DA-683 Windows Embedded Standard 7 Software Manual

First Edition, April 2014

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DA-683 Windows Embedded Standard 7 Software Manual

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1

Introduction

Thank you for buying Moxa’s DA-683 rackmount computer. It comes with the Windows Embedded Standard 7 software platform, providing a simple and familiar development environment for on-board train applications.

❒ **Software Components**

Software Components

Refer to the following table to review the software components of your Windows Embedded Standard 7 operating system.

Windows Embedded Standard 7

Core OS:

- 32-bit support
- Remote Client
- Remote Procedure Call

Applications and Services Development:

- .Net Framework 3.5
- Remote Desktop Protocol 7.1
- COM OLE Application Support
- COM+ Application Support
- MSMQ

Internet Services:

- Internet Explorer 8.0
- IIS 7.0

File Systems and Data Store:

- Windows Data Access Components
- Windows Backup and Restore

Diagnostics:

- Common Diagnostic Tools
- Problem Reports and Solutions

Fonts:

Chinese (Trad. and Simp.), Japanese, Korean, Western, Middle Eastern, South-East and South Asian

Graphics and Multimedia:

- MPEG DTV-DVD Audio Decoder (MPEG-2, AAC)
- MPEG Layer-3 Audio Codecs(MP3)
- MPEG4 Decoders
- Windows Media Video VC-1 (WMV) Codecs
- DirectX and Windows Device Experience
- Windows Media Player 12

International:

- IME Simplified Chinese Support
- IME Traditional Chinese Support
- IME Japanese Support
- IME Korean Support

Management:

- Group Policy Management
- Windows Management Instrument (WMI)
- Windows Update

Networking:

- Extensible Authentication Protocol (EAP)
- Internet Authentication Service
- Telnet Server
- Bluetooth
- Domain Services
- Network Access Protection
- Network and Sharing Center
- Quality of Service
- Remote Access Service (RAS)
- Telephony API Client
- Windows Firewall
- Wireless Networking

Security:

- Credential Roaming Service
- Credentials and Certificate Management
- Windows Authorization Manager (AZMAN)
- Windows Security Center
- Active Directory Rights Management
- Security Base
- Encrypted File System (EFS)

Embedded Features:

- Enhanced Write Filter (EWF)
- File-Based Write Filter (FBWF)
- Message Box Default Reply
- Registry Filter
- WSDAPI for .NET

Embedded Self-Health Diagnostic Software:

SNMP-based remote scripting layer for monitoring, reporting, and control

2

System Initialization

This chapter describes how to create a new user account on the DA-683 computer.

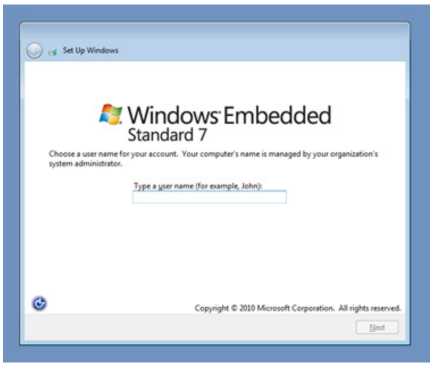
❒ **Create a New User Account**

Create a New User Account

1. When you boot into the DA-683 for the first time you will need to first create a user account.
2. Type the password, and then retype the password below. In addition, you may also type a password hint in case you forget your password. If you do not want to set a password for the account, leave the entry box blank and click **Next**.

ATTENTION

Remember to use a strong password, preferably one that is at least eight characters long, is not a proper word, and contains numbers, letters, and symbols.



Choose a user name for your account. Your computer's name is managed by your organization's system administrator.

Type a user name (for example, John):

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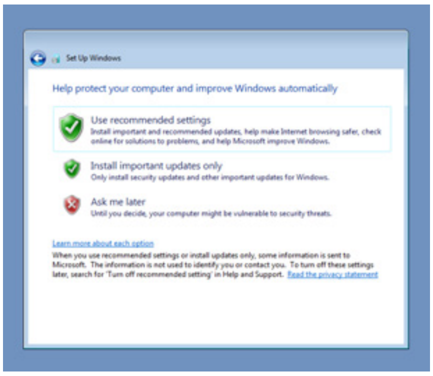
1. Select the **Windows Update** option, then set your time zone and whether you use daylight savings time.



Help protect your computer and improve Windows automatically

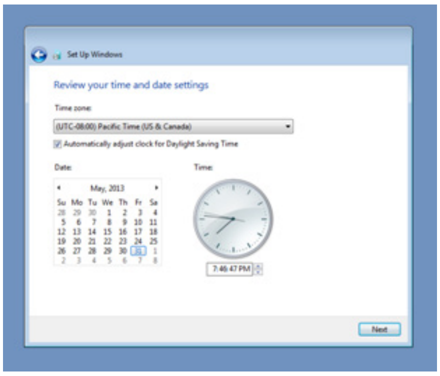
Use recommended settings
Install important and recommended updates, help make Internet browsing safer, check online for solutions to problems, and help Microsoft improve Windows.

Install important updates only
Only install security updates and other important updates for Windows.

Ask me later
Until you decide, your computer might be vulnerable to security threats.

Learn more about each option

When you use recommended settings or install updates only, some information is sent to Microsoft. The information is not used to identify you or contact you. To turn off these settings later, search for 'Turn off recommended setting' in Help and Support. Read the privacy statement



Review your time and date settings

Time zone:
(UTC-08:00) Pacific Time (US & Canada)

☑ Automatically adjust clock for Daylight Saving Time

Date:

May, 2013

Su	Mo	Tu	We	Th	Fr	Sa
28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1
2	3	4	5	6	7	8

Time:
7:46:47 PM

2. Now you may begin using your DA-683 embedded computer.

3

Enabling Embedded Filters

This chapter describes how to set up and configure Windows 7 bit-level and file-level write protections on the DA-683 storage drives.

The following topics are covered in this chapter:

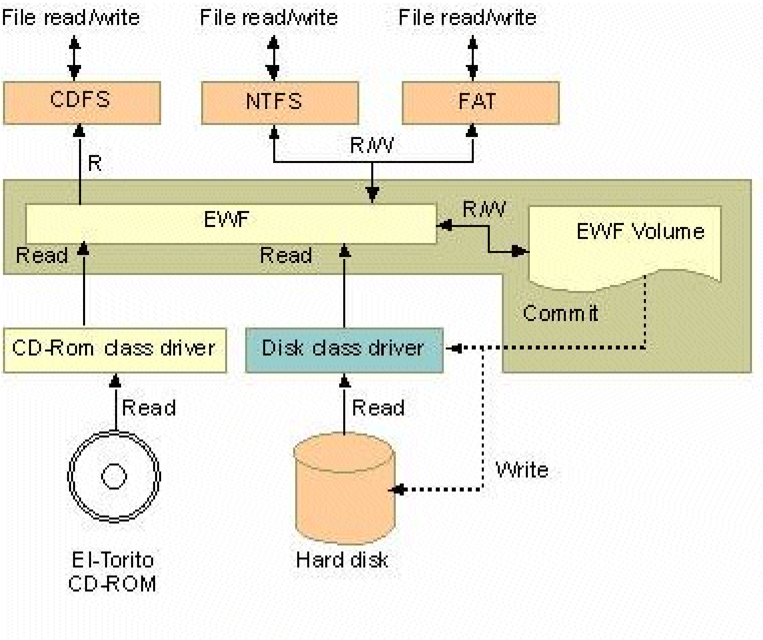
- **Enhanced Write Filter**
  - Overview
  - Enabling Enhanced Write Filter
  - Committing Data and/or Disabling EWF
- **File-Based Write Filter**
  - Overview
  - Configuring File-Based Write Filter
  - Excluding Files from FBWF Protection
  - Managing Temporary Files Cached in the Overlay

Enhanced Write Filter

Overview

Enhanced Write Filter (EWF) provides a means for protecting a volume from unauthorized writes by making the main OS drive a write-protected volume, effectively making the system a read-only system for most users. This gives much stronger protection against malicious computer code like trojans, worms, and viruses.

Enhanced Write Filter (EWF) allows Windows 7 users to protect their all information on their storage drive from permanent changes of any sort, at the lowest level of hardware protection available: the bit level. **EWF** allows the operating system (OS) to boot from the hard disk, but protects the system by creating a virtual file system called an **overlay**. All writes to an EWF-protected volume (the **hard disk**, in Fig. 1) are only recorded on this virtual overlay (the **EWF Volume**, in Fig. 1), which is stored independently in random access memory (RAM). Because EWF does not write data directly to the hard disk but instead only records system writes to this virtual RAM overlay, any data that is "written" during system operation will disappear upon the next re-boot. This approach allows the system to operate as if it is writeable when in reality all OS and user-space file systems are stored in a permanent, read-only state. If desired, the data written to the overlay may be committed to the protected volume, but this requires additional setup and permissions that can only be granted by the administrator. Refer to the following figure (from Microsoft) for an overview of the EWF structure.



For more details about EWF configuration and usage, you may:

- Visit Microsoft's EWF Volume Configuration help pages.
- Visit Microsoft's EWF overview on the official Microsoft EWF help pages.
- Visit Microsoft's detailed description of EWF modes on the EWF help pages.
- Visit Microsoft's detailed description of the EWF API.

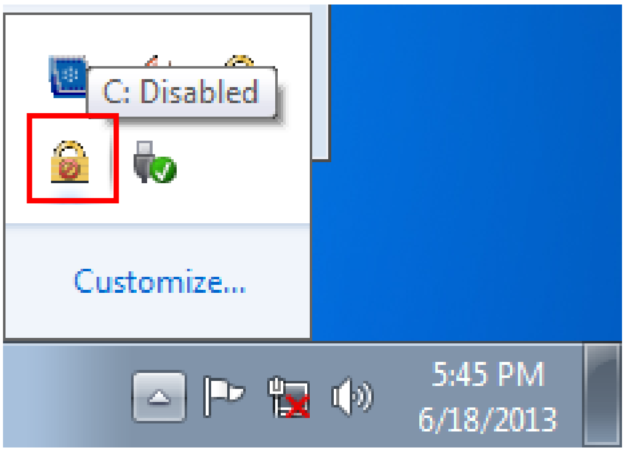
For the EWF commands, refer to the MSDN web site:

http://msdn.microsoft.com/en-us/library/ms940853%28v=winembedded.5%29.aspx

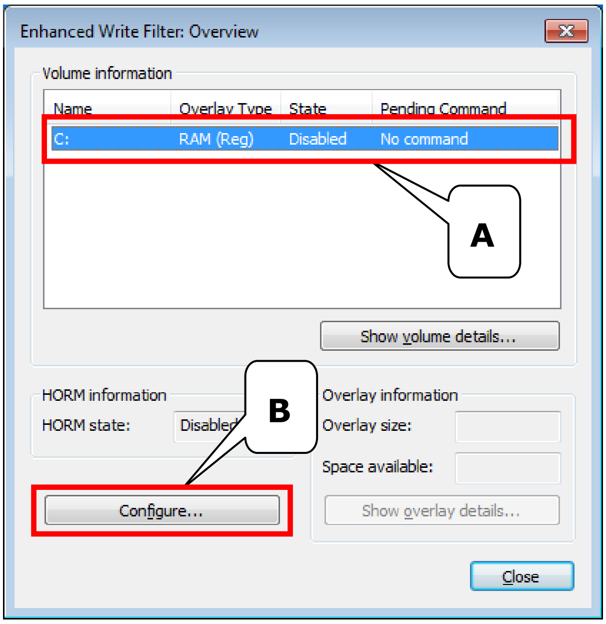
Enabling Enhanced Write Filter

Follow these steps to enable the Enhanced Write Filter.

1. To open the EWF control dialog, open the system tray (located in the lower right corner of the desktop) and right-click on the padlock icon.



2. Select the volume you wish to enable write-protection on by selecting the partition (**A**) in the **Volume Information** dialog, and then pressing the **Configure** button (**B**) in the lower left section of the dialog.


Enhanced Write Filter: Overview

Volume information

Name	Overlay Type	State	Pending Command
C:	RAM (Reg)	Disabled	No command

HORM information

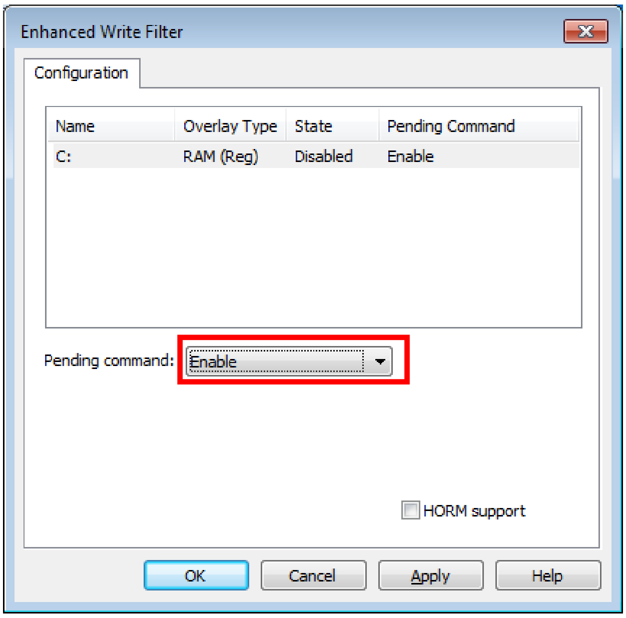
HORM state: Disabled

Overlay information

Overlay size:

Space available:

3. After opening the configuration dialog, choose to enable Enhanced Write Filter on your drive volume by selecting **Enable** from the **Pending command** dialog and then clicking **OK** to close the dialog.


Enhanced Write Filter

Configuration

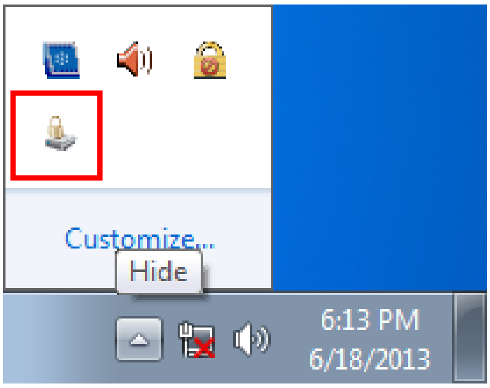
Name	Overlay Type	State	Pending Command
C:	RAM (Reg)	Disabled	Enable

Pending command: Enable

□ HORM support

4. Reboot the system.

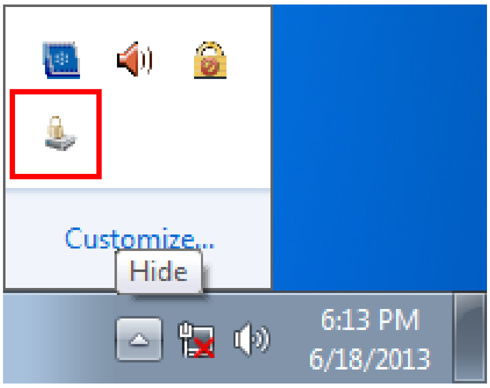
5. After logging in to the desktop environment, open the system tray (located in the lower right corner of the desktop) and check to verify that the padlock icon now shows the drive volume is locked down with EWF.



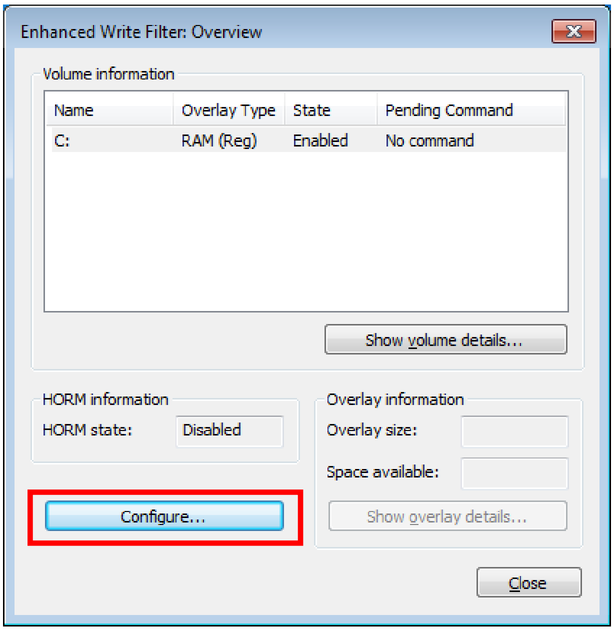
Committing Data and/or Disabling EWF

When EWF is enabled on a drive users will need to go through a special process to write any data to the hard drive. Writing data to the drive in this situation is called a **Commit**, and users must be given administrator privileges to be able to do so.

1. Open the EWF control dialog by right-clicking on the padlocked drive in the system tray (located in the lower right corner of the desktop).



2. Once the EWF control dialog is open, select the drive you wish to operate and click on the **Configure** button in the lower left corner. This will open the EWF **Configuration** page.



Enhanced Write Filter: Overview

Volume information

Name	Overlay Type	State	Pending Command
C:	RAM (Reg)	Enabled	No command

HORM information

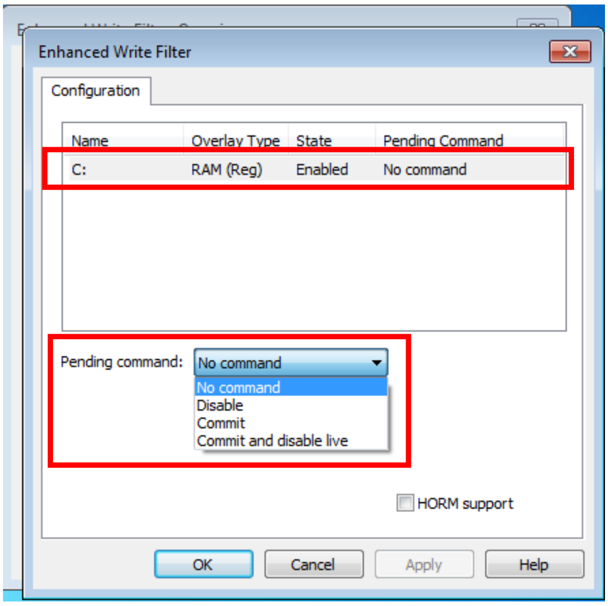
HORM state: Disabled

Overlay information

Overlay size:

Space available:

3. Once the EWF control dialog is open, select the drive you wish to operate from the upper window of the dialog, and then click on the **Pending Command** drop-down menu just beneath. Here, you will see four choices:
   - **No Command**
   - **Disable:** This disables EWF on the selected drive. Be aware that the system will automatically reboot if you select this command.
   - **Commit:** This writes all current changes to the system data to the hard drive; any changes that have been made to the system settings.
   - **Commit and Disable Live:** This writes all current data and changes to the system, and also turns off EWF on the selected drive (so that all future data and system changes will also be committed to the drive, as well). Selecting this option will NOT automatically reboot your system.



Enhanced Write Filter

Name	Overlay Type	State	Pending Command
C:	RAM (Reg)	Enabled	No command

Pending command: No command

For more detailed descriptions of these commands, please refer to the Microsoft website shown below: http://msdn.microsoft.com/en-us/library/ff794092(v=winembedded.60).aspx

File-Based Write Filter

Overview

This section describes how to use the File-Based Writer Filter (FBWF). Please note that when Enhance Writer Filter is enabled, the File-Based Writer Filter function will not work.

According to Microsoft:

> *File-Based Write Filter (FBWF) allows the Windows Embedded platform to maintain the appearance of read and write access on write-sensitive or read-only storage. FBWF makes read and write access transparent to applications.*
> *Writing to storage media may be undesirable or impossible in embedded devices. FBWF redirects all writes targeted for protected volumes to a RAM cache called an overlay. Used in this context, an overlay is similar to a transparency overlay on an overhead projector. Any change made to the overlay affects the picture as seen in the aggregate, but if the overlay is removed, the underlying picture remains unchanged.*

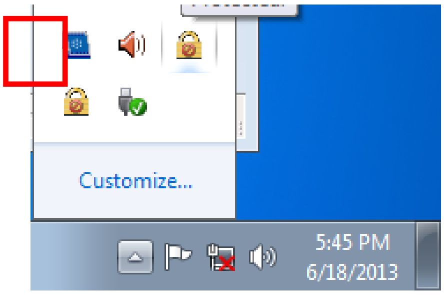
FBWF provides the advanced feature than EWF to let user specify the directory to write the data to disk drive directly, in our default setting, the default directory is under c:\temp, which means you can read/write the data into disk without commit action.

Configuring File-Based Write Filter

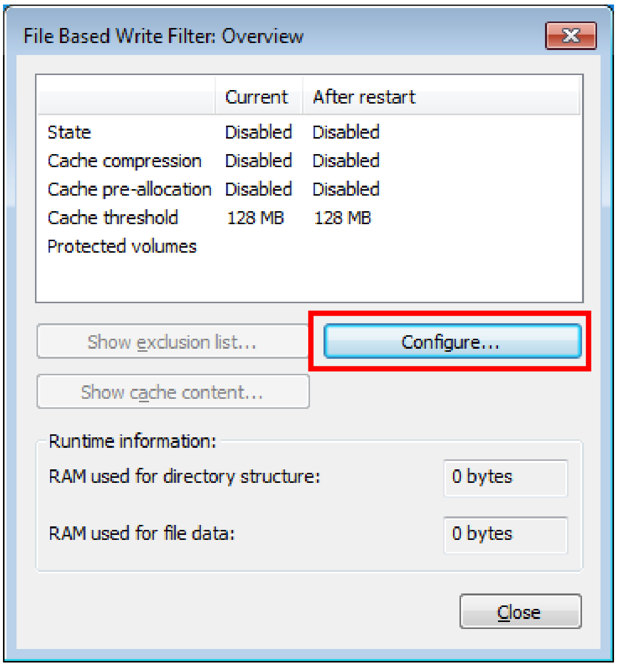
Follow these steps to enable the Enhanced Write Filter. Keep in mind that, while FBWF and EWF may both be enabled on the same machine; FBWF can not protect a volume also protected by EWF. Similarly, EWF can not protect a volume also protected by FBWF.

1. To open the FBWF overview window, open the system tray (located in the lower right corner of the desktop) and right-click on the padlock icon.

   NOTE: When disabled, the icons for EWF and FBWF are identical. After the dialog opens b sure to verify you have opened the correct window.



2. When the overview window opens, you will receive a quick report on the current FBWF configuration. The diagram at right shows what it will look like before it is enabled. To continue with the setup, click on the **Configure** button just before the report window.



File Based Write Filter: Overview

	Current	After restart
State	Disabled	Disabled
Cache compression	Disabled	Disabled
Cache pre-allocation	Disabled	Disabled
Cache threshold	128 MB	128 MB
Protected volumes		

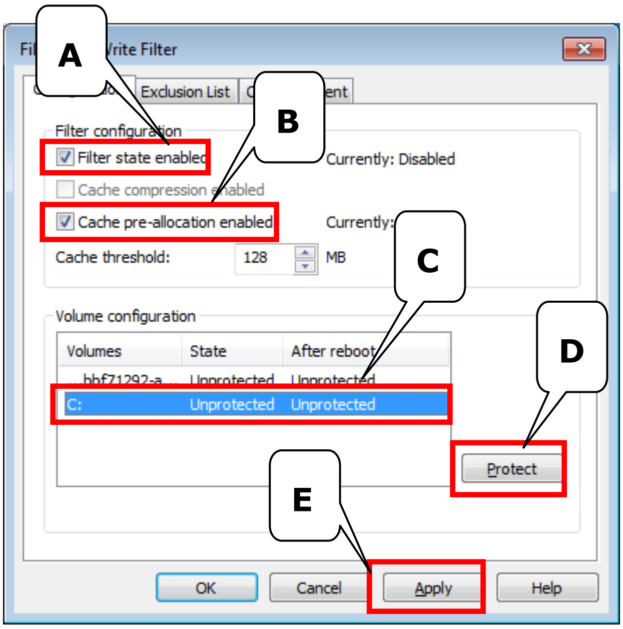
Runtime information:

RAM used for directory structure: 0 bytes

RAM used for file data: 0 bytes

3. The FBWF configuration window is considerably more complicated than the EWF setup. To enable FBWF protection on your main storage drive, you will need to enable the filter by ticking **Filter state enabled** (**A**) and **Cache pre-allocation enabled** (**B**). Next, select the drive you want to protect from the **Volume Configuration** menu (**C**) and then click on the **Protect** button. Finally, click on **Apply** (**E**), or **OK** to set the FBWF configuration.

   Cache compression may be used on the overlay cache to minimize the amount of memory used. Cache compression decreases performance when accessing protected volumes, and cannot be used with pre-allocation.



Filter configuration

☑ Filter state enabled — Currently: Disabled

□ Cache compression enabled

☑ Cache pre-allocation enabled — Currently:

Cache threshold: 128 MB

Volume configuration

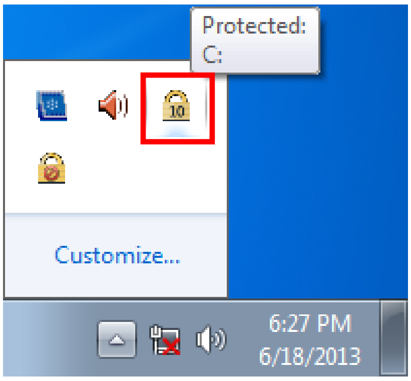
Volumes	State	After reboot
bbf71292-a...	Unprotected	Unprotected
C:	Unprotected	Unprotected

   Cache pre-allocation sets the memory space available for the overlay cache at the system's start, instead of adjusting it as needed. It cannot be used with cache compression.

   The **cache threshold s**pecifies the amount of memory that can be used by the write filter for the overlay cache. The default value and size limits for the overlay cache vary by operating system.

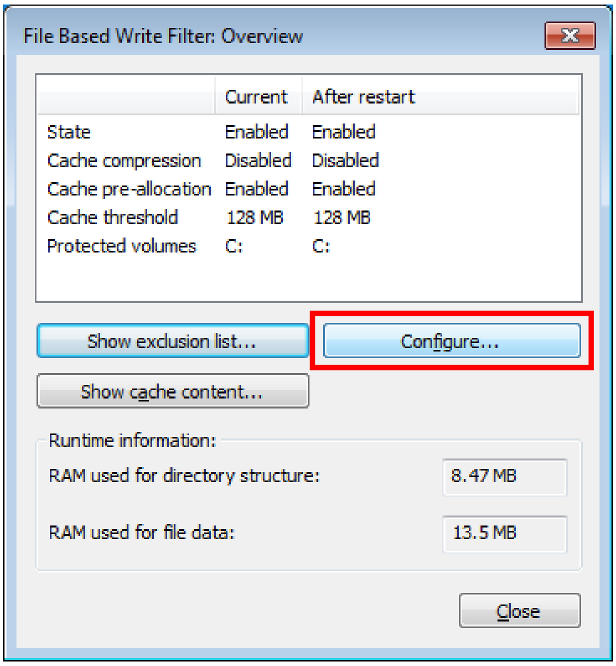
4. Reboot the system.

5. Once again, open the system tray (located in the lower right corner of the desktop) and check to verify that the padlock icon now shows you have enabled FBWF. The icon should have changed to become a padlock displaying the number 10, as shown in the figure at right.



Excluding Files from FBWF Protection

1. Click on the FBWF icon (in the desktop systray) to open the **Overview** dialog. Click on **Configure** to switch to the configuration interface.


File Based Write Filter: Overview

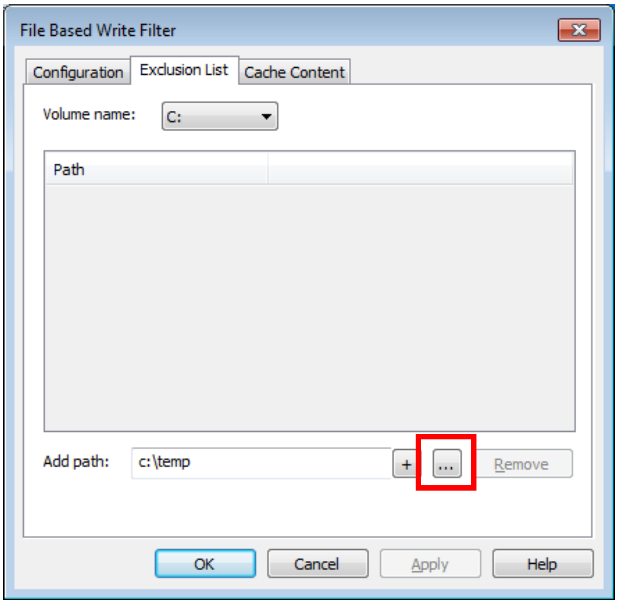
	Current	After restart
State	Enabled	Enabled
Cache compression	Disabled	Disabled
Cache pre-allocation	Enabled	Enabled
Cache threshold	128 MB	128 MB
Protected volumes	C:	C:

Runtime information:

RAM used for directory structure: 8.47 MB

RAM used for file data: 13.5 MB

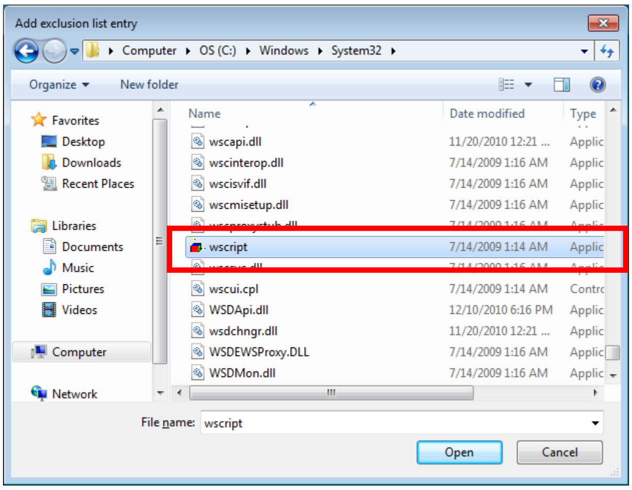
2. Click on the **Exclusion List** tab. Make sure the correct drive volume is shown in the dropdown menu labeled **Volume Name**; if not, select the correct volume from the dropdown menu.
Next, you must select the file path you wish to exclude from FBWF protection; this wll allow the drive to write to the selected files and directories, so be careful. You may indicate an entire section of the file tree by selecting an entire file path, or you may select individual files.
To select individual files, click on the **Browse** button (marked with ellipses, in the lower right corner, as shown at right). This will open a Windows Explorer interface.


File Based Write Filter

Volume name: C:

Add path: c:\temp

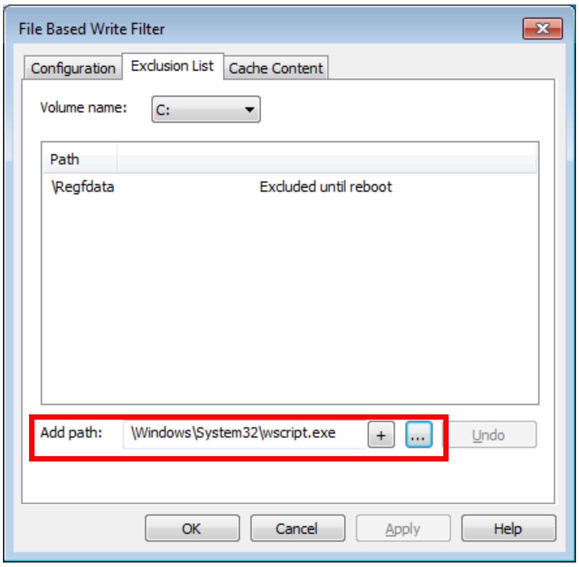
3. Navigate to the file(s) you wish to exclude from FBWF protection, select the file, and then click **Open** to enter the path into the exclusion dialog; this will exit the Windows Explorer interface and return you to the **Exclusion List** interface shown in step 2.



Name	Date modified	Type
wscapi.dll	11/20/2010 12:21 ...	Applic
wscinterop.dll	7/14/2009 1:16 AM	Applic
wscisvif.dll	7/14/2009 1:16 AM	Applic
wscmisetup.dll	7/14/2009 1:16 AM	Applic
wscproxystub.dll	7/14/2009 1:16 AM	Applic
wscript	7/14/2009 1:14 AM	Applic
wscsvc.dll	7/14/2009 1:16 AM	Applic
wscui.cpl	7/14/2009 1:14 AM	Contrc
WSDApi.dll	12/10/2010 6:16 PM	Applic
wsdchngr.dll	11/20/2010 12:21 ...	Applic
WSDEWSProxy.DLL	7/14/2009 1:16 AM	Applic
WSDMon.dll	7/14/2009 1:16 AM	Applic

File name: wscript

4. You should now see the file or file path you selected for exclusion listed in the **Add Path** dialog, at the bottom of the **Exclusion List** tab. Click the add button (**+**) to add the path or file to the exclusion list.

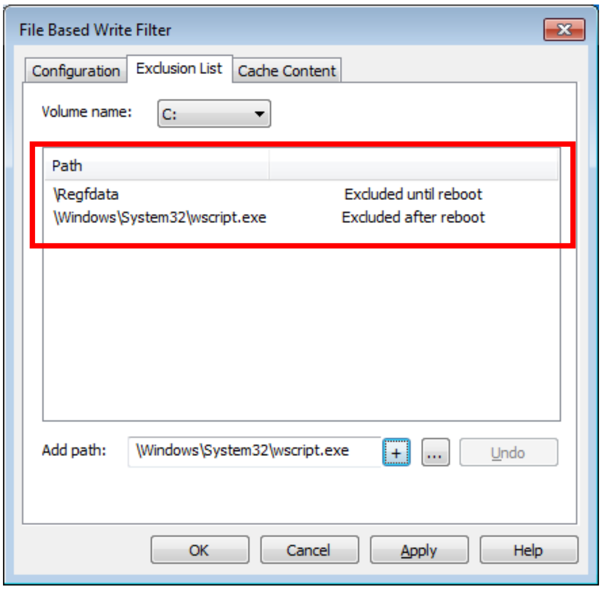


Volume name: C:

Path	
\Regfdata	Excluded until reboot

Add path: \Windows\System32\wscript.exe

5. After adding a file or path to the exclusion list, you should see it listed in the **Path** window. If the file does not appear, then it has not yet been added.



Volume name: C:

Path	
\Regfdata	Excluded until reboot
\Windows\System32\wscript.exe	Excluded after reboot

Add path: \Windows\System32\wscript.exe

13. Reboot the system for the changes to take effect.

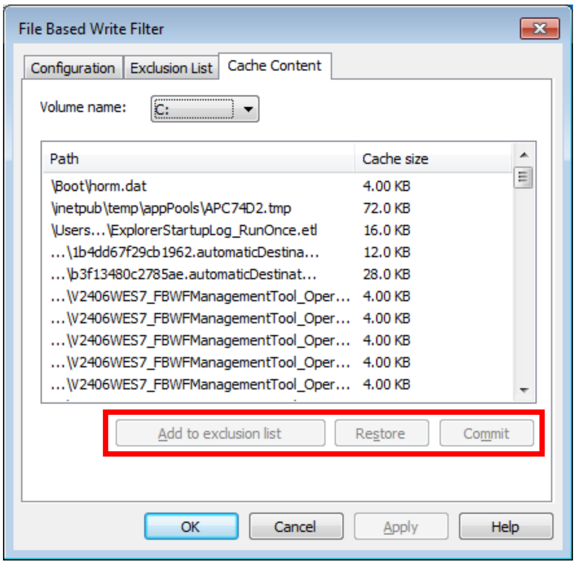
Managing Temporary Files Cached in the Overlay

1. In the **Cached Content** tab you will see all the files currently cached in the RAM overlay, with three commands you may execute:

   Commit will save a file from the cache to permanent storage, deleting the file from the overlay and overwriting the original.

   Restore will return the file to its original state, removing it from the overlay cache and discarding the changes that caused it to be added to the cache.

   Add to exclusion list adds the file to the exclusion list after the next restart. Because this makes the file read-only, if it is executed on the wrong file it may render your system or particular applications inoperable.

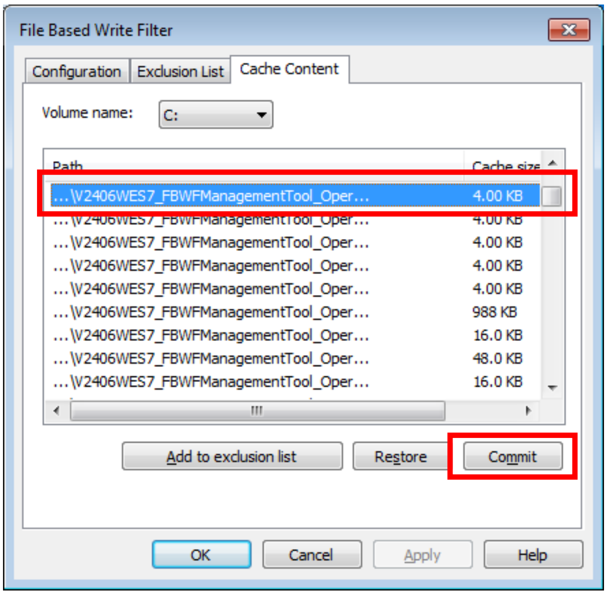


Volume name: C:

Path	Cache size
\Boot\horm.dat	4.00 KB
\inetpub\temp\appPools\APC74D2.tmp	72.0 KB
\Users…\ExplorerStartupLog_RunOnce.etl	16.0 KB
…\1b4dd67f29cb1962.automaticDestina…	12.0 KB
…\b3f13480c2785ae.automaticDestinat…	28.0 KB
…\V2406WES7_FBWFManagementTool_Oper…	4.00 KB
…\V2406WES7_FBWFManagementTool_Oper…	4.00 KB
…\V2406WES7_FBWFManagementTool_Oper…	4.00 KB
…\V2406WES7_FBWFManagementTool_Oper…	4.00 KB
…\V2406WES7_FBWFManagementTool_Oper…	4.00 KB

2. The most common usage of the Cache Content filter will likely be to permanently write content to the hard drive. To do this, select the file you wish to write to permanent memory and click on the **commit** button. This will delete the file from the cached overlay and replace the current file in permanent storage with the modified cache file.

   Users should understand that if they commit a configuration or application file, they will be permanently altering the setup and/or performance of the application or system.



Volume name: C:

Path	Cache size
…\V2406WES7_FBWFManagementTool_Oper…	4.00 KB
…\V2406WES7_FBWFManagementTool_Oper…	4.00 KB
…\V2406WES7_FBWFManagementTool_Oper…	4.00 KB
…\V2406WES7_FBWFManagementTool_Oper…	4.00 KB
…\V2406WES7_FBWFManagementTool_Oper…	4.00 KB
…\V2406WES7_FBWFManagementTool_Oper…	988 KB
…\V2406WES7_FBWFManagementTool_Oper…	16.0 KB
…\V2406WES7_FBWFManagementTool_Oper…	48.0 KB
…\V2406WES7_FBWFManagementTool_Oper…	16.0 KB

To get more details about FBWF configuration and usage, you may consult the Micrsoft help file that comes with your computer, or:

Go to Microsoft's FBWF Installation and Configuration help pages.

Go to Microsoft's FBWF overview on the official Microsoft FBWF help pages.

Go to Microsoft's detailed description of FBWF features on the FBWF help pages.

Go to Microsoft's detailed description of the FBWF API.

4

Customizable Sample Code

This chapter uses sample code to show how scripting may be used to add customized capabilities to the DA-683 computing platform.

The following topics are covered in this chapter:

❒ **Sample Code for Customizing the DA-683**

➢ The DIO Control Walkthrough

➢ The LED Control Walkthrough

❒ **Watchdog Control Code**

➢ The Watchdog Control Code Walkthrough

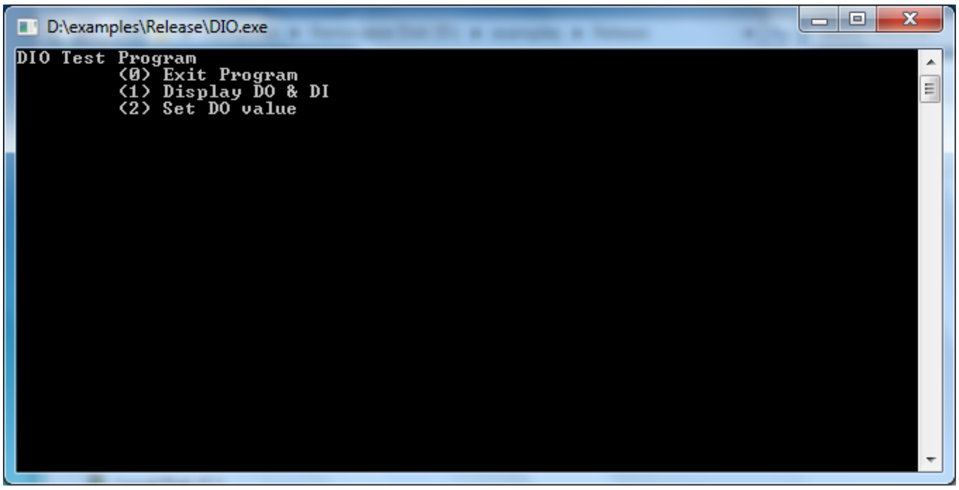
Sample Code for Customizing the DA-683

The DA-683 computer comes with several pieces of sample code that may be used to customize its behavior for LED notifications, DIO Control, or to initiate emergency reboots when critical system applications come to a halt.

The DIO Control Walkthrough

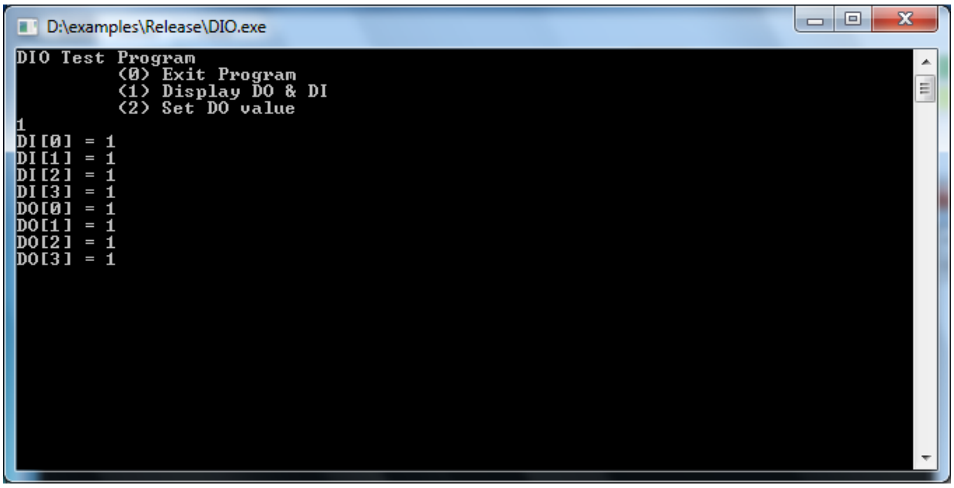
The DA-683 is designed with 4 digital inputs and 4 digital outputs that integrators and system administrators may customize for their needs. The source code for controlling digital I/O behavior is located in the folder **<Software DVD>\examples\Example\C++\DIO**, while the compiled executable **DIO.exe** is located under **<Software DVD>\examples\Release.** You can follow the steps below to test the digital I/O control script, or you may freely modify the control script to create customized patterns that are associated with specific system events. To review the digital I/O control code, see the section **Sample Code for Digital I/O Control** in **Appendix A** of this manual.

1. Create the **c:\programs\examples** folder and copy **DIO.exe** into that folder. Run **DIO.exe**.
2. You will be presented with a menu of three choices; first, select **1** to display the DIO's current status.



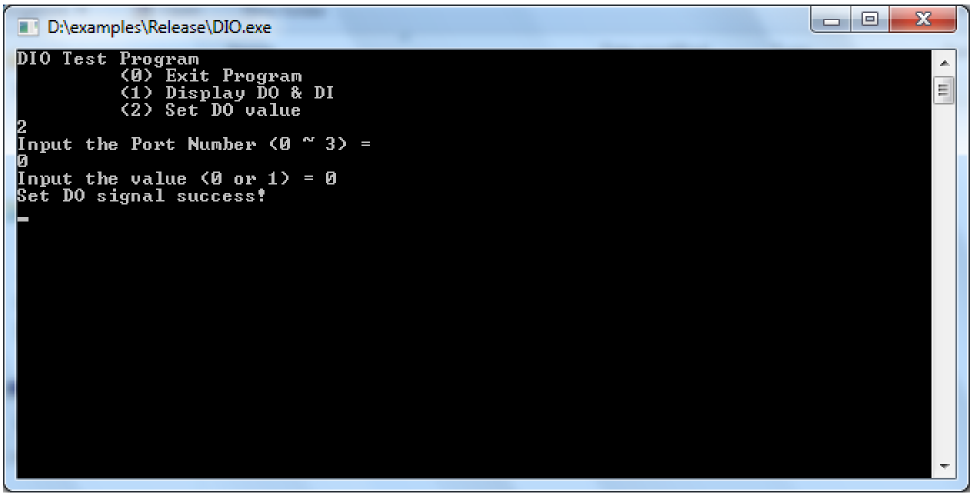
```
DIO Test Program
         (0) Exit Program
         (1) Display DO & DI
         (2) Set DO value
```

3. In the screenshot below, the user has selected **1**.



```
DIO Test Program
         (0) Exit Program
         (1) Display DO & DI
         (2) Set DO value
1
DI[0] = 1
DI[1] = 1
DI[2] = 1
DI[3] = 1
DO[0] = 1
DO[1] = 1
DO[2] = 1
DO[3] = 1
```

4. You may now run **DIO.exe** again, but this time select **2**. At the next prompt, enter the ID number (0 to 3) of a DIO to activate, and when prompted enter either **1** (to turn it on), or **0** (to turn it off).



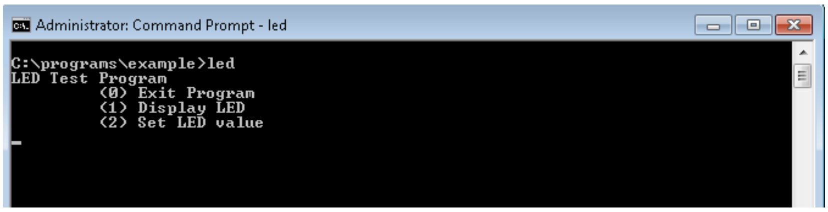
```
DIO Test Program
             (0) Exit Program
             (1) Display DO & DI
             (2) Set DO value
2
Input the Port Number (0 ~ 3) =
0
Input the value (0 or 1) = 0
Set DO signal success!
_
```

The LED Control Walkthrough

The DA-683 is designed with 8 programmable LEDs that integrators and system administrators may customize for their notification needs. The source code for controlling LED behavior is located in the folder <Software DVD>**examples**Example\C++\LED\, while the compiled executable **LED.exe** is located under <Software DVD>\examples\Release. You can follow the steps below to test the LED control script, or you may freely modify the control script to create customized patterns that are associated with specific system events. To review the LED control code, see the section **Sample Code for LED Control** in Appendix A of this manual.

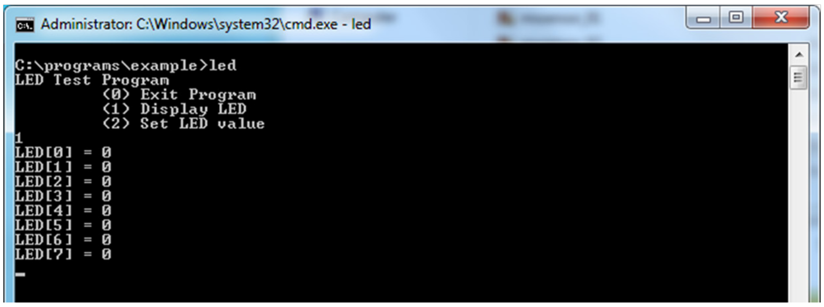
5. Create the **c:\programs\examples** folder and copy **LED.exe** into that folder. Run **LED.exe**.

6. You will be presented with a menu of three choices; first, select **1** to display the LED's current status.



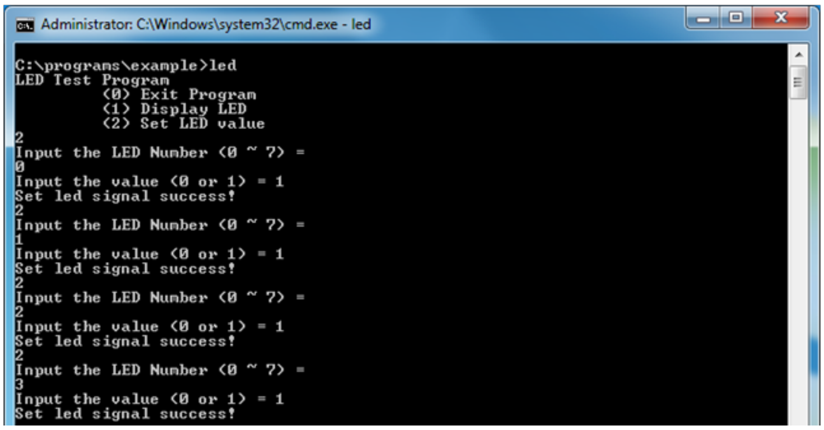
```
C:\programs\example>led
LED Test Program
           (0) Exit Program
           (1) Display LED
           (2) Set LED value
_
```

7. In the screenshot below, the user has selected **1** and is viewing the current status of all LEDs. The value **0** shown next to each entry indicates that all of the LEDs are currently turned off. Visually verify this by examining the DA-683's front panel.



```
C:\programs\example>led
LED Test Program
           (0) Exit Program
           (1) Display LED
           (2) Set LED value
1
LED[0] = 0
LED[1] = 0
LED[2] = 0
LED[3] = 0
LED[4] = 0
LED[5] = 0
LED[6] = 0
LED[7] = 0
_
```

8. You may now run **LED.exe** again, but this time select **2**. At the next prompt, enter the ID number (0 to 7) of an LED to activate it. When prompted enter either **1** (to turn it on), or **0** (to turn it off). The LEDs on the main DA-683 panel correspond to 0 through 3; 4 and 5 correspond to those on the first module; and 6 and 7 to those on the second.



```
C:\programs\example>led
LED Test Program
         (0) Exit Program
         (1) Display LED
         (2) Set LED value
2
Input the LED Number (0 ~ 7) =
0
Input the value (0 or 1) = 1
Set led signal success!
2
Input the LED Number (0 ~ 7) =
1
Input the value (0 or 1) = 1
Set led signal success!
2
Input the LED Number (0 ~ 7) =
2
Input the value (0 or 1) = 1
Set led signal success!
2
Input the LED Number (0 ~ 7) =
3
Input the value (0 or 1) = 1
Set led signal success!
```

Watchdog Control Code

The code for controlling the watchdog/COP timer is the simplest and least-customizable of the included sample scripts. The code itself is provided on the software DVD, under **\examples\Example\C++\WatchDog**, and the executable file **Watchdog.exe** is on the software DVD**\examples\Release**. This sample code may be modified to integrate the watchdog timer with specific applications

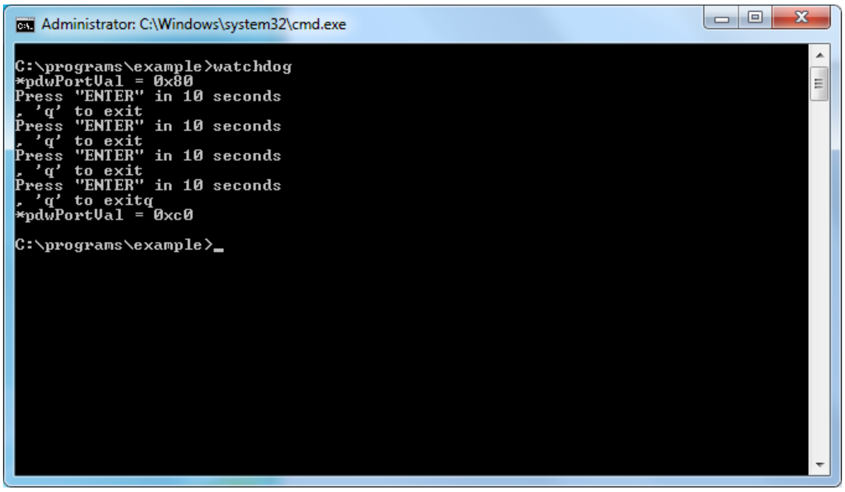
Using this code, any program may be set up so that the watchdog timer will provide a last-line failsafe against application crashes. For instance, the DA-683 may be set up so that whenever a mission-critical application fails the watchdog timer will send a message to a system administrator and then initiate an automatic reboot. To test the watchdog executable, follow the steps below.

The Watchdog Control Code Walkthrough

1. If you haven't yet, create the folder `c:\programs\examples`, then copy over **Watchdog.exe** and run the script.

2. To keep the system from rebooting, press Enter at least once every 10 seconds, or the system will reboot automatically.

3. To stop the watchdog, press **q** to exit the program.



```
C:\programs\example>watchdog
*pdwPortVal = 0x80
Press "ENTER" in 10 seconds
, 'q' to exit
Press "ENTER" in 10 seconds
, 'q' to exit
Press "ENTER" in 10 seconds
, 'q' to exit
Press "ENTER" in 10 seconds
, 'q' to exitq
*pdwPortVal = 0xc0

C:\programs\example>_
```

5

System Recovery

The DA-683 ready-to-run embedded computers come with the Windows Embedded Standard 7 platform. This chapter describes the recovery process in the event of system instability.

The following topics are covered in this chapter:

- ❒ **Overview: Setting Up the Recovery Environment**
- ❒ **Step 1: Prepare the USB drive**
- ❒ **Step 2: Setting the BIOS to Boot via USB**
- ❒ **Step 3 (opt.): Create a Custom System Image**
- ❒ **Step 4: Reset BIOS to Original State**
- ❒ **Step 5: Perform a Test Restoration**

Overview: Setting Up the Recovery Environment

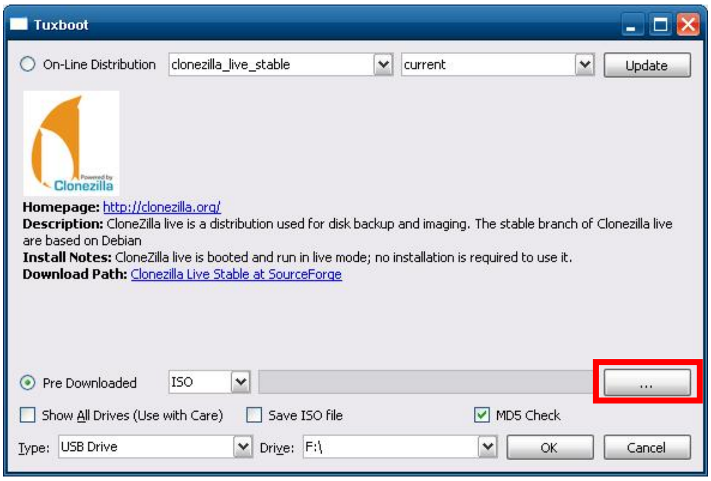
The recovery procedure itself requires only a DA-683 computer, a 4 GB (min.) USB drive, and a copy of the recovery suite to set up the recovery environment. The recovery procedure itself requires only a DA-683 computer and a bootable USB drive.

The following procedure describes the basic process of setting up the system recovery environment.

1. First, the recovery programs and system image file will be copied over to the USB drive, and the drive will be set up to provide a system boot process by copying an ISO image of the boot environment to the USB.
2. The system will be re-booted, and BIOS will be manually configured to boot the system from the USB port.
3. An image of the current software system will be created on the USB drive for the recovery environment to use when restoring the system.
4. The system will be re-booted again, and the BIOS returned to its original state.

Step 1: Prepare the USB drive

1. Load the software DVD that came with your DA-683 computer and execute `tuxboot-windows-23.exe` from the software DVD`\recovery\` folder, select **Pre-Downloaded**, and click the button marked with an ellipsis (**...**) to browse the file system and find the location of the boot environment's ISO image.



○ On-Line Distribution: clonezilla_live_stable, current, Update

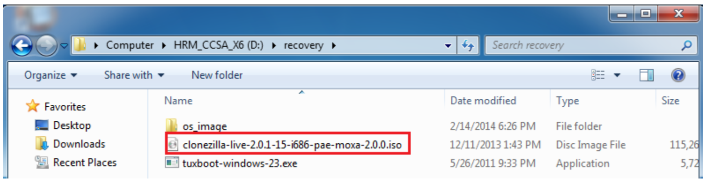
Homepage: http://clonezilla.org/
Description: CloneZilla live is a distribution used for disk backup and imaging. The stable branch of Clonezilla live are based on Debian
Install Notes: CloneZilla live is booted and run in live mode; no installation is required to use it.
Download Path: Clonezilla Live Stable at SourceForge

● Pre Downloaded: ISO, ...

□ Show All Drives (Use with Care) □ Save ISO file ☑ MD5 Check

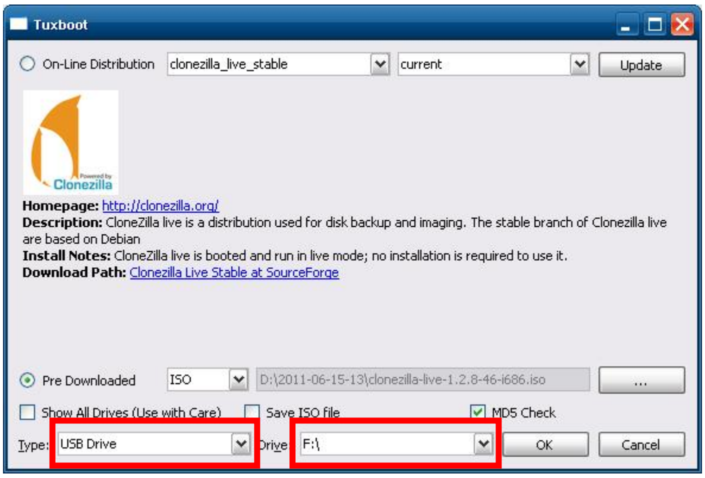
Type: USB Drive Drive: F:\ OK Cancel

2. Navigate to`\`**`recovery`**`\`on the software DVD and select the boot environment's ISO image.



Name	Date modified	Type	Size
os_image	2/14/2014 6:26 PM	File folder	
clonezilla-live-2.0.1-15-i686-pae-moxa-2.0.0.iso	12/11/2013 1:43 PM	Disc Image File	115,26
tuxboot-windows-23.exe	5/26/2011 9:33 PM	Application	5,72

3. Set the device **Type** (lower left-hand corner) as **USB Drive**, then set the **Drive** dialog to the letter under which the USB is currently mounted.



○ On-Line Distribution: clonezilla_live_stable, current, Update

Homepage: http://clonezilla.org/
Description: CloneZilla live is a distribution used for disk backup and imaging. The stable branch of Clonezilla live are based on Debian
Install Notes: CloneZilla live is booted and run in live mode; no installation is required to use it.
Download Path: Clonezilla Live Stable at SourceForge

● Pre Downloaded: ISO, D:\2011-06-15-13\clonezilla-live-1.2.8-46-i686.iso, ...

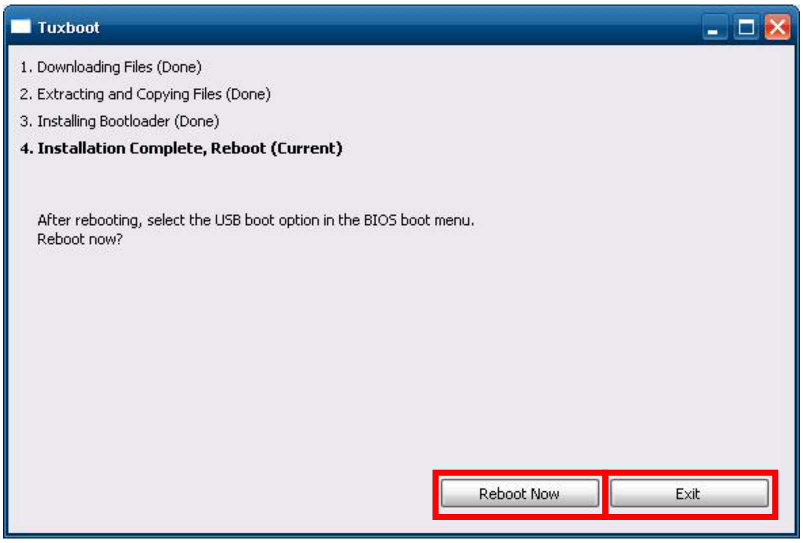
□ Show All Drives (Use with Care) □ Save ISO file ☑ MD5 Check

Type: USB Drive Drive: F:\ OK Cancel

4. Click **OK**, and the boot environment and bootloader will be copied to your USB drive.
5. Because of the file system naming conventions used, for any given computer only a single recovery image may be used on any given USB drive. Consequently, at this point, users need to make a decision about which sort of system recovery is preferred:
    - A. a basic recovery of the root OS, or
    - B. a recovery image of the fully configured OS, with all user-installed software applications and scripts.

    A. To configure the recovery environment to boot into **a fully configured system**, click **Reboot Now** to close the installation environment and restart the computer. You should then proceed to the next section, **Step 2: Setting the BIOS to Boot via USB** and continue the installation of the recovery environment by following the instructions at **Step 3 (opt.): Creating a Custom System Image**.

    B. To configure the recovery environment to boot into a clean OS image with no applications, you should instead click **Exit** here to complete the installation and return to the OS. From within the desktop environment, you should manually copy the directory containing the base OS from the software DVD over to the USB drive. To do this, copy **`#:\<SoftwareDVD>\recovery\os_image`** over to the partition image directory, **`F:\home\partimag\`**. At this point, **Step 1** has been completed, and you should proceed to **Step 2: Setting the BIOS to Boot via USB**.



1. Downloading Files (Done)
2. Extracting and Copying Files (Done)
3. Installing Bootloader (Done)
4. Installation Complete, Reboot (Current)

After rebooting, select the USB boot option in the BIOS boot menu.
Reboot now?

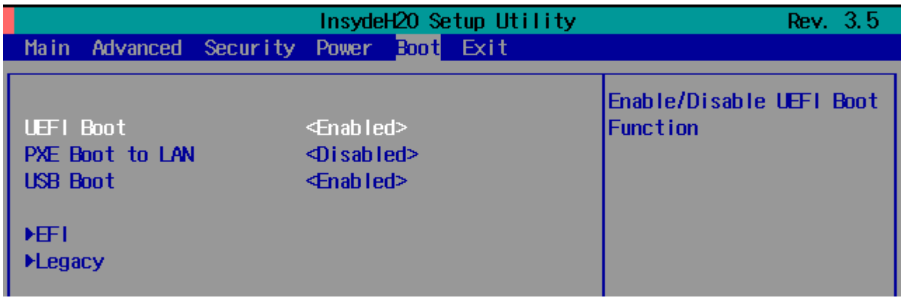
ATTENTION

Because of the peculiarities of the file tree naming, it is not possible to include both the base OS image and a fully configured system image on the same USB stick. If you wish to configure both, then two USB drives must be used, each configured according to the two different alternatives offered here.

Step 2: Setting the BIOS to Boot via USB

At this stage, reset the BIOS so that the system boots directly from the USB. This must be done before the rest of the system recovery environment can be configured

1. Turn on the computer, during the POST process, press F2 until you hear a long beep. You should then enter the BIOS setup menu.
2. Use the arrow keys to navigate to the **Boot** tab, and then press **Enter**.

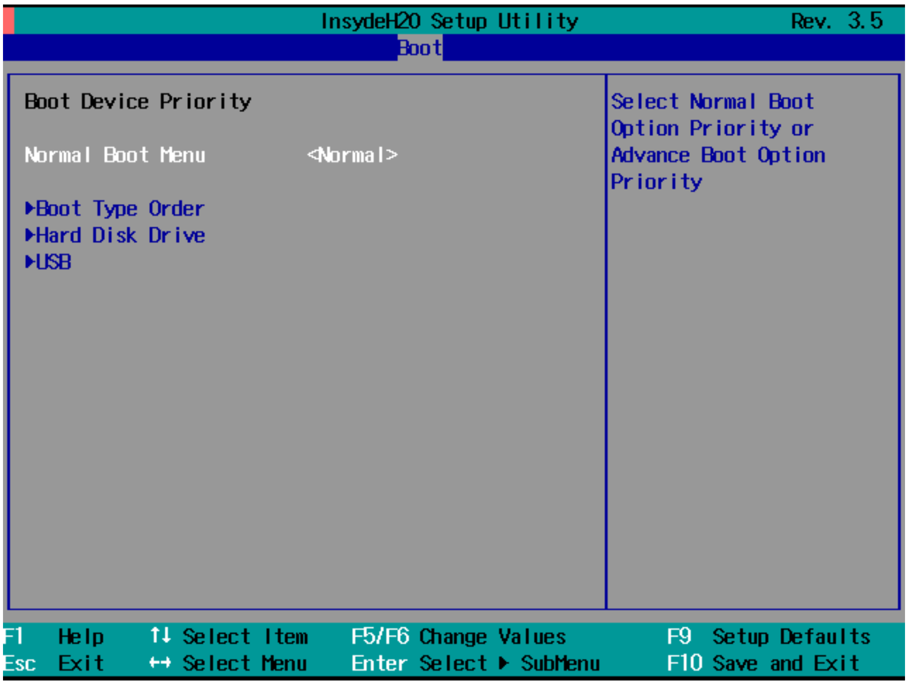


UEFI Boot <Enabled>
PXE Boot to LAN <Disabled>
USB Boot <Enabled>

▶EFI
▶Legacy

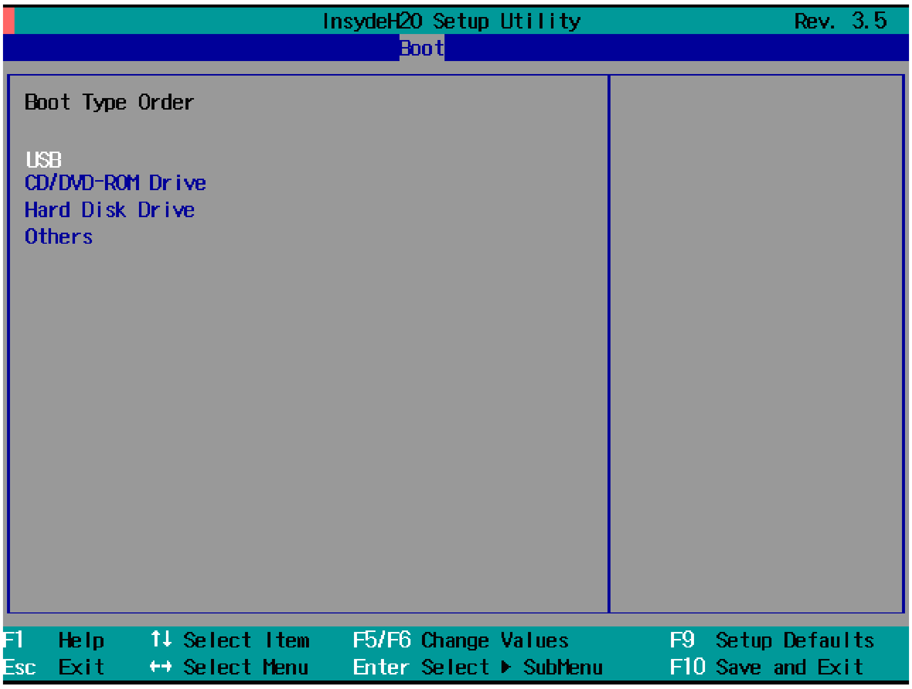
Enable/Disable UEFI Boot Function

3. Select **Boot Type Order** in **Legacy** to open the dialog that will allow you to set the boot priority for the system drives.



```
                    InsydeH20 Setup Utility                  Rev. 3.5
                                Boot
 Boot Device Priority                              Select Normal Boot
                                                   Option Priority or
 Normal Boot Menu             <Normal>             Advance Boot Option
                                                   Priority
 ▸Boot Type Order
 ▸Hard Disk Drive
 ▸USB

F1   Help    ↑↓ Select Item   F5/F6 Change Values       F9  Setup Defaults
Esc  Exit    ↔ Select Menu    Enter Select ▸ SubMenu    F10 Save and Exit
```

4. Use the arrow keys to highlight **USB** and then press the plus key (**+**) to move it to the first position, or select the other options above it and use the dash key(**–**) to move them down.



```
                    InsydeH20 Setup Utility                  Rev. 3.5
                                Boot
 Boot Type Order

 USB
 CD/DVD-ROM Drive
 Hard Disk Drive
 Others

F1   Help    ↑↓ Select Item   F5/F6 Change Values       F9  Setup Defaults
Esc  Exit    ↔ Select Menu    Enter Select ▸ SubMenu    F10 Save and Exit
```

5. Press F10 and then press **Enter** to save and exit the BIOS configuration interface. This should initiate the next reboot, during which your system should now boot from the USB drive.

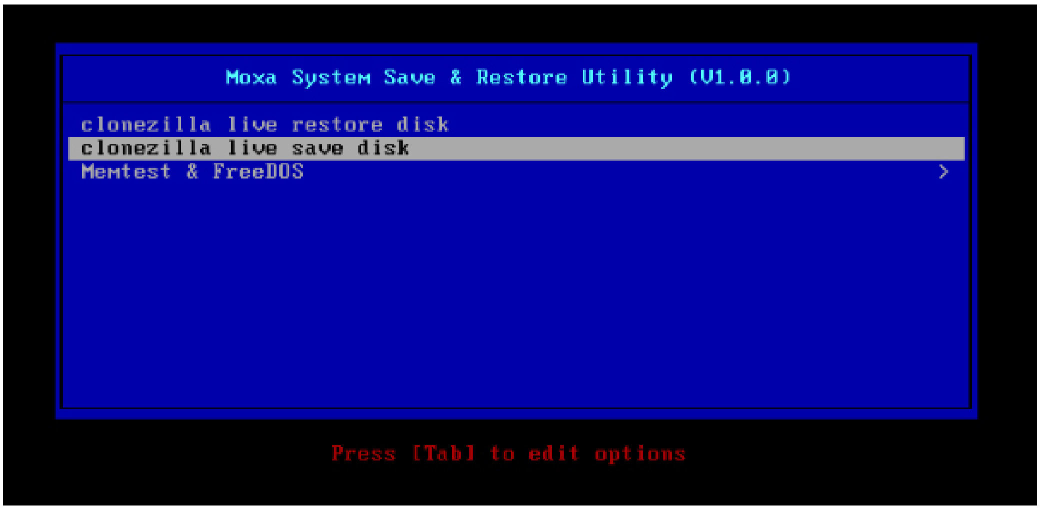
Step 3 (opt.): Create a Custom System Image

The instructions which follow are only to be used if you decided in of this process ***to create a full copy of an already-configured system***. If you have not yet installed any software on your system, then return to section 5b of **Step 1: Preparing the USB Drive** and follow the instructions to create a clean OS image.

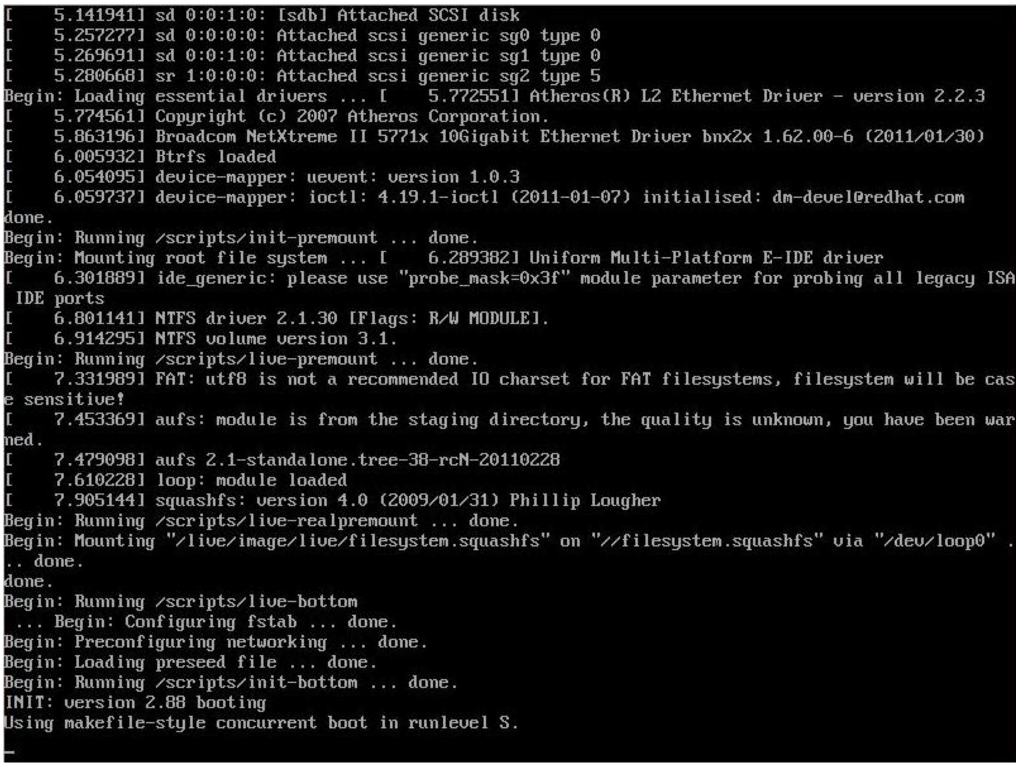
Using this procedure, you will save to the USB drive a copy of the entire system **as it is currently configured** to be used as a **full system recovery image** should the system crash. ***All files under*** **`F:\home\partimag\`**

will be overwritten. Additionally, you should have already changed the BIOS settings to make the USB drive the first boot priority. If you have not yet reset the boot priority, first return to **Step 2: Setting the BIOS to Boot via USB**, just above, and follow the directions there.

1. Once the system has launched and the DA-683 has booted the recovery environment from the USB drive, navigate to the entry **ClonezillaLive Save Disk**, and select it by pressing **Enter**. This will take you into the **recovery image creation environment**, allowing you to copy your full system setup to the USB drive.

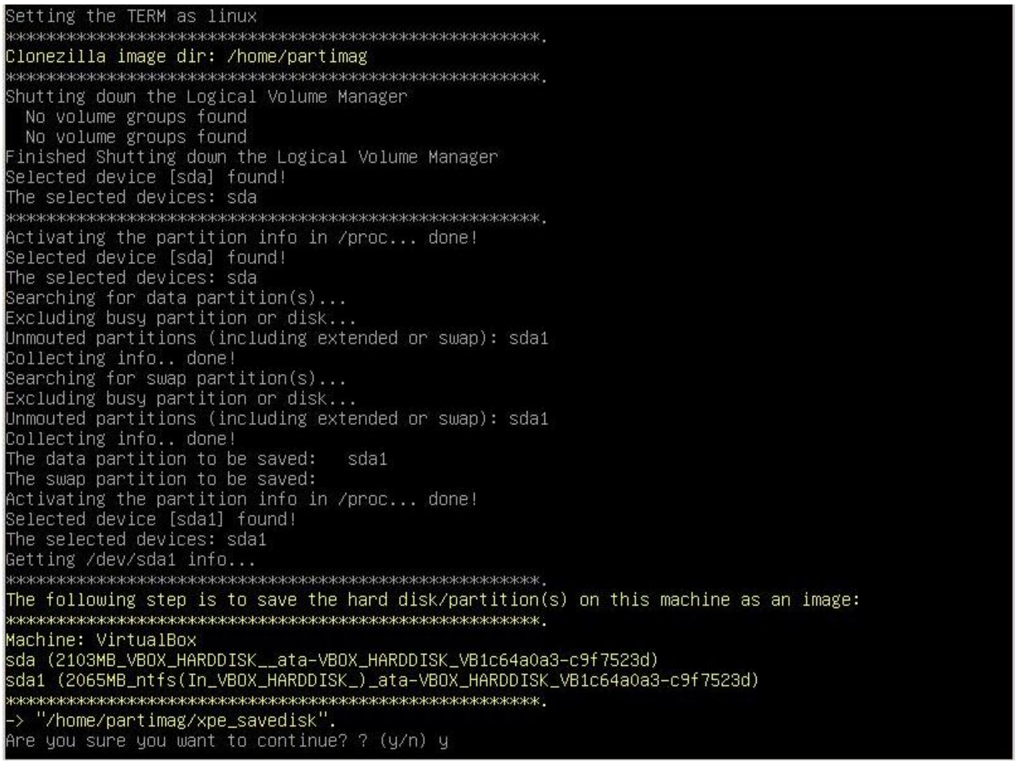

Moxa System Save & Restore Utility (V1.0.0)
clonezilla live restore disk
clonezilla live save disk
Memtest & FreeDOS >
Press [Tab] to edit options

2. The DA-683 will now boot into the image creation environment. Wait for the boot process to finish.



```
[    5.141941] sd 0:0:1:0: [sdb] Attached SCSI disk
[    5.257277] sd 0:0:0:0: Attached scsi generic sg0 type 0
[    5.269691] sd 0:0:1:0: Attached scsi generic sg1 type 0
[    5.280668] sr 1:0:0:0: Attached scsi generic sg2 type 5
Begin: Loading essential drivers ... [    5.772551] Atheros(R) L2 Ethernet Driver - version 2.2.3
[    5.774561] Copyright (c) 2007 Atheros Corporation.
[    5.863196] Broadcom NetXtreme II 5771x 10Gigabit Ethernet Driver bnx2x 1.62.00-6 (2011/01/30)
[    6.005932] Btrfs loaded
[    6.054095] device-mapper: uevent: version 1.0.3
[    6.059737] device-mapper: ioctl: 4.19.1-ioctl (2011-01-07) initialised: dm-devel@redhat.com
done.
Begin: Running /scripts/init-premount ... done.
Begin: Mounting root file system ... [    6.289382] Uniform Multi-Platform E-IDE driver
[    6.301889] ide_generic: please use "probe_mask=0x3f" module parameter for probing all legacy ISA
 IDE ports
[    6.801141] NTFS driver 2.1.30 [Flags: R/W MODULE].
[    6.914295] NTFS volume version 3.1.
Begin: Running /scripts/live-premount ... done.
[    7.331989] FAT: utf8 is not a recommended IO charset for FAT filesystems, filesystem will be cas
e sensitive!
[    7.453369] aufs: module is from the staging directory, the quality is unknown, you have been war
ned.
[    7.479098] aufs 2.1-standalone.tree-38-rcN-20110228
[    7.610228] loop: module loaded
[    7.905144] squashfs: version 4.0 (2009/01/31) Phillip Lougher
Begin: Running /scripts/live-realpremount ... done.
Begin: Mounting "/live/image/live/filesystem.squashfs" on "//filesystem.squashfs" via "/dev/loop0" .
.. done.
done.
Begin: Running /scripts/live-bottom
 ... Begin: Configuring fstab ... done.
Begin: Preconfiguring networking ... done.
Begin: Loading preseed file ... done.
Begin: Running /scripts/init-bottom ... done.
INIT: version 2.88 booting
Using makefile-style concurrent boot in runlevel S.

_
```

3. Once the image creation environment has completed booting up, you will be given a warning and asked if you wish to continue. Keep in mind that if you create the recovery image, then ***any residual files currently copied to the*** `/home/partimag` ***directory will be deleted***. If there are any files remaining in the USB **partition image** directory and you wish to save them, you must exit the recovery environment and copy these files to another disk. If you wish to continue with the image creation, press **Y** (case insensitive) to continue (screenshot at the top of the next page).

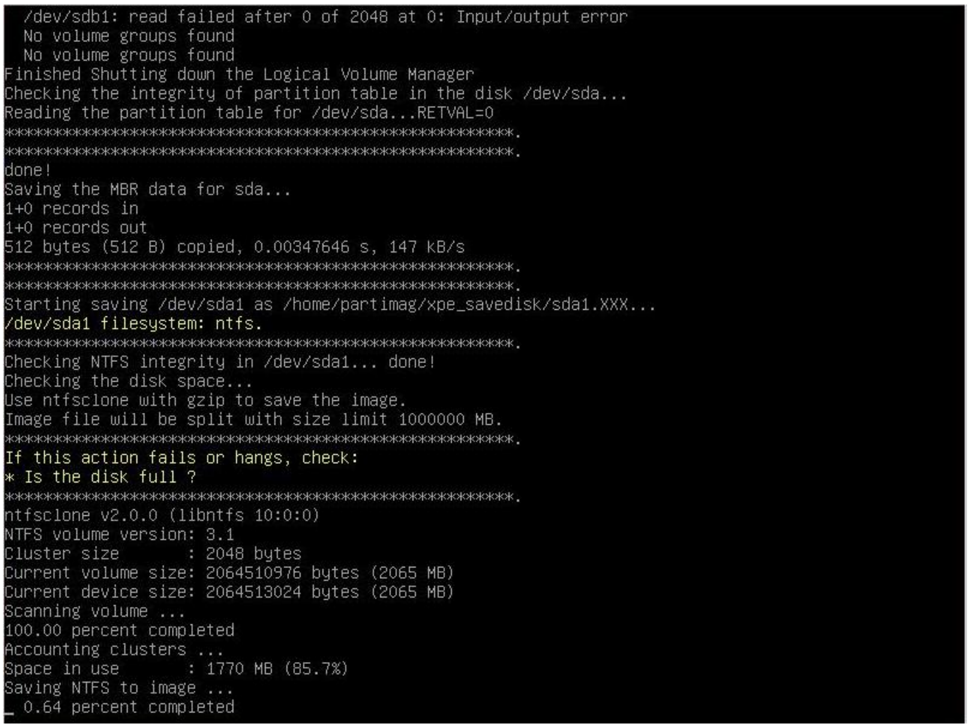


```
Setting the TERM as linux
******************************************************.
Clonezilla image dir: /home/partimag
******************************************************.
Shutting down the Logical Volume Manager
  No volume groups found
  No volume groups found
Finished Shutting down the Logical Volume Manager
Selected device [sda] found!
The selected devices: sda
******************************************************.
Activating the partition info in /proc... done!
Selected device [sda] found!
The selected devices: sda
Searching for data partition(s)...
Excluding busy partition or disk...
Unmouted partitions (including extended or swap): sda1
Collecting info.. done!
Searching for swap partition(s)...
Excluding busy partition or disk...
Unmouted partitions (including extended or swap): sda1
Collecting info.. done!
The data partition to be saved:   sda1
The swap partition to be saved:
Activating the partition info in /proc... done!
Selected device [sda1] found!
The selected devices: sda1
Getting /dev/sda1 info...
******************************************************.
The following step is to save the hard disk/partition(s) on this machine as an image:
******************************************************.
Machine: VirtualBox
sda (2103MB_VBOX_HARDDISK__ata-VBOX_HARDDISK_VB1c64a0a3-c9f7523d)
sda1 (2065MB_ntfs(In_VBOX_HARDDISK_)_ata-VBOX_HARDDISK_VB1c64a0a3-c9f7523d)
******************************************************.
-> "/home/partimag/xpe_savedisk".
Are you sure you want to continue? ? (y/n) y
```

WARNING

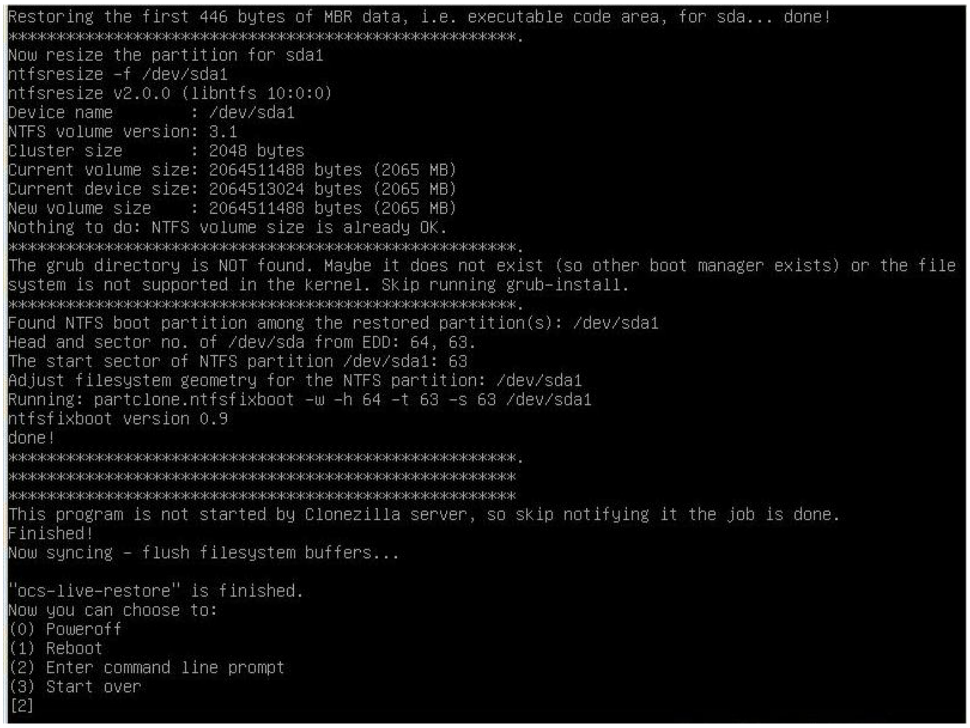
The same filename is used for all recovery images, whether for the full system backup or for the clean OS image installation. This means that currently, it is impossible to have more than one system image per USB drive.

4. At this point, the recovery environment will copy of the entire hard drive to your USB drive. This will likely take several minutes, and perhaps as long as half an hour. Do not remove the USB drive during this time; wait patiently for the process to finish. Depending on the speed of your USB drive, this may be a good time to get a cup of coffee, or take a nap.



```
  /dev/sdb1: read failed after 0 of 2048 at 0: Input/output error
  No volume groups found
  No volume groups found
Finished Shutting down the Logical Volume Manager
Checking the integrity of partition table in the disk /dev/sda...
Reading the partition table for /dev/sda...RETVAL=0
******************************************************.
******************************************************.
done!
Saving the MBR data for sda...
1+0 records in
1+0 records out
512 bytes (512 B) copied, 0.00347646 s, 147 kB/s
******************************************************.
******************************************************.
Starting saving /dev/sda1 as /home/partimag/xpe_savedisk/sda1.XXX...
/dev/sda1 filesystem: ntfs.
******************************************************.
Checking NTFS integrity in /dev/sda1... done!
Checking the disk space...
Use ntfsclone with gzip to save the image.
Image file will be split with size limit 1000000 MB.
******************************************************.
If this action fails or hangs, check:
* Is the disk full ?
******************************************************.
ntfsclone v2.0.0 (libntfs 10:0:0)
NTFS volume version: 3.1
Cluster size       : 2048 bytes
Current volume size: 2064510976 bytes (2065 MB)
Current device size: 2064513024 bytes (2065 MB)
Scanning volume ...
100.00 percent completed
Accounting clusters ...
Space in use       : 1770 MB (85.7%)
Saving NTFS to image ...
_ 0.64 percent completed
```

5. At this point you may choose to power down the computer (press **0**), reboot (press **1**), enter a console terminal (access a console TTY -- press **2**), or re-initiate the entire procedure (press **3**). ***Do not remove the USB drive until you have rebooted or powered down the system.***



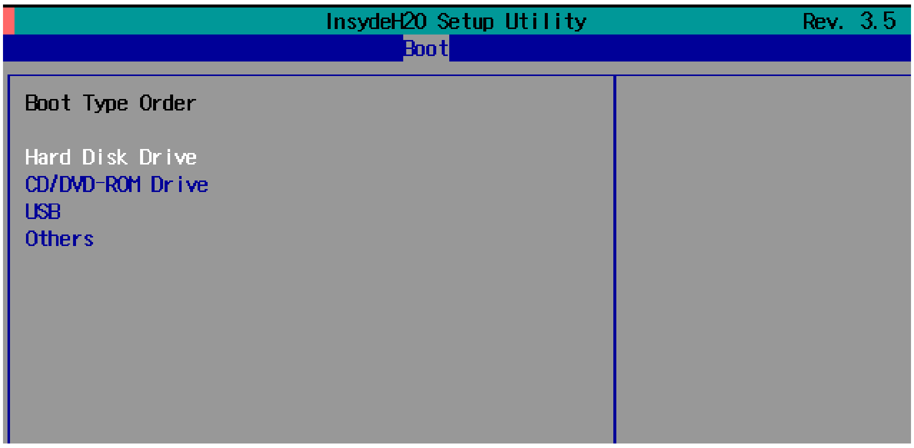
```
Restoring the first 446 bytes of MBR data, i.e. executable code area, for sda... done!
*****************************************************.
Now resize the partition for sda1
ntfsresize -f /dev/sda1
ntfsresize v2.0.0 (libntfs 10:0:0)
Device name        : /dev/sda1
NTFS volume version: 3.1
Cluster size       : 2048 bytes
Current volume size: 2064511488 bytes (2065 MB)
Current device size: 2064513024 bytes (2065 MB)
New volume size    : 2064511488 bytes (2065 MB)
Nothing to do: NTFS volume size is already OK.
*****************************************************.
The grub directory is NOT found. Maybe it does not exist (so other boot manager exists) or the file
system is not supported in the kernel. Skip running grub-install.
*****************************************************.
Found NTFS boot partition among the restored partition(s): /dev/sda1
Head and sector no. of /dev/sda from EDD: 64, 63.
The start sector of NTFS partition /dev/sda1: 63
Adjust filesystem geometry for the NTFS partition: /dev/sda1
Running: partclone.ntfsfixboot -w -h 64 -t 63 -s 63 /dev/sda1
ntfsfixboot version 0.9
done!
*****************************************************.
*****************************************************
*****************************************************
This program is not started by Clonezilla server, so skip notifying it the job is done.
Finished!
Now syncing - flush filesystem buffers...

"ocs-live-restore" is finished.
Now you can choose to:
(0) Poweroff
(1) Reboot
(2) Enter command line prompt
(3) Start over
[2]
```

6. Once you have powered down the system and removed the USB drive, you have finished configuring the recovery environment. The USB drive should be clearly labeled and stored in a safe place. You may now continue to the next section, where you will return the BIOS to its original state (Step 4) and test the recovery procedure for successful configuration (Step 5).

Step 4: Reset BIOS to Original State

Now you will need to return the boot priority to its original configuration so that the system will boot from the original disk. This is done for two reasons; the first is security, so that the machine may not be rebooted from unauthorized USB drives. The second, however, is functional: currently, if the DA-683 is set to boot from the USB drive, then ***the DA-683 will hang any time a USB data drive (i.e.: non-bootable image) is inserted in the machine at boot time***. The DA-683 does not currently have the capacity to distinguish between simple USB data drives and boot-capable OS drives.

1. Reboot the system, and press F2 to enter the BIOS setup menu.
2. Select **Hard Disk** and shift it to the top boot priority by using the + key, then press **Enter**. Make sure the hard disk has first boot priority.



Boot Type Order

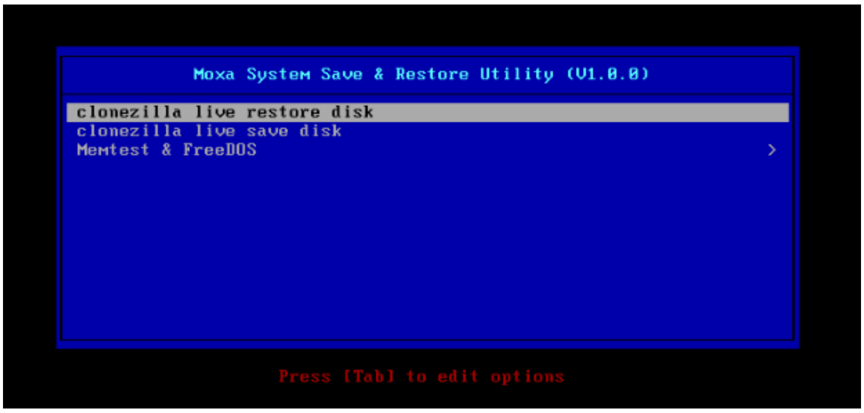
Hard Disk Drive
CD/DVD-ROM Drive
USB
Others

3. Press F10 and then press **Enter** to save and exit the BIOS settings dialog.

Step 5: Perform a Test Restoration

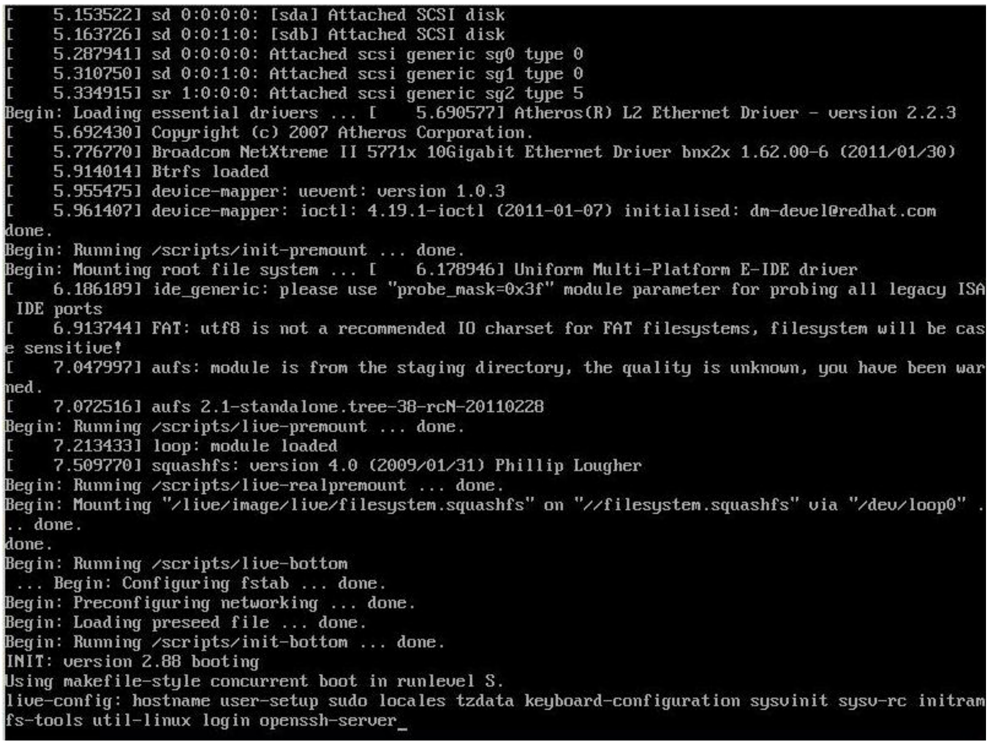
Connect the USB drive to any of the DA-683's USB ports and then reboot the computer. The system will boot from the USB into the Clonezilla boot loader.

1. Select **ClonezillaLive Restore Disk** to boot into the system restoration environment.



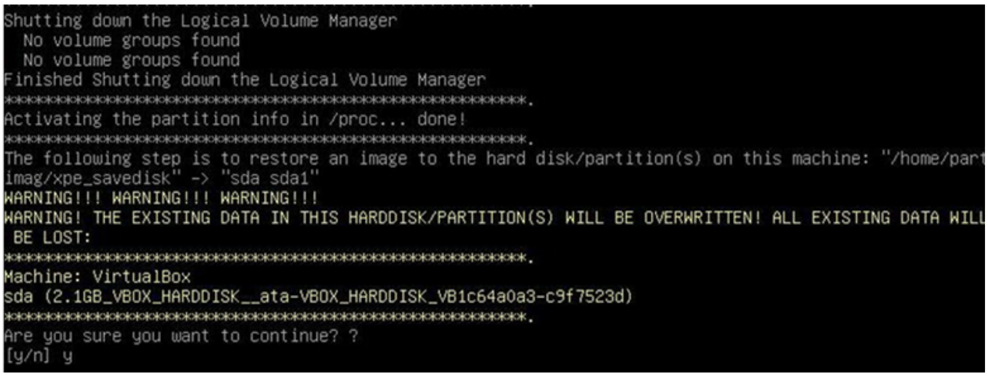
```
Moxa System Save & Restore Utility (V1.0.0)

clonezilla live restore disk
clonezilla live save disk
Memtest & FreeDOS                                        >

Press [Tab] to edit options
```

2. Wait for the boot process to finish.



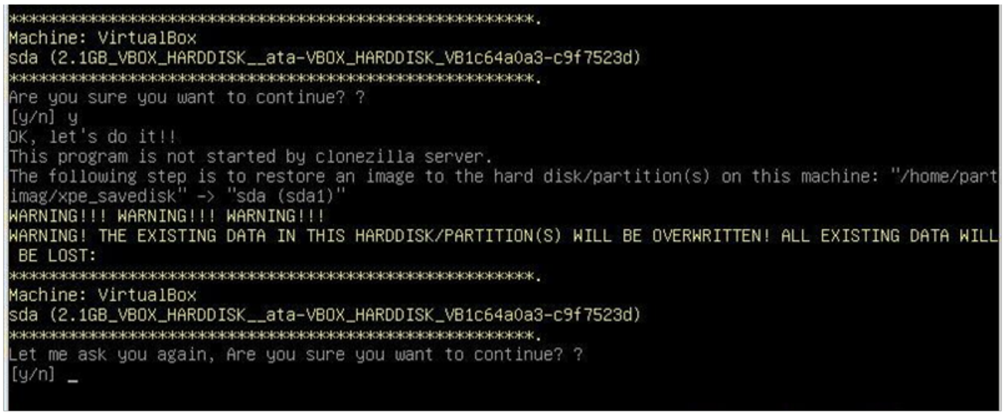
```
[    5.153522] sd 0:0:0:0: [sda] Attached SCSI disk
[    5.163726] sd 0:0:1:0: [sdb] Attached SCSI disk
[    5.287941] sd 0:0:0:0: Attached scsi generic sg0 type 0
[    5.310750] sd 0:0:1:0: Attached scsi generic sg1 type 0
[    5.334915] sr 1:0:0:0: Attached scsi generic sg2 type 5
Begin: Loading essential drivers ... [    5.690577] Atheros(R) L2 Ethernet Driver - version 2.2.3
[    5.692430] Copyright (c) 2007 Atheros Corporation.
[    5.776770] Broadcom NetXtreme II 5771x 10Gigabit Ethernet Driver bnx2x 1.62.00-6 (2011/01/30)
[    5.914014] Btrfs loaded
[    5.955475] device-mapper: uevent: version 1.0.3
[    5.961407] device-mapper: ioctl: 4.19.1-ioctl (2011-01-07) initialised: dm-devel@redhat.com
done.
Begin: Running /scripts/init-premount ... done.
Begin: Mounting root file system ... [    6.178946] Uniform Multi-Platform E-IDE driver
[    6.186189] ide_generic: please use "probe_mask=0x3f" module parameter for probing all legacy ISA
 IDE ports
[    6.913744] FAT: utf8 is not a recommended IO charset for FAT filesystems, filesystem will be cas
e sensitive!
[    7.047997] aufs: module is from the staging directory, the quality is unknown, you have been war
ned.
[    7.072516] aufs 2.1-standalone.tree-38-rcN-20110228
Begin: Running /scripts/live-premount ... done.
[    7.213433] loop: module loaded
[    7.509770] squashfs: version 4.0 (2009/01/31) Phillip Lougher
Begin: Running /scripts/live-realpremount ... done.
Begin: Mounting "/live/image/live/filesystem.squashfs" on "//filesystem.squashfs" via "/dev/loop0" .
.. done.
done.
Begin: Running /scripts/live-bottom
 ... Begin: Configuring fstab ... done.
Begin: Preconfiguring networking ... done.
Begin: Loading preseed file ... done.
Begin: Running /scripts/init-bottom ... done.
INIT: version 2.88 booting
Using makefile-style concurrent boot in runlevel S.
live-config: hostname user-setup sudo locales tzdata keyboard-configuration sysvinit sysv-rc initram
fs-tools util-linux login openssh-server_
```

3. At this point, the system will remind you that you are about to overwrite your entire operating system with a new drive image, and ask you if you want to continue. When prompted, enter **Y** (case insensitive) from the keyboard to start the system restoration process. Any other letter or Ctrl-C will cancel and exit Clonezilla.



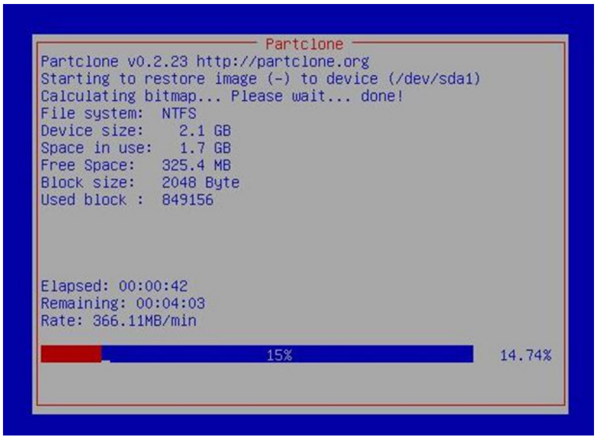
```
Shutting down the Logical Volume Manager
  No volume groups found
  No volume groups found
Finished Shutting down the Logical Volume Manager
*****************************************************.
Activating the partition info in /proc... done!
*****************************************************.
The following step is to restore an image to the hard disk/partition(s) on this machine: "/home/part
imag/xpe_savedisk" -> "sda sda1"
WARNING!!! WARNING!!! WARNING!!!
WARNING! THE EXISTING DATA IN THIS HARDDISK/PARTITION(S) WILL BE OVERWRITTEN! ALL EXISTING DATA WILL
 BE LOST:
*****************************************************.
Machine: VirtualBox
sda (2.1GB_VBOX_HARDDISK__ata-VBOX_HARDDISK_VB1c64a0a3-c9f7523d)
*****************************************************.
Are you sure you want to continue? ?
[y/n] y
```

4. The system will give you another warning that you are about to overwrite your hard drive, and erase all data on the partition listed (**sda1**, in the example below). If you wish to continue, enter **Y** (case insensitive).



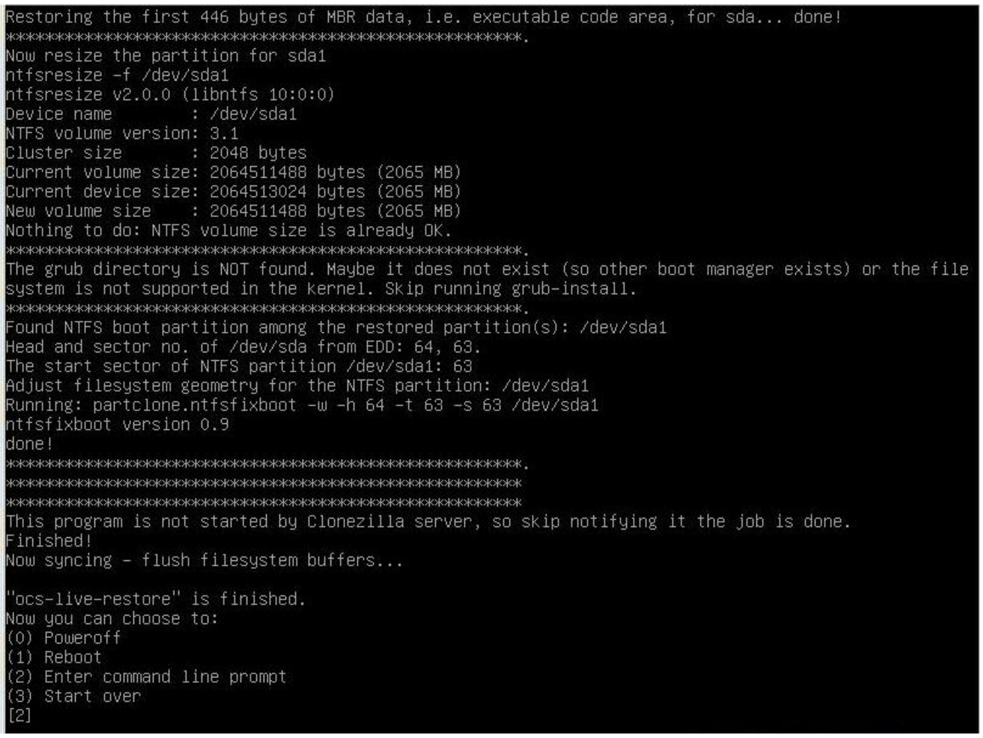
```
******************************************************.
Machine: VirtualBox
sda (2.1GB_VBOX_HARDDISK__ata-VBOX_HARDDISK_VB1c64a0a3-c9f7523d)
******************************************************.
Are you sure you want to continue? ?
[y/n] y
OK, let's do it!!
This program is not started by clonezilla server.
The following step is to restore an image to the hard disk/partition(s) on this machine: "/home/part
imag/xpe_savedisk" -> "sda (sda1)"
WARNING!!! WARNING!!! WARNING!!!
WARNING! THE EXISTING DATA IN THIS HARDDISK/PARTITION(S) WILL BE OVERWRITTEN! ALL EXISTING DATA WILL
 BE LOST:
******************************************************.
Machine: VirtualBox
sda (2.1GB_VBOX_HARDDISK__ata-VBOX_HARDDISK_VB1c64a0a3-c9f7523d)
******************************************************.
Let me ask you again, Are you sure you want to continue? ?
[y/n] _
```

5. Wait for the process to finish.



```
Partclone
Partclone v0.2.23 http://partclone.org
Starting to restore image (-) to device (/dev/sda1)
Calculating bitmap... Please wait... done!
File system:  NTFS
Device size:    2.1 GB
Space in use:   1.7 GB
Free Space:   325.4 MB
Block size:   2048 Byte
Used block :  849156



Elapsed: 00:00:42
Remaining: 00:04:03
Rate: 366.11MB/min

                 15%                  14.74%
```

6. At this point, complete the restoration by selecting (**0**) Power off. The computer will shut down; however, if the **Power Switch** remains inserted in the front panel of the computer and is left in the **ON** position, then the system will fail to shutdown and will immediately initiate a soft reboot, instead. To avoid this, use the switch to cut power to the computer immediately following the shutdown, or simply remove the power switch from the front panel and then use the console to shut down the computer by pressing **0**.



```
Restoring the first 446 bytes of MBR data, i.e. executable code area, for sda... done!
******************************************************.
Now resize the partition for sda1
ntfsresize -f /dev/sda1
ntfsresize v2.0.0 (libntfs 10:0:0)
Device name        : /dev/sda1
NTFS volume version: 3.1
Cluster size       : 2048 bytes
Current volume size: 2064511488 bytes (2065 MB)
Current device size: 2064513024 bytes (2065 MB)
New volume size    : 2064511488 bytes (2065 MB)
Nothing to do: NTFS volume size is already OK.
******************************************************.
The grub directory is NOT found. Maybe it does not exist (so other boot manager exists) or the file
system is not supported in the kernel. Skip running grub-install.
******************************************************.
Found NTFS boot partition among the restored partition(s): /dev/sda1
Head and sector no. of /dev/sda from EDD: 64, 63.
The start sector of NTFS partition /dev/sda1: 63
Adjust filesystem geometry for the NTFS partition: /dev/sda1
Running: partclone.ntfsfixboot -w -h 64 -t 63 -s 63 /dev/sda1
ntfsfixboot version 0.9
done!
******************************************************.
******************************************************
******************************************************
This program is not started by Clonezilla server, so skip notifying it the job is done.
Finished!
Now syncing - flush filesystem buffers...

"ocs-live-restore" is finished.
Now you can choose to:
(0) Poweroff
(1) Reboot
(2) Enter command line prompt
(3) Start over
[2]
```

7. After the computer has powered down, remove the USB drive and store it in a safe place.

A

Sample Code for DA-683 Customization

This appendix gives you a hard copy of the sample code included with the DA-683. These short programs are intended to be used either as standalone scripts, or to be included in scripts created to build custom features for end users. You can find the sample code in C# and C++ from *DVD\examples\Example\* folder.

The following topics are covered in this appendix:

❒ **The DIO Control Sample Code**

❒ **The LED Control Sample Code**

❒ **The Watchdog Control Sample Code**

Sample Code for Digital I/O Control

Below we reproduce the LED control code. This is a simple function that users may freely modify to suit their needs.

```
/*  Copyright (C) MOXA Inc. All rights reserved.
    This software is distributed under the terms of the
    MOXA License.  See the file COPYING-MOXA for details.
*/

#include "stdafx.h"
#include <windows.h>
#include "..\\Include\\mxdev.h"

#define DI_PORT_NUMBER 4
#define DO_PORT_NUMBER 4

int _tmain(intargc, _TCHAR* argv[])
{
    HANDLE hDioDev;
intport_no;
int data;
intnData = 0;
intnRet = 0;
int port = 0;
int mode = 0;
int n = 0;

    TCHAR sin;
    TCHAR smode;

    _tprintf(_T("DIO Test Program\r\n"));
    _tprintf(_T("\t (0) Exit Program\r\n"));
    _tprintf(_T("\t (1) Display DO & DI\r\n"));
    _tprintf(_T("\t (2) Set DO value\r\n"));

    sin = _gettchar();
    n = _tstoi(&sin);

    do
    {
        switch (n)
        {
            // if char == '1', display the DI/DO status
            case 1:
                // Open device
hDioDev = mxdgio_open();

                for (inti = 0; i< DI_PORT_NUMBER; i++)
                {
                    // Get digital input
port_no = i;
nData = mxdgio_get_input_signal( hDioDev, port_no);
                    _tprintf(_T("DI[%d] = %d\r\n"), port_no, nData);
                }
                for (inti = 0; i< DO_PORT_NUMBER; i++)
                {
                    // Get digital input
port_no = i;
nData = mxdgio_get_output_signal( hDioDev, port_no);
                    _tprintf(_T("DO[%d] = %d\r\n"), port_no, nData);
                }

                // Close device
mxgpio_close(hDioDev);
                break;

            // if char == '2', Set the DO
            case 2:
                // Get Port Number
                _gettchar();
                _tprintf(_T("Input the Port Number (0 ~ %d) = \r\n"),
DO_PORT_NUMBER-1);
smode = _gettchar();
port_no = _tstoi(&smode);

                // Get Value
                _gettchar();
                _tprintf(_T("Input the value (0 or 1) = "));
smode = _gettchar();
                data = _tstoi(&smode);

                // Open device
hDioDev = mxgpio_open();

                   // Set DO
nRet = mxdgio_set_output_signal( hDioDev, port_no, data);

                if ( nRet == -1 )
                {
                    _tprintf(_T("Set DO signal fail!\r\n"));
                }
                else
                {
                    _tprintf(_T("Set DO signal success!\r\n"));
                }

                // Close device
mxgpio_close(hDioDev);
                break;
        }
         _gettchar();
        sin = _gettchar();
        n = _tstoi(&sin);
    } while (n != 0);

    return 0;
}
```

Sample Code for LED Control

Below we reproduce the LED control code. This is a simple function that users may freely modify to suit their needs.

```
/*  Copyright (C) MOXA Inc. All rights reserved.
           This software is distributed under the terms of the

   MOXA License.  See the file COPYING-MOXA for details.
*/

#include "stdafx.h"
#include <windows.h>
#include "..\\Include\\mxdev.h"

#define LED_PORT_NUMBER 8

int _tmain(intargc, _TCHAR* argv[])
{
   HANDLE hLedDev;
intport_no;
int data;
intnLED = 0;
intnRet = 0;
int port = 0;
int mode = 0;
int n = 0;

   TCHAR sin;
   TCHAR smode;

   _tprintf(_T("LED Test Program\r\n"));
   _tprintf(_T("\t (0) Exit Program\r\n"));
   _tprintf(_T("\t (1) Display LED\r\n"));
   _tprintf(_T("\t (2) Set LED value\r\n"));

   sin = _gettchar();
   n = _tstoi(&sin);

   do
   {
      switch (n)
      {
         // if char == '1', display the LED output status
         case 1:
            // Open device
hLedDev = mxgpio_open();

            for (inti = 0; i< LED_PORT_NUMBER; i++)
            {
               // Get digital input
port_no = i;
nLED = mxgpio_get_data( hLedDev, port_no);
               _tprintf(_T("LED[%d] = %d\r\n"), port_no, nLED);
            }
```

```
             // Close device
mxgpio_close(hLedDev);
             break;

          // if char == '2', Set the LED output
          case 2:
             // Get Port Number
             _gettchar();
             _tprintf(_T("Input the Port Number (0 ~ %d) = \r\n"),
LED_PORT_NUMBER-1);
smode = _gettchar();
port_no = _tstoi(&smode);

             // Get Value
             _gettchar();
             _tprintf(_T("Input the value (0 or 1) = "));
smode = _gettchar();
             data = _tstoi(&smode);

             // Open device
hLedDev = mxgpio_open();

                // Set LED
nRet = mxgpio_set_data( hLedDev, port_no, data);

             if ( nRet == -1 )
             {
                _tprintf(_T("Set led signal fail!\r\n"));
             }
             else
             {
                _tprintf(_T("Set led signal success!\r\n"));
             }

             // Close device
mxgpio_close(hLedDev);
             break;
       }
        _gettchar();
       sin = _gettchar();
       n = _tstoi(&sin);
   } while (n != 0);

   return 0;
}
```

The Watchdog Control Sample Code

```
/*  Copyright (C) MOXA Inc. All rights reserved.
    This software is distributed under the terms of the
    MOXA License.  See the file COPYING-MOXA for details.
*/

#include "stdafx.h"
#include <windows.h>
#include "..\\Include\\mxdev.h"

int _tmain(intargc, _TCHAR* argv[])
{
    PVOID fd; // Handle to device, obtain from mxwdg_open
    ULONG time;

    // starts watchdog timer
    time = 10;
fd = mxwdg_open(time);

    while ( TRUE )
    {
        _tprintf( _T("Press \"ENTER\" in 10 seconds\n, 'q' to exit"));
        TCHAR ch = _gettchar();
        if ( ch == (TCHAR)'q' )
        {
            break;
        }

        // refresh watchdog timer
mxwdg_refresh(fd);
    }

    // stops watchdog timer
mxwdg_close(fd);
    return 0;
}
```