Manufacturer HSM Installation and Setup

User Guide

v12.0

Microsemi

a Microchip company

Table of Contents

Introduction

This User Guide provides installation and setup instructions for the Manufacturer HSM (M-HSM) Server.

The M-HSM server is used for all tasks related to execution of programing jobs by the Contract Manufacturer as a part of the Microsemi SPPS flow.

This User Guide contains the following chapters:

Chapter 1, "M-HSM Server", describes the M-HSM server components and system requirements.

Chapter 2, "M-HSM Installation and Setup Scenarios", provides a general description of the installation scenarios.

Chapter 3, "Initial M-HSM Server Installation and Setup", explains the installation and setup process.

Chapter 4, "M-HSM Reconfiguration and Post-Installation Actions", provides instructions for the setup and maintenance actions that can be performed on an installed and provisioned M-HSM server.

Chapter 5, "M-HSM Server Replication", explains how to replicate an existing M-HSM server to one or more new M-HSM servers.

For more information about the SPPS flow, refer to the Secure Production Programming Solution (SPPS) User Guide.

For installation and setup instructions for the User HSM (U-HSM), refer to the *User HSM Installation and Setup Guide.*

Referenced Documents

This User Guide references the following documents:

- *Secure Production Programming Solution (SPPS) User Guide* (Microsemi SOC)
- *Programming Job Manager User Guide* (Microsemi SOC)
- *FlashPro Express User Guide (*Microsemi SOC)
- *Libero SoC Design Flow User Guide* (Microsemi SOC)
- *PolarFire FPGA Design Flow User Guide* (Microsemi SOC)
- *nShield Edge and Solo User Guide for Windows* (Thales)
- *User HSM Installation and Setup Guide* (Microsemi SOC)

1 – M-HSM Server

The M-HSM server is used by the FlashPro Express tool to generate security protocol data during the manufacturing process. FlashPro Express must be configured to work with the M-HSM. For more information, refer to the FlashPro Express User’s Guide.

Server Components

Figure 1-1 shows the components of the M-HSM server.

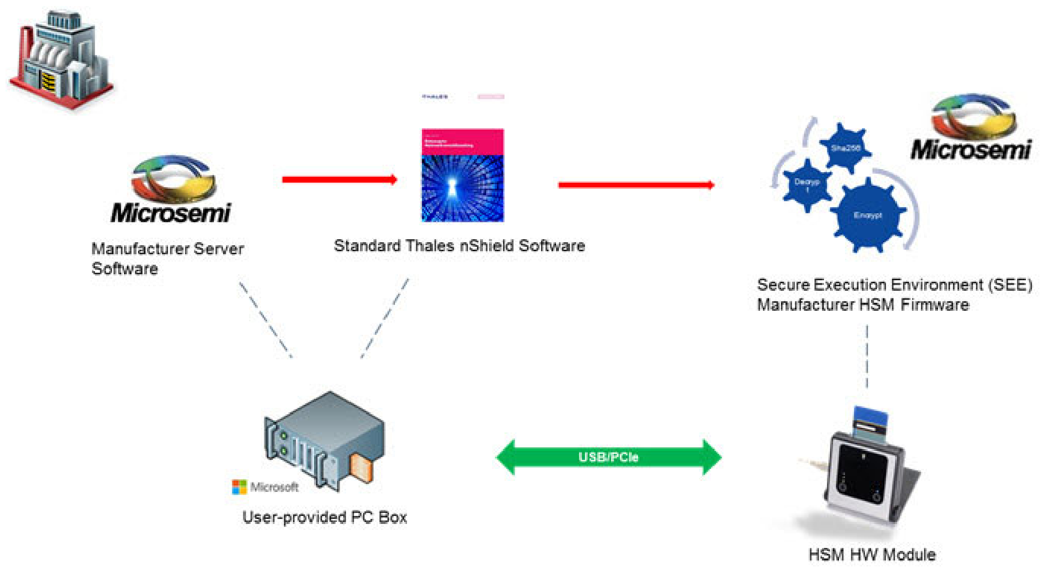
Microsemi
Manufacturer Server Software
Standard Thales nShield Software
Sha256
Decrypt
Encrypt
Microsemi
Secure Execution Environment (SEE) Manufacturer HSM Firmware
Microsoft
User-provided PC Box
USB/PCIe
HSM HW Module

Figure 1-1 • M-HSM Server Components

Security World and HSM Modules

The most important component of the M-HSM server is the HSM module. The HSM module carries out cryptographic operations involving protected security keys. All data is stored outside the module on the disk of the host system in encrypted form. Every module is associated with the Security World (see the Secure Production Programming Solution (SPPS) User Guide*)* that combines a set of keys giving module access to the information in the database located on the PC side. The Security World can be replicated to multiple HSM servers, if needed. The HSM module is controlled via standard Thales nShield software that includes hardware drivers and low level components providing access to the services inside the module. Custom SEE firmware (algorithms related to the protocols implemented in Microsemi devices) and known as the SEE Machine is stored on the disk of the host PC, and is loaded into the module as part of the power up process.

HSM Module Types

Microsemi is the official redistributor of nShield Edge (Figure 1-2) and nShield Solo HSM Modules (Figure 1-3).

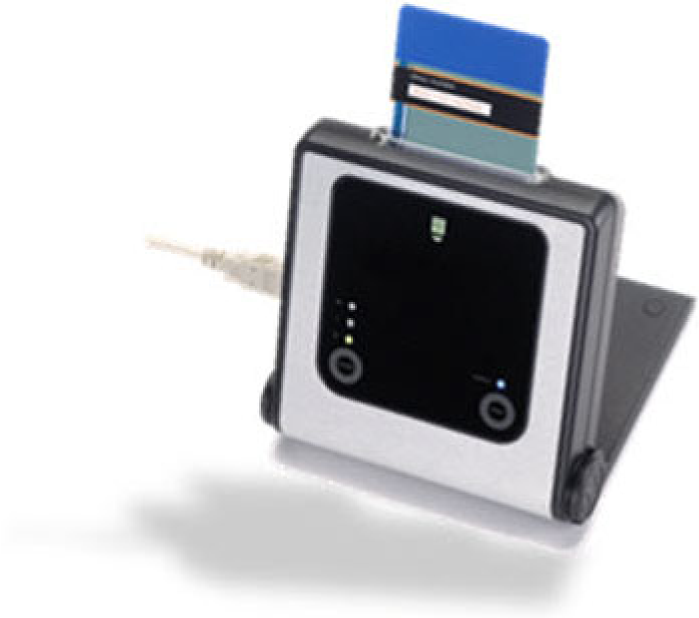

Figure 1-2 • Thales nShield Edge HSM Module

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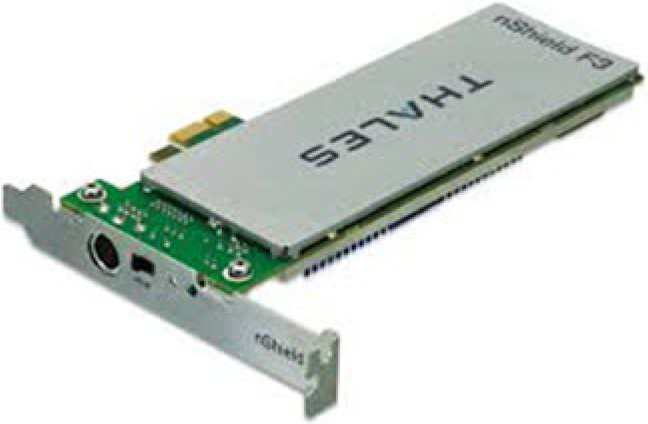


Figure 1-3 • nShield Solo PCIe HSM Module

The nShield Edge module is attached to USB 2.0 port of the PC and has an integrated card reader. The nShield Solo module is PCIe-based and requires a desktop PC with a spare PCIe port. The card reader is attached to the module via cable.

Note: For the HSM module specification, including performance characteristics, refer to the *nShield Edge and Solo User Guide for Windows*.

Security World Cards

Both types of HSM modules are shipped with the nShield Security World cards (Figure 1-4) that can be used to create an Administrator Card Set (ACS). The ACS provides access to the administrative functions of the Security World:

- Controls access to Security World configuration
- Authorizes recovery and replacement operations

ACS cards are initialized upon creation of the Security World.

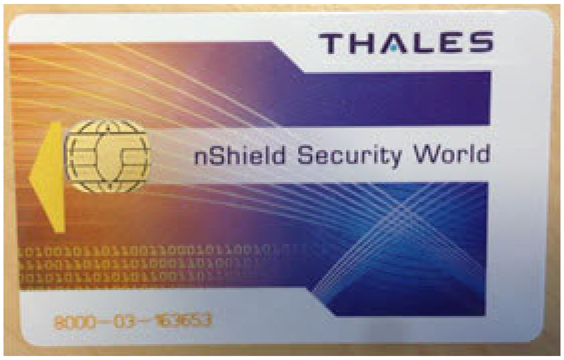


Figure 1-4 • Example of nShield Security World Card

Note: There is a special requirement regarding total and quorum numbers of ASC cards. Refer to the *nShield Edge and Solo User Guide for Windows* for more information.

Activator Card and Feature Licensing (Thales)

The Activator Card (Figure 1-5) enables HSM Module product features and is generated along with the license purchase. Installation instructions in this document show how to use this type of card.

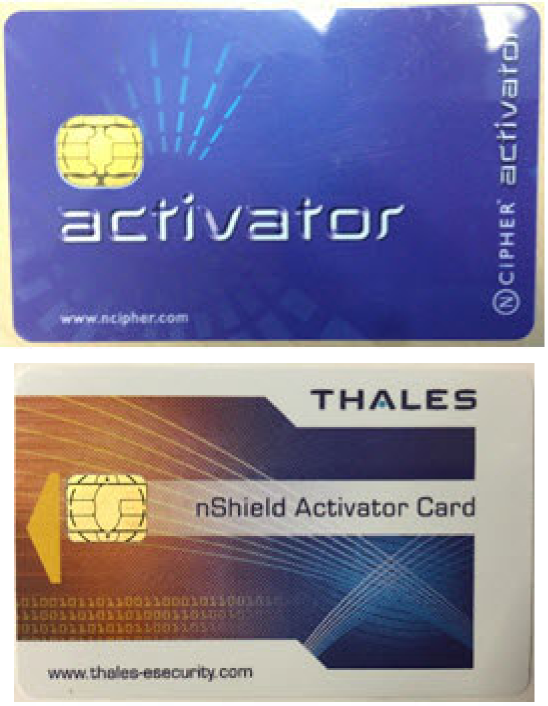
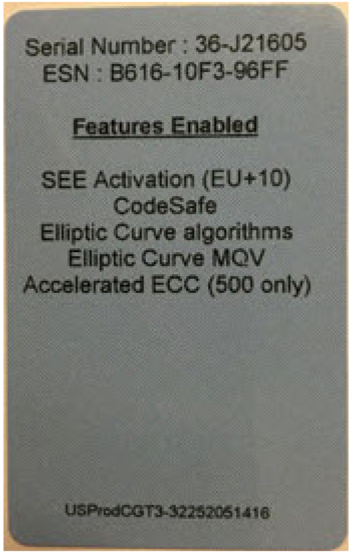


Figure 1-5 • Example of Activator Card

This card is linked to the specific hardware module and must match the module serial number (see Figure 1-6). The "Serial Number" field shown on the back of the card should match the Serial Number of the module.

All features that can be enabled by this card are listed on the back of the card.



Serial Number : 36-J21605
ESN : B616-10F3-96FF

Features Enabled

SEE Activation (EU+10)
CodeSafe
Elliptic Curve algorithms
Elliptic Curve MQV
Accelerated ECC (500 only)

USProdCGT3-32252051416

Figure 1-6 • Back of the Activator Card

Note: In addition to Activation Cards, licensing features can be enabled using a file on disk or by entering an initialization bitstream from the keyboard. Additional licensing features can be added to the module later via a separate PO process.

Module Warrant File (Thales)

Every nShield HSM Module comes with a warrant file generated by Thales. This file provides cryptographic proof of module origin (explained in the key management section of the Secure Production Programming Solution (SPPS) User Guide). The warrant file is provided via the HSM Module purchase process.

HSM Module License File (Microsemi)

Microsemi provides a Microsemi-generated license file that binds the user-created Security World with one or more HSM modules through their serial numbers.

System Requirements

The M-HSM server can run on Windows 7 x64 Pro or Windows 8.1 x64 operating systems. Server software is installed on a dedicated physical machine with one nShield Edge or Solo HSM module attached.

Note: It is possible to use a virtual machine to run HSM server. However, Microsemi has only validated M-HSM server functionality on the nShield Edge module using a VMWare virtual machine. Validation was performed using the Thales-suggested method of connecting the Edge module directly to the host system and then giving the virtual machine module access via a virtual COM interface added to the host system by the module driver. See the *nShield Edge and Solo User Guide for Windows* for setup instructions.

Acquire the M-HSM Components

HSM hardware modules are purchased directly from Microsemi. Every module comes with the components described in "Security World and HSM Modules" on page 4.

The following is a list of the M-HSM components. Figure 1-7 provides a high level flow view:

1. nShield Edge or Solo HSM Module
   - Module
   - Card Reader (Solo module only. Edge module has integrated card reader)
   - Mounting hardware for regular and compact desktop form factors (Solo module only)
   - Set of Security World cards
   - Activator Card (additional licensing features can be provided in a separate file)
2. Warrant File (created by Thales, supplied by Microsemi)
3. Licensing File (created and provided by Microsemi after a Security World UUID is issued for the M-HSM)
4. User provides PC with supported operating systems installed (see "System Requirements" on page 7)
5. M-HSM Installation Utility (download from Microsemi website)
   - Third party software prerequisite packages
   - Thales nShield standard software
   - M-HSM Server Software, including SEE Machine images

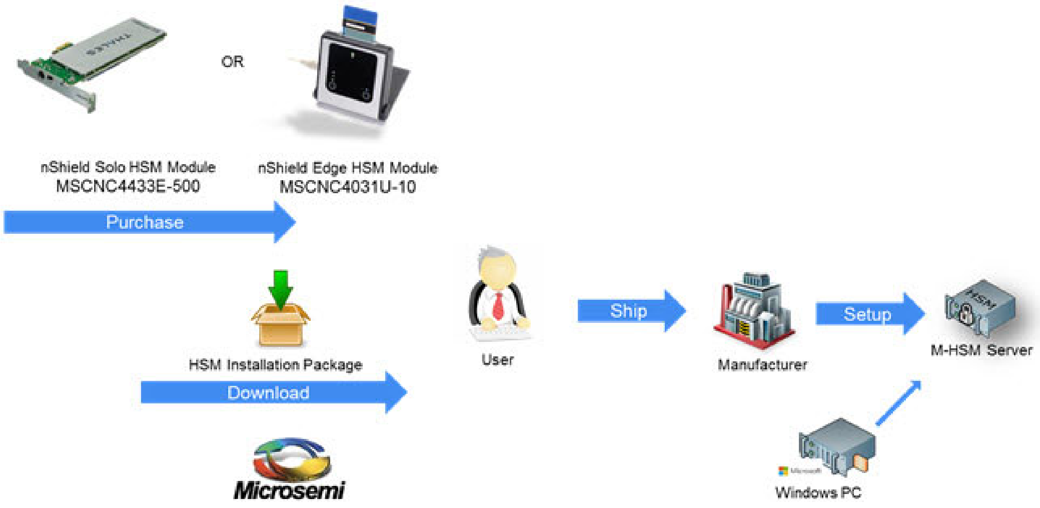


Figure 1-7 • Acquiring M-HSM Parts

2 – M-HSM Installation and Setup Scenarios

This User Guide describes the following installation and setup options:

1. **Initial setup**

   a. Install all required software components.

   b. Update all required configuration files.

   c. Install the HSM module.

   d. Provision the M-HSM server.

   – Create new Security World and Administrator Card Set (ACS).

   – Generate all required keys.

   – Exchange public encryption and public verify keys with the U-HSM.

   – Import Diversified Factory Key Database (DFK DB) and the manufacturing keys received from the U-HSM.

2. **Post-installation (maintenance) steps**

   a. Upgrade the HSM Module Firmware.

   b. Replace the HSM module.

   c. Import public keys of the U-HSM.

   d. Export public keys for sending to a U-HSM.

   e. Import new DFK DB and Manufacturing keys for the target Microsemi device(s).

3. **Replication of the existing M-HSM server (creates a copy of already provisioned M-HSM server)**

   a. Install all required software components.

   b. Copy over Security World from the source M-HSM server.

   c. Copy over the M-HSM server software.

   d. Copy over the existing DFK DB.

   e. Install and connect new HSM module to the Security World and install module license file.

3 – Initial M-HSM Server Installation and Setup

This chapter describes how to install and set up a new M-HSM server.

Note: Text highlighted in red in this chapter indicates commands and other information to take note of.

Software Installation

This section explains the manual installation process for setting up the M-HSM server.

One of the supported operating systems must be installed with all security and stability updates applied.

1. Microsoft Visual C++ 2010 Redistributable Package (x64) available from Microsoft
2. Visual C++ Redistributable for Visual Studio 2012 (x64) available from Microsoft
3. .NET Framework 4.0 or up available from Microsoft
4. FTP Server (e.g. FileZilla)
5. Java Runtime 2 32-bit available from Oracle
6. Latest version of the nShield Security World Software (comes with the HSM modules).
   - The installation disk contains a folder with documentation in PDF format.
   - Installation of SNMP client can be ignored as the software for this implementation does not use it.
   - The default installation directory for the Security World is C:\Program Files (x86)\nCipher\nfast.
   - All Security World utilities referred to in this guide are located in %NFAST_HOME%\bin.
   - The Microsemi SPPS solution is tested against the specific version of the Security World. Refer to the M-HSM server Release Notes for the compatible version number.

M-HSM Server Software Installation

1. Create the top level directory.

   Note: This User Guide uses C:\Microsemi as an example
2. Unpack all files and subdirectories from the provided zip file under the *M-HSM* directory and copy to C:\Microsemi.
3. Verify that the following additional subdirectories exist:
   - C:\Microsemi\DFKDB - This location will be used for storing imported DFK databases
   - C:\Microsemi\JobDB - This location will store job ticket database files
   - C:\Microsemi\JobDB\JobDBArchive - Folder for archiving completed job ticket database files
   - C:\Microsemi\Logs - For log files

HSM Hardware Module Installation

Note: This section provides the steps to connect a new HSM module to the PC. If you are replacing the HSM module on a configured M-HSM server, start from "HSM Module Replacement" on page 39. If you are replicating the M-HSM server, refer to "Set Up a New HSM Module" on page 39.

The M-HSM server requires the presence of a single HSM module. After the installation of nShield software, as shown in "Software Installation" on page 10, the system should have module drivers and all nShield utilities installed.

Connect the HSM Module to the PC

Follow the instructions in the *nShield Edge and Solo User Guide for Windows* to physically connect the module to the PC.

Once the module is connected, read module status with the nfkminfo utility. The output of nfkminfo shows information about the attached module, such as ESN (serial number), status, etc. If the module is not detected or in the "failed" state, restart the nfast server and read the module status again:

```
net stop "nfast server"
net start "nfast server"
```

Note: If necessary, the HSM module can be erased to the factory state using the new-world command. *Example:* new-world -e -m1 erases the module with the ID=1 to the factory state. This operation is done in the pre-initialization mode.

Upgrade HSM Module Firmware

This section provides instructions for Thales firmware upgrade. This firmware physically resides inside the HSM module and is different from the Microsemi-provided SEE machine.

Firmware Revisions

The firmware revision of the HSM module that is used in SPPS must be approved by Microsemi. The list of the approved firmware revisions is available in the M-HSM Release Notes. Additional instructions about firmware revisions may be published via Microsemi security advisories.

Note: Any HSM firmware revision that is not approved by Microsemi is not guaranteed to work and is not guaranteed to satisfy security requirements of the SPPS solution. The use of such firmware revisions is done at customer's own risk.

Thales HSM module firmware images are available in the HSM Installation media, or can be obtained directly from Thales customer service.

Note: Installation media may include various versions of the firmware that may be FIPS certified or awaiting FIPS certification. Your choice depends on the security policies of your organization.

Compatibility of Firmware Revisions

Warning! The firmware upgrade may be non-reversible. Read this section for important details.

Thales HSM module firmware has two versioning characteristics:

- Firmware revision number
- Version Security Number (VSN)

The firmware revision number identifies the individual version of the firmware, while the VSN can group multiple revisions together and is used to restrict revision downgrade, so that intruders cannot move a module to the firmware with known security issues. The downgrade is possible to any firmware revision with the same VSN as the one in the module. The upgrade can be done to any revision with the same or higher VSN number.

Information about firmware revisions and their respective VSN numbers is available on the Security World installation media of firmware upgrade media distributed as part of Thales security advisories.

Read the HSM Module Firmware Revision Info

The current revision of the HSM firmware can be checked using the "enquiry" Security World utility.

An example of reading the firmware revision number is shown in Figure 3-1.

```
Module #1:
 enquiry reply flags  none
 enquiry reply level  Six
 serial number        1301-C8A9-BEF7
 mode                 operational
 version              2.55.1
 speed index          544
 rec. queue           19..152
 level one flags      Hardware HasTokens
 version string       2.55.1cam7 built on Jul 08 2015 14:24:15
 checked in           000000004856847b Mon Jun 16 08:19:23 2008
 level two flags      none
 max. write size      8192
 level three flags    KeyStorage
 level four flags     OrderlyClearUnit HasRTC HasNVRAM HasNSOPermsCmd ServerHasPollCmds
FastPollSlotList HasSEE HasKLF H
asShareACL HasFeatureEnable HasFileOp HasPCIPush HasKernelInterface HasLongJobs ServerHasLongJobs
AESModuleKeys NTokenCm
ds JobFragmentation LongJobsPreferred Type2Smartcard ServerHasCreateClient HasInitialiseUnitEx
 module type code     7
 product name         nC1003P/nC3023P/nC3033P
 device name          #1 PCI bus 6 slot 5
 EnquirySix version   6
 impath kx groups     DHPrime1024 DHPrime3072
 feature ctrl flags   LongTerm
 features enabled     GeneralSEE StandardKM
 version serial       26
 rec. LongJobs queue  18
 SEE machine type     PowerPCSXF
 supported KML types  DSAp1024s160 DSAp3072s256
```

Figure 3-1 • Reading HSM Module Firmware Revision

Upgrade Firmware

This section provides general guidance for the firmware update. If the firmware upgrade is done due to a Microsemi security advisory, please follow the instructions in the advisory. General description of the upgrade process and instruction for switching HSM module into specific mode is available in the *nShield Edge and Solo User Guide for Windows*.

Note: The firmware upgrade process erases all information contained in the module except the enabled licensing features explained in "Enable the Module Licensing Feature" on page 13.

Step 1

Switch the module mode to the "maintenance" mode.

To switch the nShield Edge module to the maintenance state, use the Mode button to change mode to the "M" (maintenance mode) and then push and hold down the "Clear" button to activate the "M" state.

The mode switching on the Solo HSM module is done by moving the three-position switch to the "M" state and resetting the module using a paper clip. Both module controls are located on the Solo module and are accessible outside the PC box.

For more detailed mode switching instructions, refer to the *nShield Edge and Solo User Guide for Windows*.

Step 2

Load the new firmware using the "loadrom" command, pointing to the firmware image.

Note: When entered, the "loadrom" command starts without prompting for user confirmation.

An example of the output during firmware upgrade is shown in Figure 3-2.

```
C:\>loadrom -m1 C:\shared\FWUpgrade\firmware\2-55-1\ncx1z-26.nff

 version 2.50.16cam18 built on Sep 23 2010 20:36:19
programming module #1
module erased
starting programming *+
firmware integrity mech. DSAhSHA256
module accepted signature
block size allowed by unit 1910, using 1910
loading chunk 0 +++++++++++++++++++++++++++++++++++ programming done
loading chunk 1 +++++++++++++++++++++++++++++++++++ programming done
loading chunk 2 +++++++++++++++++++++++++++++++++++ programming done
loading chunk 3 +++++++++++++++++++++++++++++++++++ programming done
loading chunk 4 +++++++++++++++++++++++++++++++++++ programming done
loading chunk 5 +++++++++++++++++++++++++++++++++++ programming done
loading chunk 6 +++++++++++++++++++++++++++++++++++ programming done
loading chunk 7 +++++++++++++++++++++++++++++++++++ programming done
loading chunk 8 +++++++++++++++++++++++++++++++++++ programming done
loading chunk 9 +++++++++++++++++++++++++++++++++++ programming done
loading chunk 10 +++++++++++++++++++++++++++++++++++ programming done
loading chunk 11 +++++++++++++++++++++++++++++++++++ programming done
programming done
```

Figure 3-2 • Firmware Upgrade

Step 3

Switch module mode to the "pre-init" mode.

Step 4

Initialize the module using the "initunit" command.

```
C:\>initunit
Initialising Unit 1 (SetNSOPerms)
Setting dummy HKNSO
Module Key Info:
HKNSO  is:C8 39 AC 0D EE D9 A9 65 AC F9 12 0F F2 02 F9 79 8C 2C A4 5D
HKM[0] is:FD 2D 47 53 86 05 CF F4 27 53 1A 01 FD 8D E8 02 00 DD C7 55
```

Figure 3-3 • Module Initialization during firmware upgrade

Step 5

Confirm that the module firmware revision is upgraded as expected using the "enquiry" command.

Enable the Module Licensing Feature

This section shows how to enable specific HSM module features.

Note: To activate new license features using the fet utility, the module must be switched to the pre-initialization mode.

To run custom firmware created for the SPPS system (SEE Machine), the module must have the "SEE Activation (EU+10)" feature enabled as shown in the sample in Figure 3-4. Feature status of the module can be checked or activated using fet (feature enabling tool).

```
C:\>fet

                            Feature Enable Tool
                            ===================

                      payShield Activation
                       |  ISO Smart Card Support
                       |   |  Remote Operator
                       |   |   |  Korean Algorithms
                       |   |   |   |  SEE Activation (EU+10)
                       |   |   |   |   |  SEE Activation (Restricted)
                       |   |   |   |   |   |  CodeSafe SSL
                       |   |   |   |   |   |   |  Elliptic Curve algorithms
                       |   |   |   |   |   |   |   |  Elliptic Curve MQV
                       |   |   |   |   |   |   |   |   |  Accelerated ECC
Mod   Electronic       |   |   |   |   |   |   |   |   |   |
No.  Serial Number
 1  586F-B963-9146 -- NO  NO  NO  NO  YES NO  NO  YES YES NO

0. Exit Feature Enable Tool.
1. Read FEM certificate(s) from a smart card or cards.
2. Read FEM certificate from a file.
3. Read FEM certificate from keyboard.
4. Write table to file.

Enter option :
```

Figure 3-4 • Sample output of the Feature Activation Tool

Choose option #1 and activate the features listed on your Activator Card (see "Activator Card and Feature Licensing (Thales)" on page 6). The feature activating tool auto-detects the card and performs activation. New activation status is printed on the screen.

If your Activator Card did not include the "SEE Activation (EU+10)" feature, it may have been provided to you in a separate file. The file name includes the module serial number, for example:

USProdCGT3-01253481317_SEEUE_8FD6-2609-F7A2.txt

This file can be used during activation independently from the Activator Card by selecting option #2.

If you plan to use advanced security features in Microsemi devices, such as ECC PUF keymodes, make sure that "Elliptic Curve algorithms" and "Elliptic Curve MQV" are activated as shown in the example above.

Note: Erasing a module to the factory settings does not remove licensing features enabled using the fet tool. Licensing feature reset can only be done at the factory.

M-HSM Server Provisioning

Create the Security World

Security World is created with the new-world utility documented in the *nShield Edge and Solo User Guide for Windows* . The module must be moved to the pre-initialization mode.

The new-world utility has the following options.

-i Creates a new Security World.

-m Specifies ID of the physical HSM module to be added to the Security World.

-i Creates a new Security World.

-Q Specifies the minimum number of smart cards needed from the ACS to authorize a feature and the total number of smart cards to be used in the ACS. This example has a total of two cards, with only one card needed to authorize a feature.

-c Specifies the type of key to use for the new Security World. This example uses the AES key.

The example shown in Figure 3-5 creates a new Security World.

During creation of the Security World, the user is prompted to insert and initialize all ACS cards specified by the -Q option.

```
C:\Microsemi\Tools>new-world -i -m 1 -Q 1/2 -c DLf1024s160mRijndael dseeall

Create Security World:
 Module 1: 0 cards of 2 written
 Module 1 slot 0: empty
 Module 1 slot 0: unknown card
 Module 1 slot 0:- no passphrase specified - overwriting card
 Module 1: 1 card of 2 written
 Module 1 slot 0: remove already-written card #1
 Module 1 slot 0: empty
 Module 1 slot 0: unknown card
 Module 1 slot 0:- no passphrase specified - overwriting card
Card writing complete.

security world generated on module #1; hknso = 15d0780e37252b3a1d8bf339a9bd6d779d1991bc
```

Figure 3-5 • Sample output from creation of new Security World

Tip: The values of the hknso parameters can be used to uniquely identify the Security World.

Tip: If the module is not in the pre-initialization state, creation of the Security World may encounter an error, as shown in Figure 3-6.

```
12:46:57 WARNING: Module #1: Module has failed
new-world: module 1 not suitable: module key type Rijndael not supported
new-world: Aborting world operation.
```

Figure 3-6 • Error message if module is not in pre-initialization state

The new Security World is a file that is created in the following location: %NFAST_KMDATA%\local

Note: This location also contains all other related security keys.

Once the Security World is created, the module must be moved to the operational mode.

Read the Status of the Security World

The status information related to the existing Security World and attached module(s) can be viewed using the nfkminfo utility. Refer to the *nShield Edge and Solo User Guide for Windows* for more information.

This status information contains several important fields. The *hknso* and *hkm* fields allow the user to uniquely identify the specific Security World.

Once a module is moved to the operational state, the module status read by nfkminfo should indicate "usable" module state.

Figure 3-7 shows sample output of the nfkminfo utility.

```
C:\Microsemi\Tools>nfkminfo
World
 generation  2
 state      0x1f250000 Initialised !Usable Recovery !PINRecovery !ExistingClient RTC NVRAM FTO !Alw
aysUseStrongPrimes SEEDebugForAll
 n_modules   1
 hknso       15d0780e37252b3a1d8bf339a9bd6d779d1991bc
 hkm         e113ba16497e0576b99bd2f0150f126204426507 (type Rijndael)
 hkmwk       1d572201be533ebc89f30fdd8f3fac6ca3395bf0
 hkre        c59ca14ee277dca5497b2e4c5a113d238b613c0b
 hkra        078ea5ba02d3300c462e9c84988e673a09896dcb
 hkmc        4f18cdf70289ee823520bc252060ebf97eb61032
 hkrtc       90c54dafcb5836ccec08d2cd75776cb5d53d6a6c
 hknv        b8b80d9794b98588dddfedf650bfd59a7bed1765
 hkdsee      6fc988762e441e44de4a5c1a6ba6b34a2fb47aa2
 hkfto       3a70b6e939cc3ee779ddae9ce5fb79cb067c42c0
 hkmnull     0100000000000000000000000000000000000000
 ex.client   none
 k-out-of-n  1/2
 other quora m=1 r=1 nv=1 rtc=1 dsee=1 fto=1
 createtime  2015-01-13 23:29:09
 nso timeout 10 min
 ciphersuite DLf1024s160mRijndael

Module #1
 generation 2
 state      0xa InitMode
 flags      0x0 !ShareTarget
 n_slots    2
 esn        586F-B963-9146
 hkml       ac4e6e3e02f27d7a7d0a182077546a62ec390513

Module #1 Slot #0 IC 3
 generation    1
 phystype      SmartCard
 slotlistflags 0x2 SupportsAuthentication
 state         0x4 Admin
 flags         0x0
 shareno       2
 shares        LTNSO LTM LTR LTNV LTRTC LTDSEE LTFTO
 error         OK
No Cardset

Module #1 Slot #1 IC 0
 generation    1
 phystype      SoftToken
 slotlistflags 0x0
 state         0x2 Empty
 flags         0x0
 shareno       0
 shares
 error         OK
No Cardset

No Pre-Loaded Objects
```

Figure 3-7 • Status of the Security World

Install the SEE Integ Key

The SEE Integ Key is a key used to link SEE firmware and keys used in SPPS (see the Secure Production Programming Solution (SPPS) User Guide for details). It must be installed before any other keys can be generated or exported.

The key is installed by simply copying its file key_seeinteg_userdata-signer located under the SEE folder of the M-HSM server directory to the Security World data folder: %NFAST_KMDATA%\local.

Example: copy C:\Microsemi\SEE\key_seeinteg_userdata-signer %NFAST_KMDATA%\local

Proper installation of the SEE Signer Key can be confirmed using the "nfkminfo -k" command, as shown in Figure 3-8.

```
C:\Program Files (x86)\nCipher\nfast\bin>nfkminfo -k

Key list - 1 key
 AppName seeinteg             Ident userdata-signer
```

Figure 3-8 • Confirming correct installation of the SEE Signer key

Get Hash of the SEE Integ Key

The hash of the signer key is used for key identification and referencing key signer during various operations such as creation of the HSM private/public key pairs.

The hash value of the key signer can be retrieved using nfkminfo:

nfkminfo -k seeinteg userdata-signer | find "hash"

See the example below:

```
 C:\Microsemi\Tools>nfkminfo -k seeinteg userdata-signer | find "hash"

 hash      e0d5146a74ec125f22d4b15088d424b963b88109
```

Create NVRAM-based Storage in the HSM Module

This step uses the nvram-sw utility to create an internal flash-based storage file for ticket processing and other tasks that must keep certain information inside the physical module (i.e., make them physically uncloneable). The example in Figure 3-9 shows output during NVRAM creation.

To run this action:

- The module must be in the operational mode.
- The ACS (admin) card must be inserted into the card reader.

Enter the following command to create NRAM:

nvram-sw.exe -a -b 8096 -n udsigner -k seeinteg,userdata-signer

The -b parameter specifies memory size. The value of 8096 specifies partition size. This value is fixed in the current version of the M-HSM server.

Note: The -k parameter must follow the exact format: comma separated values with no spaces.

```
C:\>nvram-sw.exe -a -b 8096 -n udsigner -k seeinteg,userdata-signer
Load Admin Card (for KNV):
 Module 1 slot 0: `SEEOCS' #2
 Module 1 slot 0: empty
Card reading complete.
```

Figure 3-9 • Creating ENVM storage inside the HSM module

Erase Already Created NVRAM

If NVRAM already exists in the module, it can be removed by entering the following command:

nvram-sw.exe -d -n udsigner

Note: Deletion of the existing NVRAM file erases all tickets (if loaded into the module).

Configure the M-HSM Server and Tools

This section provides setup instructions for the M-HSM server. It assumes that the directory structure for the M-HSM server was created in the default location C:\Microsemi.

Update Server and Tools Configuration File

The M-HSMMaster.config file contains settings for the M-HSM server. Currently, there are two separate config files with the same name and identical content. For the default installation location, the file path is:

C:\Microsemi\Server\M-HSMMaster.config

and

C:\Microsemi\Tools\M-HSMMaster.config

Change the following settings as shown:

1. DFK database location - confirm the location matches actual path:

   <add key="G4HSMAPI.DFKDBPath" value="C:\Microsemi\DFKDB" />
2. Ticket database location - confirm the location matches actual path:

   <add key="G4HSMAPI.JobTicketDBPath" value="C:\Microsemi\JobDB"/>
3. Ticket archive directory:

   <add key="G4HSMAPI.JTPLogArchivePath" value="C:\Microsemi\JobDB\JobDBArchive"/>
4. M-HSM UUID 40 symbols long hex string obtained from Microsemi (00..02 in this example):

   <add key="My_UUID" value="0000000000000000000000000000000000000002"/>
5. SEEK Secret key: g4cm-seesk-<M_HSM_UUID> (00..02 in this example):

   <add key="G4HSMAPI.CSEEKey" value="g4cm-seesk-0000000000000000000000000000000000000002" />
6. Option to automatically remove tickets pending job file import. This allows the HSM server to automatically remove tickets that do not have an associated job file loaded. By default, this service is off. To use this automatic ticket cleanup service, the user must turn it on and specify the time interval (in seconds) at which the service will run. The same time interval is also used to specify the maximum lifetime of tickets pending job file. This helps free up memory inside the HSM module.

   <add key="TicketCleanup.Service" value="off"/>

   <add key="TicketCleanup.TimeoutValue" value="86400"/> <!--TimeoutValue is in seconds.-->

Generate the ISK key (*g4see-isk)

The ISK key is a global system key used for internal system functions such as import U-HSM public keys (seepk and seespk).

Generate the ISK key as follows:

1. Open the command prompt as an administrator and change directory to C:\Microsemi\Tools.
2. Execute the following script (see the sample output in Figure 3-10).

"%nfast_home%\python\bin\python.exe" C:\Microsemi\Tools\gensymmkey.py -u userdata-signer -i g4see-isk.

```
C:\Microsemi\Tools>"%nfast_home%\python\bin\python.exe" C:\Microsemi\Tools\gensymmkey.py -u
userdata-signer -i g4see-isk
===========================================================
= Generating symmetric key with ExportAsPlain enabled
=
= KeyIdent:        simple/g4see-isk
= KeyHash:         7a7895eb 081498b9 0f05d9de 257ae43d 7896dacd
=   SEE App KeyIdent:  seeinteg/userdata-signer
=   SEE APP KeyHash:   57827118 b0e20b11 2ff56be0 820a6020 7154b8a7
=
= Open group perms:  DuplicateHandle|ReduceACL|GetACL
= SEE App perms:     ExportAsPlain|GetAppData
===========================================================

Success!  Generated key simple/g4see-isk
```

Figure 3-10 • Sample output from generation of the ISK key

Install HSM Module License File

The license file is issued by Microsemi and binds the UUID used by Security World and one or more HSM modules.

Once available, this file must be put in the Server and Tools directories of the current installation.

The file name follows pattern <M_UUID>.g4sl.

Example: 00000000000000000000000000000000000002.g4sl

Set Up the SEE Machine Firmware for Loading into the HSM Module

This step configures the system to load firmware into the HSM module. The loadsee-setup command sets up paths to the SEE Machine files. See the sample output in Figure 3-11:

```
loadsee-setup -m 1 -s -p g4cmsee -M C:\Microsemi\SEE\M-HSMsee-edg.sar -U
C:\Microsemi\SEE\userdata.sar

Module #1 has an existing configuration:

Module #1:
  Machine file:             C:\Microsemi\SEE\M-HSMsee-edg.sar
  Encryption key:
  Signing key hash:
  Userdata file:            C:\Microsemi\SEE\userdata.sar
  WorldID published object: g4cmsee
  Postload helper:
  Postload args:

Erase this configuration? (yes/no): yes
Module #1 new SEE configuration saved, new configuration follows:

Module #1:
  Machine file:             C:\Microsemi\SEE\M-HSMsee-edg.sar
  Encryption key:
  Signing key hash:
  Userdata file:            C:\Microsemi\SEE\userdata.sar
  WorldID published object: g4cmsee
  Postload helper:
  Postload args:
```

Figure 3-11 • Setting up SEE firmware loading

Different HSM module types require different firmware images. All images are located in the SEE folder and have the extension *sar*. The userdata.sar file works with any module type.

Module Type	Firmware File
nShield Edge	M-HSMsee-edg.sar
nShield Solo	M-HSMsee-ppc.sar

The next step is to confirm that the SEE Machine firmware has loaded successfully. Use the GetLoadingSEEName.bat script in the Utils folder, as shown in Figure 3-12. The SEE Machine firmware is loaded when the -MemAllocUser variable reads a non-zero value.

Note: Actual loading of the SEE firmware after setting it up with the loadsee-setup command may take a few minutes for the slower Edge module. During that period, -MemAllocUser remains 0.

```
C:\Microsemi\Tools>C:\Microsemi\Utils\GetLoadingSEEName.bat

WorldID = 'g4cmsee'
         -MemAllocUser         933888
If MemAllocUser is 0, SEE is not loaded
```

Figure 3-12 • Confirming loading of the SEE firmware

If the module cannot load firmware, check the correctness of the parameters specified during the loadsee-setup step and repeat the attempt, making sure the proper module type is selected.

Generate the SEE Private/Public Encryption and Signing Keys

The SEE Key pairs are created to provide secured exchange of information between U-, M- and MFG-HSM servers. One pair of keys is used for encryption and decryption and the other pair is used for creating and verifying digital signatures.

Obtain the Manufacturer UUID from Microsemi

Manufacturer UUID (M_UUID) is a 40-symbol hex string identifier that is assigned by Microsemi via the Microsemi Portal (see the Secure Production Programming Solution (SPPS) User Guide for details).

Example of the Manufacturer UUID: "0000000000000000000000000000000000000002"

Note: UUID must have all lower case characters.

Private/Public SEE keys must use the Manufacturer UUID assigned by Microsemi.

Once the UUID value is available, update the tag in both M-HSMMaster.config files, under the server and tools directories, as explained in "Update Server and Tools Configuration File" on page 18.

Generate the M-HSM Private Keys

1. Open the command prompt as an administrator and change directory to C:\Microsemi\Tools.
2. Create the SEE Key for encryption using the M-HSMGenImp utility:

M-HSMGenImp -p g4cmsee -g -c <*key_signer_hash*> **-n g4cm-seesk-**<*M_HSM_UUID*>

M_HSM_UUID: Microsemi-assigned UUID

The "-c" flag must be used as shown in this example. It corresponds to the userdata-signer key installed during the installation of the SEE Integ key (see "Install the SEE Integ Key" on page 16.

See the sample in Figure 3-13.

```
C:\Microsemi\Tools>M-HSMGenImp -p g4cmsee -g -c e0d5146a74ec125f22d4b15088d424b963b88109 -n g4cm-
seesk-0000000000000000000000000000000000000002
Starting to generate SEE RSA key...
SEE RSA key: g4cm-seesk-0000000000000000000000000000000000000002  ...generated
```

Figure 3-13 • Creating SEE Key for encryption and decryption

The created key is stored in the Security World directory as follows (with the highlighted part corresponding to the Manufacturer UUID):

key_simple_g4cm-seesk-0000000000000000000000000000000000000002

Once the key is generated, it needs to be set up in both M-HSMMaster.config files, in the Server and Tools directories, as described in "Update Server and Tools Configuration File" on page 18.

3. Create the SEE Key for signing using the M-HSMGenImp utility:

M-HSMGenImp -p g4cmsee -g -c <*key_signer_hash*> **-n g4cm-seessk-**<*M_HSM_UUID*> **-S**

All of the parameters are same as in step 2 with the exception of name (i.e., seessk vs. seesk) and a flag. The "-S" flag corresponds to generating the key for the signing operation instead of for encryption.

See the sample in Figure 3-14.

```
C:\Microsemi\Tools>M-HSMGenImp -p g4cmsee -g -c e0d5146a74ec125f22d4b15088d424b963b88109 -n g4cm-
seessk-0000000000000000000000000000000000000002 -S
Starting to generate SEE RSA key...
SEE RSA key: g4cm-seessk-0000000000000000000000000000000000000002 ...generated
```

Figure 3-14 • Creating SEE Key for signing and verify

The created key is stored in the Security World directory as follows (with the highlighted part corresponding to the Manufacturer UUID):

key_simple_g4cm-seessk-0000000000000000000000000000000000000002

Export the M-HSM Public Keys

This step exports the public component of the M-HSM SEE keys for importing into other HSM machines for secure information exchange. One public key is used by HSM servers to encrypt data that is to be sent back to this M-HSM server and the other public key is used to verify the signature of data sent out from this M-HSM server.

Set Up the Warrant File

Before starting the key export, make sure to copy the HSM module warrant file from Thales into the Tools directory. This file contains a cryptogram that identifies the origin of the HSM module. The file name follows the format:

"warrant-[ESN].txt"

where ESN is the module serial number that can be printed using the nfkminfo utility. The following is an example of the warrant file copied into the Tools directory:

C:\Microsemi\Tools\warrant-586F-B963-9146.txt

Export Public Key for Encryption

Enter the following command to export:

ExportSeekey.bat g4cm-seesk-<*M_UUID*>

This file is placed in the current directory (Tools, in this case). See the sample output in Figure 3-15.

```
C:\Microsemi\Tools> ExportSeeKey.bat g4cm-seesk-0000000000000000000000000000000000000002
C:\Microsemi\Tools>"C:\Program Files (x86)\nCipher\nfast\python\bin\python.exe" makekeypackage.py -
i g4cm-seesk-0000000000000000000000000000000000000002
Package data for key 'simple/g4cm-seesk-0000000000000000000000000000000000000002' written to file
'pkg-g4cm-seepk-0000000000000000000000000000000000000002-2db19054'
```

Figure 3-15 • Export of the SEE public key for encryption

Export Public Key for Verifying Signature

Enter the following command to export:

ExportSeekey.bat g4cm-seessk-<*M_UUID*>

This file is placed in the current directory (Tools, in this case). See the sample output in Figure 3-16.

```
C:\Microsemi\Tools> ExportSeeKey.bat g4cm-seessk-0000000000000000000000000000000000000002
C:\Microsemi\Tools>"C:\Program Files (x86)\nCipher\nfast\python\bin\python.exe" makekeypackage.py -
i g4cm-seessk-0000000000000000000000000000000000000002
Package data for key 'simple/g4cm-seessk-0000000000000000000000000000000000000002' written to file
'pkg-g4cm-seespk-0000000000000000000000000000000000000002-091d1213'
```

Figure 3-16 • Export of the SEE public key for verifying signature

Once exported, these files should be sent for further import into the U-HSM(s) that are preparing programming jobs for this M-HSM server.

Open the Server Port

To make the M-HSM server accessible to the clients running outside the host operating system, the firewall rules must be changed to open 8000.

Start the M-HSM Server

The M-HSM server can be executed from the command line or as a Windows service.

Command Line Mode

While it can be used for the normal server operation, the command line mode is best during initial M-HSM server setup and provisioning, because it prints out error messages directly to the screen and makes it easy for the user to start and stop M-HSM server during this process. This mode, however, can only be used under the admin account.

Service Mode

The service mode is designed for normal M-HSM server operation and can be used under a non-admin account. The server configuration must be performed by the user with admin privileges.

While a non-admin user has restricted access to the system resources and services, the M-HSM Control Panel application allows a non-admin user to perform certain administration tasks of the M-HSM server.

For more details about service mode of execution and setup instructions, see "Running M-HSM Server as a Service" on page 33.

Using M-HSM Server in Command Line Mode

The steps below require a user account with administrative privileges.

The M-HSM server executable "M-HSMServer.exe" is located in the Server directory:.

Example: C:\Microsemi\Server\M-HSMServer.exe

1. Start the console window: type **cmd** in the Windows Start Menu window and right-click "Command Prompt desktop app". Then choose **Run as administrator**.
2. In the open console window, navigate to the "server" directory and type **m-hsmserver.exe**.

Upon startup, the server initializes a session with the HSM module. You will see the output shown in Figure 3-17.

```
C:\Microsemi\Server>M-HSMServer.exe
The service is running.
Info: Ticket cleanup service is running.
Initializing session...
Session is initialized.
Press <ENTER> to exit.
```

Figure 3-17 • M-HSM Server is initializing session with the HSM module

If the SEE machine firmware load is still in progress, the session initialization waits for the load to finish. The SEE machine firmware load takes place in the following cases:

- Turning on or restarting the PC hosting the M-HSM server
- Restarting the Thales nFast Server service that handles HSM modules
- HSM module reinitialization via issuing Security World commands, such as nopclearfail
- Setting up or changing settings for the SEE firmware load (example: loadsee-setup)

Note: When a session is waiting for the SEE firmware to load, session initialization time depends on the module type, and may vary from one minute for a Solo module to four minutes for an Edge module, respectively.

Sample output after session initialization is finished after waiting for SEE firmware load is shown in Figure 3-21*.*

```
C:\Microsemi\Server>M-HSMServer.exe
The service is running.
Info: Ticket cleanup service is running.
Initializing session...
Waiting for the SEE firmware to load…
Session is initialized.
Press <ENTER> to exit.
```

Figure 3-18 • M-HSM Server is initialized

The session can be terminated by pressing the **Enter** key, as shown in Figure 3-22.

```
C:\Microsemi\Server>M-HSMServer.exe
The service is running.
Info: Ticket cleanup service is running.
Initializing session...
Session is initialized.
Press <ENTER> to exit.

Session is stopping…
Server is stopped.
```

Figure 3-19 • M-HSM Server is stopped

Note: During the session, the server produces log output to this file: C:\ProgramData\G4KMSServer\G4KMSHSMAPI.log

Import the M-HSM Public Keys

The M-HSM server needs to import its own public verify key so that it can securely remove the tickets.

Use the M-HSMGenImp utility for import:

M-HSMGenImp -p g4cmsee -i -n g4cm-seespk-<M_UUID> **-a pkg-g4cm-seespk-**<M_UUID><HEX VALUE> **-k g4see- isk**

M_UUID: 40 hex characters long UUID for the imported M-HSM public key.

Example: "0000000000000000000000000000000000000002"

pkg-g4cm-seespk-<*M_UUID*><HEX VALUE>*:* This is the container file on the disk with the signature verification key to be imported.

Example: pkg-g4cm-seespk- 0000000000000000000000000000000000000002-705f18e9

The resulting file is created in the Security World folder. Information about this key can be viewed using the "nfkminfo -k" command.

Example of resulting key file:
key_simple_g4cm-seespk-0000000000000000000000000000000000000002

Sample output from key import is shown in Figure 3-20..

```
C:\Microsemi\Tools> M-HSMGenImp.exe -i -m 1 -p g4cmsee -n g4cm-seespk-
0000000000000000000000000000000000000002-k g4see-isk -a pkg-g4cm-seespk-
0000000000000000000000000000000000000002-705f18e9
RedeemTicket successful
Starting to import SEE public key...
Vimport successful
= 20 bytes
                               705f18e9 5ac25b2c fcb66b9c 62c7b069 849394b0
= 20 bytes
                               705f18e9 5ac25b2c fcb66b9c 62c7b069 849394b0
SEE public key, g4cm-seespk-0000000000000000000000000000000000000002, imported successfully
```

Figure 3-20 • Importing the M-HSM Public Key

Import the U-HSM Public Keys

The M-HSM server needs the public keys of the U-HSM to send it information in a secure way and to verify the authenticity of the data.

Use the M-HSMGenImp utility for imports:

M-HSMGenImp -p g4cmsee -i -n g4cu-seepk-<*U_UUID*> **-a** ***pkg-g4cu-seepk***-<*U_UUID*><HEX VALUE> **-k g4see-isk**

M-HSMGenImp -p g4cmsee -i -n g4cu-seespk-<*U_UUID*> **-a pkg-g4cu-seespk-**<*U_UUID*><HEX VALUE> **-k g4see-isk**

U_UUID: 32 bytes long UUID for the imported U-HSM public key.

Example: "00000000000000000000000000000001"

pkg-g4cu-seepk-<*U_UUID*><HEX VALUE>*:* This is the container file on the disk with the encryption key to be imported.

Example: pkg-g4cu-seepk-00000000000000000000000000000001-5a4a52b3

pkg-g4cu-seespk-<*U_UUID*><HEX VALUE>: This is the container file on the disk with the signature verification key to be imported.

Example: pkg-g4cu-seespk-00000000000000000000000000000001-0754c1eb

The resulting files are created in the Security World folder.

Example of resulting key files:
key_simple_g4cu-seepk-00000000000000000000000000000001 and key_simple_g4cu-seespk-00000000000000000000000000000001

Information about these keys can be viewed using the "nfkminfo -k" command.

Sample output from key import is shown in Figure 3-21.

```
C:\Microsemi\Tools> M-HSMGenImp -p g4cmsee -i -n g4cu-seepk-00000000000000000000000000000001 -a
pkg-g4cu-seepk-00000000000000000000000000000001-5a4a52b3 -k g4see-isk
RedeemTicket successful
Starting to import SEE public key...
Vimport successful
= 20 bytes
                               5a4a52b3 2c9dc635 a5511840 c5489833 0af6d21a
= 20 bytes
                               5a4a52b3 2c9dc635 a5511840 c5489833 0af6d21a
SEE public key, g4cu-seepk-00000000000000000000000000000001, imported sucessfully

C:\Microsemi\Tools> M-HSMGenImp -p g4cmsee -i -n g4cu-seespk-00000000000000000000000000000001 -a
pkg-g4cu-seespk-00000000000000000000000000000001-0754c1eb -k g4see-isk
RedeemTicket successful
Starting to import SEE public key... Vimport successful
= 20 bytes
                               0754c1eb 2c9dc635 a5511840 c5489833 0af6d21a
= 20 bytes
                               0754c1eb 2c9dc635 a5511840 c5489833 0af6d21a
SEE public key, g4cu-seespk-00000000000000000000000000000001, imported sucessfully
```

Figure 3-21 • Importing the U-HSM Public Keys

Import U-HSM Device Data

To perform programming actions, the M-HSM server needs to receive and import the following data:

- DFK DB
  - This database includes HSM-protected per-device Diversified Factory Keys (DFK) used for initial device programming
- Manufacturing Keys
  - These keys are per device type and can be imported multiple times (they are ignored if they already exist)

For information about the DFK DB and manufacturing keys, refer to the Secure Production Programming Solution (SPPS) User Guide.

DFK Database and Manufacturing Keys

The U-HSM prepares the DFK DB for the M-HSM, which contains information about DFK and Manufacturing Keys. This database is a file with the name following this pattern:

DFK-<U_UUID>.DFKDB

where U_UUID is the UUID of the U-HSM (this is not the M-HSM UUID)

Example: DFK-00000000000000000000000000000001.DFKDB

M-HSM imports device information using the following command:

M-HSMImportDeviceData.exe <DFKDB_file>

This step imports DFKDB and device-type specific manufacturing keys. If any of those manufacturing keys have already been imported, the utility ignores them.

For each imported manufacturing key, a new file is created in the key folder of the Security World. The file has the following format: key_simple_g4mf-klk-<device_key_uuid>

Example: key_simple_g4mf-klk-10000000000000000000000000000000000000005

Restart the HSM Server

Perform the following steps to restart the server and ensure that the M-HSM server loads the new configuration correctly.

1. Stop M-HSMServer.exe.
2. Run "nopclearfail -c -m1".
3. Wait until the SEE machine is loaded, as shown in Figure 3-12.
4. Start M-HSMServer.exe.

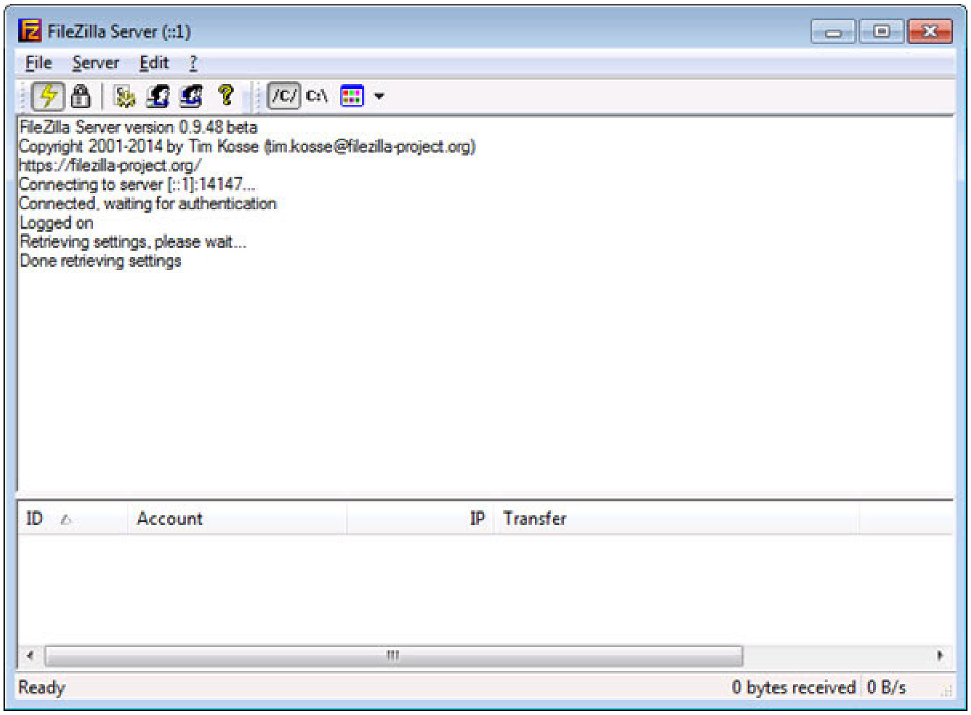
FTP Server Setup

An FTP server is required on the M-HSM to provide access to the job status and job termination functions for the administrator on FlashProExpress. The server is used to retrieve information from the ticket database located in the directory specified by M-HSMMaster.config file (see "Update Server and Tools Configuration File" on page 18 for details).

The following example shows how to set up the FTP server using FileZilla.

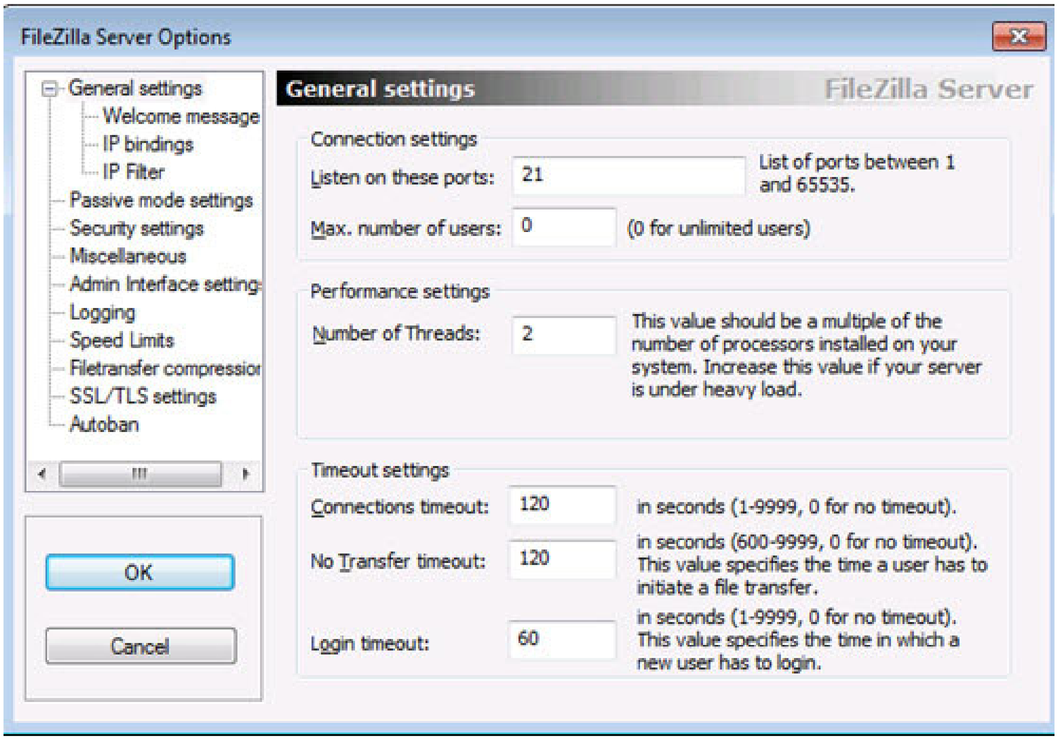
The FTP port is set to 21. The home directory is set to C:\Microsemi\ftp, and the ticket DB (/JobDB) is set to C:\Microsemi\JobDB.

1. Open the FileZilla Server application.



```
FileZilla Server version 0.9.48 beta
Copyright 2001-2014 by Tim Kosse (tim.kosse@filezilla-project.org)
https://filezilla-project.org/
Connecting to server [::1]:14147...
Connected, waiting for authentication
Logged on
Retrieving settings, please wait...
Done retrieving settings
```

2. Go to **Menu->Edit->Settings**, make sure the default port is set to 21, and close the dialog.



General settings

Connection settings

Listen on these ports: 21 List of ports between 1 and 65535.

Max. number of users: 0 (0 for unlimited users)

Performance settings

Number of Threads: 2 This value should be a multiple of the number of processors installed on your system. Increase this value if your server is under heavy load.

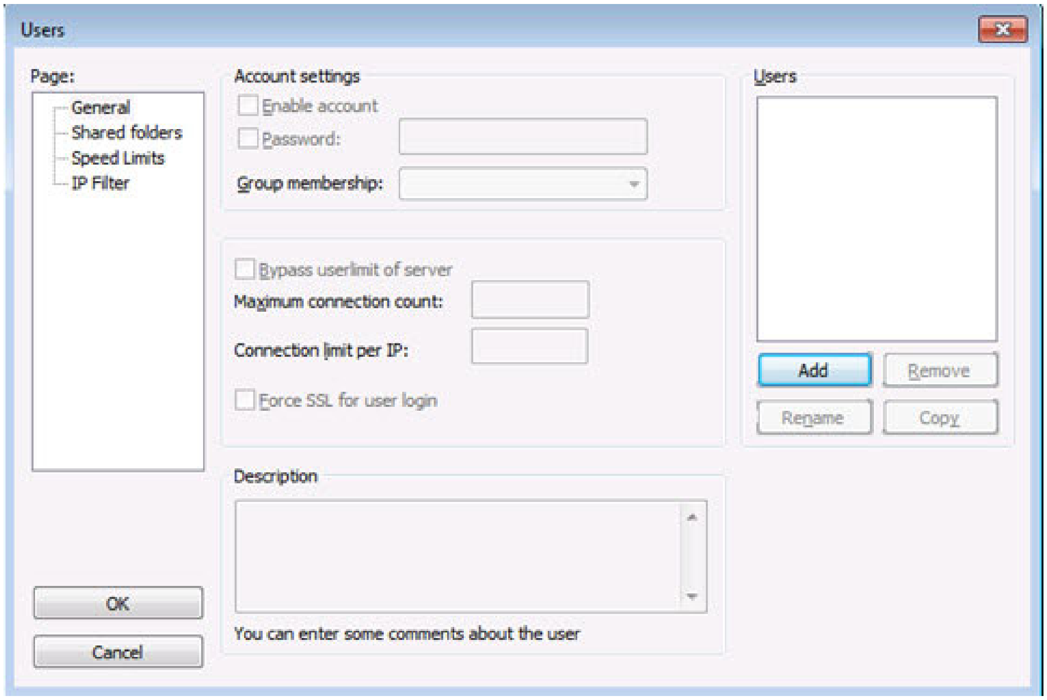
Timeout settings

Connections timeout: 120 in seconds (1-9999, 0 for no timeout).

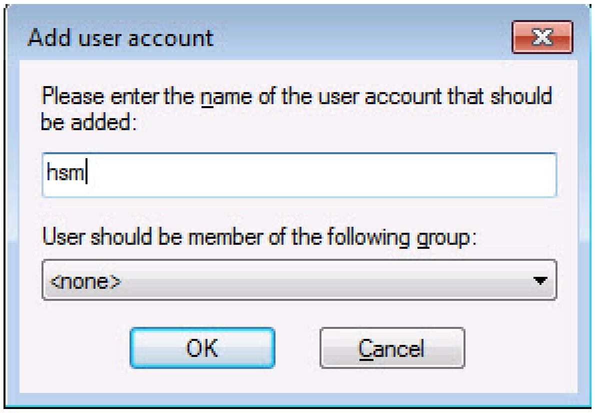
No Transfer timeout: 120 in seconds (600-9999, 0 for no timeout). This value specifies the time a user has to initiate a file transfer.

Login timeout: 60 in seconds (1-9999, 0 for no timeout). This value specifies the time in which a new user has to login.

3. Open user settings: **Menu->Edit->Users**.



4. Click **Add** and enter the new user name, for example, "hsm".



Please enter the name of the user account that should be added:

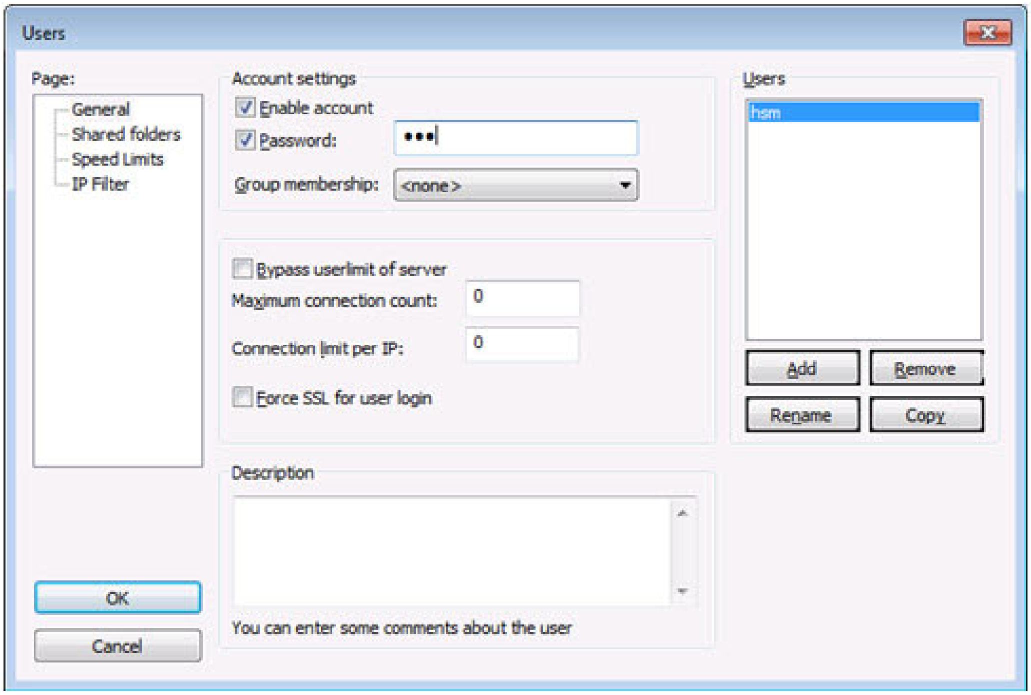
hsm

User should be member of the following group:

<none>

5. Click **OK**.

6. In the Users dialog, select the Password check box and enter your password. This password will be used when setting up HSM parameters for FlashPro Express.



Users

Page:
- General
- Shared folders
- Speed Limits
- IP Filter

Account settings

☑ Enable account

☑ Password: •••

Group membership: <none>

□ Bypass userlimit of server

Maximum connection count: 0

Connection limit per IP: 0

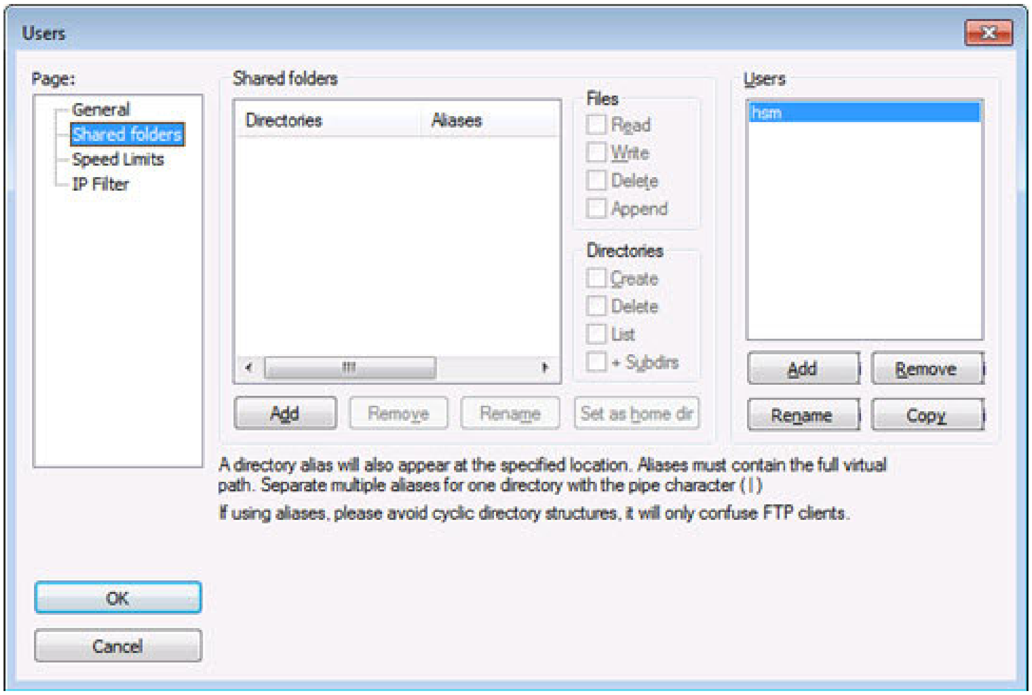
□ Force SSL for user login

Description

You can enter some comments about the user

Users: hsm

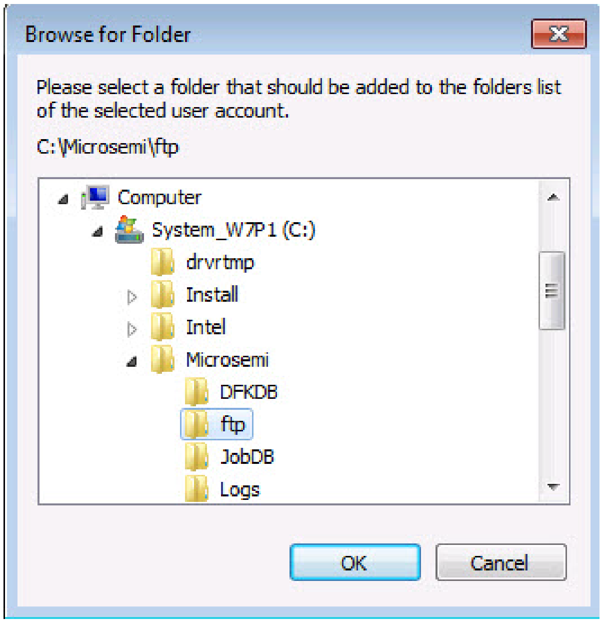
7. In the "Page" tree view, select the "Shared folders" option.



A directory alias will also appear at the specified location. Aliases must contain the full virtual path. Separate multiple aliases for one directory with the pipe character (|)

If using aliases, please avoid cyclic directory structures, it will only confuse FTP clients.

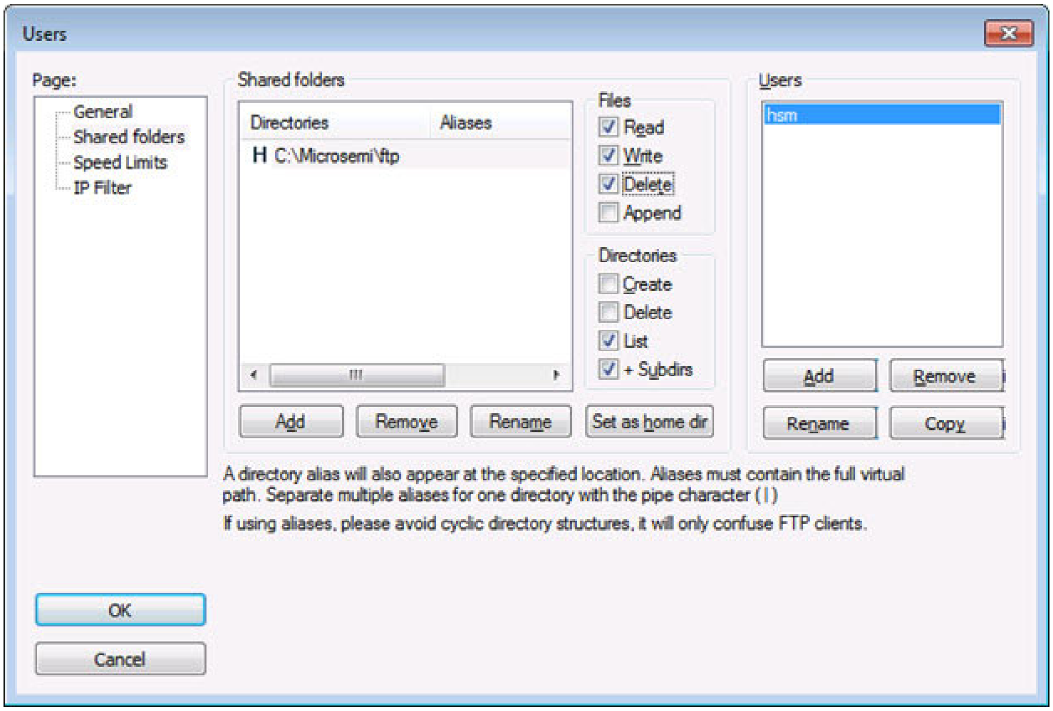
8. Click **Add**.
9. Navigate to the C:\Microsemi\ftp folder.
10. Click **OK**.



Please select a folder that should be added to the folders list of the selected user account.

C:\Microsemi\ftp

11. Set permissions for this directory to Read/Write/Delete.



Directories: H C:\Microsemi\ftp

Users: hsm

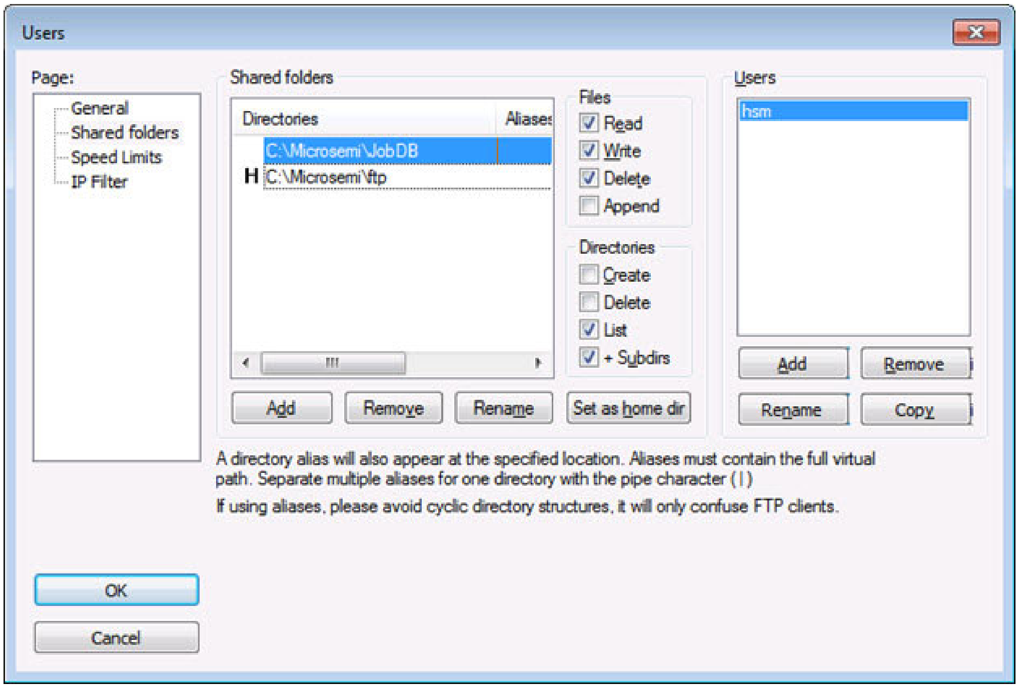
Files
☑ Read
☑ Write
☑ Delete
□ Append

Directories
□ Create
□ Delete
☑ List
☑ + Subdirs

A directory alias will also appear at the specified location. Aliases must contain the full virtual path. Separate multiple aliases for one directory with the pipe character (|)

If using aliases, please avoid cyclic directory structures, it will only confuse FTP clients.

12. Repeat this step and add the location of the ticket database.



Directories:
C:\Microsemi\JobDB
H C:\Microsemi\ftp

Users: hsm

Files
☑ Read
☑ Write
☑ Delete
□ Append

Directories
□ Create
□ Delete
☑ List
☑ + Subdirs

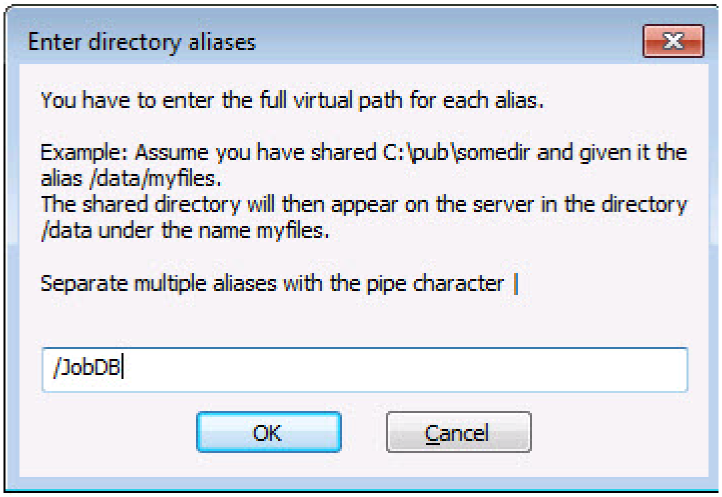
A directory alias will also appear at the specified location. Aliases must contain the full virtual path. Separate multiple aliases for one directory with the pipe character (|)

If using aliases, please avoid cyclic directory structures, it will only confuse FTP clients.

13. Make sure the JobDB directory has Read/Write/Delete permissions.

14. Right-click the JobDB entry and choose **Edit aliases**.

15. Set alias as "/JobDB".



Enter directory aliases

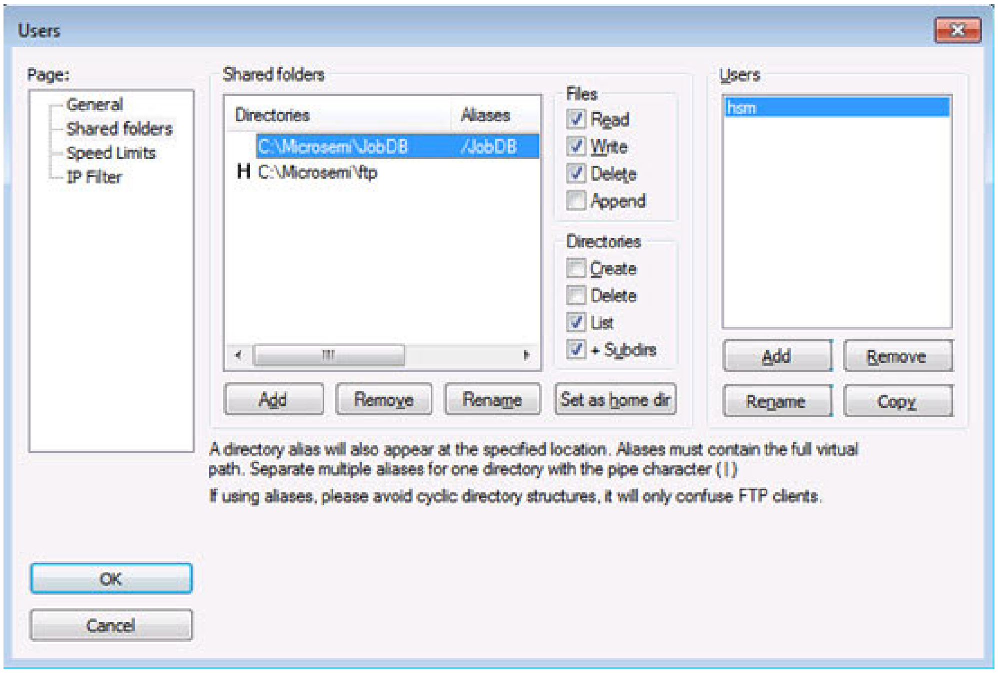
You have to enter the full virtual path for each alias.

Example: Assume you have shared C:\pub\somedir and given it the alias /data/myfiles.
The shared directory will then appear on the server in the directory /data under the name myfiles.

Separate multiple aliases with the pipe character |

/JobDB

16. Confirm the home directory is set to the ftp folder and alias to the JobDB, as shown below.



Users

Shared folders

	Directories	Aliases
	C:\Microsemi\JobDB	/JobDB
H	C:\Microsemi\ftp	

Files
☑ Read
☑ Write
☑ Delete
☐ Append

Directories
☐ Create
☐ Delete
☑ List
☑ + Subdirs

Users
hsm

A directory alias will also appear at the specified location. Aliases must contain the full virtual path. Separate multiple aliases for one directory with the pipe character (|)
If using aliases, please avoid cyclic directory structures, it will only confuse FTP clients.

17. Confirm that the FTP server functions as expected. Follow the example in Figure 3-22 below.

```
C:\Microsemi\DFKDB>ftp sjsocprgw7p1

Connected to sjsocprgw7p1.microsemi.net.
220-FileZilla Server version 0.9.48 beta
220-written by Tim Kosse (tim.kosse@filezilla-project.org)
220 Please visit https://filezilla-project.org/
User (sjsocprgw7p1.microsemi.net:(none)): hsm
331 Password required for hsm
Password:
230 Logged on

ftp> ls
200 Port command successful
150 Opening data channel for directory listing of "/"
JobDB
226 Successfully transferred "/"

ftp> cd JobDB
250 CWD successful. "/JobDB" is current directory.
ftp> ls
200 Port command successful
150 Opening data channel for directory listing of "/JobDB"
226 Successfully transferred "/JobDB"
ftp>
```

Figure 3-22 • Checking setup of the FTP server

18. Similarly, create the /JobDBArchive FTP location at the same level as /JobDB and pointing to C:\Microsemi\JobDB\JobDBArchive.

4 – Running M-HSM Server as a Service

This chapter describes how to run M-HSM as a service.

The M-HSM server can be set up to run as a Windows service. This mode allows a non-admin user to operate the server once service configuration is done under the administrator account.

In service mode, all interactions with the M-HSM server are done via the M-HSM Control Panel application.

Service Setup

The service setup and configuration steps require administrator privileges.

Before starting service configuration, ensure that M-HSMServer.exe is not running.

Create Service Entry

Open a command prompt in "As Admin" mode: type **cmd** in the Windows Start menu, right-click the "cmd" entry, and run in "As Admin" mode.

Create a service entry called M-HSMServer following the example below:

```
C:\Microsemi\SEE>sc create M-HSMServer binPath= "C:\Microsemi\server\m-hsmserver.exe"
DisplayName= "Manufacturer HSM Server"
[SC] CreateService SUCCESS
```

Note: If you need to delete this entry, use following command:

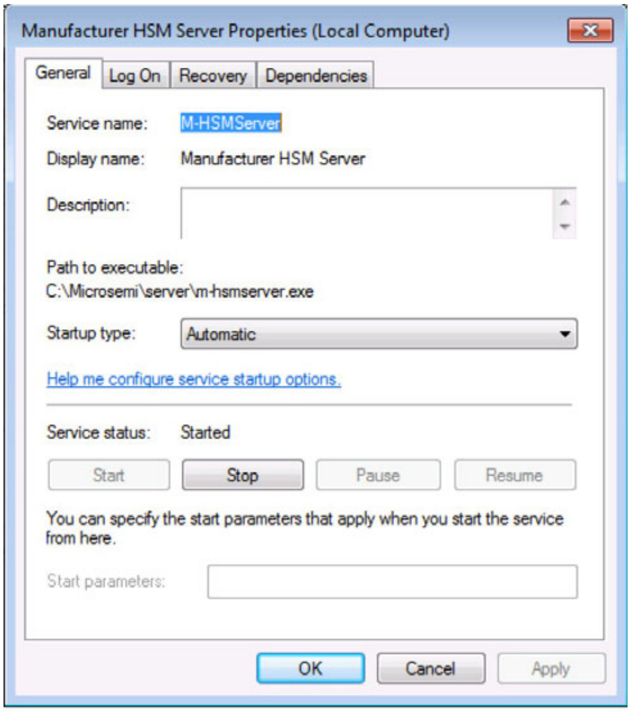
sc delete M-HSMServer

Update Service Properties

To update service properties, perform the following steps:

1. Open the Control Panel and go to "Services". Find the "Manufacturer HSM Service" entry and open the service properties windows.

2. On the **General** tab, set Startup type to **Automatic**, as shown below.



Manufacturer HSM Server Properties (Local Computer)

General | Log On | Recovery | Dependencies

Service name: M-HSMServer

Display name: Manufacturer HSM Server

Description:

Path to executable:
C:\Microsemi\server\m-hsmserver.exe

Startup type: Automatic

Help me configure service startup options.

Service status: Started

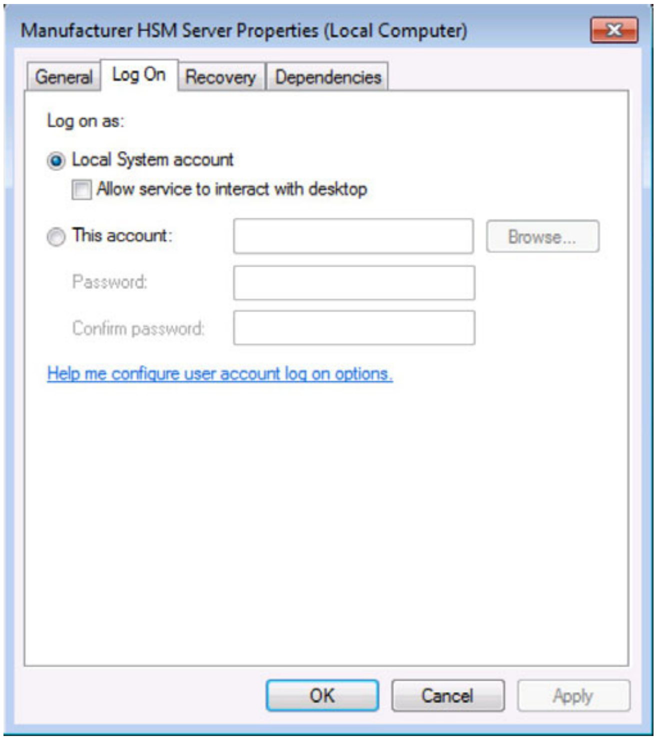
Start | Stop | Pause | Resume

You can specify the start parameters that apply when you start the service from here.

Start parameters:

OK | Cancel | Apply

3. On the **Log On** tab, make sure "Log On as" is set to **Local System account**.



Manufacturer HSM Server Properties (Local Computer)

General | Log On | Recovery | Dependencies

Log on as:

● Local System account

□ Allow service to interact with desktop

○ This account: Browse...

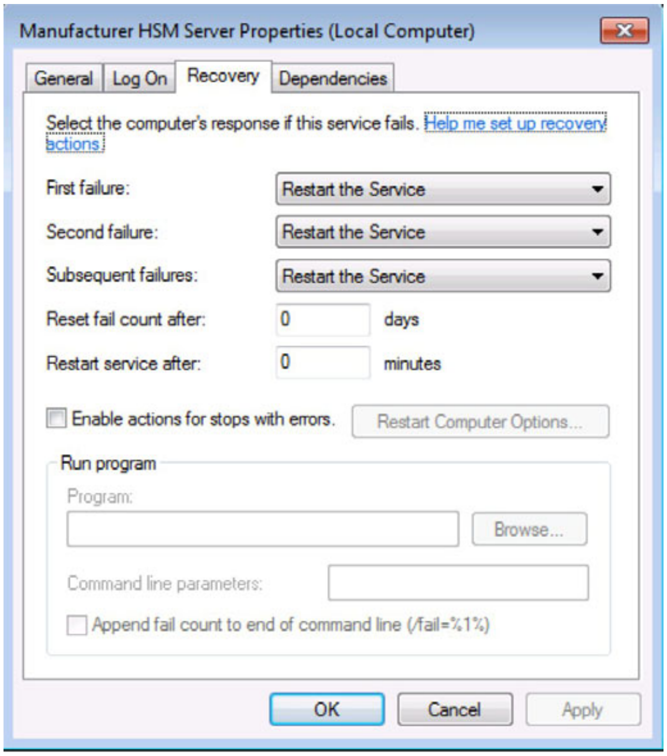
Password:

Confirm password:

Help me configure user account log on options.

OK | Cancel | Apply

4. On the **Recovery** tab, set all failure recovery fields to **Restart the Service**, as shown below. This setting tells Windows to automatically restart the server if an error occurs.



Manufacturer HSM Server Properties (Local Computer)

Select the computer's response if this service fails. Help me set up recovery actions.

First failure:	Restart the Service
Second failure:	Restart the Service
Subsequent failures:	Restart the Service
Reset fail count after:	0 days
Restart service after:	0 minutes

□ Enable actions for stops with errors.

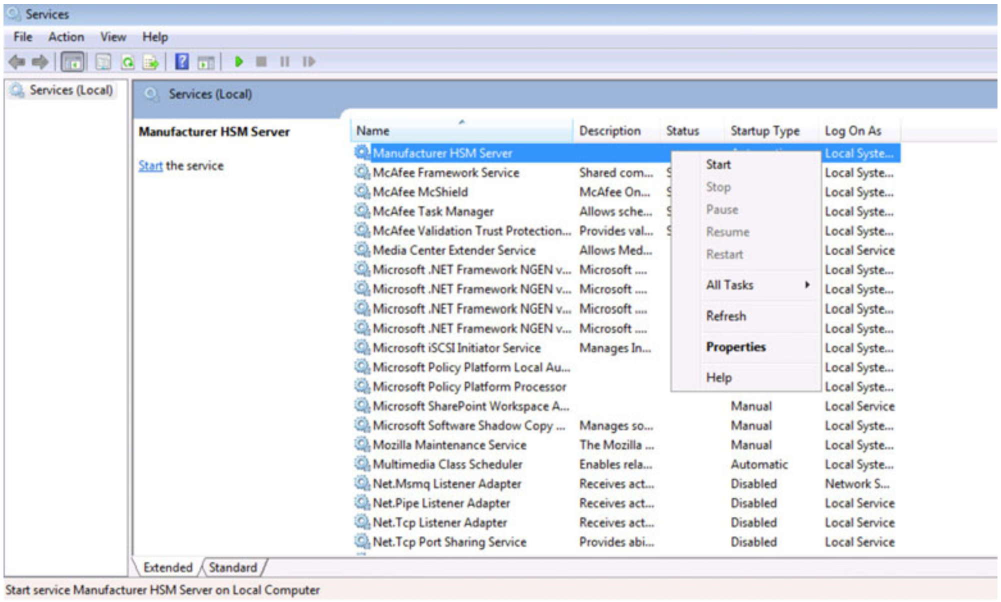
Run program

Program:

Command line parameters:

□ Append fail count to end of command line (/fail=%1%)

5. When done, click **OK** and close the dialog. Then attempt to manually start the server: navigate to the Manufacturer HSM Server entry, right-click and choose **Start**.



Manufacturer HSM Server

Start the service

Name	Description	Status	Startup Type	Log On As
Manufacturer HSM Server				Local Syste...
McAfee Framework Service	Shared com...	S		Local Syste...
McAfee McShield	McAfee On...	S		Local Syste...
McAfee Task Manager	Allows sche...	S		Local Syste...
McAfee Validation Trust Protection...	Provides val...	S		Local Syste...
Media Center Extender Service	Allows Med...			Local Service
Microsoft .NET Framework NGEN v...	Microsoft			Local Syste...
Microsoft .NET Framework NGEN v...	Microsoft			Local Syste...
Microsoft .NET Framework NGEN v...	Microsoft			Local Syste...
Microsoft .NET Framework NGEN v...	Microsoft			Local Syste...
Microsoft iSCSI Initiator Service	Manages In...			Local Syste...
Microsoft Policy Platform Local Au...				Local Syste...
Microsoft Policy Platform Processor				Local Syste...
Microsoft SharePoint Workspace A...			Manual	Local Service
Microsoft Software Shadow Copy ...	Manages so...		Manual	Local Syste...
Mozilla Maintenance Service	The Mozilla ...		Manual	Local Syste...
Multimedia Class Scheduler	Enables rela...		Automatic	Local Syste...
Net.Msmq Listener Adapter	Receives act...		Disabled	Network S...
Net.Pipe Listener Adapter	Receives act...		Disabled	Local Service
Net.Tcp Listener Adapter	Receives act...		Disabled	Local Service
Net.Tcp Port Sharing Service	Provides abi...		Disabled	Local Service

Start service Manufacturer HSM Server on Local Computer

6. Once service is confirmed, you can reboot the PC and logon using a non-admin user account.

Note: Under the non-admin account, you can only observe service status using the Windows Services tool.

M-HSM Control Panel Application

The control panel application can be used under admin and non-admin user accounts.

The control panel application provides the following functions:

- Observe status of M-HSM server
- Restart service for error recovery
- Stop and Start active session with the HSM module
- Export M-HSM server activity log

Setup

The M-HSM Control Panel application is located in the "M-HSMControlPanel" folder.

The application executable M-HSMControlPanel.exe can be started like other Windows applications and does not require admin privileges to operate.

For convenience, it can be added to the Windows start-up applications as a shortcut placed in the Windows Startup folder:

Example: C:\Users\hsm_nonAdmin_user\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Startup

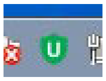
Once added to the startup applications, the M-HSM Control Panel application is automatically started by Windows upon startup.

Note: Upon initial startup, the application registers its icon in the Windows registry. Once registered, the application executable name or path cannot be changed without removing that entry in the Windows Registry. See the ReadMe.txt file for the cleanup instructions.

Only one running running instance of the application is allowed at a time.

Notification Icon

The application appears as an icon in the Windows Notification Area.

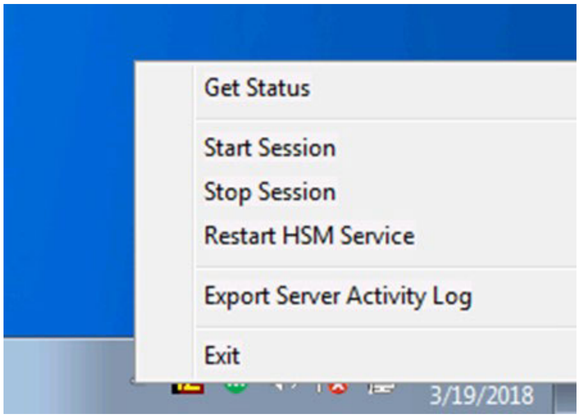


Depending on the status of the M-HSM server, the icon of the M-HSM Control Panel application can be one of the following:

- **Green** - indicates server normal working state
- **Red** - indicates that the connection with the server is established, but the session with the HSM module is not active. It can be either in the "starting", "stopping", or "not running" state
- **Gray** - indicates connection with the server cannot be established. In most cases, this means the service is not running.

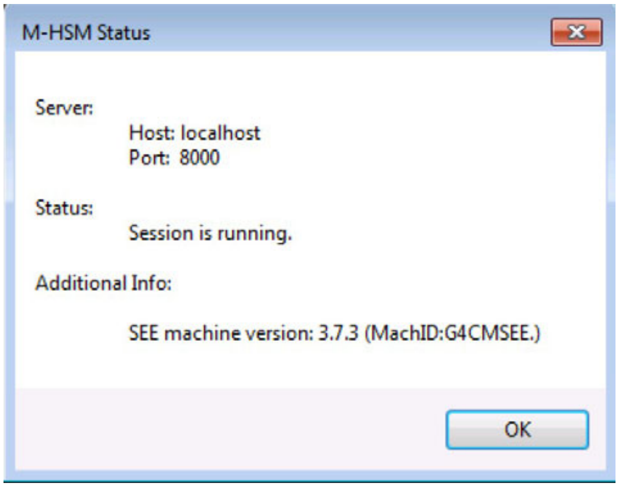
In addition to color coding, the server state is indicated in the tooltip that appears when the cursor hovers over the icon.

Left-clicking the application icon opens the context menu shown below.



Get Status

The **Get Status** option indicates M-HSM connection state, state of the session with the HSM module, and version of the SEE firmware running on the HSM module, if session with the HSM module is active.



M-HSM Status

Server:
Host: localhost
Port: 8000

Status:
Session is running.

Additional Info:

SEE machine version: 3.7.3 (MachID:G4CMSEE.)

Start and Stop Session

These two options control the active session state with the HSM module inside the M-HSM server application. The session with the HSM module automatically starts with the startup of the M-HSM server. Upon its startup, the session loads information from the server configuration files and establishes connection with the SEE machine running in the HSM module. If SEE firmware is being loaded, the HSM server waits until the firmware load is finished.

Stopping the session allows the user to manipulate HSM server settings and HSM module hardware without having to stop M-HSM Service.

Note: Upon receiving a session stop request, the HSM server stops accepting new client requests, while allowing requests still in progress to complete.

Restart M-HSM Service

This option allows user to restart M-HSM server service to recover from certain errors. This eliminates the need to restart the PC.

Note: This action may terminate client requests currently in progress and should be used with caution. It may be a good practice to attempt stopping a session first.

Export Server Activity Log

Export Server Activity Log retrieves the log file located in the sever directory and exports it to the file specified by the user. Information in this log file can be used to analyze current server activities.

Exit

Exit terminates the M-HSM Control Panel application session. It does not impact M-HSM server operation, and can be restarted by a non-admin user at any time.

5 – M-HSM Reconfiguration and Post-Installation Actions

This chapter provides instructions for the setup and maintenance actions that can be performed on an installed and provisioned M-HSM.

HSM Module Replacement

Note: Only one module at a time can be connected to the M-HSM.

Overbuild Protection During Module Maintenance

Note: **If the old module is removed or erased from the M-HSM, unfinished programming jobs will not be able to proceed.**

For any jobs in progress, certain ticket information is stored inside the NVRAM of the HW module, which makes job tickets physically uncloneable.

Module maintenance, such as replacement, firmware upgrades, and erase invalidate unfinished jobs. The user must submit a new job to continue manufacturing. However, issuing a new job without having a proof or termination of previous job(s) creates a potential threat of overbuilding. To minimize this risk, before undertaking such module maintenance actions, any active job(s) should be terminated using the complete_prog_job Tcl command (see the Libero SoC or PolarFire FPGA Tcl Command Reference Guide). This job termination command will generate a Job End Certifier that can be validated on the U-HSM. This certifier is protected by the HSM and cannot be modified. It provides the user with assurance that further device programming is not possible from the old job. Once the Job End certifier has been validated by the user on the U-HSM, it is safe to issue a new job after maintenance has completed.

Remove the Old HSM Module

Physically disconnect the old module. The M-HSM Security World contains a file with the module information. While this file can co-exist with the files for other modules added to the system, the user can choose to remove it for security reasons. The file is located in the Security World directory: %NFAST_KMDATA%\local directory. The file name follows the pattern "module_<module_ESN>". If needed, the user can also remove the licensing file from the Server and Tools directories: <M_UUID>.g4sl.

Set Up a New HSM Module

After the module is installed on the system, it must be added to the Security World and set up to load SEE Machine firmware per module type.

Module Installation

1. Install a new HSM module (see "HSM Hardware Module Installation" on page 10).
2. Install the Microsemi-issued HSM module license (see "Install HSM Module License File" on page 19).
3. Install the module warrant file (see "HSM Hardware Module Installation" on page 10).

Add the HSM Module to the Security World

The following steps require the Administrative Card Set (ACS). The number of required cards and their respective passphrases depend on the settings specified during Security World creation (see "Create the Security World" on page 14)

1. Set the module to the pre-init state.

2. Add the HSM module to the security world using the new-world command:

   new-world --program --no-remoteshare-cert -m 1
3. Create a new NVRAM file (see "Create NVRAM-based Storage in the HSM Module" on page 17).
4. Set module to the operational state.
5. Set up the HSM module to load SEE Machine firmware: follow instructions in "Set Up the SEE Machine Firmware for Loading into the HSM Module" on page 19.

Import the Public Key of the M-HSM

Follow the instructions in "Import the M-HSM Public Keys" on page 23.

Import the Public Keys of the U-HSM

Follow the instructions in "Import the U-HSM Public Keys" on page 23.

Export the Public Keys for Sending to a U-HSM

Follow the instructions in "Export the M-HSM Public Keys" on page 21.

Import the New DFK DB and Manufacturing Keys from the U-HSM

Follow the instructions in "Import U-HSM Device Data" on page 24.

Upgrade the HSM Module Firmware

This step shows how to upgrade HSM module firmware (not SEE Machine firmware). The firmware upgrade may be necessary in the following cases:

- The HSM module has a firmware revision that is not supported by the FlashProExpress version used (see M-HSM release notes for the supported revisions).
- The user wants to switch to another revision of Microsemi-supported firmware.
- Microsemi issues a security advisory.

Note: If the M-HSM has any active programming jobs, they will be disabled through the firmware upgrade. Also, the firmware upgrade will erase NVRAM and any information about module association with the Security World. Follow the steps below to upgrade the firmware of the HSM module and restore the HSM module on the M-HSM server:

1. Read the important notes in "Upgrade HSM Module Firmware" regarding the firmware upgrade procedure and firmware revisions compatibilities.

   Note: If the firmware upgrade is initiated by a Microsemi security advisory, the instructions in the advisory shall supersede the instructions in this guide.
2. Terminate any active job(s) and forward job end certifier to the U-HSM.

   Read important information regarding overbuild protection during HSM module maintenance operations in "Overbuild Protection During Module Maintenance" on page 39.
3. Upgrade the HSM module firmware.

   HSM module firmware upgrade instructions are provided in "Upgrade HSM Module Firmware" on page 11.
4. Restore the module association with the Security World.

   Follow the instructions in "Add the HSM Module to the Security World".
5. Start the M-HSM server.

Follow the instructions in "Start the M-HSM Server" on page 21 and confirm successful server startup.

6. Resubmit new programming jobs, if necessary.

6 – M-HSM Server Replication

An existing M-HSM server can be replicated to one or more new M-HSM servers. As a result, the replicated server gets a copy of the Security World, all HSM keys, imported public keys, the DFK DB, and manufacturing keys already existing on the source system.

Note: Programming jobs cannot be replicated, but they can be transferred. The overbuild protection does not allow cloning of any job that may exist in the source system. Job tickets reside inside the physical HSM module, and can only be transferred to the new system along with the physical module.

The following sections provide instructions for M-HSM server replication:

Install the Software

Follow the instructions in "Software Installation" on page 10 and install all required software packages.

Copy Over the Security World

Copy the content of the Security World directory from the source to the destination machine. The location of the security world directory is: %NFAST_KMDATA%\local.

This step copies over the entire security environment:

- Security World data
- Created M-HSM keys
- Imported public keys
- Imported MFG keys

Copy Over the M-HSM Server

1. Copy HSM server software components from the source HSM to the destination folder of the new server (the default location is C:\Microsemi).
2. On the destination machine, delete the ticket db files (job cannot be replicated):
   – C:\Microsemi\JobDB and
   – C:\Microsemi\JobDB\JobDBArchive

Install a New HSM Module

Follow the instructions in "Set Up a New HSM Module" on page 39.

Start the M-HSM Server

Follow the instructions in "Start the M-HSM Server" on page 21.

Set Up the FTP Server

Follow the instructions in "FTP Server Setup" on page 25.

A – Product Support

Microsemi SoC Products Group backs its products with various support services, including Customer Service, Customer Technical Support Center, a website, electronic mail, and worldwide sales offices. This appendix contains information about contacting Microsemi SoC Products Group and using these support services.

Customer Service

Contact Customer Service for non-technical product support, such as product pricing, product upgrades, update information, order status, and authorization.

From North America, call **800.262.1060**
From the rest of the world, call **650.318.4460**
Fax, from anywhere in the world, **650.318.8044**

Customer Technical Support Center

Microsemi SoC Products Group staffs its Customer Technical Support Center with highly skilled engineers who can help answer your hardware, software, and design questions about Microsemi SoC Products. The Customer Technical Support Center spends a great deal of time creating application notes, answers to common design cycle questions, documentation of known issues, and various FAQs. So, before you contact us, please visit our online resources. It is very likely we have already answered your questions.

Technical Support

For Microsemi SoC Products Support, visit http://www.microsemi.com/products/fpga-soc/design-support/fpga-soc-support.

Website

You can browse a variety of technical and non-technical information on the Microsemi SoC Products Group home page, at www.microsemi.com/soc.

Contacting the Customer Technical Support Center

Highly skilled engineers staff the Technical Support Center. The Technical Support Center can be contacted by email or through the Microsemi SoC Products Group website.

Email

You can communicate your technical questions to our email address and receive answers back by email, fax, or phone. Also, if you have design problems, you can email your design files to receive assistance. We constantly monitor the email account throughout the day. When sending your request to us, please be sure to include your full name, company name, and your contact information for efficient processing of your request.

The technical support email address is soc_tech@microsemi.com.

My Cases

Microsemi SoC Products Group customers may submit and track technical cases online by going to My Cases.

Outside the U.S.

Customers needing assistance outside the US time zones can either contact technical support via email (soc_tech@microsemi.com) or contact a local sales office.

Visit About Us for sales office listings and corporate contacts.

Sales office listings can be found at www.microsemi.com/soc/company/contact/default.aspx.

ITAR Technical Support

For technical support on RH and RT FPGAs that are regulated by International Traffic in Arms Regulations (ITAR), contact us via soc_tech_itar@microsemi.com. Alternatively, within My Cases, select **Yes** in the ITAR drop-down list. For a complete list of ITAR-regulated Microsemi FPGAs, visit the ITAR web page.

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About Microsemi

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