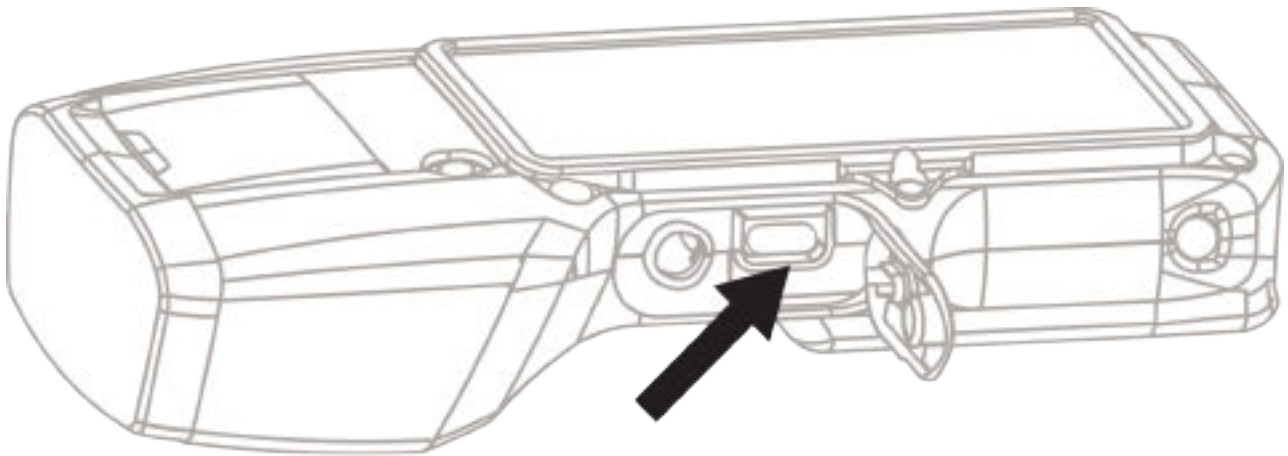
- For target radio using the DB9 Port, connect the KVL and the target radio using the DB9 Port, an appropriate data cable, and a DB9 Gender Changer.

Figure 6: KVL DB9 Port



- For target radio that supports only USB key loading, connect the KVL to the radio through the micro USB adapter

Figure 7: KVL Micro USB Port



6.11

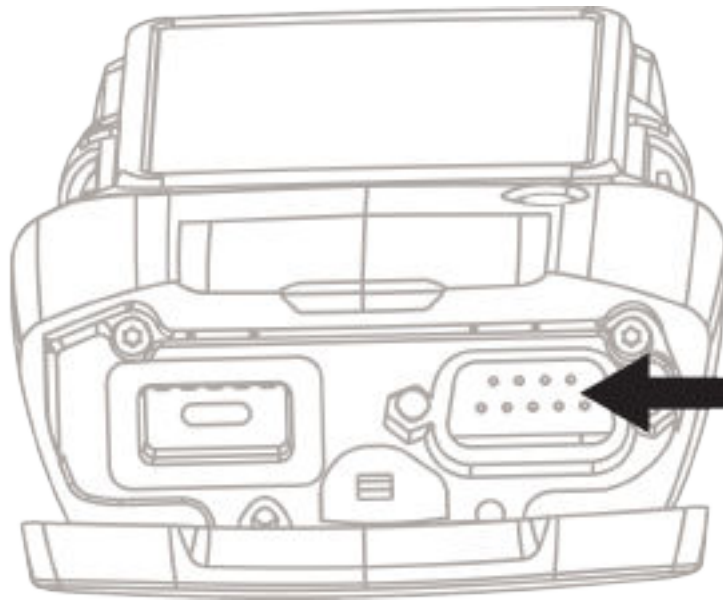
Connecting KVL to a Radio for Tactical OTAR and Control Head Key Loading

For information on appropriate device cables, see [KVL 5000 Orderable Parts on page 170](#).

Procedure:

Connect the KVL and the target radio (or Control Head) using the DB9 Port, an appropriate data cable, and a DB9 Gender Changer.

Figure 8: KVL DB9 Port



6.12

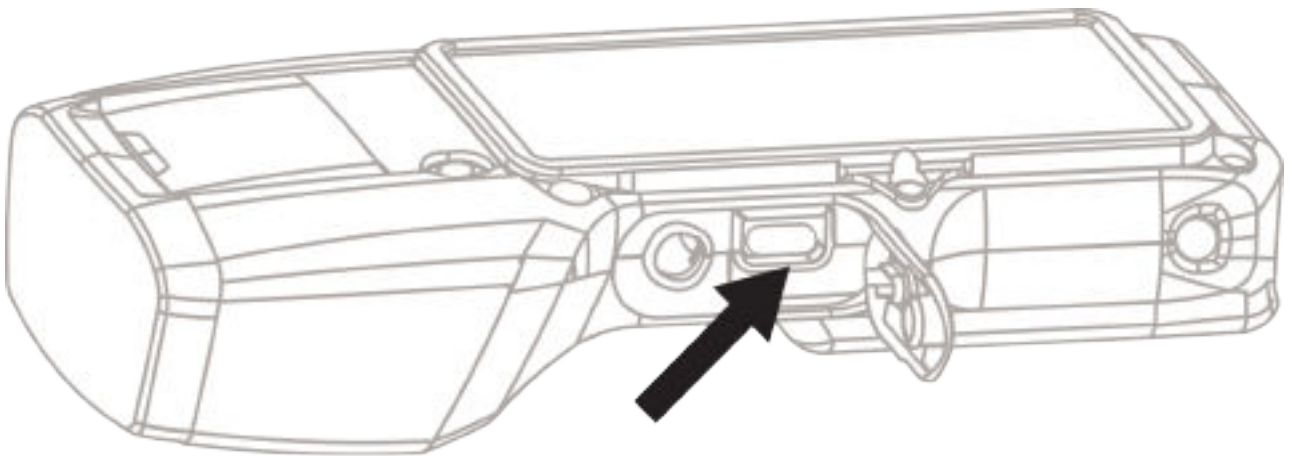
Connecting KVL to a PC

You need to connect the Key Variable Loader (KVL) to a PC to transfer files to or from the KVL. For information on appropriate device cables, see [KVL 5000 Orderable Parts on page 170](#).

Procedure:

Connect the KVL to a PC using micro USB cable

Figure 9: KVL Micro USB Port



6.13

Connecting the KVL to the KMF Using Direct Connection

Prerequisites:

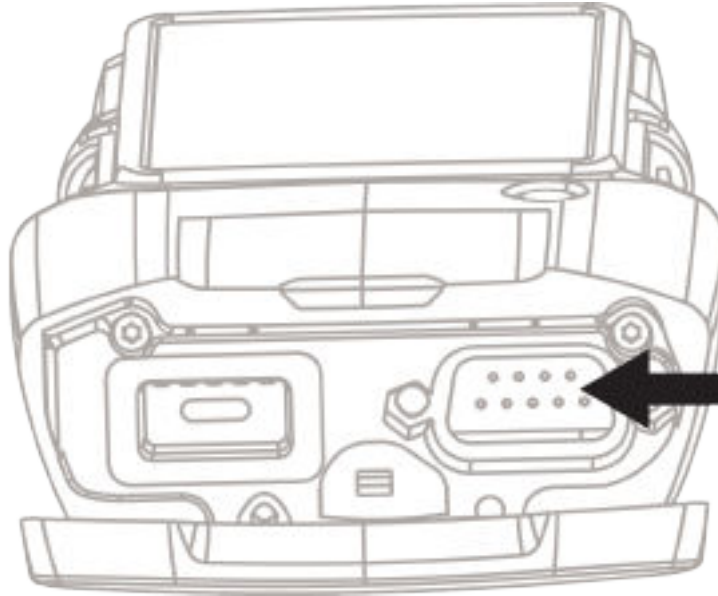
- Obtain the Null Modem Cable.
- Ensure that the KVL is charged.

For information on appropriate device cables, see [KVL 5000 Orderable Parts on page 170](#).

Procedure:

Connect the KVL to the KMF through the DB9 Port (RS-232) using a Null Modem Cable.
Depending on the cable type, you may need to use a DB9 Gender Changer.

Figure 10: KVL DB9 Port



6.14

Connecting the KVL to the KMF or AuC Using Network Connection

Prerequisites:

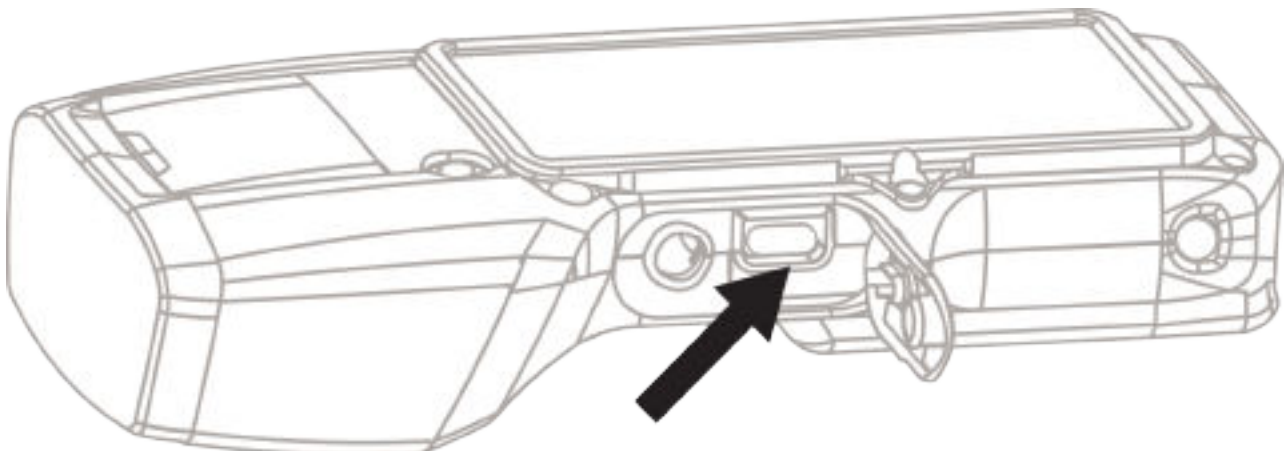
- Obtain the micro USB to Ethernet Adapter by Portsmith Technologies.
- Ensure that the KVL is charged.

For information on appropriate device cables, see [KVL 5000 Orderable Parts on page 170](#).

Procedure:

- 1 Connect the micro USB to Ethernet Adapter to the micro USB Port on the KVL.

Figure 11: KVL Micro USB Port



- 2 Connect the network cable into network port of Ethernet Adapter.

6.15

Connecting the KVL to the KMF Using USB Modem

Prerequisites:

Obtain:

- Micro USB adapter
- USB modem

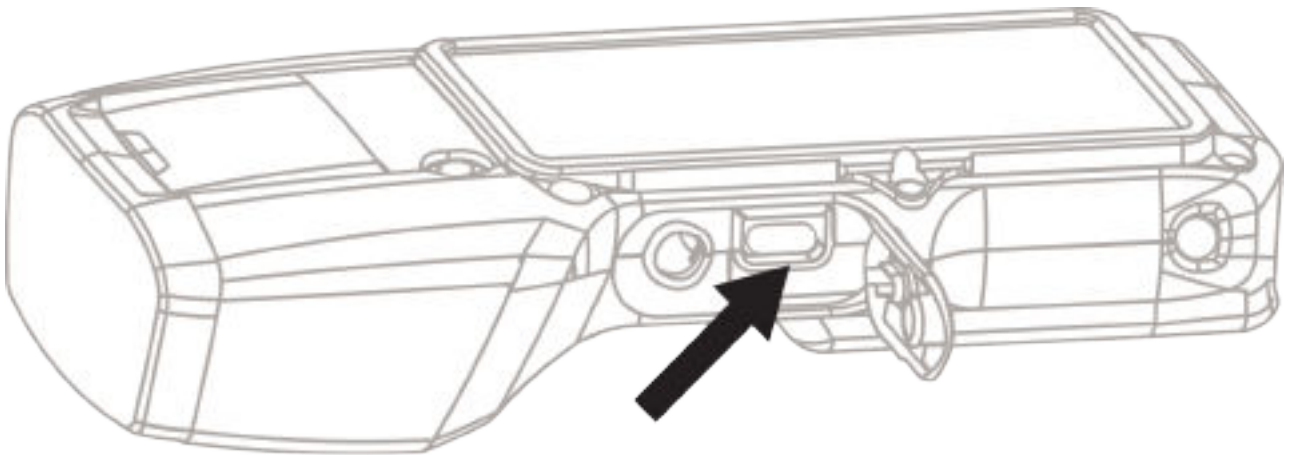
Ensure that the KVL is charged.

For information on appropriate device cables, see [KVL 5000 Orderable Parts on page 170](#).

Procedure:

- 1 Connect the KVL to the USB modem via the micro USB adapter.

Figure 12: KVL Micro USB Port



- 2 Connect the USB modem to the telephone line.

6.16

Connecting the KVL to the CRYPTR micro

Prerequisites:

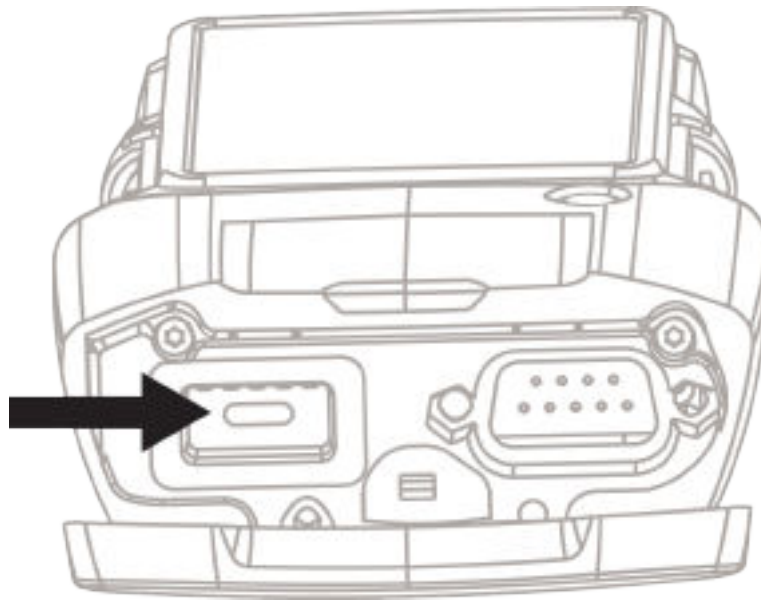
Obtain the CRYPTR micro key load cable.

For information on appropriate device cables, see [KVL 5000 Orderable Parts on page 170](#).

Procedure:

- 1 Connect the CRYPTR micro key load cable to the key load port on the KVL.

Figure 13: KVL 5000 Key Load Port



KVL 5000 is compatible with the previous models of the KVL.

- 2 Insert the CRYPTR micro into the SD Slot of the cable.

6.17

KVL User Preference Parameters

Setting the user preference parameters is not required for KVL operation, but allows you to customize certain functions to suit your individual needs.

6.17.1

Setting the KVL Turn Off Time

To avoid unnecessary battery drain, you can set the inactivity time after which the KVL turns off. The default is five minutes. The KVL emits a sound 30 seconds before turning off.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**Security**→**Inactivity timeout**.
- 3 Enter the preferred value.
Maximum duration is 30 minutes.

- 4 Tap .

6.17.2

Setting the KVL Screen Timeout

You can set the inactivity time after which the KVL screen turns off. Longer timer impacts the battery life. To turn on the display, press any button on the KVL.

Procedure:

- 1 From the KVL main menu, go to **Settings→General→Hardware→Device→Screen timeout**
- 2 Enter the preferred value.

The default is one minute.

Maximum duration is 29 minutes (inactivity timeout minus one minute). If inactivity timeout is lowered to a lower value than screen timeout, the screen timeout is adjusted automatically.



- 3 Tap

6.17.3

Setting the KVL Screen Color Scheme

You can set the KVL screen to one of the two color schemes: Day Time or Night Time. These schemes define the text and background colors of the KVL screen. By default, the KVL screen is set to the Day Time scheme.

Procedure:

On the KVL main screen, select **Settings→General→Color scheme**.

6.17.4

Enabling and Disabling KVL Screen Rotation

You can enable or disable the KVL auto rotation. When enabled, the screen adjusts when you rotate the KVL horizontally.

Procedure:

- 1 From the main menu, go to **Settings→General→Hardware→Device**.
- 2 Tap **Auto rotation**.

The current setting is displayed.

6.17.5

Managing the Logon Banner

Procedure:

- 1 From the KVL main menu, go to **Settings→Security→Logon banner**.
- 2 To enable/disable the logon banner, tap **Logon banner**.
- 3 To modify the existing logon banner, tap the text field and modify the text.



To clear the text, tap → **Clear text**.



- 4 To restore the default logon banner, tap → **Restore default**.



- 5 To save changes, tap


6.17.6

Changing the Main Menu Banner

You can change the text displayed in the upper-left corner of the main menu.

Procedure:

- 1 From the KVL main menu, go to **Setting**→**General**→**Main menu banner**.
- 2 Enter the desired main menu banner.

- 3 To restore the default main menu banner, tap →**Restore default**.

- 4 Tap 

6.18

KVL System-Dependent Parameters

Depending on the KVL operating mode, you can set various system-dependent parameters on your KVL.

6.18.1

Checking FIPS Status

You can check if your KVL is compliant with Federal Information Processing Standard (FIPS). Setting Level 3 FIPS mode (as shown in [Changing the FIPS Mode on page 90](#)) may not be enough to make your KVL compliant with FIPS. The possible reasons are:

- Algorithms not approved by FIPS. See [Removing Algorithms from the KVL on page 156](#)
- Operator password set as PIN. See [Changing the Operator Password Type on page 78](#)

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**Security**→**FIPS**→**FIPS status**.

6.18.2

Changing the FIPS Mode



CAUTION: Changing the FIPS mode erases all keys, passwords, Store and Forward messages, target devices to update, and sets the System Key to its default value.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**Security**→**FIPS**→**FIPS mode**.
The list of available values appears, with the currently selected value highlighted.
- 3 Select the preferred value.
The available values are:
 - **Legacy level 3 (High)**
 - **Level 2 (Standard)**

FIPS Legacy Level 3 mode is the same functionality that was used in the KVL 4000 under FIPS level 3 mode. It is not certified, but it was validated to work the same as on 4000.

- 4 When prompted, confirm your choice by entering the Administrator password.



NOTE: Setting FIPS Level 3 has the following effects:

- The following features are disabled:
 - Key Sharing
 - Radio Authentication
 - USB key loading
 - Key file export
- Password masking mode is changed to **All characters masked** and cannot be changed.
- You cannot preview a key value while entering a key (**Show** button does not appear).
- You cannot set the Operator password to PIN.

- 5 Set new passwords for Operator and Administrator.

FIPS mode is changed. You are moved to **FIPS mode** screen.

6.18.3

Turning Sharing On/Off

In addition to loading keys into target devices, the KVL can also share its keys with another KVL. In order to share keys, the sharing feature must be turned on in both the source and target KVL.



NOTE: Sharing is not available with FIPS Legacy level 3 mode.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**Security**→**Sharing**.
The chosen current sharing setting is displayed.

6.18.4

Enabling/Disabling Key File Export

With your KVL, you can export keys and/or key groups to an `.xml` file and then transfer the key file to a target device configured with software-based key storage.



NOTE: Key file export is not available with FIPS Legacy level 3 mode.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**Key File Export**.
The chosen current sharing setting is displayed.

6.18.5

Managing USB Key Loading Settings

USB Key loading is disabled by default. If you want to load keys to a radio that supports USB key loading only, you need to enable USB key loading on the KVL and enter the UDP port number.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**USB key loading**
- 3 Perform one of the following actions:

If...	Then...
If you want to enable USB key loading,	<ol style="list-style-type: none"> a Tap Radio over USB. b Tap Enabled.
If you want to enter the UDP port for loading End to End Encryption keys,	<ol style="list-style-type: none"> a Tap E2EE UDP port. b Enter the same port number as the one set on the target radio.
If you want to enter the UDP port for Radio Authentication for loading End to End Encryption keys,	<ol style="list-style-type: none"> a Tap Radio Auth UDP port. b Enter the same port number as the one set on the target radio.

6.18.6

Managing System Key

DVI-XL and CFX-256 algorithms require a System Key to be set up properly.



CAUTION:

Maintain the values of Master Key and System Key and store them in a secure location.




Maintain Master Key (or Keys) for each KMF that the KVL communicates with.

Only one algorithm at a time can use the system key (either DVI-XL or CFX-256).

Procedure:

- 1 Log on to the KVL as an Administrator.
- 2 From the KVL main menu, select **Settings**→**Security**→**System Key**.
- 3 Perform one of the following actions:

If...	Then...
If you want to use the default system key,	Select Use default . This option is selected by default.
If you want to enter a custom system key,	Perform the following actions: <ol style="list-style-type: none"> a Select Custom key. b Tap Enter key... and enter the key value. If you want to clear the Enter key... field, tap Clear.





If...	Then...
	<p>If you want to generate a key automatically, tap Auto (not available for CFX algorithm).</p> <p>If you want to preview the whole key value, tap Show.</p> <p>Show button is disabled when Federal Information Processing Standard (FIPS) is set to FIPS legacy level 3. See Changing the FIPS Mode on page 90</p> <p> NOTE: Changing the System Key removes all keys associated with it.</p> <p></p> <p>c Save changes by tapping .</p>

6.18.7

Editing Modem Connection String

Procedure:

- 1 From the KVL main menu go to **Settings**→**General**→**Hardware**→**Modem**.
- 2 Tap the modem for which you want to edit the connection string.
Motorola Solutions supports two types of modems: MultiTech and USRobotics.
- 3 Perform one of the following actions:

If...	Then...
If you want to edit the connection string,	<p>tap the field with the connection string and enter the desired value. There are maximum 100 characters, excluding spaces.</p> <p>You can quickly clear the field by tapping  → Clear.</p>
If you want to import a value from a <code>txt</code> file,	<p>perform the following actions:</p> <p>a Connect the KVL to the PC. See Connecting KVL to a PC on page 85</p> <p>b Make sure that the <code>txt</code> file with the connection string is in the following location: <code>This PC\kvl5000\Internal shared storage\settings</code></p> <p></p> <p>c Tap  → Import from file</p>
If you want to restore the default connection string value,	<p>a Tap  → Reset to default</p>

- 4 Tap  to save.

6.18.8

Configuring the KVL Log

KVL Log stores detailed records of events regarding KVL operation, such as information about errors and warnings. KVL Logs are useful when you want to troubleshoot KVL with the assistance of Motorola Solutions technicians.

You can view log files on a PC.

You can either save KVL logs locally on your KVL memory, or send them to a PC.

Procedure:

- 1 From the KVL main menu, go to **Settings**→**General**→**KVL Log**.
- 2 Select **Log to file**.
- 3 Choose what kind of events are logged by tapping **Logging level** and selecting an item from the list.

The events on the list are sorted from the most severe to the least severe. When you choose a type of event, all more severe events will be logged as well.

For example, if you choose **Warnings**, then **Fatal errors**, **Errors**, and **Warnings** will be logged.


See the following table for more information on the event types:

Table 4: KVL Log Events Description

Event Type	Description
Fatal errors	Errors that cause the KVL to stop working correctly
Errors	Errors that do not stop the KVL from running
Warnings	Potentially harmful events
Infos	General informational messages about KVL operation
Debugs	Detailed information about events that are helpful while debugging the KVL
Traces	The lowest severity level of events. All events are logged

- 4 Tap **Max files size (MB)** and enter the maximum amount of KVL memory you want to use for KVL logs.

If you exceed the maximum size, the logs will be overwritten, starting with the oldest.

- 5 To restore the default settings, tap →**Restore default**.
- KVL logs are disabled by default.

6.19

KVL VPN Settings

The Key Variable Loader (KVL) can use a trusted Virtual Private Network (VPN) of your organization to communicate with Key Management Facility (KMF) or Authentication Center (AuC).

6.19.1

Configuring a VPN Connection

Perform this procedure to add a new VPN connection or edit an existing one.

Procedure:

- 1 From the KVL main menu, go to **Settings**→**General**→**Hardware**→**VPN**.
- 2 Perform one of the following actions:

- To add a new VPN connection, tap



- To edit an existing VPN connection, tap



- 3 In the **Edit VPN Profile** window, fill in the fields according to the requirements of your organization.





When choosing a protocol type, you may need to scroll to see all available options.


The number of fields in the **Edit VPN Profile** window is determined by selected type of protocol.



For the description of the fields, see the following table:

Table 5: KVL 5000 VPN Fields

Field	Description
Name	Profile name
Type	VPN profile type. Choosing the type brings up additional fields (described below). Available types: <ul style="list-style-type: none"> • IPsec PSK • IPsec XAuth PSK • PPTP • L2PT/IPsec PSK
Server address	DNS Name or IP address of the VPN server
DNS search domains	List of the domain names (separated by a single space) used to create a fully qualified domain name (FQDN) from a relative name during DNS address resolution. Domains are searched in the order entered here and the search stops when a valid name is found. Example: If DNS search domain list contains entries: <code>internal.domain.com</code>

Field	Description
	<p>domain.com domain.org, the name server is resolved as:</p> <ul style="list-style-type: none"> • server • server.internal.domain.com • server.domain.com • server.domain.org <p> NOTE: This setting can override configuration sent by the VPN server.</p>
DNS servers	<p>List of IP addresses of the DNS servers used after establishing the VPN tunnel, separated by a single space.</p> <p> NOTE: This setting can override configuration sent by the VPN server.</p>
Forwarding routes	<p>List of routes (separated by a single space) which are only forwarded through VPN tunnel (Split Tunneling). Packets that do not mach these criteria are sent through Ethernet interface. If the field is not defined, the whole traffic is sent through VPN tunnel.</p> <p>Example: If forwarding routes list contains entries: 10.0.0.0/24 192.168.0.0/16, then packets addressed to 10.0.0.6 are routed through VPN tunnel, but packets to 10.0.1.6 are routed though default gateway (Ethernet interface).</p> <p> NOTE: This setting can override configuration sent by the VPN server.</p>
IPSec specific fields	
IPSec identifier	<p>Optional identifier related with the VPN profile on server or KVL device.</p> <p> NOTE: When IPSec identifier is defined, the VPN client uses the Aggressive Mode in the Phase1</p>
IPSec identifier type	<p>Type of IPSec identifier entered in the IPSec identifier field.</p> <p>Possible values:</p> <p>Auto</p> <p>Identifier type is determined based on identifier value:</p> <ul style="list-style-type: none"> • Default identifier type is Key ID

Field	Description
	<ul style="list-style-type: none"> If identifier contains a dot (.) then type is set to <code>FQDN</code> If identifier contains @ then type is set to <code>User FQDN</code> <p>FQDN Fully Qualified Domain Name</p> <p>User FQDN User Fully Qualified Domain Name</p> <p>Key ID Key Identifier</p>
IPSec pre-shared key	Pre-shared key (PSK) used for establishing Phase1.
IKE Aggressive Mode	<p>Uses the Aggressive instead of Main Mode in Phase1</p> <p> NOTE: When IPSec identifier is defined, the VPN client uses the Aggressive Mode regardless of this setting.</p>
IKE Diffie-Hellman group	<p>Diffie-Hellman group used in all proposals offered in Phase1. Available values:</p> <ul style="list-style-type: none"> DH Group 1 (768 bit) DH Group 2 (1024 bit) DH Group 5 (1536 bit) DH Group 14 (2048 bit) DH Group 15 (3072 bit) DH Group 16 (4096 bit) DH Group 17 (6144 bit) DH Group 18 (8192 bit)
Perfect Forward Secrecy	<p>Enables Perfect Forward Secrecy (PFS) and configures Diffie-Hellman group used for periodically exchanging new keys in Phase2. Available values:</p> <ul style="list-style-type: none"> PFS Disabled DH Group 1 (768 bit) DH Group 2 (1024 bit) DH Group 5 (1536 bit) DH Group 14 (2048 bit) DH Group 15 (3072 bit) DH Group 16 (4096 bit) DH Group 17 (6144 bit) DH Group 18 (8192 bit)

Field	Description
Phase1 key lifetime	Lifetime (in seconds) of a key used in Phase1. Minimum: 120s. Default: 28800s (8 hours)
Phase2 key lifetime	Lifetime (in seconds) of a key used in Phase2. Minimum: 120s. Default: 28800s (8 hours)
Internal address assignment	<p>Configures how IP address is assigned to the Tunnel Interface. Available values:</p> <ul style="list-style-type: none"> • Manual Internal address and the netmask is set from the Internal address field. • IKE Mode Config VPN client sends IKE Mode Config request and expects to receive internal address and the netmask from the VPN server. • Clone external IP An equivalent of the Local IP address mode available on KVL 4000. In this mode Tunnel Interface uses same IP as assigned to the external (Ethernet) network interface. <p> NOTE: Some Cisco and Juniper equipment (for example SRX 345) performs Mode Config PUSH (configuration is sent as an unsolicited message) which is not supported with KVL releases prior to R01.06.x.</p> <p> NOTE: Manual or Clone external IP configuration may be overridden by IKE Mode Config message pushed by the VPN server</p>
Internal address	<p>IP address and netmask of the Tunnel network Interface created after establishing the VPN session.</p> <p>This field is visible only when Internal address assignment is set to Manual.</p> <p>If not defined, the default address 1.0.0.1/32 is used.</p>
L2PT specific fields:	
L2PT secret	Shared secret used to authenticate L2TP tunnel. This secret is not used in most cases because L2PT tunnel is already authenticated by the IPSec.
PPTP specific fields:	

Field	Description
PPP encryption (MPPE)	Enables Microsoft Point-to-Point Encryption (MPPE)

- 4 Optional: To use a domain name instead of IP address for the VPN server, select the **Show advanced options** checkbox and fill in the fields.
- 5 Tap **Save**.

6.19.2

Connecting to a VPN

Procedure:

- 1 Connect KVL to the network. See [Connecting the KVL to the KMF or AuC Using Network Connection on page 86](#)
- 2 From the KVL main menu, go to **Settings**→**General**→**Hardware**→**VPN**.
- 3 From the list, select the VPN connection by tapping its name.
If the list is empty, you need to configure a VPN connection. See [Configuring a VPN Connection on page 95](#).
- 4 When prompted, enter the credentials for your VPN.
For **IPsec PSK** profile, user name is always `kvl` and password is the same as the one set in **IPsec pre-shared key** field.
Connected status is displayed




- 5 To disconnect from a VPN, tap →**Disconnect**.

6.19.3

Removing a VPN Connection

Use this procedure to remove the configured VPN from the available VPNs list.

Procedure:

- 1 From the KVL main menu, go to **Settings**→**General**→**Hardware**→**VPN**.
- 2 On the list, find the connection you want to remove and tap  on the right side of the screen.
- 3 Tap **Forget**.
The VPN connection is removed from the list.

Chapter 7

KVL 5000 Operations

This section provides the necessary information for using KVL 5000.
Choose the relevant section from the panel on the left.

7.1

Managing Keys


This section describes how to create, edit and remove keys and key groups on the KVL.
Keys used in Tactical OTAR groups cannot be modified or deleted in **Manage keys** view.
Control Head keys are not visible on the list.

7.1.1

Adding a Single Key

When and where to use:

Procedure:

- 1 Log in as an administrator.
- 2 From the KVL main menu, go to **Manage keys**→**Manage keys**.
To sort items on the list, see [Sorting and Filtering Items in KVL on page 101](#).
- 3 Tap →**Add new key**.
The **Add key** menu appears.
- 4 In the **Name** field, type in the name of the key.
The name can consist of up to 16 characters, including spaces.
- 5 In the **Algorithm** field, select the encryption algorithm from the list.
Some algorithms may not work on certain radios.
- 6 In the **Key type** field, choose one of the key types from the list.
- 7 In the **CKR ID** field, the next available Common Key Reference (CKR) number is inserted automatically. Tap the field to change it.
- 8 In the **Key ID** field, the next available key ID is inserted automatically. Tap the field to change it.
- 9 Tap **Key value** and perform the following actions:
 - a Enter the key value manually by tapping the **Enter key** field.
 - b If you want to generate the key automatically, tap **Auto**.
 - c If you want to preview the whole key value, tap **Show**.
Show button is disabled when Federal Information Processing Standard (FIPS) is set to **FIPS legacy level 3**. See [Changing the FIPS Mode on page 90](#)
 - d If you want to clear the **Enter key** field, tap **Clear**.

- e Confirm the key value by tapping



KVL supports up to 1024 keys.

For DES algorithms, if you enter an invalid string of digits, the digits become red and `Invalid byte parity` message appears.

- 10 Confirm your selections by tapping




appears once you fill in all the fields.

7.1.2

Sorting and Filtering Items in KVL

Using Sort and Filter options allow you to quickly find the desired item in KVL.

Procedure:

- 1 To sort items, tap  → **Sort by** and select the desired parameter.
Items are sorted by a chosen parameter in ascending order.
- 2 To display items with a specific attribute (like name or algorithm used), perform the following actions:

- a Tap  → **Filter**.

- b Enter the name of the desired attribute and tap **Filter**.

Step example: To search for items named `example_item`, type `example_item` or `example`. You do not need to enter the entire name, only the beginning.
For example, to search for items that use AES algorithms (if applicable), type `AES`.

- c To clear filter, tap  → **Clear filter**.

Select all and **Unselect all** options will affect only the filtered items.

7.1.3

Adding Multiple Keys

Use this procedure to generate multiple keys with automatically generated value at once.

Procedure:

- 1 Log in as an administrator.
- 2 From the KVL main menu, go to **Manage keys** → **Manage keys**.
To sort items on the list, see [Sorting and Filtering Items in KVL on page 101](#).



3 Tap → **Add multiple keys** .

4 In the **Add multiple keys** menu, perform the following actions:

a In the **Name prefix** field, type in the name for the batch of keys.

The name can consist of up to 12 characters, including spaces.

Step example: Created keys are named *<example 1>*, *<example 2>*, and so on.

b In the **Keys count** field, select the number of keys you want to create.

KVL supports up to 1024 keys. Any keys beyond that limit will not be added.

c In the **Algorithm** field, select the encryption algorithm you want to use.

Some algorithms may not work on certain radios.

d In the **Key type** field, choose one of the key types from the list.

e In the **CKR ID** field, the next available Common Key Reference (CKR) number is inserted automatically. Tap the field to change it.

f In the **Key ID** field, the next available key ID is inserted automatically. Tap the field to change it.

g Create keys by tapping



7.1.4

Adding a Group of Keys

The Key Variable Loader (KVL) provides a convenient feature called key groups. This feature allows you to associate several keys stored in the KVL memory with a specified group name. You can then load the entire group of keys to the target device in a single operation. This is especially useful when loading the same group of keys to several target devices, such as a fleet of radios.

The KVL supports up to 20 groups at a time.

Procedure:

1 Log on to the KVL as the Administrator

2 From the KVL main menu, go to **Manage keys**→**Manage groups**.

To sort items on the list, see [Sorting and Filtering Items in KVL on page 101](#).



3 Tap → **Add new group**.

4 In the **Name** field, enter the group name.

5 To add or remove keys from the group:

a Tap the **Keys** field.

b Select or unselect keys by tapping their names.

A group can consist of maximum 250 keys.

c To sort the list of keys, tap



d Confirm by tapping



6 In the upper-right corner of the screen, in the **Add group** menu, tap



7.1.5

Editing Single Keys

Procedure:

- 1 Log in as an administrator.
- 2 From the KVL main menu, go to **Manage keys**→**Manage keys**.
To sort items on the list, see [Sorting and Filtering Items in KVL on page 101](#).
- 3 Tap the key that you want to edit.
Edit Key menu appears.



- 4 Optional: To remove the key, tap
- 5 Make the desired changes by tapping the appropriate fields.
You can edit the following fields:
 - Name
 - Key ID
 - Key value

KVL does not accept keys of the same algorithm type with duplicate Key IDs.



- 6 Confirm the changes by tapping

7.1.6

Editing Groups of Keys

Procedure:

- 1 Log on to the KVL as the Administrator
- 2 From the KVL main menu, go to **Manage keys**→**Manage groups**.
To sort items on the list, see [Sorting and Filtering Items in KVL on page 101](#).
- 3 Tap the key group that you want to edit.
Edit group menu appears.



- 4 Optional: To remove the group, tap
- 5 To edit the name of the group, tap the **Name** field.
- 6 To add or remove keys from the group:

- a Tap the **Keys** field.
- b Select or unselect keys by tapping their names.
A group can consist of maximum 250 keys.



- c To sort the list of keys, tap in the upper-right corner of the screen.



- d Tap to confirm.
You return to **Edit group** menu.





- 7 Confirm the changes by tapping .

7.1.7

Removing Keys

Procedure:

- 1 Log in as an administrator.
- 2 From the Key Variable Loader (KVL) main menu, go to **Manage keys**→**Remove keys**.
Control Head keys are not visible on the list.
- 3 Perform one of the following actions:

If...	Then...
If you want remove all keys of a specific type or all keys with a specific encryption algorithm,	tap Remove <i><algorithm or type></i>
If you want to manually remove selected keys,	<p>perform the following actions:</p> <ul style="list-style-type: none"> a Tap Remove selected. b Select or unselect items by tapping their names. To filter items on the list, see Sorting and Filtering Items in KVL on page 101. You can select keys meeting specific criteria by applying Filter and tapping →Select all. c To remove the selected keys, tap .
If you want to remove all control head keys,	tap Remove control head keys .
If you want to remove all keys,	tap Remove all .

7.2

Loading Encryption Keys into Target Devices

In ASTRO® 25 systems, you can load encryption keys into the following devices:

- Secure ASTRO® 25 Single Key Target Radios
- Secure ASTRO® 25 Multiple Key Target Radios
- MCC 7500 VPM Dispatch Console
- PDEG Encryption Unit
- CAI Data Encryption Module (CDEM)
- KMF CryptR
- CRYPTR micro in User Equipment
- MCC7500E Console CRYPTR

7.2.1

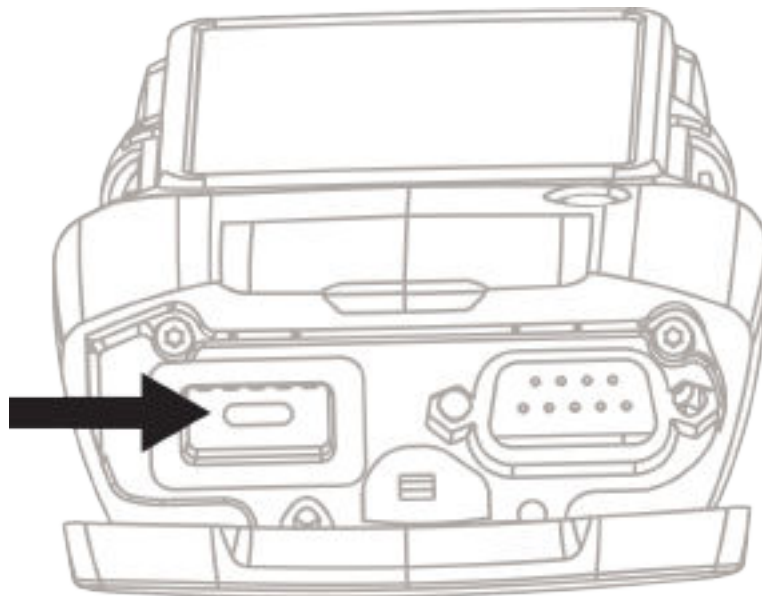
Loading Keys

Prerequisites: For USB key loading, make sure that USB key loading settings are correct. See [Managing USB Key Loading Settings on page 106](#)

Procedure:

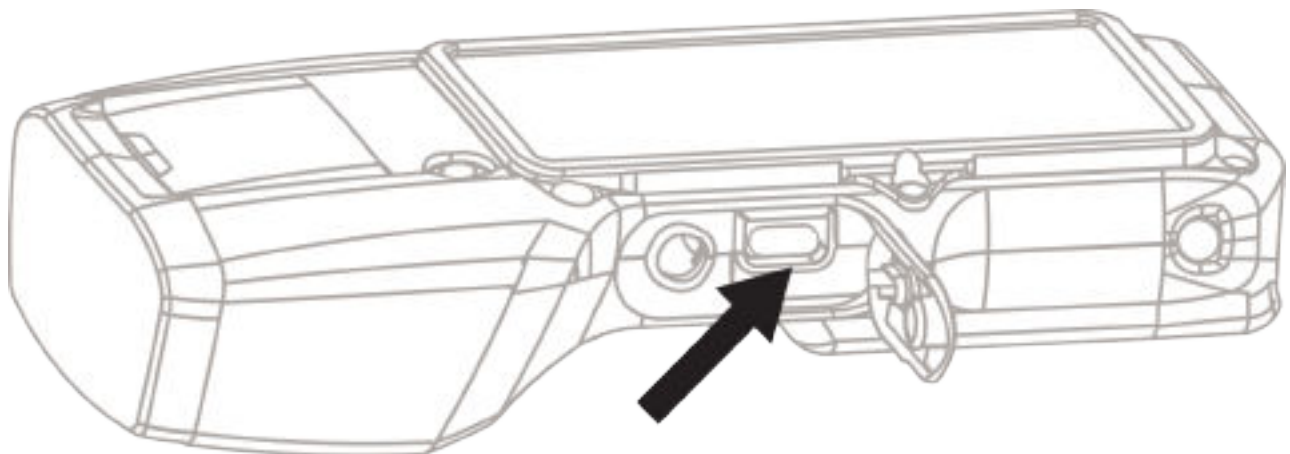
- 1 Connect the target device to the Key Variable Loader (KVL) using an appropriate key load cable.
 - Connect the KVL to the radio through the key load port.

Figure 14: KVL 5000 Key Load Port



- For target radio that supports only USB key loading, connect the KVL to the radio through the micro USB adapter


Figure 15: KVL Micro USB Port




2 From the KVL main menu, go to **Load Keys**→**Load keys**.

3 Select or unselect keys by tapping their names.

To filter the items on the list, see [Sorting and Filtering Items in KVL on page 101](#)

You can select items meeting specific criteria by using **Filter** and tapping →**Select all**.

4 To load the selected keys, tap .

Progress bar appears. *Completed* tone is played. Status for each key is displayed.

5 If you want to load the same keys to another target device, disconnect the current target device and connect another one.

The loading process starts automatically.

6 To return to **Select keys** menu, tap .

7.2.2

Managing USB Key Loading Settings

USB Key loading is disabled by default. If you want to load keys to a radio that supports USB key loading only, you need to enable USB key loading on the KVL and enter the UDP port number.

Procedure:

- 1** Log on as an Administrator.
- 2** From the KVL main menu, go to **Settings**→**USB key loading**
- 3** Perform one of the following actions:

If...	Then...
If you want to enable USB key loading,	a Tap Radio over USB . b Tap Enabled .

If...	Then...
If you want to enter the UDP port for loading End to End Encryption keys,	<p>a Tap E2EE UDP port.</p> <p>b Enter the same port number as the one set on the target radio.</p>
If you want to enter the UDP port for Radio Authentication for loading End to End Encryption keys,	<p>a Tap Radio Auth UDP port.</p> <p>b Enter the same port number as the one set on the target radio.</p>

7.2.3

Loading Keys Using Push to Load (PTL) Button

You can quickly repeat the last successful keys or key groups loading operation by using the PTL button. PTL button is disabled if an operation is in progress (for example share keys or upgrade).

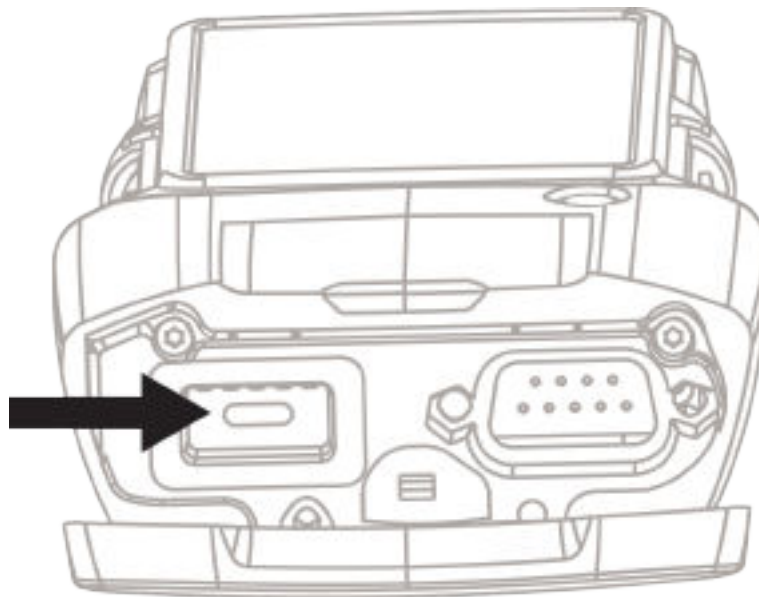
Prerequisites: Log on to the Key Variable Loader (KVL).

For USB key loading, make sure that USB key loading settings are correct. See [Managing USB Key Loading Settings on page 106](#)

Procedure:

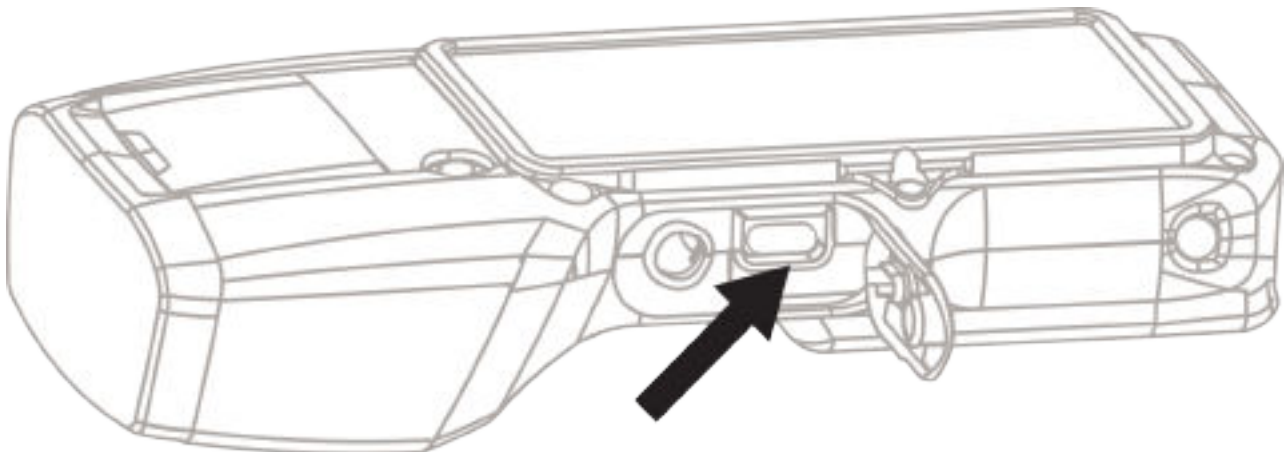
- 1 Connect the target device to the Key Variable Loader (KVL) using an appropriate key load cable.
 - Connect the KVL to the radio through the key load port.

Figure 16: KVL 5000 Key Load Port






- For target radio that supports only USB key loading, connect the KVL to the radio through the micro USB adapter

Figure 17: KVL Micro USB Port



- 2 Depending on whether you previously loaded any keys, perform one of the following actions:

If...	Then...
<p>If this is the first time you are loading keys (or previously loaded keys were removed from KVL),</p>	<p>perform the following actions:</p> <p>a Push the PTL button (big button on the right side of the KVL. See KVL 5000 Ports and Hardware Buttons on page 69). You are moved to Select keys menu. You can go back to your previous screen</p> <p style="text-align: center;">by pressing </p> <p>b Select or unselect keys by tapping their names To filter the items on the list, see Sorting and Filtering Items in KVL on page 101 You can select items meeting specific criteria by using Filter and tapping</p> <p style="text-align: center;"> → Select all.</p> <p>c To load the selected keys, tap </p> <p>Progress bar appears. <i>Completed</i> tone is played. Status for each key is displayed.</p> <p>d If you want to load the same key to another target device, disconnect the current target device and connect another one. The loading process starts automatically.</p>
<p>If you previously loaded keys to a target device,</p>	<p>perform the following actions:</p>

If...	Then...
	<p>a Push the PTL button (big button on the right side of the KVL. See KVL 5000 Ports and Hardware Buttons on page 69).</p> <p>Keys or groups that you loaded previously are immediately loaded into the target device.</p> <p>Progress bar appears. <i>Completed</i> tone is played. Status for each key or group is displayed.</p> <p>Any changes made to keys or key groups (such as name or number of keys in the group) are included.</p> <p>If you want to select different keys or groups, see Loading Keys on page 105 or Loading a Group of Keys on page 109.</p> <p>b If you want to load the same key or group to another target device, disconnect the current target device and connect another one.</p> <p>The loading process starts automatically.</p>

- 3** Optional: You can load auto generated Radio Authentication key to the same radio using PTL button. See [Provisioning Radios with Authentication Keys using PTL Button on page 140](#)

7.2.4

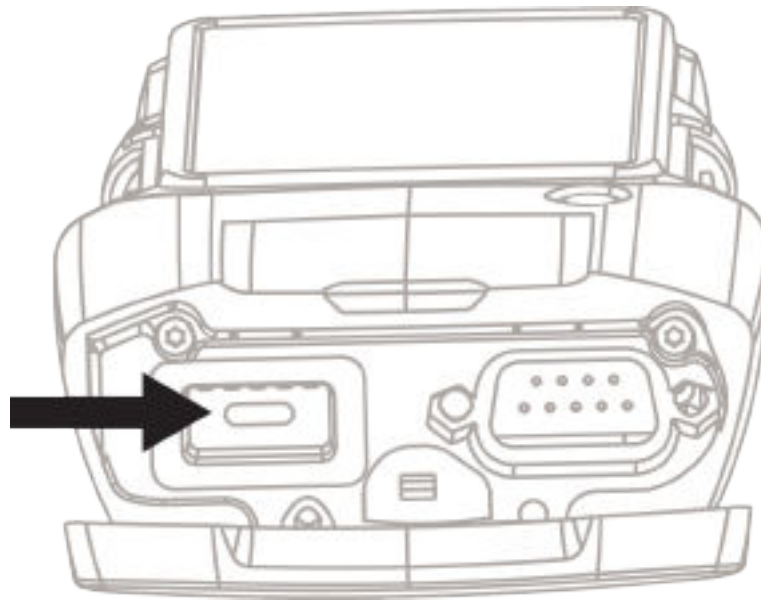
Loading a Group of Keys

Prerequisites: For USB key loading, make sure that USB key loading settings are correct. See [Managing USB Key Loading Settings on page 106](#)

Procedure:

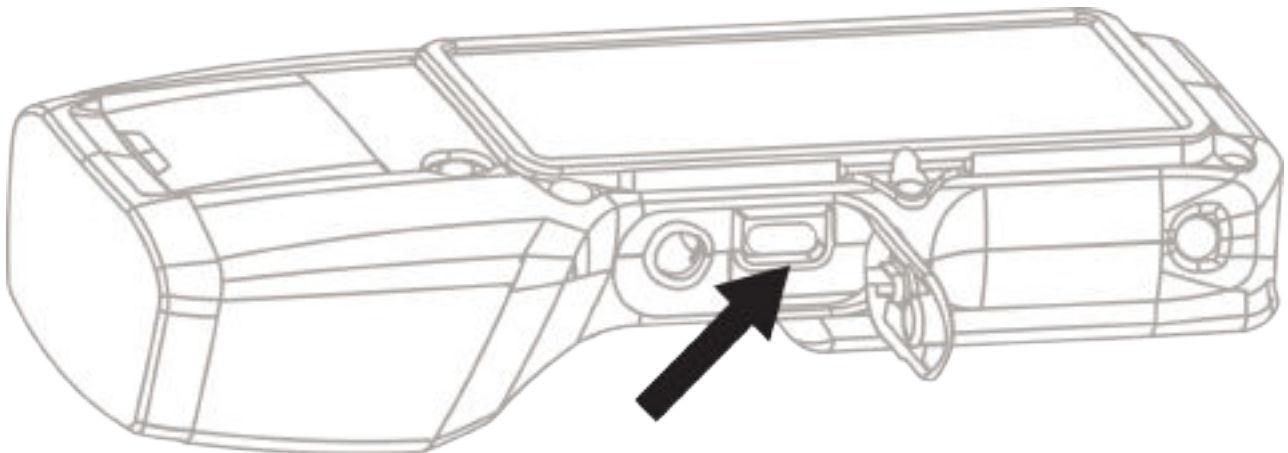
- 1** Connect the target device to the Key Variable Loader (KVL) using an appropriate key load cable.
 - Connect the KVL to the radio through the key load port.

Figure 18: KVL 5000 Key Load Port



- For target radio that supports only USB key loading, connect the KVL to the radio through the micro USB adapter


Figure 19: KVL Micro USB Port



- 2 From the KVL main menu, go to **Load Keys**→**Load groups**.
- 3 Select or unselect groups by tapping their names.

To filter the items on the list, see [Sorting and Filtering Items in KVL on page 101](#)

You can select items meeting specific criteria by using **Filter** and tapping →**Select all**.

- 4 To load the selected groups, tap 
Progress bar appears. When the process is successful, a *completed* tone is played.
- 5 If you want to load the same key group to another target device, disconnect the current target device and connect another one.

The loading process starts automatically.

7.2.5
Exporting Key Files for Target Device

With your KVL, you can export keys and/or key groups to an `.xml` file and then transfer the key file to a target device configured with software-based key storage.

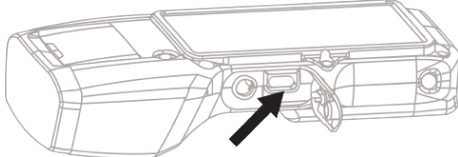
Currently, the following algorithms support key file export:


- ADP
- AES-256
- DES-OFB

Prerequisites: Unless you are an Administrator, ensure that all keys for each algorithm exist in the KVL database. Only Administrator can add new keys to KVL.

Procedure:

- 1 If key file export is not enabled, go to **Settings**→**Key File Export** and enable it.
- 2 On the KVL main screen, select **Load keys**→**Export keys**→**Export keys**.
- 3 In the **Name** field, enter a name for the key file or leave the default one.
The default key file name contains the date and hour of the export.
- 4 Tap **Storage** and choose one of the following options:


If...	Then...
If you want to store the key file in the internal KVL memory,	select Internal KVL storage .
If you want to export the key file to a USB flash drive,	perform the following actions: a Connect the USB flash drive to the KVL by using the micro USB adapter.  b Select the USB flash drive.

- 5 For **Keys**, select the key from the list and tap .

- 6 For **Groups**, select the key group from the list and tap .

If a group contains keys with unsupported algorithms or keys that you already selected, they are filtered out.

- 7 For each type of algorithm, perform the following actions:
 - a** Tap **KEKs**.
 - b** From the list of available algorithms, tap the algorithm type.
 - c** From the list of available KEKs, select a KEK.

Administrator can create a new KEK key using the same algorithm by tapping  → **Add new key** .

d Tap .

8 Tap .

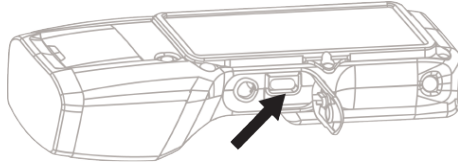
For USB export, when the export is successful, you are prompted to safely disconnect the USB flash drive.

9 For USB export, perform one of the following actions:

- To perform another export operation, tap **Yes**.
- To disconnect the USB flash drive, tap **No**.

If you do not disconnect the USB flash drive, you receive a notification that it is still connected.
If you do not disconnect the USB flash drive after a successful export, the key file may not be saved correctly on the USB flash drive.

10 Transfer the key file to the target device:

If...	Then...
If you saved the key file on the internal KVL memory	<p>perform the following actions:</p> <p>a Go to Load keys→Export keys→View internal key files.</p> <p>b Connect the KVL to the PC by using the USB micro adapter.</p>  <p>On the PC, go to This PC\KVL5000\Internal shared storage\key files to obtain your key files.</p> <p>c Transfer the key file to your target device.</p>
If you saved the key file on the USB flash drive,	connect the USB flash drive to the target device.

7.2.5.1

Managing Exported Key Files in KVL Internal Memory

Procedure:

- 1 On the KVL main screen, select **Load keys**→**Export keys**→**View internal key files**.
- 2 To remove files, select their checkboxes and tap **Remove selected**.

- 3 When prompted, confirm your choice.

7.3

Configuring Target Devices Using KVL

This section describes how to configure a device, such as radio, using Key Variable Loader (KVL), and how to remove keys or algorithms from a device using KVL.

7.3.1

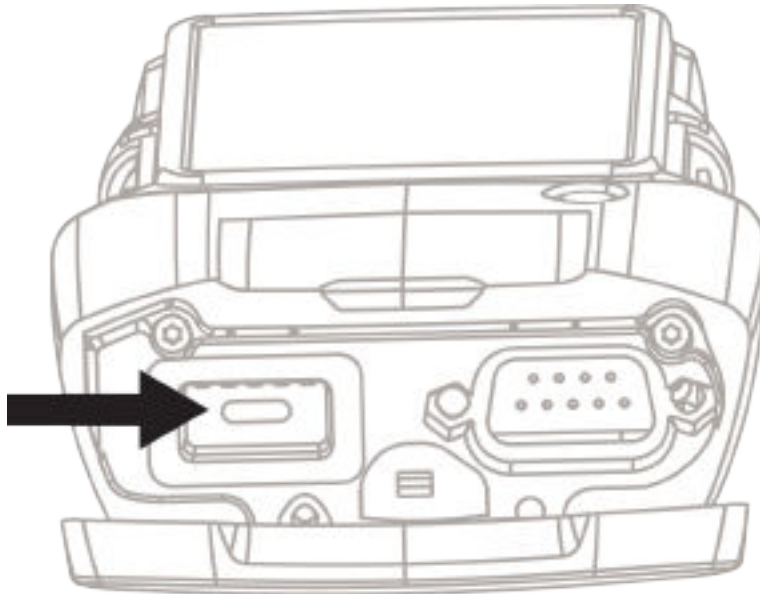
Configuring a Target Device

Prerequisites: For USB key loading, make sure that USB key loading settings are correct. See [Managing USB Key Loading Settings on page 106](#)

Procedure:

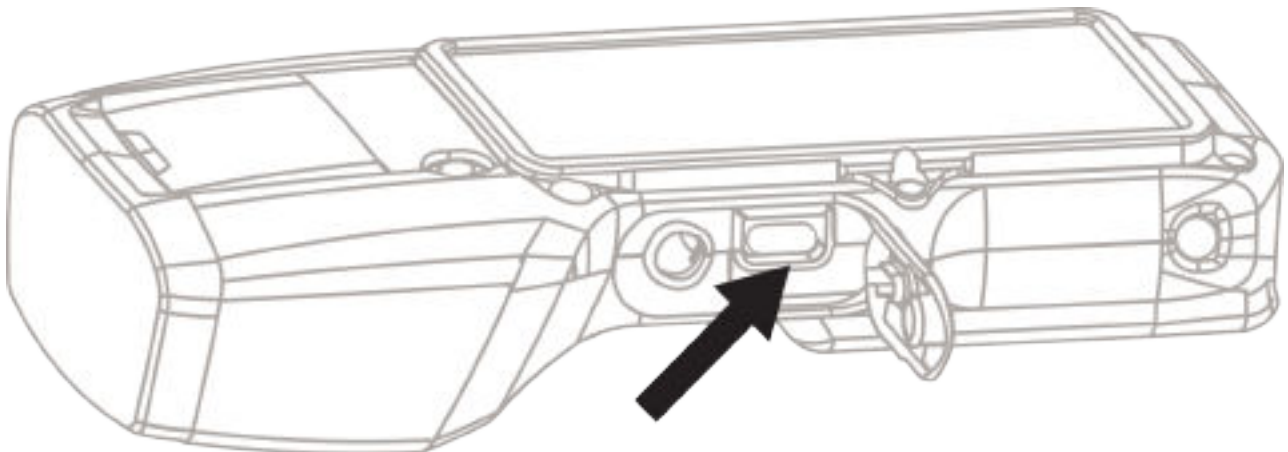
- 1 Connect the target device to the Key Variable Loader (KVL) using an appropriate key load cable.
 - Connect the KVL to the radio through the key load port.

Figure 20: KVL 5000 Key Load Port



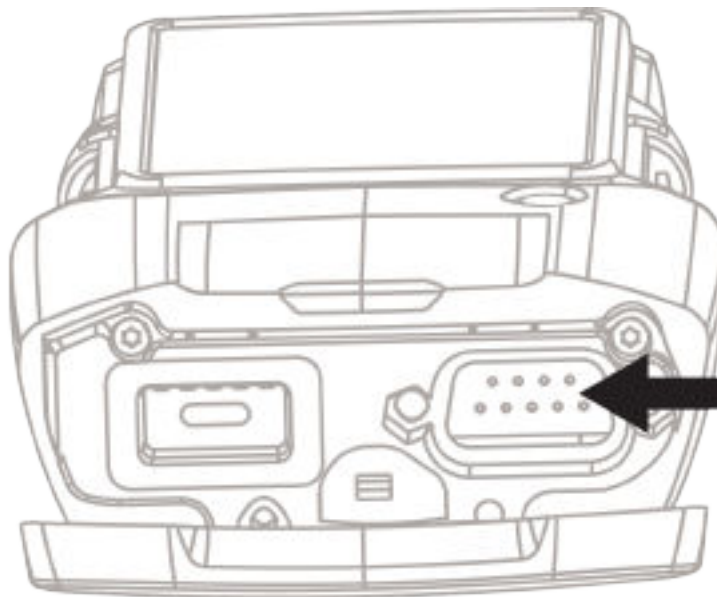
- For target radio that supports only USB key loading, connect the KVL to the radio through the micro USB adapter





Figure 21: KVL Micro USB Port



- For mobile radio's Remote Control Head, use the DB9 Port, an appropriate data cable, and a DB9 Gender Changer.

Figure 22: KVL DB9 Port



- 2 From the KVL main menu, go to **Configure a device**.
- 3 To view and change the device Radio Set Identifiers (RSIs), perform following actions:
 - a Tap **RSIs**.
 - b To change the device RSI, tap **RSI** and enter the desired value.

 - c Save the change by tapping .
 - d To change the KMF RSI, tap **KMF RSI** and enter the desired value.

 - e Save the change by tapping .

f To go back to **Configure a device** screen, tap .

Group RSI field is read-only.

4 To view the device Common Key Reference (CKR) keys, tap **CKR keys**.

a To sort items on the list, see [Sorting and Filtering Items in KVL on page 101](#).

b To go back to **Configure a device** screen, tap .

5 To choose a keyset, tap **Keysets** and select a keyset from the list.

6 To change the Message Number Period (MNP), perform the following actions:


a Tap **MNP**.

b Enter the desired MNP value.

The default value is 1000.



NOTE: MNP value close to maximum is less secure. MNP value close to minimum is more secure, but in case of connectivity errors you may need to recover the MNP value.

c Save the change by tapping .

7 To remove keys from a target device, see [Removing Keys from Target Devices on page 115](#).

7.3.2

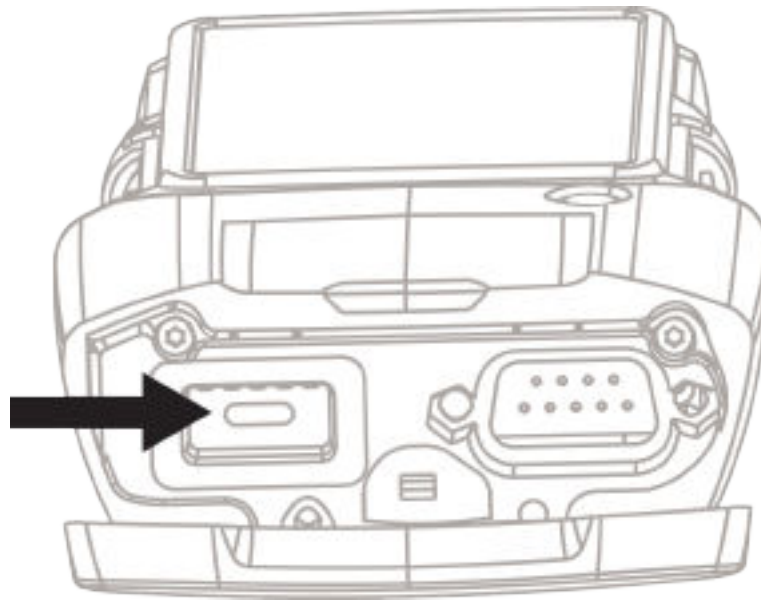
Removing Keys from Target Devices

Prerequisites: For USB key loading, make sure that USB key loading settings are correct. See [Managing USB Key Loading Settings on page 106](#)

Procedure:

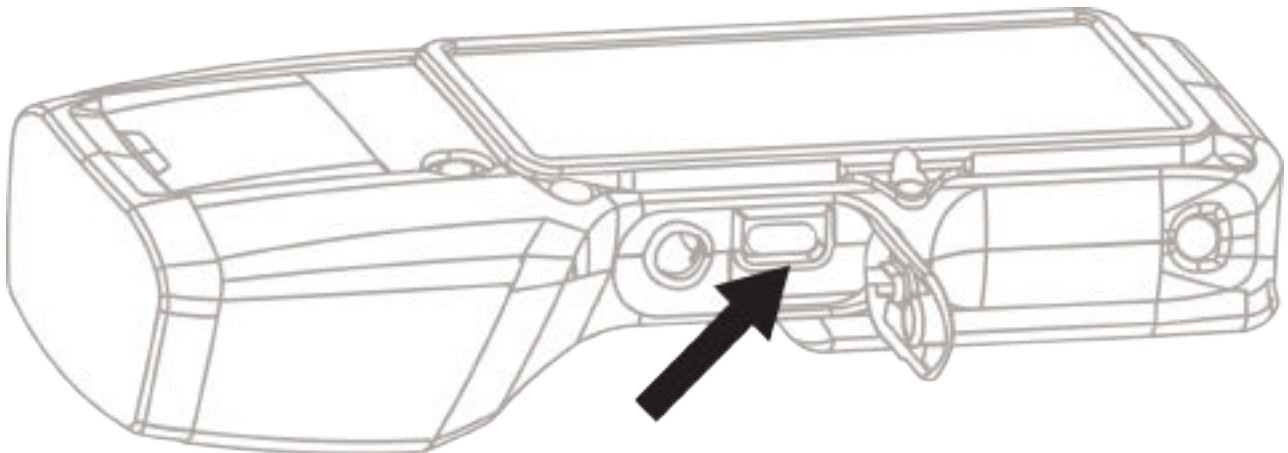
- 1 Connect the target device to the Key Variable Loader (KVL) using an appropriate key load cable.
 - Connect the KVL to the radio through the key load port.

Figure 23: KVL 5000 Key Load Port








- For target radio that supports only USB key loading, connect the KVL to the radio through the micro USB adapter

Figure 24: KVL Micro USB Port



- 2 From the Key Variable Loader (KVL) main menu go to **Configure a radio**→**Remove keys**.
- 3 Perform one of the following actions:

If...	Then...
If you want to remove selected keys from a target device,	<p>perform the following actions:</p> <ol style="list-style-type: none"> Tap Remove keys. To sort items on the list, see Sorting and Filtering Items in KVL on page 101. Select or unselect keys by tapping their names. <div style="text-align: center;">  </div> <ol style="list-style-type: none"> To remove selected keys, tap

If...	Then...
	<p>e To go back to Remove keys screen, tap . Removal of the Remote Control Head SEK and KEK keys is not supported using this option.</p>
If you want to remove selected groups from a target device,	<p>perform the following actions:</p> <p>a Tap Remove groups.</p> <p>b To sort items, tap  and choose the desired parameter from the list.</p> <p>c Select or unselect groups by tapping their names.</p> <p>d To remove selected groups, tap .</p> <p>e To go back to Remove keys screen, tap .</p>
If you want to remove all keys from a target device,	<p>tap Remove all. When prompted, confirm your choice. This option removes Control Head keys as well, but disconnects the target device.</p>

7.3.3

Removing Algorithms from Target Devices

You can remove a single algorithm from a connected target device.



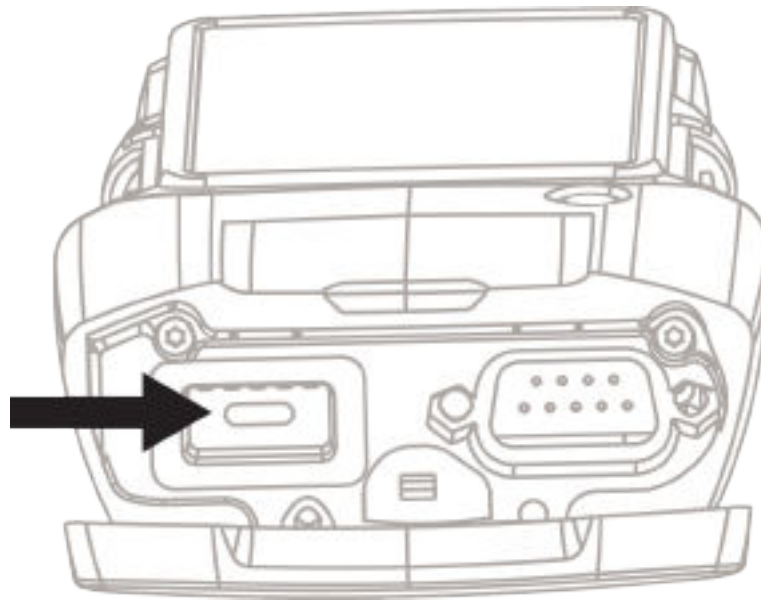
NOTE: You cannot perform this procedure for a radio that supports USB key loading only.

Prerequisites: Remove all keys associated with the algorithm you want to remove from the target device.

Procedure:

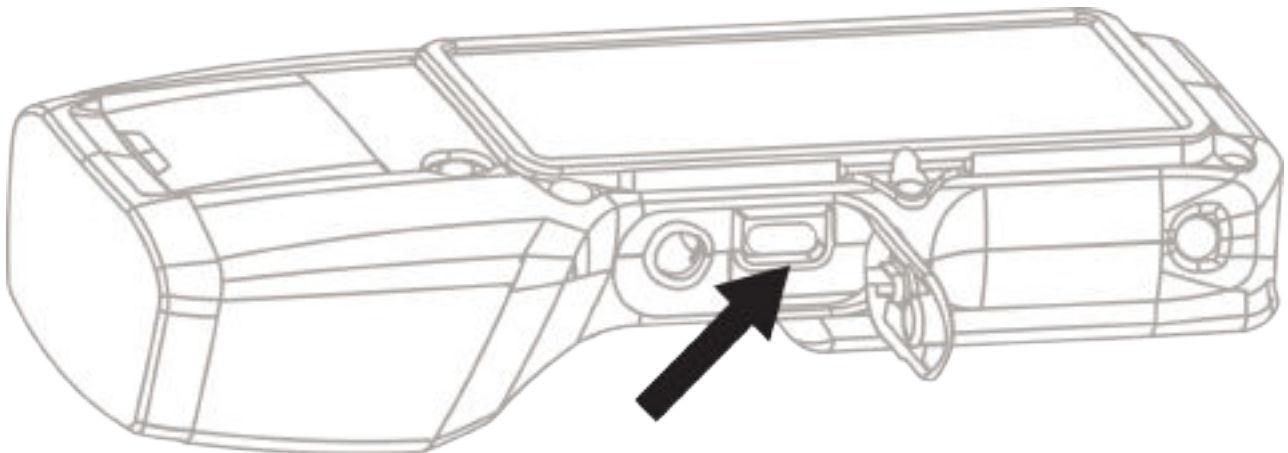
- 1 Connect the target device to the Key Variable Loader (KVL) using an appropriate key load cable.
 - Connect the KVL to the radio through the key load port.

Figure 25: KVL 5000 Key Load Port



- For target radio that supports only USB key loading, connect the KVL to the radio through the micro USB adapter

Figure 26: KVL Micro USB Port



2 From the KVL main menu, go to **Settings**→**Manage firmware**→**External module firmware**→**Remove algorithm**.

3 Select an algorithm you want to remove.

A warning that you should remove all keys associated with the algorithm you want to remove appears.

4 Select **Yes, continue**.

5 Select **Remove now**.

A progress animation appears, indicating that the algorithm is being removed, followed by a confirmation message.



NOTE: If the target device is KMF CryptR, CDEM, or PDEG, if the removal process starts, but does not progress after 30 seconds, press the **Reset** button on the target device.

Postrequisites: Some target devices may need to be restarted after removing an algorithm.

7.4

Sharing Keys Between KVLs

In addition to loading keys into target devices, the KVL can also load (share) its keys or key groups to another KVL of the same or different model.

The following rules apply to sharing:

- Sharing must be turned ON in both the source and target KVL. See [Turning Sharing On/Off on page 120](#).
- Only key data and key groups are shared. KVL configuration settings, the Unique Key Encryption Key (UKEK) for each algorithm, and log records for the target KVL remain unchanged.
- In order to share keys or key groups used by algorithms that require a System Key, the System Keys of both KVLs must match.
- Sharing is not available with FIPS Legacy level 3 mode.
- If there are keys on the receiving KVL that are used in Tactical OTAR groups, those keys are not overwritten during sharing operation.



Procedure:








- 1 From KVL main menu, select **Share keys**.
- 2 Connect the target KVL using the KVL to KVL cable. See [Connecting Two KVL Units on page 81](#).)



NOTE: If you want to receive keys from KVL 4000, select the desired keys (drag the sliders) on KVL 4000 **before** connecting the cable to KVL 5000.

- 3 Choose one of the following scenarios:

If...	Then...
If you want to receive keys from another KVL,	tap Receive .
If you want to send all keys and groups to another KVL,	tap Share All .  NOTE: In order to share all keys, the target KVL must support the same algorithms as the source KVL (assuming that there is at least one key defined for each algorithm).
If you want to send selected keys to another KVL,	perform the following actions: <ol style="list-style-type: none"> a Tap Share Keys b Select or unselect keys by tapping their names. To sort items on the list, see Sorting and Filtering Items in KVL on page 101 You can select items meeting specific criteria by using Filter and  tapping → Select all.

If...	Then...
	<p>c To send keys, tap </p> <p>d If you want to select other keys, go to back Select keys screen</p> <p> (tap ) and repeat the operation.</p>
If you want to send selected key groups to another KVL,	<p>perform the following actions:</p> <p>a Tap Share Groups</p> <p>b Select or unselect groups by tapping their names. To sort items on the list, see Sorting and Filtering Items in KVL on page 101 You can select items meeting specific criteria by using Filter and</p> <p>tapping  → Select all.</p> <p>c To send groups, tap </p> <p>d If you want to select other groups, go back to Select keys screen</p> <p> (tap ) and repeat the operation.</p>

The operation can either be Completed or Completed with errors.

Errors are marked with **X**. To see the error details, tap the item with **X**

7.4.1

Turning Sharing On/Off

In addition to loading keys into target devices, the KVL can also share its keys with another KVL. In order to share keys, the sharing feature must be turned on in both the source and target KVL.

Procedure:

- 1 Log on as an Administrator.
- 2 On the KVL main screen, select **Settings**→**Security**→**Sharing**.

The chosen current sharing setting is displayed.

7.5

KVL 5000 in OTAR Systems

The Over-the-Air Rekeying (OTAR) system is a secure communications system in which encryption keys can be sent to subscriber units through the radio transmission in addition to directly connecting a KVL to a radio to load keys. OTAR provides flexibility and convenience in managing and administering encryption keys.

One of the infrastructure components in an OTAR system is the Key Management Facility (KMF). The KMF is responsible for:

- Storing and managing the encryption keys for an OTAR system
- Initiating key transmissions to radios

The KVL can interface with the KMF to provide the following functions:

Transfer the encryption keys required by the OTAR system from the KVL to the KMF

You can load the required keys into the KVL, connect the KVL to the KMF through a standard key load cable, and transfer the keys (one at a time) to the KMF for storage and management (see [Loading Keys on page 105](#)). The KMF then transfers encryption keys to target devices via OTAR.

Download encryption keys from the KMF into the KVL

Two methods are available for transferring encryption keys when OTAR cannot be performed, such as for radios that do not support OTAR, radios that are out of range, or radios that have not yet been initialized. The two methods of downloading keys are:

- Individual keys are downloaded to the KVL key database which are then loaded directly into target devices. This method requires that you know the Common Key References (CKRs) of the keys in the KVL key database.
- With the use of the Store and Forward feature, Key Management Messages (KMMs), usually containing encryption keys, are downloaded to the KVL that is in turn used to update target devices. This operation does not require that you know the CKRs of the keys in the KVL database. This simplifies the key loading procedure. (See [Updating a Target Device on page 128](#))

The following parameters are required by target devices to operate within an Over-the-Air Rekeying (OTAR) system:

- Radio Set Identifier (RSI) of the target
- RSI of the Key Management Facility (KMF)
- Message Number Period (MNP)

In most cases, these parameters are loaded into the target devices automatically by the Key Variable Loader (KVL) during the initial Store and Forward update through the KMF. The KVL has the capability of viewing these parameters, and loading new parameters into target devices (if necessary).

7.5.1

Entering the KVL RSI

The KVL requires a Radio Set Identifier (RSI) in order to operate in the OTAR system.

Prerequisites: Your KVL must support KMF operation.

Procedure:

- 1 From the KVL main menu, go to **Settings**→**KVL RSI**.
- 2 Enter the RSI.

The KVL RSI must match the individual RSI assigned to this KVL in the KMF.

- 3 Tap .

7.5.2

Entering the KMF RSI

The KMF requires a Radio Set Identifier (RSI) in order to operate in the OTAR system. The KVL only accepts keys and KMMs from the KMF with this RSI.



CAUTION: Changing the KMF RSI removes received jobs.

Prerequisites: Your KVL must support KMF operation.

Procedure:

- 1 From the KVL main menu, go to **Settings**→**KMF**→**KMF RSI**.
- 2 Enter the RSI.

- 3 Tap .

7.5.3

Entering the MNP

The Message Number Period (MNP) is a feature used in an ASTRO® 25 system that provides additional security in the over-the-air rekeying (OTAR) of subscriber units. The MNP number serves as an offset value used in synchronizing OTAR rekeying transmissions.



NOTE: MNP value close to maximum is less secure. MNP value close to minimum is more secure, but in case of connectivity errors you may need to recover the MNP value.

Prerequisites: Your KVL must support KMF operation.

Procedure:

- 1 From the KVL main menu, go to **Settings**→**KMF**→**MNP**.
- 2 Enter the MNP by using the decimal keypad.

- 3 Tap .

7.5.4

Selecting Main or Backup KMF

For KVL to KMF remote connections, determine the which KMF (main/backup) communicates with KVL.



NOTE: KVL connects only to the selected KMF. For example, selecting Main KMF does not mean that KVL will try to connect to Backup KMF if the connection fails.

Prerequisites: Your KVL must support KMF operation.

Procedure:

- 1 From the KVL main menu, go to **Settings**→**KMF**→**Active KMF**.
A list of available options appears, with the currently selected KMF highlighted.
- 2 Select the desired KMF.
The KMF you have selected is now active.

7.5.5

Entering the KMF Port

For the KVL to connect with the KMF through the Network, you need to configure the KMF port on the KVL.

Prerequisites: Your KVL must support KMF operation.

Procedure:

- 1 Log on the KVL as an Administrator.
- 2 From the KVL main menu, go to **Settings→KMF→KMF port**.
- 3 In the **KMF Port** field, enter the port number for the KMF.



- 4 Tap .

The KMF ports are set.

7.5.6

Entering the KMF Baud Rate

Set the baud rate for KMF communication

Prerequisites: Your KVL must support KMF operation.

Procedure:

- 1 From the KVL main menu, go to **Settings→KMF→Baud rate**.
- 2 Choose the baud rate from the list.

Some KMFs support only **9600** rate. In this case, use the default **9600** value.

7.5.7

Entering Main and Backup KMF IP Addresses

For the KVL to connect with the KMF through the Network, you need to configure the KMF IP address on the KVL.

Prerequisites:

Your KVL must support KMF operation.

Obtain the IP address from your radio network administrator. The IP address has to be IPv4.

Procedure:

- 1 From the KVL main menu, go to **Settings→KMF→IP Address**.
- 2 Tap **Main KMF** and enter the IP address of the main KMF.



- 3 Tap .

- 4 Tap **Backup KMF** and enter the IP address of the backup KMF.

5 Tap .

The IP addresses are set.

7.5.8

Entering Main and Backup KMF Phone Numbers

The KVL supports dial-up phone numbers for the Main and Backup KMF.

Prerequisites: Your KVL must support KMF operation.

Procedure:


- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**KMF**→**Phone number**.
- 3 Depending on the KMF you want to enter the phone number for, select **Main KMF** or **Backup KMF**.
- 4 In the **Phone #** field, enter prefix (optional) and phone number.

All users can enter the prefix. Only Administrator can enter the phone number.



NOTE: You might have to experiment with your particular calling card service to determine the number of pauses needed and in which locations in the phone number string they must be placed. For example, a typical dialing sequence might be:

- Dial Access Number
- Pause 4 seconds (2 commas)
- Dial the desired phone number
- Pause 2 seconds (1 comma)
- Dial Credit Card Number (or PIN number)

5 Save the phone number by tapping .

The phone number is changed.

7.5.9

Entering the UKEK

For an Over-the-Air Rekeying (OTAR) operation, program a Unique Key Encryption Key (UKEK) into the Key Variable Loader (KVL) for each algorithm being used.

Each UKEK is a multi-character key typically assigned by the Crypto/Security Officer for the system, and is used to communicate with other secure equipment such as a Key Management Facility (KMF). The exact number of characters is determined by the algorithm.



IMPORTANT:




The UKEK entered in the KVL must match the UKEK in the KVL record in the KMF.

If the FIPS mode is changed or a system reset is performed on the KVL, all UKEKs will be destroyed and you must reenter it.

If the KVL is compromised, you must enter new UKEKs in the KVL and KMF.

Prerequisites: Your KVL must support KMF operation.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**KMF**→**UKEKs**.
A list of available algorithms appears.
- 3 Tap the algorithm you want to enter UKEK for and perform the following actions:
 - a Enter the key value manually by tapping the **Enter key** field.
 - b If you want to preview the whole key value, tap **Show**.
Show button is disabled when Federal Information Processing Standard (FIPS) is set to **FIPS legacy level 3**. See [Changing the FIPS Mode on page 90](#)
 - c If you want to clear the **Enter key** field, tap **Clear**.
 - d Confirm the key value by tapping 
For DES algorithms, if you enter an invalid string of digits, the digits become red and `Invalid byte parity` message appears.

- 4 To save the key, tap .
- 5 Repeat the procedure for each algorithm you want to enter a UKEK for.

7.5.10

Performing Store and Forward Operations

The Store and Forward feature (supported only in the ASTRO® 25 mode of operation) offers a simple and secure method of transferring keys and other messages from the KMF to target devices through the KVL.



NOTE: Motorola Solutions recommends not exceeding 1000 Store and Forward records. Performance may degrade if record count exceeds 1000.



NOTE: If there are keys on the KVL that are used in Tactical OTAR groups, those keys are not overwritten during Store and Forward operation.

The Unique Key Encryption Key (UKEK) must be present in the KVL and target devices in order to support the Store and Forward operation.

Prerequisites:





Ensure that:





- The KMF is set up to load keys and/or Store and Forward jobs to the KVL.
- The KVL battery is charged.
- The KVL is set up for KMF operations. See:
 - [Entering the KVL RSI on page 121](#)
 - [Entering the KMF RSI on page 122](#)
 - [Entering the MNP on page 122](#)
 - [Selecting Main or Backup KMF on page 122](#)
 - [Entering the KMF Port on page 123](#)
 - [Entering the KMF Baud Rate on page 123](#)
 - [Entering Main and Backup KMF IP Addresses on page 123](#)
 - [Entering Main and Backup KMF Phone Numbers on page 124](#)

[Entering the UKEK on page 124](#)

Procedure:

- 1 Log on to KVL.
- 2 From the KVL main menu, go to **Store & Forward**→**Connect to KMF**.
- 3 Choose how you want to connect to KMF:

If...	Then...
If you want to connect to KMF with a direct connection,	<p>perform the following actions:</p> <ol style="list-style-type: none"> a Connect the KVL to the KMF using the Null Modem Cable. See Connecting the KVL to the KMF Using Direct Connection on page 85 . b On the Connect to KMF menu, tap Direct. The connection between the KVL and the KMF is established, the KVL sends status reports of radios to the KMF, and then receives keys and Store and Forward jobs for radios from the KMF. In case of errors, you can retry the operation by pressing . <p>You can cancel the operation by pressing .</p>
If you want to connect to KMF with a network connection,	<p>perform the following actions:</p> <ol style="list-style-type: none"> a Connect KVL to the network. See Connecting the KVL to the KMF or AuC Using Network Connection on page 86 b On the Connect to KMF menu, tap Network. The connection between the KVL and the KMF is established, the KVL sends status reports of radios to the KMF, and then receives keys and Store and Forward jobs for radios from the KMF. In case of errors, you can retry the operation by pressing . <p>You can cancel the operation by pressing .</p>
If you want to connect to KMF with a modem connection,	<p>perform the following actions:</p> <ol style="list-style-type: none"> a Connect KVL to the network. See Connecting the KVL to the KMF Using USB Modem on page 87 b On the Connect to KMF menu, tap Modem. The connection between the KVL and the KMF is established, the KVL sends status reports of radios to the

If...	Then...
	<p>KMF, and then receives keys and Store and Forward jobs for radios from the KMF.</p> <p>In case of errors, you can retry the operation by pressing .</p> <p>You can cancel the operation by pressing .</p>
<p>If you want to connect to KMF with a VPN connection,</p>	<p>perform the following actions:</p> <ul style="list-style-type: none"> a Connect KVL to the network. See Connecting the KVL to the KMF or AuC Using Network Connection on page 86 b On the Connect to KMF menu, tap VPN Network. VPN menu appears. c Optional: If you did not configure a VPN connection earlier, you are prompted to configure a VPN connection. See Connecting to a VPN on page 99. d Select VPN connection from the list and enter credentials. <p>The connection between the KVL and the KMF is established, the KVL sends status reports of radios to the KMF, and then receives keys and Store and Forward jobs for radios from the KMF.</p> <p>In case of errors, you can retry the operation by pressing .</p> <p>You can cancel the operation by pressing .</p>

7.5.11

Viewing and Clearing the List of Received Store and Forward Jobs



NOTE: Motorola Solutions recommends not exceeding 1000 Store and Forward records. Performance may degrade if record count exceeds 1000.


Prerequisites: You can perform this procedure if Key Variable Loader (KVL) received Store and Forward jobs for radios from the Key Management Facility (KMF).

Procedure:

- 1** From the KVL main menu, go to **Store & forward**→**View received jobs**.
- 2** Optional: To sort and filter items on the list, see [Sorting and Filtering Items in KVL on page 101](#).

3



To clear the list of received Store and Forward jobs, tap  → **Clear**.



NOTE: Clearing the messages also erases all unit responses. Do not clear the messages until you have reconnected with the KMF and uploaded the unit responses.

4 At the prompt, confirm your choice.

The list of received Store and Forward jobs is cleared and you return to **Store & forward** menu.

7.5.12

Updating a Target Device

Prerequisites: Ensure that Store and Forward jobs are downloaded from the Key Management Facility (KMF) to the Key Variable Loader (KVL).



NOTE: You cannot update a target device when you connect the KVL through the micro USB port.

Procedure:

- 1 Connect the KVL to the target device.
- 2 From the KVL main menu, go to **Store & forward** → **Forward to Radio**
Update for the device starts automatically. When the update is completed, a checkmark appears.
- 3 Disconnect the target device.
- 4 Optional: Connect another target device to update.

Postrequisites: After you have performed a successful update on a target device, it cannot be updated again until you have connected the KVL to the KMF to upload the unit response messages.

7.5.13

Performing a Keyset Changeover on a Target Device

You can use the Key Variable Loader (KVL) to perform a keyset changeover (such as switching from Keyset 1 to Keyset 2) on a target device.

Prerequisites: Obtain:

- an appropriate key load cable
- an adapter (if required)

Procedure:

- 1 Connect the KVL to the target device.
A list of available options appears.
- 2 From the KVL main menu, go to **Configure a device** → **Keysets**.
- 3 Tap the list item for the keyset which you want to set as active.
- 4 Disconnect the target device.

7.5.14

Changing the Target Device MNP

You can connect the Key Variable Loader (KVL) to a target device, such as a radio. This allows you to view or change the MNP (Message Number Period) currently stored in the device.

Prerequisites: Obtain:

- an appropriate key load cable
- an adapter (if required)

Procedure:

- 1 Connect the KVL to the target device.
- 2 From the KVL main menu, go to **Configure a radio**→**MNP**.
The **MNP** list item appears with the currently selected value presented.

3



Enter the MNP desired value and tap

The default value is 1000.



NOTE: MNP value close to maximum is less secure. MNP value close to minimum is more secure, but in case of connectivity errors you may need to recover the MNP value.

- 4 Disconnect the target device.

7.5.15

Changing the Target Device and KMF RSI

You can connect the Key Variable Loader (KVL) to a target device, such as a radio. This allows you to view or change the RSI (Radio Set Identifier) and KMF RSI currently stored in the device.

Prerequisites: Obtain:

- an appropriate key load cable
- an adapter (if required)

Procedure:

- 1 Connect the target device.
- 2 From the KVL main menu, go to **Configure a radio**→**RSIs**.
The **RSI** list items appear with the currently selected values presented. The **Group RSI** list item is read-only.

- 3 Depending on which parameter you want to change, tap one of the following items:

- **RSI**
- **KMF RSI**

The default value for **RSI** is 9999998.

The default value for **KMF RSI** is 9999999.



- 4 Enter the desired RSI value and tap

- 5 Disconnect the target device.

7.6

Tactical OTAR Groups

Tactical OTAR is a Motorola Solutions feature that allows a KVL to wirelessly manage a key (TEK only) for a small group of radios, with one radio serving as an RF modem. The radio serving as an RF modem must be equipped with the Tactical Rekey/OTAR feature. The radio serving as an RF modem may also be a member of any one of the managed Tactical OTAR groups.

Equipment Needed For Tactical OTAR

- Radio equipped with the Tactical Rekey/OTAR feature
- Data cable and DB9 Gender Changer or APX-USB Cable and USB OTG
- Key load cable

7.6.1

Creating a Tactical OTAR Group

Procedure:

- 1 Log in as an administrator.
- 2 From the KVL main screen, go to **Tactical OTAR**→**Manage OTAR Groups**.
Existing Tactical OTAR groups are displayed on the screen.

- 3 Tap →**Add new OTAR group**.

Fill in the fields:

- 4 Enter the group name.
- 5 From the list, select the algorithm.
- 6 For **TEK**, perform one of the following actions:
 - To select the existing TEK, choose it from the list.

- 7 For **SEK**, perform one of the following actions:
 - To select the existing SEK, choose it from the list.

- To create a new SEK, tap →**New** and fill in the fields.

- 8 For **KEK**, perform one of the following actions:
 - To select the existing KEK, choose it from the list.

- To create a new KEK, tap →**New** and fill in the fields.

- 9 Enter the MNP (Message Number Period) for the group.

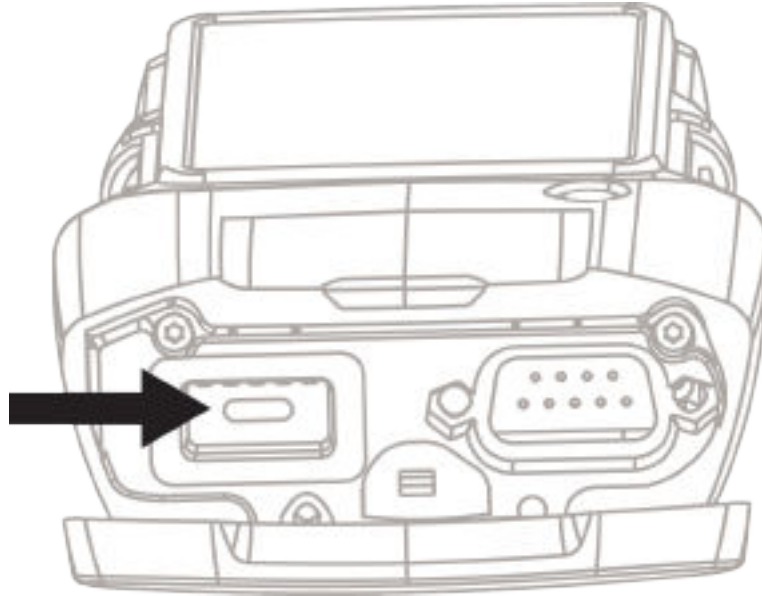


NOTE: MNP value close to maximum is less secure. MNP value close to minimum is more secure, but in case of connectivity errors you may need to recover the MNP value.

10 To add members, perform the following actions:

- a** Tap **Members**
- b** Connect the target radio to the KVL through the key load port.

Figure 27: KVL 5000 Key Load Port



The radio is added.

- c** Tap



7.6.2

Updating a Tactical OTAR Group

Prerequisites: If you want to perform Tactical OTAR update through USB you need to enable USB key loading. See [Managing USB Key Loading Settings on page 106](#).

Procedure:

- 1** Power on all the member radios of the Tactical OTAR group.
- 2** From the KVL main screen, go to **Tactical OTAR**→**Update OTAR Groups**.
- 3** Select the group from the list.
A list of members and their status (current or not current) appears.
- 4** Connect the radio through the DB9 port or through USB.

Figure 28: KVL DB9 Port

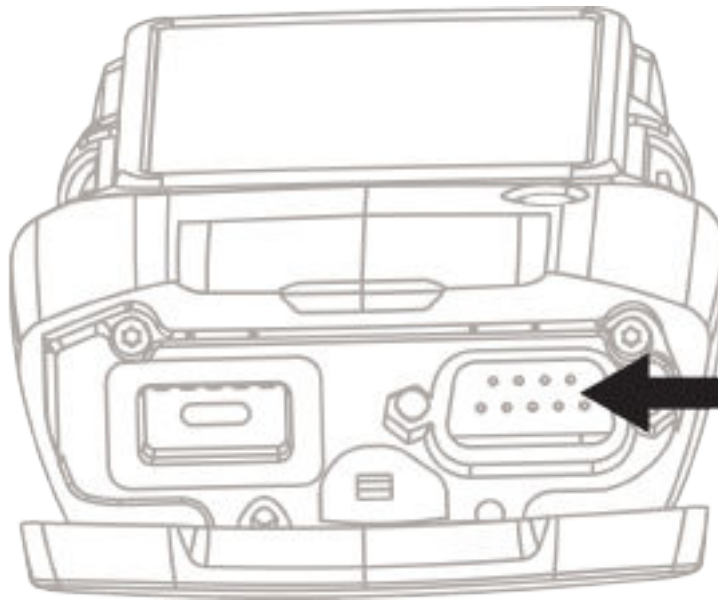
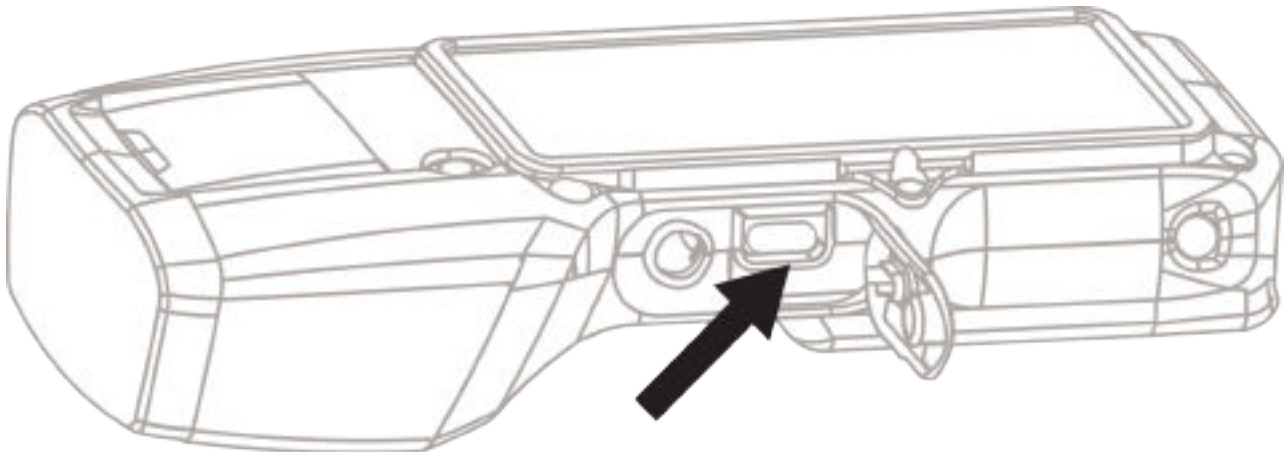



Figure 29: KVL Micro USB Port



- 5 Tap  and choose one of the following options:

- **Full update** updates all radios in the range.
- **Quick update** updates only radios in the range marked as not current.

Status of the operation for all members is displayed.

7.6.3

Editing Tactical OTAR Groups

You can edit the following parameters of the existing Tactical OTAR group:


- Name
- TEK
- MNP

- Add and remove members


Procedure:

- 1 Log in as an administrator.
- 2 From the KVL main screen, go to **Tactical OTAR**→**Manage OTAR Groups**.
- 3 From the list, select the Tactical OTAR group to edit.
- 4 Optional: Enter the group name.
- 5 For **TEK**, perform one of the following actions:
 - To edit the existing TEK, change the **Key ID** and **Key value**.



- To select the existing TEK, go to →**Select new TEK** and choose it from the list.
- To create a new TEK, perform the following actions:




- 1 Tap →**Select new TEK**.



- 2 Tap tap →**Add new key**.



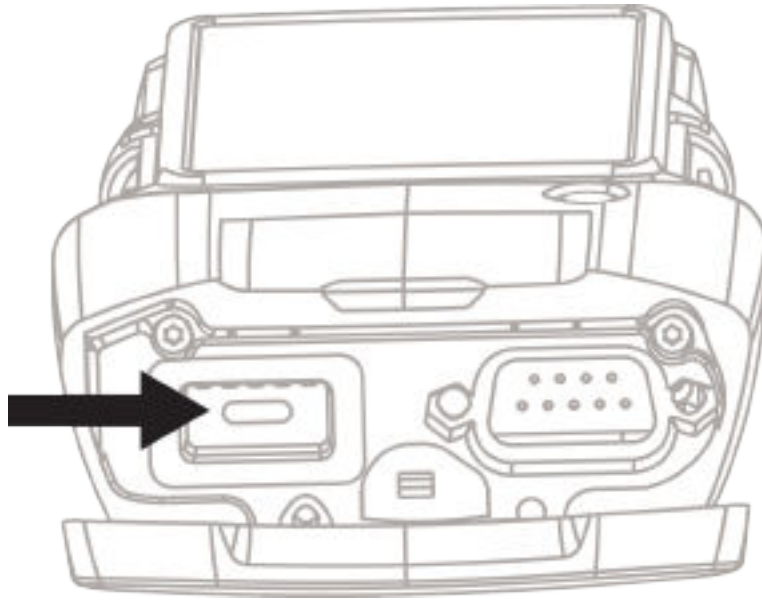
- 3 Fill in the fields and tap 
- 6 Enter the MNP (Message Number Period) for the group.



NOTE: MNP value close to maximum is less secure. MNP value close to minimum is more secure, but in case of connectivity errors you may need to recover the MNP value.


- 7 To add members, perform the following actions:
 - a Tap **Members**
 - b Connect the target radio to the KVL through the key load port.

Figure 30: KVL 5000 Key Load Port



The radio is added and a successful tone is played.



Even if you tap  and **Discard** the changes, the radio will remain a member of the Tactical OTAR group.


8 To remove members, perform the following actions:


a Tap **Members**

b Select the members to remove from the list.

c Tap  → **Remove selected**.

d When prompted, confirm your choice.

 **NOTE:** It is strongly advised to change a TEK for the group after removing a member.

e Tap  to go to main edit screen.

9 Tap  to save your changes.


7.6.4

Removing Tactical OTAR Groups

Procedure:

- 1 Log in as an administrator.
- 2 From the KVL main screen, go to **Tactical OTAR**→**Remove OTAR Groups**.
- 3 Select the groups to remove from the list.



- 4 Tap .
- 5 When prompted, confirm your choice.

7.7

KVL 5000 Radio Authentication

The Radio Authentication (RA) solution provides an extra level of verification, every time a radio registers to the system.

The Radio Authentication keys are generated on a KVL unit and these keys are used for provisioning all radios in the system. Before the radio may use this key, KVL must send the key to Authentication Center (AuC), which is responsible to propagate it in the correct form to the system infrastructure components responsible for subscriber registration.

Any unauthorized radio, without the correct key, will be denied access to the system and an alert will be sent to the system manager.

You need to configure all options to prepare the KVL for Radio Authentication key management operations.

7.7.1

Entering the KVL Radio Authentication ID

For Radio Authentication key management operations, the KVL needs a unique ID to communicate with the Authentication Center (AuC) and the target radio.



NOTE: KVL Radio Authentication ID must match the ID set for this KVL in AuC.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**KVL Radio Auth ID**.
- 3 Enter the KVL Radio Authentication ID.



- 4 Tap .

7.7.2

Entering the System ID

For the Radio Authentication key management operations, the KVL needs a unique System ID to communicate with the Authentication Center (AuC) and the target radio for automatic authentication key management.



CAUTION: System ID on AuC, target radio and KVL must be the same.
Changing the System ID erases all stored radio - key pairs.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**Radio authentication**→**System ID**.
- 3 Enter the System ID.

The available values range from 000 through FFF. The default value is 000 (not set). When the value is not set, you are not able to communicate with AuC.

- 4 Tap .

7.7.3

Entering the WACN ID

For the Radio Authentication key management operations, the KVL needs a unique WACN ID to communicate with the Authentication Center (AuC) and the target radio for automatic authentication key management.



CAUTION: WACN ID on AuC, target radio and KVL must be the same.
Changing the WACN ID erases all stored radio - key pairs.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**Radio authentication**→**WACN ID**.

The available values range from 00000 through FFFFF. The default value is 00000 (not set).
When the value is not set, you are not able to communicate with AuC.

- 3 Tap .

7.7.4

Entering the Radio Destination Port

For the Radio Authentication Key Management operations, you must configure the KVL with the destination port of the radio the KVL is going to communicate with.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings**→**Radio authentication**→**Radio port**.
- 3 Enter the radio destination port value.

The available values range from 49165 through 65535. The default value is 49165.

4 Tap .

7.7.5

Entering the AuC ID

For the Radio Authentication key management operations, enter the ID of the Authentication Center (AuC) your KVL communicates with.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Settings→Radio authentication→Authentication center→AuC ID**
- 3 Enter the AuC ID

The available values range from 1 through 9999999. The default value is 1.

4 Tap .

7.7.6

Entering the UKEK for Radio Authentication

For the Radio Authentication key management operations, program a Unique Key Encryption Key (UKEK) into the KVL for the AES-128 algorithm. The UKEK is a key used to communicate with AuC.



IMPORTANT:

The UKEK entered in the KVL must match the UKEK for this KVL in the AuC.

If the FIPS mode is changed or a system reset is performed on the KVL, the UKEK will be destroyed and you must reenter it.

If the KVL is compromised, you must enter a new UKEK in the KVL and AuC.

Procedure:

- 1 Log on as an Administrator.
- 2 On the KVL main screen, select **Settings→Radio authentication→Authentication center→UKEKs→AES128**.
- 3 Enter the UKEK.

4 Tap .

7.7.7

Entering the AuC IP Address

Procedure:

- 1 From the KVL main menu, go to **Settings→Radio authentication→Authentication center→IP address**.
- 2 Tap **Main AuC** and enter the IP address for main AuC.

The default value is 10.0.0.6



3 Tap

4 Tap **Backup AuC** and enter the IP address for backup AuC.

The default value is 10.0.1.6



5 Tap

7.7.8

Entering the AuC Port

Procedure:

1 From the KVL main menu, go to **Settings**→**Radio authentication**→**Authentication center**→**AuC port**

2 Enter the AuC port

The available values range from 49165 through 65535. The default value is 49165.



3 Tap

7.7.9

Selecting Main or Backup AuC

Choose whether your KVL communicates with main or backup Authentication Center (AuC).



NOTE: KVL connects only to the selected AuC. For example, selecting Main AuC does not mean that KVL will try to connect to Backup AuC if the connection fails.

Procedure:

1 Log on as an Administrator.

2 From the KVL main menu, go to **Settings**→**Radio authentication**→**Authentication center**→**Active AuC**

3 Select the AuC that your KVL communicates with.

7.7.10

Provisioning Radios with Authentication Keys

In the KVL, you can define authentication keys and load them into ASTRO® 25 radios.

Prerequisites:

Prepare your KVL for Radio Authentication key management operations. See:

- [Entering the KVL Radio Authentication ID on page 135](#)
- [Entering the System ID on page 136](#)
- [Entering the WACN ID on page 136](#)
- [Entering the Radio Destination Port on page 136](#)
- [Entering the AuC ID on page 137](#)

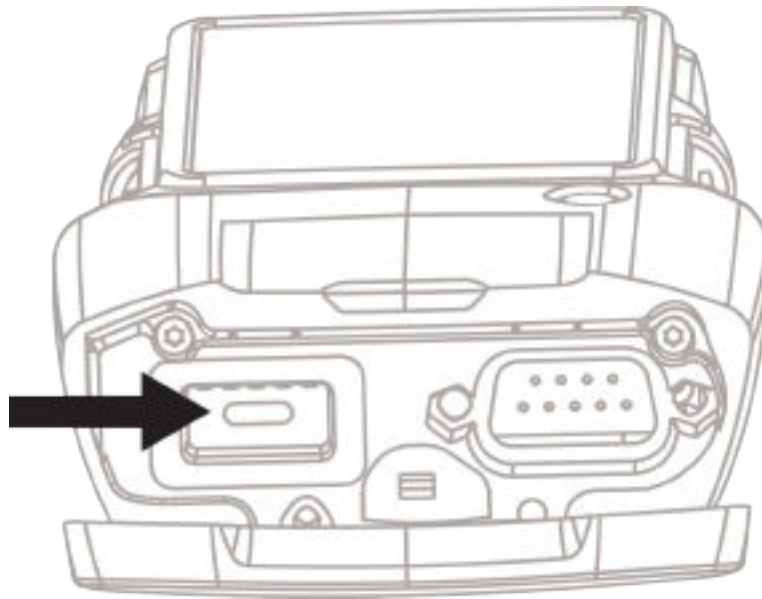
- [Entering the UKEK for Radio Authentication on page 137](#)
- [Entering the AuC IP Address on page 137](#)
- [Entering the AuC Port on page 138](#)

For USB key loading, make sure that USB key loading settings are correct. See [Managing USB Key Loading Settings on page 106](#)

Procedure:

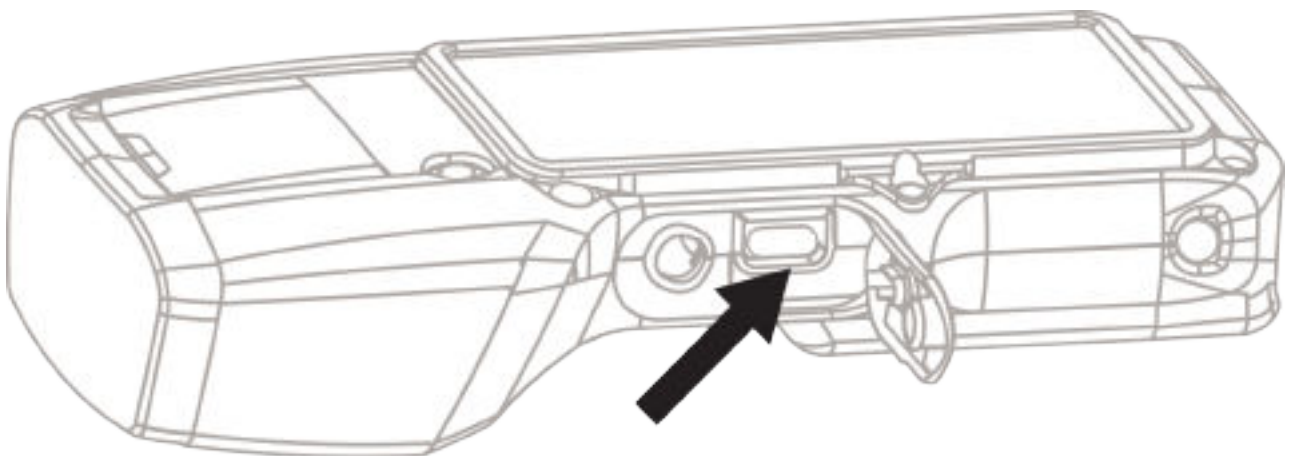
- 1 Connect the target device to the Key Variable Loader (KVL) using an appropriate key load cable.
 - Connect the KVL to the radio through the key load port.

Figure 31: KVL 5000 Key Load Port




- For target radio that supports only USB key loading, connect the KVL to the radio through the micro USB adapter

Figure 32: KVL Micro USB Port



- 2 From the KVL main menu, go to **Radio authentication**→**Provision radio**.
- 3 Perform one of the following actions:

If...	Then...
If you want to provision authentication keys automatically,	tap Auto generated . Key value is automatically generated and sent to AuC. Radio - key pairs for automatically generated keys are stored in the KVL memory.
If you want to provision authentication keys manually,	perform the following actions: a Tap Manually entered . b Enter the key value or tap Auto to generate a random key. <div></div> NOTE: For the Manually entered option, radio - key pairs are not stored in the KVL. Write down the key value to enter it in the AuC. <div></div> c Tap 

In case of errors, you can retry the operation by tapping **Try again**.

- 4 Optional: To provision another radio, connect the radio and tap **Provision next radio**.

7.7.11

Provisioning Radios with Authentication Keys using PTL Button

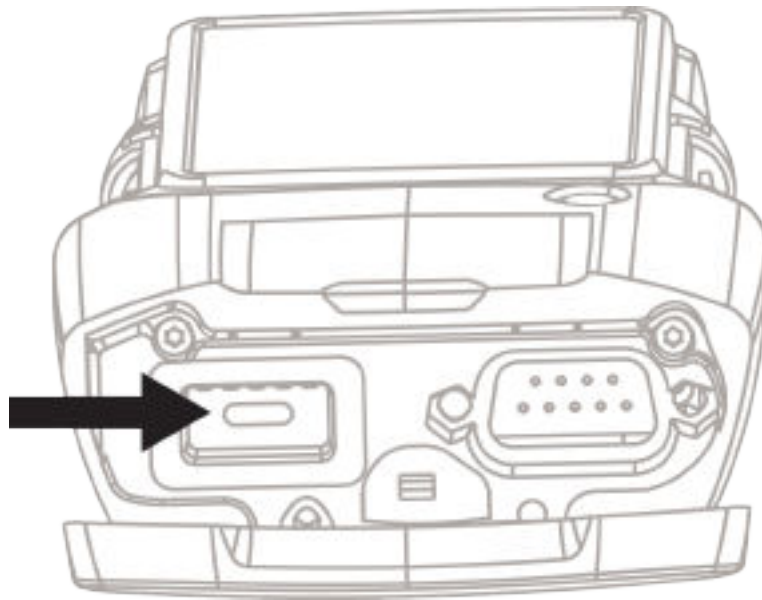
You can load auto generated authentication key to a radio using Push to Load (PTL) button.

Prerequisites: For USB key loading, make sure that USB key loading settings are correct. See [Managing USB Key Loading Settings on page 106](#)

Procedure:

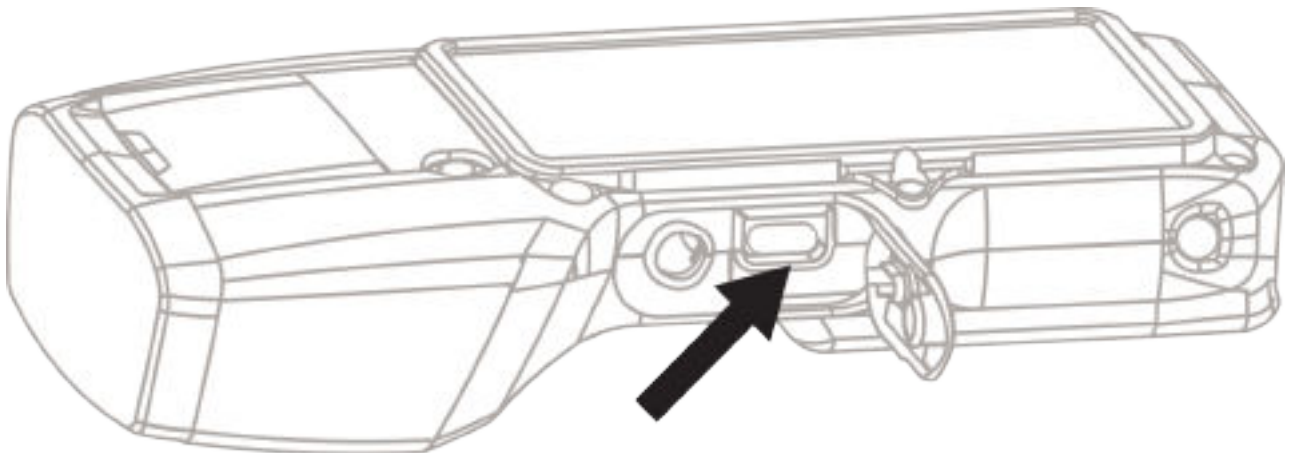
- 1 Connect the target device to the Key Variable Loader (KVL) using an appropriate key load cable.
 - Connect the KVL to the radio through the key load port.

Figure 33: KVL 5000 Key Load Port



- For target radio that supports only USB key loading, connect the KVL to the radio through the micro USB adapter

Figure 34: KVL Micro USB Port



- 2 Press the PTL button for a few seconds.

Key value is automatically generated and sent to AuC. Radio - key pairs for automatically generated keys are stored in the KVL memory.

- 3 Optional: You can load encryption keys to the same radio using PTL button. See [Loading Keys Using Push to Load \(PTL\) Button on page 107](#)

7.7.12

Uploading Radio-Key Pairs to AuC

Once you provision radio authentication keys, you need to load them to AuC. This applies only to auto generated keys. Manually generated key need to be manually entered in the AuC.

Procedure:

- 1 Connect the KVL to the network. See [Connecting the KVL to the KMF or AuC Using Network Connection on page 86](#)
- 2 From the KVL main menu, go to **Radio authentication**→**Connect to AuC**.
- 3 Choose how you want to connect to the Auc:

If...	Then...
If you want to connect to the Auc using network connection,	tap Network .
If you want to connect to the Auc using VPN connection,	perform the following actions: a Tap VPN Network . b Optional: If you did not configure a VPN connection earlier, you are prompted to configure a VPN connection. See Configuring a VPN Connection on page 95 . c Select VPN connection from the list and enter credentials.



In case of errors, you can retry the operation by pressing



You can cancel the operation by pressing

Auto generated radio - key pairs are uploaded to the AuC.

7.7.13

Viewing and Removing Radio - Key Pairs

The KVL can store a maximum of 475 radio - key pairs for Radio Authentication. Only auto generated keys are stored in the KVL memory. Once you upload them, you may remove them from the KVL.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu, go to **Radio authentication**→**View provisioned radios**.
To sort items on the list, see [Sorting and Filtering Items in KVL on page 101](#).
- 3 Perform one of the following actions:
 - To remove a single radio - key pair, select its checkbox from the list.



- To remove all radio - key pairs, tap →**Select all**.

- 4 Tap  → **Remove selected**.

7.8

KVL 5000 Operations Through a Remote Control Head

Sometimes the radio may be mounted in a vehicle's trunk and is difficult to access. Remote Control Head feature allows you to load and manage keys on a radio through a Remote Control Head that can be mounted in a vehicle's cabin.

7.8.1

Setting Up KVL for Remote Control Head Operations

Before using the feature, program the necessary parameters.

7.8.1.1

Entering the MNP for Remote Control Head Operations

The Message Number Period (MNP) is a feature used in an ASTRO® 25 system to provide additional security in the remote rekeying of subscriber units. The MNP number may range from 2 through 65535, and serves as an offset value used in synchronizing remote rekeying transmissions.

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main screen go to **Settings**→**Control Head**→**MNP**.
- 3 Enter the MNP value.



NOTE: MNP value close to maximum is less secure. MNP value close to minimum is more secure, but in case of connectivity errors you may need to recover the MNP value.

7.8.1.2

Entering the SEK and KEK for Remote Control Head Operations


You need to define both SEK and KEK for each algorithm used by the KVL.


Procedure:


- 1 Log on as an Administrator.
- 2 From the KVL main screen go to **Settings**→**Control Head**→**Control head keys**.
- 3 Select the desired algorithm.

The list contains all algorithms on your KVL.

ADP algorithm is not supported for Remote Control Head Operations

- 4 Tap **SEK**, enter the key and tap 

- 5 Tap **KEK**, enter the key and tap 

- 6 To confirm, tap  Control head keys for the algorithm are defined.

- 7 To define SEK and KEK for another algorithm, repeat [step 3](#) to [step 6](#) for this algorithm.

7.8.2

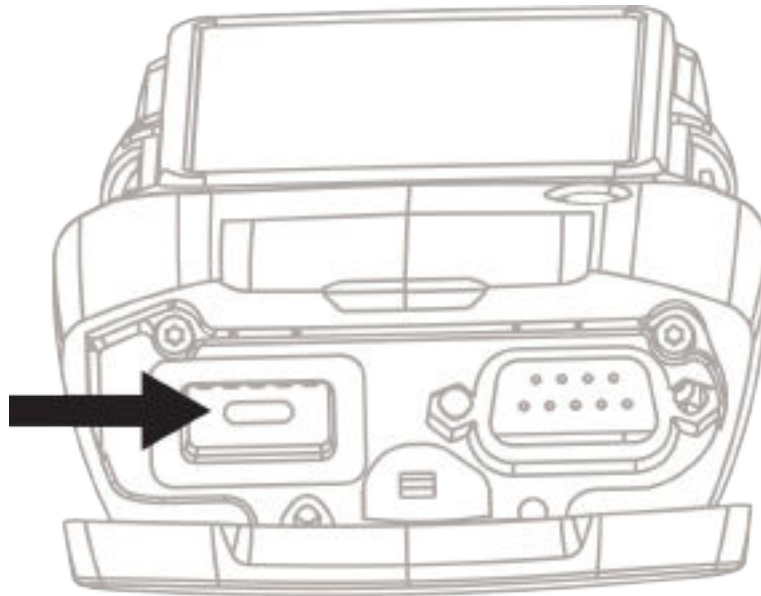
Provisioning a Radio for Remote Control Head Key Loading

To be able to perform operations through a Remote Control Head, provision a radio with keys for the available algorithms.

Procedure:

- 1 Connect the KVL to the mobile radio through the key load port.

Figure 35: KVL 5000 Key Load Port



- 2 From the KVL main screen go to **Load keys**→**Provision mobile radio**.
The provisioning process starts for each of the defined algorithms one by one.
- 3 Disconnect the radio.
- 4 Optional: Connect the next radio you want to provision.

7.8.3

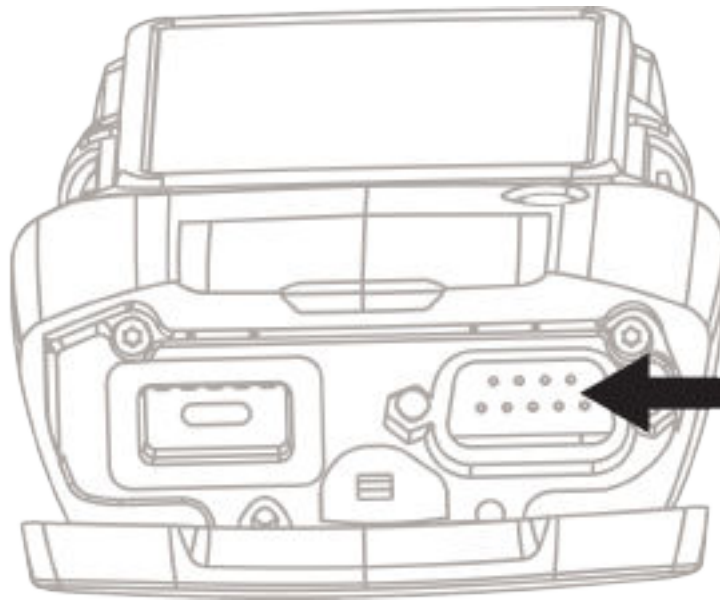
Performing KVL Operations Through a Remote Control Head

Prerequisites: Set up the KVL for Remote Control Head operations and provision each radio with appropriate algorithm(s).

Procedure:

- 1 Connect the KVL to the mobile radio's Remote Control Head using the DB9 Port, an appropriate data cable, and a DB9 Gender Changer.

Figure 36: KVL DB9 Port



- 2 You can perform the following operations through the Remote Control Head:
- [Loading Encryption Keys into Target Devices on page 105](#)
 - [Configuring Target Devices Using KVL on page 113](#)
 - [Updating a Target Device on page 128](#)

7.9

KVL Audit Log

Audit logs store information about activities performed in Key Variable Loader (KVL), such as adding, loading, or removing keys.

You can export and view logs on a PC.

7.9.1

Viewing the Audit Log

The log records are stored chronologically, with the most recent log record displayed first each time you access the log records.

The format of each log record entry on the list is:

- First line: Date and time
- Second Line: User role (Operator, Administrator, or Unknown)
- Third line: Type of action performed and details (for example, key name, key CKR, target device RSI)

Procedure:

- 1 From the KVL main menu, select **Audit log**.



- 2 To filter items on the list, tap  → **Filter** and apply one or more of filtering criteria.


See the following table:

Table 6: KVL Audit Log Filter Options

Parameter	Definition
Action type	Type of action performed on the Key Variable Loader (KVL). Example: Single key load, Key zero (key removal from a target device).
User Role	User role: Administrator or Operator Unknown user applies to a scenario when you launch the KVL for the first time before you define passwords or when log entry is added before logging in.
Target RSI	Target device Radio Set Identifier (RSI)
CKR ID	Common Key Reference (CKR) number of a key. This field appears only when you make a selection in Action type field.
Name	Key or key group name. This field appears only when you make a selection in Action type field.
From	The oldest date of operations on the list. You can set the date using the touch interface and tap Set . To clear the date, tap From → Clear
To	The latest date of operations on the list. You can set the date using the touch interface and tap Set . To clear the date, tap To → Clear

- 3 To apply filtering criteria, tap **Filter**.



- 4 To clear all filtering criteria, tap →**Filter**→**Reset**.

7.9.2


Exporting and Viewing Audit Logs on a PC

You can export audit log files to a PC and view them in .html format. .html view provides more details about operations

Procedure:

- 1 Launch Key Variable Loader (KVL) as an Administrator.
- 2 Connect KVL to a PC using micro USB cable. See [Connecting KVL to a PC on page 85](#)
- 3 From the KVL main menu, go to **Audit log**.



- 4 Tap →**Export logs**.
- 5 On the PC, go to `This PC\KVL5000\Internal shared storage\kvl logs\audit`.
Logs are stored in .html format. Audit logs file names contain date and time of the operation.

7.9.3

Setting the Audit Logs Limit

Key Variable Loader (KVL) can store between 1000 to 10000 audit logs. When you reach the limit that you set, audit logs are exported to .html format. You can view them on a PC.

Procedure:

- 1 Launch Key Variable Loader (KVL) as an Administrator.
- 2 From the main menu, go to **Settings**→**Security**→**Audit log back limit**.

- 3 Enter the **Export threshold** value and tap .

7.9.4

Clearing the Audit Log

Procedure:

- 1 Launch KVL as an Administrator.
- 2 From the KVL main menu, go to **Audit log**.

- 3 Tap →**Clear logs**.

- 4 When prompted, confirm your choice.

Chapter 8

KVL 5000 Upgrade

8.1


Upgrading KVL 5000 HSM and Operating System

Use this procedure to upgrade the HSM and the operating system of the KVL device.



NOTE: Both upgrade files must be compatible with each other.
You cannot perform a downgrade. If you upload earlier version of upgrade files, the upgrade is not possible.

Procedure:

- 1 Log on to the KVL as the administrator.
- 2 From the KVL main menu, go to **Settings**→**Manage firmware**→**KVL firmware**→**Upgrade**.
- 3 Connect the KVL to the PC using the micro USB cable. See [Connecting KVL to a PC on page 85](#)
- 4 On the PC, copy the dedicated HSM upgrade file and OS_Upgrade_<version number>.zip into the following directory: This PC\kvl5000\Internal shared storage\fwupdate.
The dedicated file extension for HSM upgrade is .bin_kvl
- 5 In the KVL, wait until the upgrade file is detected and tap **HSM & Operating System**.
- 6 When prompted, confirm your choice.
- 7 If a dialog box appears informing that the total number of algorithms after the upgrade exceeds the limit, you need to remove some of the algorithms before proceeding. See [Removing Algorithms from the KVL on page 156](#)
- 8 When prompted, confirm your choice by entering the Administrator password.
 **NOTE:** This prompt appears in a scenario when you have algorithms compliant with FIPS and upgrade operation adds algorithms not compliant with FIPS. Such operation makes changes the KVL into not compliant with FIPS and removes all keys and resets all passwords.
- 9 Confirm **EULA** screen.
- 10 If FIPS status changed, set new passwords for Operator and Administrator.

8.2

Removing Algorithms from the KVL

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu go to **Settings**→**Manage firmware**→**KVL firmware**→**Remove an algorithm**.

- 3 Select the algorithm you want to remove.



NOTE:

Algorithms other than AES are not compliant with FIPS. When you remove them, KVL status changes to compliant with FIPS. This operation removes all keys and resets all passwords.

Keys and Store and Forward messages associated with the algorithm are deleted.

- 4 Perform one of the following actions:

If...	Then...
If FIPS status changed,	perform the following actions: <ol style="list-style-type: none"> a Confirm your choice by entering the Administrator password. b Set new passwords for Operator and Administrator.
If FIPS status did not change,	when prompted, confirm your choice.

8.3

Upgrading the KVL 5000 Operating System

Use this procedure to upgrade the operating system of the KVL device.

Upgrading the OS automatically upgrades the KVL 5000 software.

You cannot perform the OS upgrade if the KVL battery is below 25%.

Procedure:

- 1 Log on to the KVL as the administrator.
- 2 In the main menu, select **Settings**→**Manage firmware**→**KVL firmware**→**Upgrade**.
- 3 Connect KVL to the PC using micro USB cable. See [Connecting KVL to a PC on page 85](#)
- 4 On the PC, copy the OS_Upgrade_<version number>.zip upgrade file into the following directory: This PC\kvl5000\Internal shared storage\fwupdate
 If you already upgraded your KVL OS, only the later version of the upgrade file is accepted.
- 5 In the KVL, wait until the upgrade file is detected and tap **Operating System**.
- 6 When prompted, confirm your choice.

The upgrade starts.

8.4

Upgrading the Hardware Security Module (HSM)

Use this procedure to upgrade the HSM.


Procedure:

- 1 Log on to the KVL as the administrator.
- 2 From the KVL main menu, go to **Settings**→**Manage firmware**→**KVL firmware**→**Upgrade**.
- 3 Connect the KVL to the PC using the micro USB cable. See [Connecting KVL to a PC on page 85](#)

- 4 On the PC, copy the dedicated HSM upgrade file into the following directory: This PC\kvl5000\Internal shared storage\fwupdate.
The dedicated file extension for HSM upgrade is .bin_kvl
- 5 In the KVL, wait until the upgrade file is detected and tap **HSM**.
- 6 When prompted, confirm your choice.
The upgrade file is uploaded into HSM.
- 7 If a dialog box appears informing that the total number of algorithms after the upgrade exceeds the limit, perform one of the following actions:
 - To continue, tap **Upgrade**.



IMPORTANT: The algorithms that exceed the limit will not be present after the upgrade.


- To cancel the upgrade operation, tap **Cancel**.
- 8 When prompted, confirm your choice by entering the Administrator password.
-  **NOTE:** This prompt appears in a scenario when you have algorithms compliant with FIPS and upgrade operation adds algorithms not compliant with FIPS. Such operation makes changes the KVL into not compliant with FIPS and removes all keys and resets all passwords.
- 9 Confirm **EULA** screen.
 - 10 If FIPS status changed, set new passwords for Operator and Administrator.

8.5

Upgrading KVL 5000 HSM and Software

Use this procedure to upgrade the HSM and KVL software.

Procedure:

- 1 Log on to the KVL as the administrator.
 - 2 From the KVL main menu, go to **Settings**→**Manage firmware**→**KVL firmware**→**Upgrade**.
 - 3 Connect the KVL to the PC using the micro USB cable. See [Connecting KVL to a PC on page 85](#)
 - 4 On the PC, copy the dedicated HSM upgrade file and com.motorola.kvl-**<version number>**.apk into the following directory: This PC\kvl5000\Internal shared storage\fwupdate.
The dedicated file extension for HSM upgrade is .bin_kvl
 - 5 In the KVL, wait until the upgrade file is detected and tap **HSM & Host**.
 - 6 When prompted, confirm your choice.
 - 7 If a dialog box appears informing that the total number of algorithms after the upgrade exceeds the limit, you need to remove some of the algorithms before proceeding. See [Removing Algorithms from the KVL on page 156](#)
 - 8 When prompted, confirm your choice by entering the Administrator password.
-  **NOTE:** This prompt appears in a scenario when you have algorithms compliant with FIPS and upgrade operation adds algorithms not compliant with FIPS. Such operation makes changes the KVL into not compliant with FIPS and removes all keys and resets all passwords.

9 Confirm **EULA** screen.

10 If FIPS status changed, set new passwords for Operator and Administrator.

8.6

Upgrading KVL 5000 Software

Use this procedure to upgrade Key Variable Loader (KVL) software.

Procedure:

- 1 Log on to the KVL as the administrator.
- 2 From the KVL main menu, go to **Settings→Manage firmware→KVL firmware→Upgrade**.
- 3 Connect the KVL to the PC using the micro USB cable. See [Connecting KVL to a PC on page 85](#)
- 4 On the PC, copy the `com.motorola.kvl-<version number>.apk` host upgrade file into the following directory: `This PC\kvl5000\Internal shared storage\fwupdate`
- 5 In the KVL, wait until the upgrade file is detected and tap **Host**.
- 6 When prompted, confirm your choice.

The upgrade starts.

Postrequisites: When the upgrade is finished, you are prompted to reboot the KVL. If you do not take any actions for 15 seconds, the KVL reboots automatically.

8.7

External Device Upgrade with KVL

Upgrade Notes

- The KVL 5000 can only process the most recently uploaded upgrade file.
- Each upgrade file allows the KVL5000 to perform a specific number of upgrades
- When you load a new upgrade file, KVL continues to keep track of the number of remaining upgrades from a previously loaded file.
- When you reload a previously loaded upgrade file, KVL continues to track the remaining number of upgrades. An upgrade file can be uploaded to the KVL multiple times.

8.7.1

Upgrading Radios

Procedure:

- 1 Log on to the KVL as the administrator.
- 2 In the main menu, select **Settings→Manage firmware→External module firmware→Upgrade**.
- 3 Connect the KVL to the PC using the micro USB cable. See [Connecting KVL to a PC on page 85](#)
- 4 On the PC, copy the external KVL upgrade file into the following directory: `This PC\kvl5000\Internal shared storage\fwupdate`.
The dedicated file extension for the upgrade is `.bin_module`.
- 5 In the KVL, wait until the upgrade file is detected and tap **Upload File to HSM**.

- 6 When prompted, confirm your choice.
The upload starts.
- 7 Once the upload is finished, connect the external device compatible with the uploaded upgrade file.
- 8 In the KVL, wait until the upgrade file is detected and tap **Upgrade Device**.
- 9 When prompted, confirm your choice.
The upgrade starts.
- 10 Once the upgrade is completed, disconnect and reboot the target device.
- 11 To upgrade another target device, connect the new one.

8.7.2

Upgrading MCC 7500 VPM Dispatch Consoles or MCC 7500 AIS Secure Cards

Prerequisites: Obtain the previously recorded and maintained key and configuration data for the target device so that it can be re-loaded once the upgrade is complete.



CAUTION: During the upgrade, all key and configuration data stored in the target device will be erased. The target device will require this data after the upgrade is complete. Failure to recover this information after the upgrade could result in a temporary loss of functionality.

Procedure:

- 1 Perform one of the following actions:
 - If you are upgrading an MCC 7500 VPM Dispatch Console Secure Card, log out of the Dispatch Console Application (Elite) or use Network Manager to disable the MCC 7500 VPM Dispatch Console.
 - If you are upgrading an MCC 7500 AIS Secure Card, use Network Manager to disable the AIS.
- 2 Verify the **KVL Ready** LED on the target device is lit.
- 3 Ensure the target device is powered on. Do not switch off the target device before completing the upgrade procedure.
- 4 Log on to the KVL as the administrator.
- 5 In the main menu, select **Settings**→**Manage firmware**→**External module firmware**→**Upgrade**.
- 6 Connect the KVL to the PC using the micro USB cable. See [Connecting KVL to a PC on page 85](#)
- 7 On the PC, copy the external KVL upgrade file into the following directory: This
`PC\kv15000\Internal shared storage\fwupdate.`
The dedicated file extension for the upgrade is `.bin_module`.
- 8 In the KVL, wait until the upgrade file is detected and tap **Upload File to HSM**.
- 9 When prompted, confirm your choice.
The upload starts.
- 10 Once the upload is finished, connect the external device compatible with the uploaded upgrade file.
- 11 In the KVL, wait until the upgrade file is detected and tap **Upgrade Device**.

12 When prompted, confirm your choice.



NOTE: After a successful upgrade, the target device resets itself. (It may take up to 6 minutes for the target device to complete the reset.) Before proceeding, wait until the **KVL Ready** LED on the target device is lit again.

13 Once the upgrade is completed, disconnect and reboot the target device.

14 Perform one of the following actions:

- If you are upgrading an MCC 7500 VPM Dispatch Console Secure Card, log on to the Dispatch Console Application (Elite) again or use the Network Manager to re-enable the MCC 7500 VPM Dispatch Console.
- If you are upgrading an MCC 7500 AIS Secure Card, use the Network Manager to re-enable the AIS.

15 Verify the **KVL Ready** LED on the target device is **not** lit.

Postrequisites: Re-configure the target device with all the key data and configuration information.

8.7.3

Upgrading Algorithms on TMGs and/or VPMs

Prerequisites: Obtain the previously recorded and maintained key and configuration data for the target device so that it can be re-loaded once the upgrade is complete.



CAUTION: During the upgrade, all key and configuration data stored in the target device will be erased. The target device will require this data after the upgrade is complete. Failure to recover this information after the upgrade could result in a temporary loss of functionality.

Procedure:

- 1 Verify the **KVL Ready** LED on the target device is lit.
- 2 Ensure the target device is powered on. Do not switch off the target device before completing the upgrade procedure.
- 3 Log on to the KVL as the administrator.
- 4 In the main menu, select **Settings**→**Manage firmware**→**External module firmware**→**Upgrade**.
- 5 Connect the KVL to the PC using the micro USB cable. See [Connecting KVL to a PC on page 85](#)
- 6 On the PC, copy the external KVL upgrade file into the following directory: This
PC\kvl5000\Internal shared storage\fwupdate.
The dedicated file extension for the upgrade is `.bin_module`.
- 7 In the KVL, wait until the upgrade file is detected and tap **Upload File to HSM**.
- 8 When prompted, confirm your choice.
The upload starts.
- 9 Once the upload is finished, connect the external device compatible with the uploaded upgrade file.
- 10 In the KVL, wait until the upgrade file is detected and tap **Upgrade Device**.
- 11 When prompted, confirm your choice.



NOTE: After a successful upgrade, the target device resets itself. (It may take up to 6 minutes for the target device to complete the reset.) Before proceeding, wait until the **KVL Ready** LED on the target device is lit again.

12 Once the upgrade is completed, disconnect and reboot the target device.

Postrequisites: Re-configure the target device with all the key data and configuration information.

8.7.4

Upgrading Algorithms on KMF CryptRs

Prerequisites: Obtain the previously recorded and maintained key and configuration data for the target device so that it can be re-loaded once the upgrade is complete.



CAUTION: During the upgrade, all key and configuration data stored in the target device will be erased. The target device will require this data after the upgrade is complete. Failure to recover this information after the upgrade could result in a temporary loss of functionality.

Procedure:


- 1 Log on to the KVL as the administrator.
- 2 In the main menu, select **Settings**→**Manage firmware**→**External module firmware**→**Upgrade**.
- 3 Connect the KVL to the PC using the micro USB cable. See [Connecting KVL to a PC on page 85](#)
- 4 On the PC, copy the external KVL upgrade file into the following directory: `This PC\kvl5000\Internal shared storage\fwupdate`.
The dedicated file extension for the upgrade is `.bin_module`.
- 5 In the KVL, wait until the upgrade file is detected and tap **Upload File to HSM**.
- 6 When prompted, confirm your choice.
The upload starts.
- 7 Connect the **red** key load port on the KMF CryptR to the key load port on the KVL using an appropriate key load cable.
- 8 Put the KMF CryptR into the KVL programming mode by performing the following actions:
 - a Log on to the KMF Client application.
 - b From the main menu, select **Configuration**→**KMF CryptR**.
 - c In the **KMF CryptR Management** view, select **Program**.
 - d In the **KMF CryptR Programming Mode** window, enter your password and click **Yes**.
- 9 Ensure the KMF CryptR is powered on.
- 10 In the KVL, wait until the upgrade file is detected and tap **Upgrade Device**.
The upgrade process may take a long time. Do not switch off the KMF CryptR before the upgrade is complete.
- 11 Power cycle the KMF CryptR.
- 12 Disconnect the KMF CryptR.
- 13 Reboot the KMF Server.
- 14 In the KMF Client, reload all the master keys for each algorithm. See “Reloading Master Keys” in the *Key Management Facility User Guide*.

Postrequisites: Re-configure the KMF CryptR with all the key data and configuration information.

8.7.5

Upgrading CDEMs and/or PDEGs

Procedure:

- 1 Ensure the target device is powered on. Do not switch off the target device before completing the upgrade procedure.
 - 2 Connect the **red** key load port on the target device to the key load port on the KVL using an appropriate key load cable.
 - 3 Log on to the KVL as the administrator.
 - 4 In the main menu, select **Settings→Manage firmware→External module firmware→Upgrade**.
 - 5 Connect the KVL to the PC using the micro USB cable. See [Connecting KVL to a PC on page 85](#)
 - 6 On the PC, copy the external KVL upgrade file into the following directory: `This PC\kvl5000\Internal shared storage\fwupdate`.
The dedicated file extension for the upgrade is `.bin_module`.
 - 7 In the KVL, wait until the upgrade file is detected and tap **Upload File to HSM**.
 - 8 When prompted, confirm your choice.
The upload starts.
 - 9 Once the upload is finished, connect the external device compatible with the uploaded upgrade file.
 - 10 In the KVL, wait until the upgrade file is detected and tap **Upgrade Device**.
-  **NOTE:** If the upgrade process starts but does not progress after 30 seconds, press the **Reset** button on the CDEM.
- 11 Power cycle the target device.
 - 12 Disconnect the target device.
 - 13 Repeat all steps for **black** key load port on the target device.

8.7.6

Upgrading CRYPTR micro

Procedure:

- 1 Connect the CRYPTR micro key load cable to the key load port on the KVL.
- 2 Remove the CRYPTR micro from its host device.
- 3 Insert the CRYPTR micro into the cable's SD Slot.
- 4 Log on to the KVL as the administrator.
- 5 In the main menu, select **Settings→Manage firmware→External module firmware→Upgrade**.
- 6 Connect the KVL to the PC using the micro USB cable. See [Connecting KVL to a PC on page 85](#)
- 7 On the PC, copy the external KVL upgrade file into the following directory: `This PC\kvl5000\Internal shared storage\fwupdate`.
The dedicated file extension for the upgrade is `.bin_module`.
- 8 In the KVL, wait until the upgrade file is detected and tap **Upload File to HSM**.

- 9 When prompted, confirm your choice.
The upload starts.
- 10 In the KVL, wait until the upgrade file is detected and tap **Upgrade Device**.
- 11 When the upgrade is finished, remove the CRYPTR micro from the cable's SD Slot.
- 12 Place the CRYPTR micro back into its host device.
- 13 Disconnect the CRYPTR micro key load cable from the KVL.

8.8

Removing Algorithms from the KVL

Procedure:

- 1 Log on as an Administrator.
- 2 From the KVL main menu go to **Settings**→**Manage firmware**→**KVL firmware**→**Remove an algorithm**.
- 3 Select the algorithm you want to remove.



NOTE:

Algorithms other than AES are not compliant with FIPS. When you remove them, KVL status changes to compliant with FIPS. This operation removes all keys and resets all passwords.

Keys and Store and Forward messages associated with the algorithm are deleted.

- 4 Perform one of the following actions:

If...	Then...
If FIPS status changed,	perform the following actions: a Confirm your choice by entering the Administrator password. b Set new passwords for Operator and Administrator.
If FIPS status did not change,	when prompted, confirm your choice.

8.9

Viewing the KVL Firmware Information

You can view algorithms available in your KVL and the current KVL firmware version.

Procedure:

From the KVL main menu go to **Settings**→**Manage firmware**→**KVL firmware**→**Firmware information**.

8.10

Viewing the KVL Upgrade File Information

Before performing an upgrade, you can see the version of the upgrade file uploaded to HSM.

Procedure:

From the KVL main menu, go to **Settings**→**Manage firmware**→**KVL firmware**→**Upgrade information**.

8.11

Viewing the Target Device Firmware Information



NOTE: You cannot perform this procedure for a radio that supports USB key loading only.

Procedure:

- 1 Connect the KVL to a target device.
- 2 From the KVL main menu go to **Settings**→**Manage firmware**→**External module firmware**→**Firmware information**.

8.12

Viewing the Target Device Upgrade File Information

Procedure:

- 1 Connect the KVL to a target device.
- 2 From the KVL main menu, go to **Settings**→**Manage firmware**→**External module firmware**→**Upgrade information**.

Chapter 9

Troubleshooting

9.1

White Screen while Turning On the KVL

This happens when the KVL is in battery charging mode. Disconnect the KVL from the power source and press the Power button for a few seconds

9.2

Unlocking the Operator Account

Administrator can unlock the Operator account if it gets locked out. It is not possible to unlock the Administrator account. The Administrator account unlocks after a defined amount of time. An account gets locked out if you enter an incorrect password several times in a row. For more details, see [Setting Password Security Options on page 77](#)

Procedure:

- 1 Log on to the KVL as an Administrator.
- 2 From the main menu, go to **Settings**→**Security**→**Unlock operator account**.
- 3 When prompted, confirm your choice.

9.3

Resetting the KVL Passwords When Passwords are Not Known

If you forget both Administrator and Operator passwords, the only way to access the KVL is to perform a system reset.

Procedure:

Perform a system reset. See [Performing a System Reset on page 166](#)

9.4

KVL Error Messages

Table 7: KVL Startup Errors

Displayed at the KVL Startup. Prevent KVL from operating normally. Usually caused by unsuccessful upgrade.

Error/Status Message	Probable Cause	Remedy
Corrupted database	Database structure changed after application upgrade and the new structure is not correct	Perform a system reset.
Corrupted Key Protection Key	Key Protection Key was changed after HSM upgrade.	Perform a system reset.
HSM version verification	Current HSM version is out of date.	Upgrade the HSM.

Table 8: KVL User Entry Errors


Displayed in response to an illegal or disallowed action (such as entering an invalid value, entering a duplicate KID, and so on).

Error/Status Message	Probable Cause	Remedy
Error: The key entered is weak. Enter a strong key.	Displayed when you have entered a key that has been determined to be cryptographically weak and unworthy for use in the system.	Try entering another key.
Red key transfers are not allowed in FIPS Level 3 mode.	Displayed when an unencrypted (red) key transfer is initiated while in FIPS Level 3 mode, where only encrypted (black) key loading is allowed.	Use a target device that supports encrypted (black) key loading only, or change FIPS to Level 2. See Changing the FIPS Mode on page 90
Error: Duplicate Key ID found.	A key with this KID already exists in the KVL database.	Enter another KID value.
Error: Duplicate Name found.	The name you have entered for the key or key group already exists.	Enter another name.
Error: Duplicate CKR ID found.	A key with this CKR already exists in the KVL database.	Enter another CKR value.
Maximal number of <keys/groups> was reached	You exceeded the maximal number of allowed keys/key groups in the KVL.	Delete keys/groups to make up space for new ones.
There are no modem configuration files	Displayed when importing a modem connection string from a PC and there are no configuration files in the appropriate folder.	Connect the KVL to a PC and make sure that the <code>txt</code> file with the connection string is in the following location: This PC\kvl5000\settings

Table 9: KVL Operational Errors

Displayed during normal operation in response to a user-initiated action, such as attempting to load a key to a target device.

For most of the operational errors, the cause is a faulty cable connection between the KVL and the target device. Ensure that the connection is good and try the operation again. If it still fails, contact Motorola Solutions.

Error/Status Message	Probable Cause	Remedy
No updates for this radio.	No jobs have been received for the connected target device.	Connect to KMF to obtain jobs for the target device. <div>  NOTE: The KMF operator may have to associate this target device with the KVL in use to have the KVL Store & Forward jobs for this target device. </div>

Error/Status Message	Probable Cause	Remedy
Radio has already been updated.	The KVL has already delivered the jobs it had to this target device. No additional updates can be made.	Connect to the KMF before attempting another upload to this target device.
Error Database has been corrupted.	The KVL has suffered an event that left its database corrupted and the resulting data cannot be trusted.	Perform a System Reset or exit the application.
Could not update radio. Check connection.	The target device may be disconnected.	Check connection and retry the operation.
Could not get the radio's MNP. Check connection.	The target device may be disconnected.	Check connection and retry the operation.
Could not get the radio's keysets. Check connection.	The target device may be disconnected.	Check connection and retry the operation.
Could not get the radio's KMF RSI. Check connection.	The target device may be disconnected.	Check connection and retry the operation.
Could not get the radio's RSI. Check connection.	The target device may be disconnected.	Check connection and retry the operation.
Could not change the radio's active keysets. Check connection.	The target device may be disconnected.	Check connection and retry the operation.
Check radio's algorithm (Displayed as a key subtitle)	An algorithm issue occurred.	Check the connection to the target device and make sure that the target device supports the algorithm of the key being loaded.
Not supported by radio (Displayed as a key subtitle)	An algorithm is not supported.	Check the connection to the target device and make sure that the target device supports the algorithm of the key being loaded.
(ASTRO® 25 systems only) The KVL 3000/3000 Plus is emitting continuous success tones when connected to the KVL 5000 for sharing.	The KVL 5000 is trying to determine if the KVL 3000/3000 Plus is connected or disconnected.	Turn off the sound for the KVL 3000/3000 Plus.
There was a problem with the upload to the radio. Please connect to the KMF for more details	There were errors during while forwarding to the radio	Connect to the KMF and perform Store & Forward operation again. The details are displayed in the KMF. See Performing Store and Forward Operations on page 125

Error/Status Message	Probable Cause	Remedy
Network interface is not connected	<ol style="list-style-type: none"> 1 USB to Ethernet adapter is not connected to KVL 2 Network cable is not connected to USB to Ethernet adapter 3 DHCP server did not assign the IP address when DHCP network option is enabled 	<ol style="list-style-type: none"> 1 Connect USB to Ethernet adapter to the KVL and connect network cable to USB to Ethernet adapter 2 Turn off DHCP and set static network configuration. See Troubleshooting Potential IP Connection Issue on page 164
No response from KMF	This error happens when connecting to a modem takes too long.	Edit modem connection string. See Editing Modem Connection String on page 93
Radio is not responding	The target device may be disconnected.	Check connection and retry the operation.
Limit for <keys/groups> exceeded (Displayed as subtitle for sharing operation)	You exceeded the keys/groups limit on the target KVL.	Remove keys/groups on the target KVL to make up space for new ones.
Invalid algorithm(Displayed as subtitle for sharing operation)	The KVL does not have the same algorithm as the target KVL	<ol style="list-style-type: none"> 1 Use the KVL that has the same algorithm as the target KVL. 2 Purchase an appropriate algorithm and add it to the KVL or target KVL.
Invalid System Key(Displayed as subtitle for sharing operation)	System key on both KVLs does not match. This error can appear while sharing keys that require a system key.	Set the matching system key on both KVLs.

Table 10: KVL Radio Authentication Errors

Displayed during Radio Authentication operations

Error/Status Message	Probable Cause	Remedy
There is no AES128 algorithm on KVL that is required for Radio Authentication. (appears while provisioning a radio)	AES128 algorithm not added to the KVL	Upgrade the HSM with image file containing AES128 algorithm.
The system ID of the radio and KVL do not match. Please try again. (appears while provisioning a radio)	Incorrect System ID	Make sure that the radio and the KVL have the same System ID.
The WACN ID of the radio and KVL do not match, Please try again. (appears while provisioning a radio)	Incorrect WACN ID	Make sure that the radio and the KVL have the same WACN ID.

Error/Status Message	Probable Cause	Remedy
There was an issue with AuC connection on the application level. Please check AuC configuration and try again	Incorrect configuration of AuC ID, KVL Radio Auth ID or UKEKs	Make sure the values are correct and retry. See: Entering the KVL Radio Authentication ID on page 135 Entering the System ID on page 136 Entering the WACN ID on page 136 Entering the Radio Destination Port on page 136 Entering the AuC ID on page 137 Entering the UKEK for Radio Authentication on page 137 Entering the AuC IP Address on page 137 Entering the AuC Port on page 138 Selecting Main or Backup AuC on page 138
There was an issue with AuC connection on the network level. Please check network settings and try again	Incorrect configuration of AuC IP address, AuC port, KVL IP address or problem with Ethernet network	Make sure the values are correct and retry. See: Entering the KVL Radio Authentication ID on page 135 Entering the System ID on page 136 Entering the WACN ID on page 136 Entering the Radio Destination Port on page 136 Entering the AuC ID on page 137 Entering the UKEK for Radio Authentication on page 137 Entering the AuC IP Address on page 137 Entering the AuC Port on page 138 Selecting Main or Backup AuC on page 138

Table 11: KVL Remote Control Head Errors

Displayed during Remote Control Head operations

Error/Status Message	Probable Cause	Remedy
No control head key on KVL defined for <i><algorithm type></i>	The SEK and KEK keys for that algorithm are not set defined.	See Entering the SEK and KEK for Remote Control Head Operations on page 143
Device not provisioned with <i><algorithm type></i> key	Mobile radio is not provisioned with SEK and KEK keys for this algorithm.	See Provisioning a Radio for Remote Control Head Key Loading on page 144
Radio not provisioned. Please provision mobile radio with control head keys	Mobile radio is not provisioned with SEK and KEK keys for this algorithm.	See Provisioning a Radio for Remote Control Head Key Loading on page 144
Not supported by device	Mobile radio does not support the selected algorithm.	Upgrade the mobile radio with the desired algorithm or select a key with the correct algorithm.

9.5

KVL is not Detected when Connected to a PC

KVL is detected on a PC only when you perform operations requiring data transfer to/from the PC. Such operations are:

- Importing modem connection string
- Transferring upgrade files
- Exporting audit logs and KVL logs

Plugging KVL to a PC always charges the KVL battery.

9.6

Radio Authentication: Troubleshooting KVL - Radio Connection

In case of connection issue while connecting KVL to the Radio for Radio Authentication operations, make sure that the following conditions are met:

Procedure:

- 1 You used serial cable for connection between KVL and the radio.
- 2 KVL Radio Authentication settings are correct and match those on the radio.

See:

- [Entering the KVL Radio Authentication ID on page 135](#)
- [Entering the System ID on page 136](#)
- [Entering the WACN ID on page 136](#)
- [Entering the Radio Destination Port on page 136](#)
- [Entering the AuC ID on page 137](#)
- [Entering the UKEK for Radio Authentication on page 137](#)
- [Entering the AuC IP Address on page 137](#)
- [Entering the AuC Port on page 138](#)
- [Selecting Main or Backup AuC on page 138](#)

- 3 Radio is configured for Radio Authentication feature.

Make sure the following settings are correctly set on the radio:

- System ID
 - WACN ID
 - Radio ID
 - Radio port
- 4 Radio has the profile with correct Radio ID. For more information, see the documentation for your radio model.
 - 5 Certain features on the radio are not turned off due to low battery.

9.7

Troubleshooting USB Connectivity for Key Loading

In case of connection issue while connecting KVL to the Radio for USB key loading, make sure that the following conditions are met:

Procedure:

- 1 USB key loading is enabled on the KVL. See [Managing USB Key Loading Settings on page 106](#)
- 2 The same UDP port number is set on the KVL and the radio.
- 3 KVL is in FIPS level 2. See [Changing the FIPS Mode on page 90](#)

9.8

Troubleshooting USB Storage Problems for Key File Export

When exporting a key file to a USB flash drive, keep in mind the following potential issues:

- If you do not disconnect the USB flash drive after a successful export, the key file may not be saved correctly on the USB flash drive.
- If you disconnect the USB flash drive after a successful export and you want to perform another export, you need to unplug and plug the USB flash drive.

9.9

Troubleshooting Potential IP Connection Issue

When you connect the KVL to a network and DHCP on KVL is **On**, in some networks it is possible that the default gateway is not set properly. This may result in connection failure.

Procedure:

- 1 Connect KVL to the network. See [Connecting the KVL to the KMF or AuC Using Network Connection on page 86](#)
- 2 From the KVL main menu go to **Settings**→**General**→**Hardware**→**Ethernet**.
- 3 Note down the values from **IP address** and **Subnet mask** fields.
- 4 Set **DHCP** to **Off**.
- 5 In **IP address** and **Subnet mask** fields, manually enter the values that you noted down.
- 6 Tap **Default gateway**.

The maximum value is entered automatically.

- 7 Tap 

- 8 If the problem is not solved, in the **Default gateway** field enter the minimum allowed value.
- 9 If the problem is still not solved, contact your system administrator.

9.10

Troubleshooting Potential VPN Connection Issues

Most of the VPN connection issues may be resolved in the following way:

Procedure:

- 1 Check the cable connection between KVL and KMF.
- 2 Make sure that the VPN is configured correctly. See [Configuring a VPN Connection on page 95](#)
- 3 Disconnect and connect to a VPN again by performing the following actions:
 - a From the KVL main menu, go to **Settings**→**General**→**Hardware**→**VPN**.
 - b Disconnect from a selected VPN by tapping the VPN name on the list and tapping **Disconnect**.
 - c Connect to a VPN by tapping its name on the list.
 - d When prompted, enter the credentials for your VPN.

9.11


Exporting and Viewing the KVL Log

Logs are stored internally on the KVL. To view KVL log files stored in KVL memory, you need to export them to a PC. On a PC, you can view KVL logs in `.log` format.

Prerequisites: Make sure you enabled logging earlier by selecting **Log to file**.

Procedure:

- 1 Connect KVL to a PC. See [Connecting KVL to a PC on page 85](#)
- 2 From the KVL main menu, go to **Settings**→**General**→**KVL Log**.
- 3 Perform one of the following actions:

- To export log files related to the KVL device, tap →**Send logs**.
- To export log files related to the KVL operating system, tap **Export crash dump** at the bottom of the screen

Single KVL vibration indicates the beginning of collecting logs.

Double KVL vibration indicates that the process is complete.

- 4 On the PC, go to `This PC\KVL500\Internal shared storage\kvl logs`.

KVL Logs are stored in `.log` format. Name of the log file is the date from when they come from.

KVL operating system logs are stored in `tar.gz` format.

9.12

Clearing the Local KVL Log Repository

You can permanently remove all KVL logs stored on the KVL device.

Procedure:

- 1 From the KVL main menu, go to **Settings**→**General**→**KVL Log**.



- 2 Tap  → **Clear local log repository.**

Removing the log from the PC location (This PC\KVL5000\Internal shared storage\kvl logs) does not remove the logs from the KVL.

- 3 When prompted, confirm your choice.

9.13

Performing a System Reset

Resetting causes the KVL to erase the UKEs, all stored keys, key groups, log records, and passwords, and reset the configuration settings to the factory defaults.

Prerequisites: KVL must be turned on.



CAUTION:

Maintain the values of Master Key and System Key and store them in a secure location.

Maintain Master Key (or Keys) for each KMF that the KVL communicates with.

Only one algorithm at a time can use the system key (either DVI-XL or CFX-256).

Procedure:

- 1 Press the System Reset button (small button at the bottom, on the right side of the KVL) for 3 seconds.
- 2 When prompted, confirm your choice.
- 3 Alternatively, from the main menu you can go to **Settings**→**System reset**.

9.14

Performing KVL Factory Reset

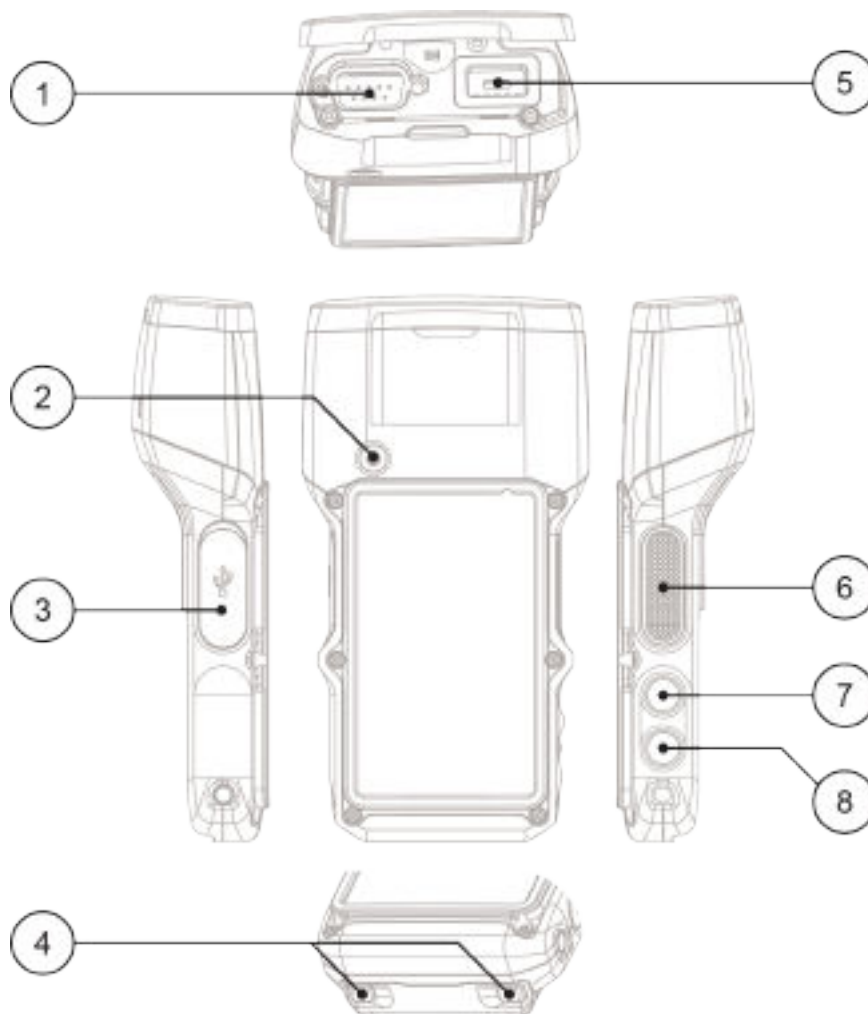
Resetting causes the KVL to erase the UKEs, all stored keys, key groups, log records, and reset the configuration settings to the factory defaults.

Perform factory reset when you are unable to perform a system reset (for example, you cannot launch KVL).

Procedure:

- 1 Make sure the KVL is turned off and not connected to power source.
- 2 Hold “Push To Load” and “Go To Main Menu” and Power buttons simultaneously for 3 seconds. (6, 7 and 2).

Figure 37: KVL 5000 Ports and Hardware Buttons (click to expand)



- 3** Select **Wipe user data and keys** using power buttons:

Hardware button	Function
System Reset (8)	Down
Go to Main Menu (7)	Up
Power (2)	Select



NOTE: The other options are not designed for regular KVL users and are out of scope of this document.

- 4** To cancel the operation, select **Power off** or **Reboot system now**.

9.15

KVL Recovery Procedure

If you are not able to use the KVL properly, you need to restore it to the default settings and perform the initial configuration again.

Procedure:

- 1 Perform System Reset. See [Performing a System Reset on page 166](#).
- 2 If you are unable to perform system reset, perform factory reset. See [Performing KVL Factory Reset on page 166](#).
- 3 Launch the KVL. See [Launching KVL for the First Time on page 73](#).
- 4 Perform the initial configuration on your KVL. See [KVL 5000 Initial Configuration on page 74](#).

Chapter 10

KVL 5000 Reference

This chapter contains additional information not directly related to KVL 5000 operation.

10.1

KVL 5000 Performance Specifications

Table 12: Electromagnetic Compatibility

EN 55032 Class A
EN 55024
FCC Part 15 Class A

Table 13: Regulatory Compliance and Approvals

Safety	EN 60950-1
	EN 62368-1
	UL 60950-1
	UL 62368-1
	cUL 60950-1
	cUL 62368-1

10.2

KVL 5000 LED Indicators

Led color on the KVL provides on current KVL status.

Table 14: KVL 5000 LED Indicators

Led color	Meaning
Red (briefly while turning the device on)	KVL is booting up
Yellow	Checking KVL data integrity
Green	KVL is ready for use
Yellow (flashing)	Formatting KVL memory. May take up to 2 minutes
Red (constant)	HSM failure. Restart the KVL. If the restart does not solve the problem, contact Motorola Solutions support.
Red (less than 3 minutes)	Upgrade in progress

10.3

KVL 5000 Orderable Parts

Table 15: KVL 5000 Model

Item	Count	Part Number
KVL 5000 Documentation CD	1	CLN1876A
KVL 5000 Quick Start Guide	1	MN004970A01
DB9 Gender Changer	1	2871926H02

Table 16: Interface Cables

Item	Part Number	Used with	Adaptor
Key Load Cable	TKN8531	XTL 5000/2500	n/a
		APX 8500/7500/6500/4500/2500	HKN6182
		MCC 7500 VPM Dispatch Console, KMF, PDEG, CDEM, KMF CryptR	n/a
	WPLN6904	APX 8000/7000/6000/4000/3000/1000 APX Next	n/a
	TKN1039	CRYPTR micro	n/a
	PMKN4013C	APX 900_VX-P949	n/a
	TDN9390	XTS 5000/2500	n/a
OTAR/Radio Authentication Cable	TKN8531C	XTS 5000/2500	NTN8613C
	HKN6183	APX 8500/7500/6500/4500/2500, XTL 5000/2500	n/a
	WPLN6905	APX 8000/7000/6000/4000/3000/1000	n/a
	PMKN4013C	APX 900_VX-P949	n/a
	WPLN6905	APX Next	n/a
KVL To KVL Cable	RKN4106	XTS 5000/2500	n/a
	TKN8209	KVL 3000/3000 Plus/4000/5000	n/a
Micro USB Programming Cable	DQUUSBOTG	KVL 5000 to PC	n/a

Table 17: Optional Accessories

Item	Part Number
Wall Power Supply Adaptor,AC,DC,7.5W,100V-240V, North America	PS000339A01
Wall Power Supply Adaptor,AC,DC,7.5W,100V-240V, Europe	PS000339A02
Wall Power Supply Adaptor,AC,DC,7.5W,100V-240V, UK/HKG	PS000339A03
Wall Power Supply Adaptor,AC,DC,7.5W,100V-240V, AUS/NZ	PS000339A04

Item	Part Number
Wall Power Supply Adaptor,AC,DC,7.5W,100V-240V, Argentina	PS000339A05
Wall Power Supply Adaptor,AC,DC,7.5W,100V-240V, China	PS000339A06
Wall Power Supply Adaptor,AC,DC,7.5W,100V-240V, Korea	PS000339A07
Wall Power Supply Adaptor,AC,DC,7.5W,100V-240V, Brazil	PS000339A08
High Capacity, Li-Ion 2925mAh Battery	PMNN4508
MultiMobile USB Modem V.92/56K	DSMT9234MUCDCXR
Portsmith Technologies USB to Ethernet Adapter	PSA1UB1E-E

10.4

Radio Frequency Interference Requirements

Notice to Users (FCC and Industry Canada)


This device complies with Part 15 of the FCC rules and Industry Canada's license-exempt RSS's per the following conditions:


- This device may not cause harmful interference
- This device must accept any interference received, including interference that may cause undesired operation.
- Changes or modifications made to this device, not expressly approved by Motorola, could void the authority of the user to operate this equipment.

10.5

KVL5000 VPN Client Capabilities

Table 18: KVL5000 VPN Client Capabilities

Item	Capabilities
Supported profiles	<ul style="list-style-type: none"> • IPSec PSK • IPSec XAuth PSK • PPTP • L2PT/IPSec PSK
Phase 1	IKEv1, Main or Aggressive Mode  NOTE: When IPSec identifier is defined, the Aggressive Mode is always used.
Phase1 proposals	<ul style="list-style-type: none"> • SHA2 384 - AES256 • SHA2 256 – AES256 • SHA2 512 – AES256 • SHA1 – AES256 • MD5 – AES256 • SHA2 384 – AES128

Item	Capabilities
	<ul style="list-style-type: none"> • SHA2 256 – AES128 • SHA2 512 – AES128 • SHA 1 – AES128 • MD5 – AES128 • SHA2 256 – 3DES • SHA1 – 3DES • MD5 – 3DES • SHA2 256 – DES • SHA 1 – DES
Phase1 Diffie-Hellman groups	<ul style="list-style-type: none"> • 1 (768 bit) • 2 (1024 bit) • 5 (1536 bit) • 14 (2048 bit) • 15 (3072 bit) • 16 (4096 bit) • 17 (6144 bit) • 18 (8192 bit)
Phase2 proposals	<p>Hash algorithms:</p> <ul style="list-style-type: none"> • SHA1 • SHA2 512 • SHA2 384 • MD5 <p> NOTE: SHA2 256 is not offered due to potential truncation bits incompatibility with the VPN server.</p> <p>Encryption algorithms:</p> <ul style="list-style-type: none"> • AES256 • AES128 • 3DES • DES
Perfect Forward Secrecy (PFS) Diffie-Hellman groups	<ul style="list-style-type: none"> • 1 (768 bit) • 2 (1024 bit) • 5 (1536 bit) • 14 (2048 bit) • 15 (3072 bit) • 16 (4096 bit) • 17 (6144 bit)

Item	Capabilities
	• 18 (8192 bit)

Appendix A

Acronyms

Table 19: Acronyms

Item	Description
<i>ADP</i>	Advanced Digital Privacy
<i>AES</i>	Advanced Encryption Standard
<i>AuC</i>	Authentication Center
<i>CFX</i>	Cryptographic Flexibility
<i>CKR</i>	Common Key Reference
<i>DES</i>	Data Encryption Standard (Cipher)
<i>DES-OFB</i>	Data Encryption Standard-Output Feed-back
<i>DES-XL</i>	Data Encryption Standard-Counter Addressing
<i>DVI-XL</i>	Digital Voice International-Range Extension
<i>DVP</i>	Digital Voice Protection
<i>DVP-XL</i>	Digital Voice Protection-Range Extension
<i>FIPS</i>	Federal Information Processing Standard
<i>FRE</i>	Field Replaceable Entity
<i>FRU</i>	Field Replaceable Unit
<i>I/O</i>	Input/Output
<i>KID</i>	Key ID
<i>KEK</i>	Key Encryption Key
<i>KMF</i>	Key Management Facility
<i>KMM</i>	Key Management Message
<i>KVL</i>	Key Variable Loader
<i>LED</i>	Light Emitting Diode
<i>MNP</i>	Message Number Period
<i>OTAR</i>	Over-the-Air Rekeying
<i>RSI</i>	Radio Set Identifier
<i>SEK</i>	Signaling Encryption Key
<i>SUID</i>	Subscriber Unit ID
<i>TEK</i>	Traffic Encryption Key
<i>UKEK</i>	Unique Key Encryption Key
<i>VPN</i>	Virtual Private Network
<i>WACN</i>	Wide Area Communications Network