

# SCADAPack E

## Firmware Update Technical Reference

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## 1 Legal Information

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

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### Address

Schneider Electric

415 Legget Drive, Suite 101, Kanata, Ontario K2K 3R1 Canada

Direct Worldwide: +1 (613) 591-1943

Fax: +1 (613) 591-1022

Toll Free within North America: 1 (888) 267-2232

[www.schneider-electric.com](http://www.schneider-electric.com)

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## 2 Technical Support

Questions and requests related to any part of this documentation can be directed to one of the following support centers.

### **Technical Support: Americas, Europe, Middle East, Asia**

Available Monday to Friday 8:00am – 6:30pm Eastern Time

Toll free within North America 1-888-226-6876

Direct Worldwide +1-613-591-1943

Email [supportTRSS@schneider-electric.com](mailto:supportTRSS@schneider-electric.com)

### **Technical Support: Australia**

Inside Australia 1300 369 233

Email [au.help@schneider-electric.com](mailto:au.help@schneider-electric.com)

### 3 Safety Information

#### Important Information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

#### **DANGER**

**DANGER** indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

#### **WARNING**

**WARNING** indicates a hazardous situation which, if not avoided, **can result in** death or serious injury.

#### **CAUTION**

**CAUTION** indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

#### **NOTICE**

**NOTICE** is used to address practices not related to physical injury.

## Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

## Before You Begin

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

 <b>WARNING</b>
<b>EQUIPMENT OPERATION HAZARD</b> <ul style="list-style-type: none"><li>• Verify that all installation and set up procedures have been completed.</li><li>• Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.</li><li>• Remove tools, meters, and debris from equipment.</li></ul> <b>Failure to follow these instructions can result in death or serious injury.</b>

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future reference.

Test all software in both simulated and real environments.

Verify that the completed system is free from all short circuits and grounds, except those grounds installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to help prevent accidental equipment damage.

## Operation and Adjustments

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to help prevent unauthorized changes in operating characteristics.

## Acceptable Use

SCADAPack E remote Programmable Automation Controllers (rPACs), Remote Terminal Units (RTUs) and input/output (I/O) modules are intended for use in monitoring and controlling non-critical equipment only. They are not intended for safety-critical applications.

### **WARNING**

#### **UNACCEPTABLE USE**

Do not use SCADAPack E rPACs, RTUs, or I/O modules as an integral part of a safety system. These devices are not safety products.

**Failure to follow this instruction can result in death or serious injury.**

### **CAUTION**

#### **EQUIPMENT OPERATION HAZARD**

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Use only Schneider Electric software or approved software with Schneider Electric hardware products.

**Failure to follow these instructions can result in minor or moderate injury.**

## 4 Introduction

The SCADAPack E RTU provides a Boot Monitor component within firmware. In conjunction with RTU hardware it provides the ability to re-load RTU operating system firmware.

Reloading firmware can be done through an RTU serial port (locally), or it can be done remotely from across network communication media.

The SCADAPack E firmware contained in hardware Flash memory contains the RTU operating system.

A separate boot loader containing a Flash re-programming Boot Monitor controls the process of starting the RTU and re-programming the RTU operating system firmware.

The SCADAPack E RTU runs the Boot Monitor from its Boot ROM or Boot FLASH sector at start-up (depending on RTU hardware model). Its purpose is to validate and run the RTU operating system firmware already stored in Flash memory, or update the RTU operating system firmware.

The Boot Monitor can be notified to update RTU Operating System Firmware or Boot Monitor Firmware by connection of a local PC initiating a firmware upgrade, or by the user initiating a remote RTU firmware update. For the SCADAPack ES and SCADAPack ER the user can also select hex switch modes on the RTU hardware to force firmware upgrade options.

At startup, if an Operating System Firmware upgrade or Boot Monitor Firmware upgrade is not initiated, the Boot Monitor will validate the RTU operating system firmware by scanning the RTU's Flash memory and comparing a computed CRC-32 value with one stored in the Flash memory. Should the operating system firmware be validated, the Boot Monitor will begin executing it. Otherwise the Boot Monitor will remain active, waiting for a new RTU operating system firmware image to be loaded to it, locally.

## 5 RTU FLASH Memory & Boot Monitor Diagnostics

### RTU Flash Memory

The RTU firmware is stored in non-volatile FLASH memory.

The SCADAPack E RTU hardware supports local and remote flash loading for the following firmware:

- Boot Monitor firmware
- Operating System Firmware

In addition, the SCADAPack ER RTU hardware supports local and remote flash loading for the following firmware:

- I/O Processor Firmware

The Boot Monitor firmware also provides RTU start-up information that may assist diagnosing potential conditions affecting start-up.

### Boot Monitor Port

The SCADAPack E RTU Boot Monitor can use a specific RTU port to load firmware during the RTU startup phases.

The following port is used by the Boot Monitor for offline firmware update connection during the startup phases of the RTU.

Some RTU models also support diagnostics on this Port at RTU start-up. If any unexpected behavior is encountered at RTU start-up, it may help to view these diagnostics. This port is known as the *BOOT MONITOR PORT*.

RTU Type	Boot Monitor Port	Firmware update on this Port?	Boot Diags on this Port?
SCADAPack ES	PORT 4	Yes	Yes
SCADAPack ER	PORT 4	Yes	Yes
SCADAPack 312E	PORT 2 (COM2)	Yes	No
SCADAPack 313E	PORT 2 (COM2)	Yes	No
SCADAPack 314E	PORT 2 (COM2)	Yes	No
SCADAPack 330E	PORT 3 (COM3)	Yes	No
SCADAPack 333E	PORT 3 (COM3)	Yes	No
SCADAPack 334E	PORT 3 (COM3)	Yes	No
SCADAPack 337E	PORT 3 (COM3)	Yes	No
SCADAPack 350E	PORT 3 (COM3)	Yes	No
SCADAPack 357E	PORT 3 (COM3)	Yes	No
SCADAPack 530E	PORT 4 (Serial4)	Yes	No
SCADAPack 535E	PORT 4 (Serial4)	Yes	No

## Boot Monitor Diagnostics (SCADAPack ES and SCADAPack ER only)

SCADAPack 300E, SCADAPack 530E and SCADAPack 535E RTUs do not provide Boot Monitor Diagnostics at startup.

To view boot monitor diagnostics on SCADAPack ES and SCADAPack ER RTUs, use HyperTerminal, or another terminal emulation program, set-up as follows:

1. Connect using an RTU serial cable to the Boot Monitor Port detailed in the table above ([Boot Monitor Port](#) <sup>(11)</sup>)
2. Set-up terminal emulator as 57600 bps, 8 Data-bits, No Parity, 1 Stop-bit
3. Restart the RTU
4. Boot Monitor diagnostics will be displayed

Typical Boot Monitor start-up diagnostics are as follows:

```
>Flash Monitor Loaded - Version 2.10
>Validating Program
>Valid Program
>Execute Program
```

Following completion of Boot Monitor start-up, the SCADAPack E RTU operating system firmware is started.

Depending upon the port configurations, the port to which you connect may display RTU firmware start-up diagnostics.

The default firmware configurations for the RTU serial port (after the Boot Monitor starts the main Operating System Firmware) are **9600 bps** (8-N-1) with **Cmd Line** functions. These may be reconfigured by the user to a different data rate, or different port functionality than the default. It is possible that the boot monitor may output its diagnostics at **57600 bps**, and the firmware output its startup diagnostics at a different rate, or possibly not start-up.

## 6 Loading Compressed RTU Firmware

Updating the RTU firmware using either a “compressed” binary image (.BIZ) or “compressed difference” binary patch file (.BIP) is an efficient mechanism provided by the SCADAPack E architecture to allow loading a new operating system version remotely. These compressed binary images are derived from a complete binary “.bin” file.

A compressed binary image is identified as a “.biz” file and can be used to update to the new firmware irrespective of the existing firmware in the RTU.

- SCADAPack ES, SCADAPack ER and SCADAPack 300E RTUs support .bin, .biz and .bip files.
- SCADAPack 530E and 535E RTUs support .biz files only. They do not support .bin or .bip files.

**Tip:** By default, firmware images will be installed to: C:\Program Files\Schneider Electric\SCADAPack E\Firmware

A “difference” file is identified as a “.bip” file and can only be used to update from one specific version to another.

Refer to Section [“Binary Difference” and “Compressed Binary” File Utility](#)<sup>[14]</sup> for more information on these compressed files and how they can be generated.

Loading compressed RTU firmware is supported through three methods:

- Offline locally using SCADAPack E Configurator Firmware Update Wizard connected to the RTU's Boot Monitor port (see [SCADAPack E Configurator Update Firmware Wizard](#)<sup>[19]</sup>).
- Online locally or remotely using SCADAPack E Configurator Firmware Update Wizard via remote DNP3 communications (see [Remotely Updating RTU Firmware](#)<sup>[24]</sup>)
- Remotely using file transfer and DNP3 commands (see [Remotely Updating RTU Firmware](#)<sup>[24]</sup>)

## 6.1 "Binary Difference" and "Compressed Binary" Files

The "differences" between two given firmware binary (.bin) files can be determined and a "binary difference" file (\*.**BIP**) can be generated that characterizes the differences between the two given binary images. The resulting ".BIP" difference file can be downloaded and applied as a firmware upgrade to the RTU through SCADAPack E Configurator locally, SCADAPack E Configurator remotely, or via manual commands.

Using a .BIP firmware upgrade to patch an older firmware version effectively replaces the *old* firmware with the *new* firmware.

The greatest advantage of the binary difference .BIP format is realized when the increment between two firmware versions is small, resulting in a relatively small \*.BIP (binary difference file), as opposed to a comparatively large \*.BIZ file (complete compressed binary image).

This is particularly useful for remotely patching outstation firmware when communications is via low-speed links.

See [Online Update of RTU Firmware](#)<sup>[24]</sup> for more information regarding remote firmware patching.

The Schneider Electric SCADAPack E Installer includes a software utility that can generate both **.BIP** files and **.BIZ** files. This utility is a Microsoft Windows® application, as detailed in the following sections.

SCADAPack 530E and 535E RTUs support **.BIZ** files only. They do not support **.BIN** or **.BIP** files.

[Firmware Difference Generator](#)<sup>[15]</sup>

## 6.2 Firmware Difference Generator

The Windows Difference Generator application provides a mechanism for generating SCADAPack E firmware .BIZ and .BIP files from operating system firmware binary image .BIN files.

The Firmware Difference Generator is used with SCADAPack ES, SCADAPack ER and SCADAPack 300E RTUs. It is not used with SCADAPack 530E and SCADAPack 535E rPACs.

If you are using the Windows 10 operating system, you need the ability to run applications as administrator to use the Firmware Difference Generator.

### To Start the Firmware Difference Generator

- Select the **Start or Windows** menu, then navigate to the **Schneider Electric** folder and select **SCADAPack E > Difference Generator**.

If you are using the Windows 10 operating system, right-click on **Difference Generator** and select **Run as administrator**.

The Firmware Difference Generator is displayed, as shown below.

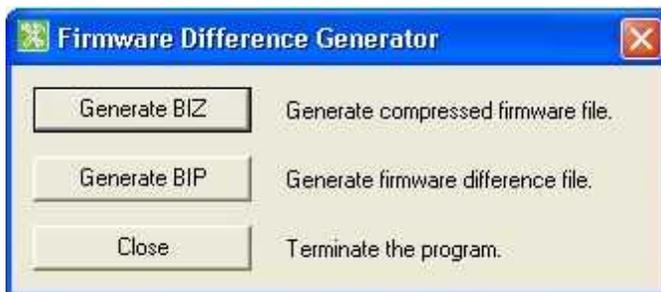
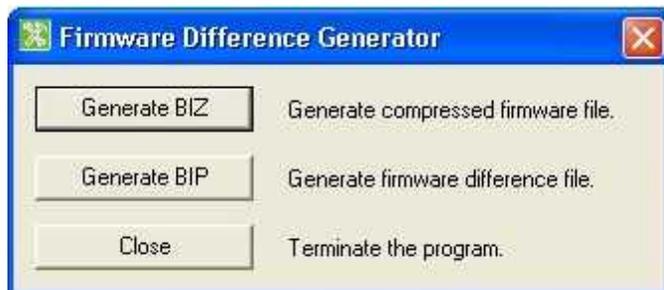


Figure 4.1: Firmware Difference Generator Interface

### To Generate a .BIZ Compressed Firmware File

1. In the Firmware Difference Generator, select **Generate BIZ**.



2. In the Generate Compressed Firmware File dialog, select the controller type.
3. Click **Browse** to locate the **.BIN** firmware file to compress.
4. Click **Browse** to select the folder and filename for the compressed target **.BIZ** file.
5. Click **Generate**.

The progress bar shows the conversion progress.

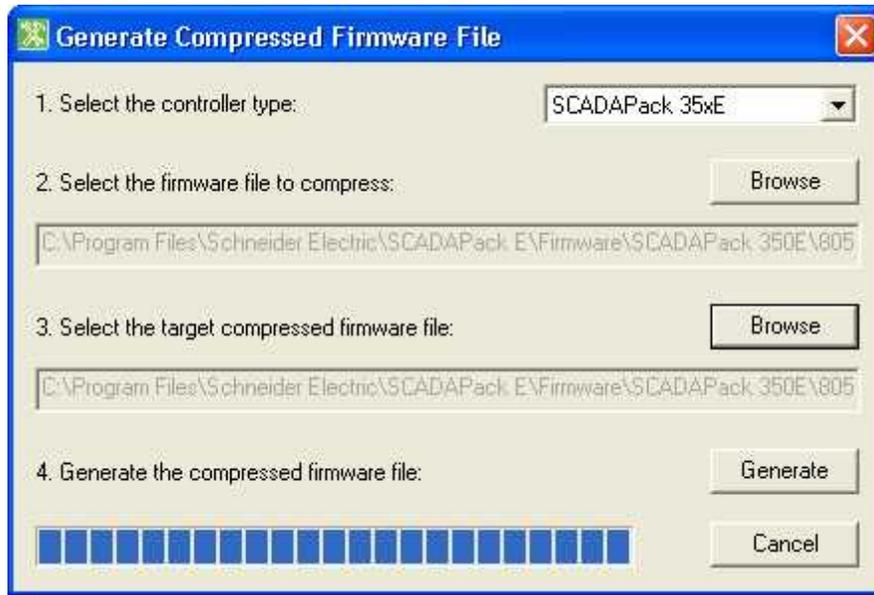
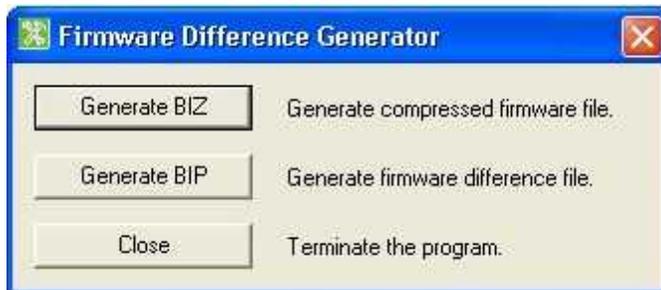


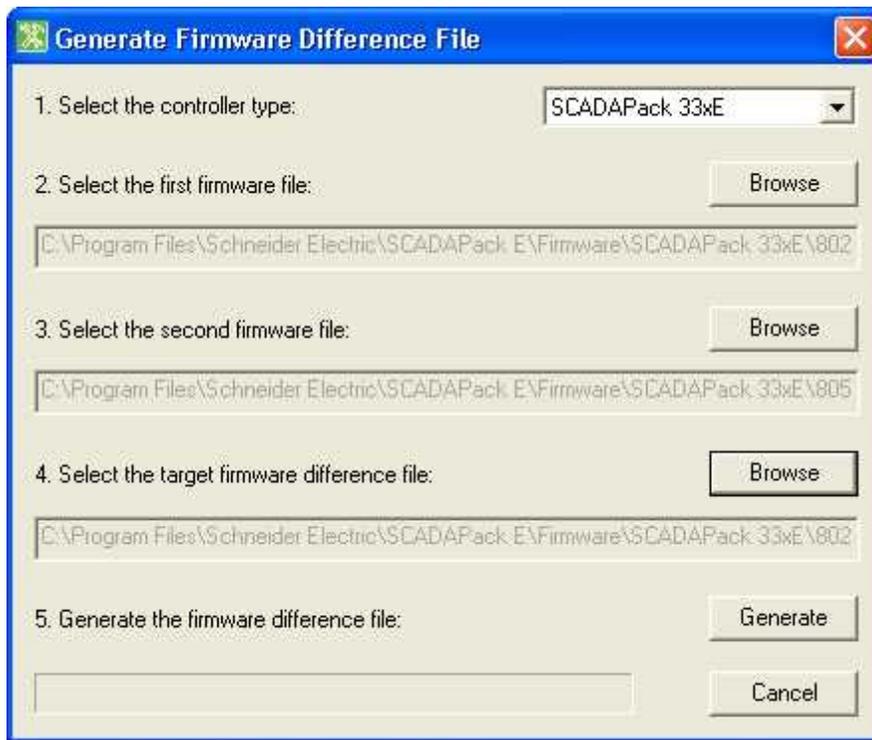
Figure 4.2: BIZ file Generation

### To Generate a .BIP Firmware Binary Difference File

1. In the Firmware Difference Generator, select **Generate BIP**.



2. In the Generate Firmware Difference File dialog, select the controller type.



**Figure 4.3: BIP file Generation**

3. Click **Browse** to select the **.BIN** firmware file for the existing RTU firmware version.
4. Click **Browse** to select the **.BIN** firmware file for the RTU firmware version you want to upgrade to.
5. Click **Browse** to select the folder and filename for the firmware difference **.BIZ** file.
6. Click **Generate**.

The progress bar shows the conversion progress.

## 7 Updating rPAC or RTU Operating System Firmware

Loading & re-programming new SCADAPack E RTU operating system firmware in FLASH memory is managed by the Boot Monitor.

The Boot Monitor can also load & re-program new Boot Monitor firmware (i.e. replace itself).

Operating System firmware upgrade can be activated in one of the following ways:

- Offline locally using the SCADAPack E Configurator **Transfer | Update System Firmware** menu command to access the Firmware Update Wizard while connected to the Boot Monitor Port of the RTU (See [Offline SCADAPack E Configurator Firmware Update Wizard](#)<sup>[19]</sup>)
- Online locally using the SCADAPack E Configurator Firmware Update Wizard while connected to a DNP3 communication port of the RTU (See [Online SCADAPack E Configurator Firmware Update Wizard](#)<sup>[25]</sup>)
- Online remotely using SCADAPack E Configurator Firmware Update Wizard across a DNP3 communication link (See [Online SCADAPack E Configurator Firmware Update Wizard](#)<sup>[25]</sup>)
- Online remotely via DNP3 file transfer of compressed RTU operating system image into an operating RTU (See [Updating Firmware by Manual Commands](#)<sup>[29]</sup>) - e.g. by Master Station

See also

- [Offline Firmware Updates](#)<sup>[22]</sup>
- [Online Firmware Updates](#)<sup>[28]</sup>

### Updating Boot Monitor Firmware

Boot Monitor firmware upgrade can be activated in one of the following ways:

- Offline locally using the SCADAPack E Configurator **Transfer | Update Boot Monitor** command to access the Boot Monitor Update Wizard while connected to the Boot Monitor Port of the RTU. (NOT SUPPORTED BY SCADAPack 300E, SCADAPack 530E and SCADAPack 535E RTUs).
- Online locally using the SCADAPack E Configurator Boot Monitor Update Wizard while connected to a DNP3 communication port of the RTU. (See [Online SCADAPack E Configurator Boot Monitor Update Wizard](#)<sup>[38]</sup>)
- Online remotely using the SCADAPack E Configurator Boot Monitor Update Wizard across a DNP3 communication link. (See [Online SCADAPack E Configurator Boot Monitor Update Wizard](#)<sup>[38]</sup>)
- Online remotely via DNP3 file transfer of the compressed RTU operating system image into an operating RTU (See [Updating Boot Monitor by Manual Commands](#)<sup>[39]</sup>) - e.g. by Master Station

See also

- [Updating Boot Monitor Firmware](#)<sup>[33]</sup>
- [Online Update of Boot Monitor Firmware](#)<sup>[37]</sup>

## 7.1 Offline SCADAPack E Configurator Firmware Update Wizard

The SCADAPack E RTU may have its Operating System firmware upgraded Offline using the SCADAPack E Configurator “Firmware Update” Wizard and selecting Local Serial Port as the update method. This locally transfers a Firmware Binary Image (.BIN file), a Compressed Binary Image (.BIZ file), or a Firmware Patch (difference) Image (.BIP file) to the RTU through the PC’s serial port and via the RTU’s Boot Monitor port. See [Boot Monitor Port](#)<sup>[12]</sup> for more information.

- SCADAPack ES, SCADAPack ER and SCADAPack 300E RTUs support .BIN, .BIZ and .BIP files.
- SCADAPack 530E and 535E RTUs support .BIZ files only. They do not support .BIN or .BIP files.

Offline firmware updates can only be performed locally, and results in complete initialization of the RTU. Also see:

- [Offline Firmware Updates](#)<sup>[22]</sup>

<b>⚠ WARNING</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b>
Before updating firmware, make sure you are connected to the correct SCADAPack E RTU.
<b>Failure to follow these instructions can result in death or serious injury.</b>

<b>⚠ WARNING</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b>
Evaluate the operational state of the equipment monitored and controlled by the SCADAPack E RTU before performing a firmware update. Hazardous situations can occur if the system state is not confirmed prior to performing a firmware update.
<b>Failure to follow these instructions can result in death or serious injury.</b>

### Using the Firmware Update Wizard for Offline Updates

Start the Wizard through the SCADAPack E Configurator “Transfer” menu by selecting “Update System Firmware”.

Select the *Local Serial Port* update method and follow the Wizard instructions, which will guide you through setting up the link to the RTU and starting the firmware update process.

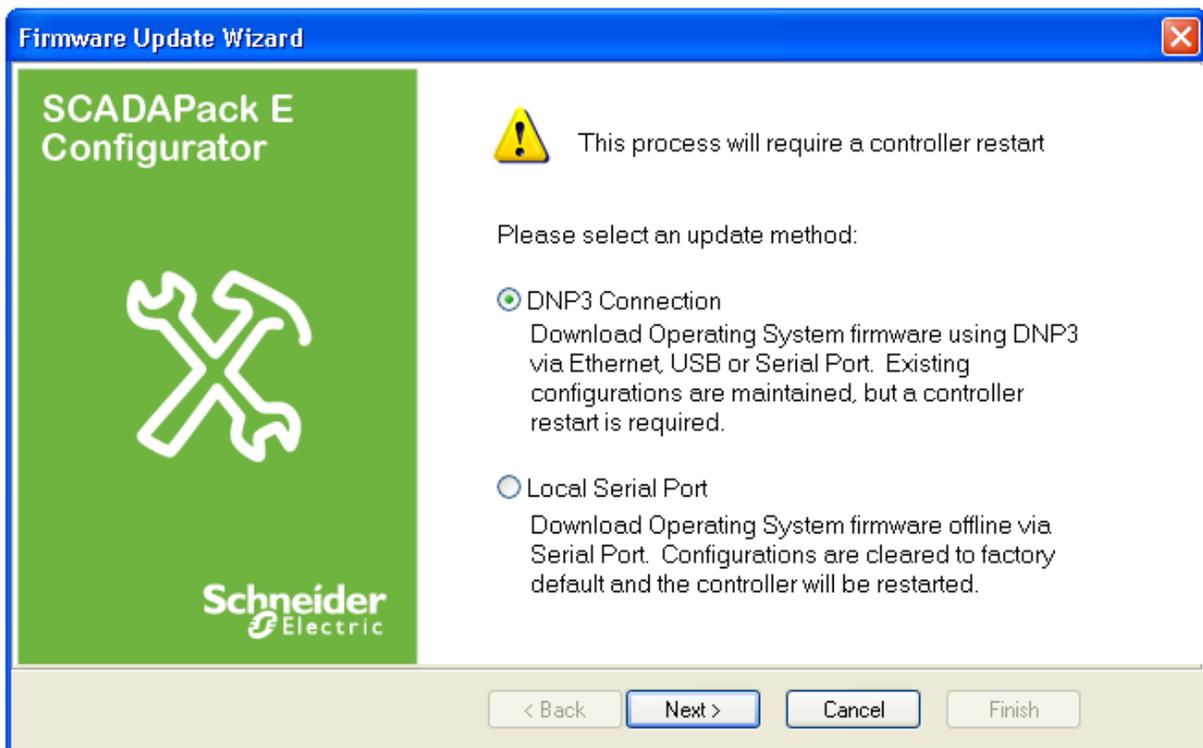
## NOTICE

### UNEXPECTED EQUIPMENT OPERATION

Reloading RTU Firmware interrupts the operation of the RTU during the Flash re-programming process, and resets the RTU configurations. Offline firmware updates clear the RTU configuration, including IEC 61131-3 application(s).

Before reloading the firmware, save a copy of the RTU configuration information, user-created applications, logs and other data to an external drive so it can be reloaded when then the firmware reloading is complete.

**Failure to follow these instructions can result in equipment damage.**



**Figure 5.1: SCADAPack E Configurator Firmware Update Wizard**

For updating RTU Operating System firmware Offline locally (i.e. plugged in to the Boot Monitor serial port on the controller), select the Local Serial Port option. Then follow the wizard instructions.

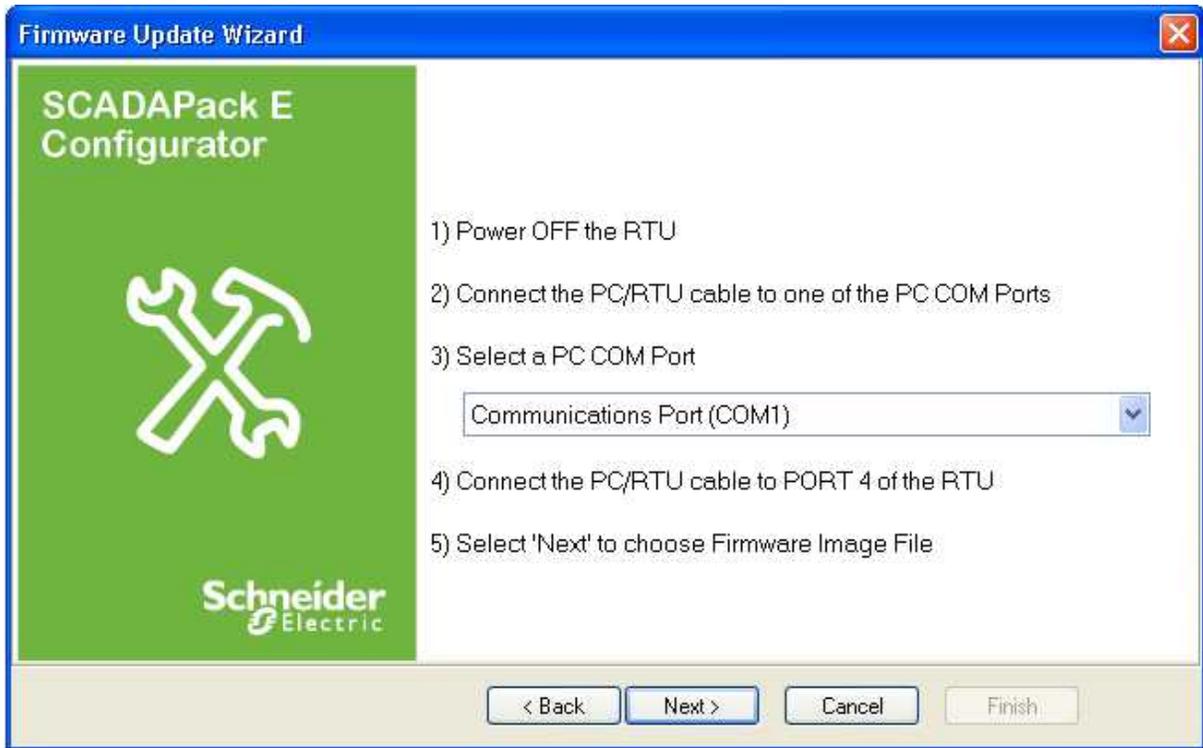


Figure 5.2: SCADAPack E Configurator Firmware Update Wizard Instructions

## 7.2 Offline Firmware Updates

This section details how to update the RTU Operating System firmware offline by local connection to an RTU serial port.

**With firmware update techniques detailed for local updates the RTU configuration is NOT retained.**

If it is necessary to update the firmware and retain configurations, applications and database values, it is recommended that the firmware is updated using one of the “online” techniques used for remote firmware updates. See [Online Update of RTU Firmware](#) [24].

<b>⚠ WARNING</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b>
Before updating firmware, make sure you are connected to the correct SCADAPack E RTU.
<b>Failure to follow these instructions can result in death or serious injury.</b>

<b>⚠ WARNING</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b>
Evaluate the operational state of the equipment monitored and controlled by the SCADAPack E RTU before performing a firmware update. Hazardous situations can occur if system state is not confirmed prior to performing a firmware update.
<b>Failure to follow these instructions can result in death or serious injury.</b>

<b>NOTICE</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b>
Reloading RTU Firmware interrupts the operation of the RTU during the Flash re-programming process, and resets the RTU configurations. Offline firmware updates clear the RTU configuration, including IEC 61131-3 application(s).
Before reloading the firmware, save a copy of the RTU configuration information, user-created applications, logs and other data to an external drive so it can be reloaded when then the firmware reloading is complete.
<b>Failure to follow these instructions can result in equipment damage.</b>

The Boot Monitor Port on the RTU is utilized by the Boot Monitor to allow Local transfer of new Operating System firmware into the RTU Flash memory.

For SCADAPack 300E RTUs, the Boot Monitor keeps the "RUN" LED OFF while it is running (RTU's "POWER" LED is ON).

For SCADAPack ES, SCADAPack ER, SCADAPack 530E and SCADAPack 535E RTUs: Upon starting, the Boot Monitor blinks the “Run” LED on the RTU quickly (about 2 flashes per second). This flash rate is faster than when the RTU is operating normally.

Transferring new operating system firmware to the RTU “locally” requires the use of SCADAPack E Configurator with a PC Com Port connected to the Boot Monitor Port on the RTU (See section [Boot Monitor Port](#) <sup>[12]</sup>).

Binary images, or compressed binary image files for the RTU are provided by Schneider Electric. Compared with standard binary image files, using the compressed (.BIZ) files are a preferred way of updating firmware due to the smaller file size and the hardware specific information included in the compressed binary file.

Firmware updates are also possible using difference binary images (.BIP) that allow the firmware to be updated from one specific version to another.

- SCADAPack ES, SCADAPack ER and SCADAPack 300E RTUs support .BIN, .BIZ and .BIP files.
- SCADAPack 530E and 535E RTUs support .BIZ files only. They do not support .BIN or .BIP files.

See [Loading Compressed RTU Firmware](#) <sup>[13]</sup> for more information regarding binary difference files.

At RTU startup, the Boot Monitor waits 2 seconds, as part of its normal boot sequence, for connection with the *SCADAPack E Configurator Firmware Update Wizard*.

Thus the RTU needs to be powered OFF prior to commencing the upgrade procedure.

## Updating Operating System Firmware Offline

1. Start the SCADAPack E Configurator Firmware Update Wizard by selecting **Transfer | Update System Firmware**.
2. Select the Local Serial Port connection on the update wizard and follow the wizard instructions to prepare the serial connection to the RTU.
3. Power ON the RTU when instructed by the Wizard.

Once communications is established with the RTU Boot Monitor, the following firmware update sequences occur automatically:

- Operating System Flash memory in RTU is erased
- Firmware Image is transferred to the RTU in blocks
- Each block is verified for data integrity and blocks are programmed into the Flash memory
- Blocks are transferred and programmed into the Flash memory until the complete binary image is transferred
- When programming a SCADAPack 300E RTU with a .BIP (binary compressed patch) file, a two-phase transfer and burn process takes place to establish update integrity. This part of the process can take longer than if using a .BIZ or .BIN file for upgrade.
- Upon completion, the user is prompted for the RTU to be restarted

## SCADAPack ES and SCADAPack ER Local Firmware Updates

If the RTU hex switches on a SCADAPack ES or SCADAPack ER RTU are set to “FF” (Flash Firmware transfer mode), the Boot Monitor waits indefinitely for a firmware update.

If not set to “FF” mode, the Boot Monitor waits 2 seconds on startup, as part of its normal boot sequence, for connection with the SCADAPack E Configurator Update Firmware Wizard as described

above.

## **NOTICE**

### **UNEXPECTED EQUIPMENT OPERATION**

Use of "FF" (Flash Firmware transfer mode) disables normal RTU operation.

Set the RTU hex switches to 00 for RUN mode.

**Failure to follow these instructions can result in equipment damage.**

In the case of the SCADAPack ES and SCADAPack ER RTU models, the RTUs may be restarted at any time after "FF" mode is set, rather than having to have the unit powered down until the wizard instructs a power up.

Set the Hex Switches then restart the RTU by one of the following methods:

- Power the RTU off & on
- Hardware reset the RTU
- Send a DNP3 Cold Restart command
- Send an RTU command line "RESTART RTU" command
- Send a SCADAPack E Configurator **Commands > Restart RTU**

### **7.3 Online Update of RTU Firmware**

See the following sections describing how to upgrade Operating System firmware online:

- [Online SCADAPack E Configurator Firmware Update Wizard](#)<sup>[25]</sup>
- [Online Firmware Updates](#)<sup>[28]</sup>
- [Updating Firmware by manual commands](#)<sup>[29]</sup>

### 7.3.1 Online SCADAPack E Configurator Firmware Update Wizard

The SCADAPack E RTU may have its Operating System firmware upgraded online using the SCADAPack E Configurator Firmware Update Wizard and selecting *DNP3 Connection* as the update method.

This transfers a Compressed Binary Image (.BIZ file), or a Firmware Patch (difference) Image (.BIP file) to the RTU through a DNP3 connection. This connection may be local to the RTU, or remote across a communications link.

- SCADAPack ES, SCADAPack ER and SCADAPack 300E RTUs support **.BIN**, **.BIZ** and **.BIP** files.
- SCADAPack 530E and 535E RTUs support **.BIZ** files only. They do not support **.BIN** or **.BIP** files.

An online firmware update will save and restore the configuration of the RTU as part of the upgrade process. When upgrading by way of Firmware Patch, this includes preservation of ISaGRAF retained-variable values. The ISaGRAF application state, ISaGRAF I/O lock states, and SCADAPack E RTU output states are not preserved during an upgrade. Also see

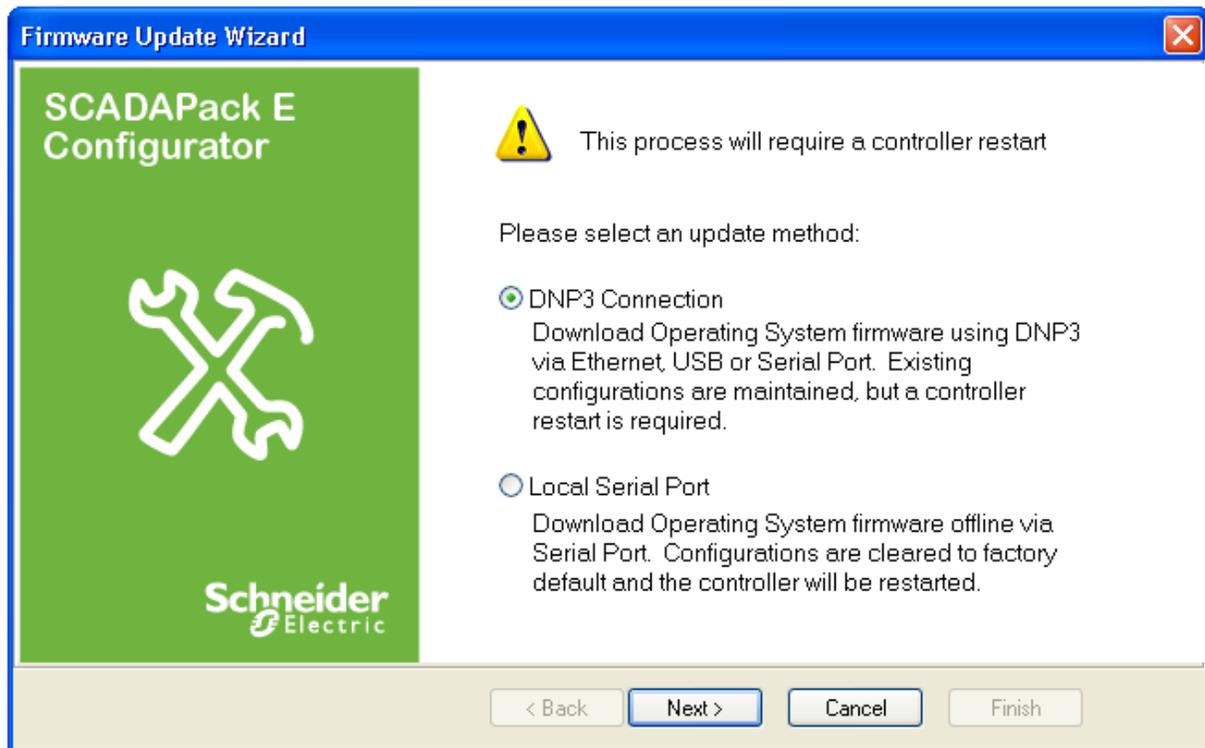
- [Online Firmware Updates](#) <sup>[28]</sup>

<b>⚠ WARNING</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b>
Before updating firmware, make sure you are connected to the correct SCADAPack E RTU. Verify the CPU ID displayed in the SCADAPack E Configurator matches the CPU ID of the RTU that firmware is intended to be updated on.
<b>Failure to follow these instructions can result in death or serious injury.</b>

<b>⚠ WARNING</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b>
Evaluate the operational state of the equipment monitored and controlled by the SCADAPack E RTU before performing a firmware update. Hazardous situations can occur if system state is not confirmed prior to performing a firmware update.
<b>Failure to follow these instructions can result in death or serious injury.</b>

### Using the Firmware Update Wizard for Online Updates

1. Start the Wizard through the SCADAPack E Configurator “Transfer” menu by selecting “Update System Firmware”.
2. Select the *DNP3 Connection* update method and follow the Wizard instructions, which will guide you through setting up the link to the RTU and starting the firmware update.



**Figure 5.3: SCADAPack E Configurator Firmware Update Wizard**

For updating RTU Operating System firmware online (i.e. via a local or remote DNP3 connection), select the *DNP3 Connection* option. On SCADAPack 300E, SCADAPack 530E and SCADAPack 535E RTUs, the USB Device (peripheral) port may be used. RTUs may use a DNP3 serial port or Ethernet interface for this connection.

Follow the wizard instructions for connection:



**Figure 5.4: SCADAPack E Configurator Online Firmware Update Wizard Connection Instructions**

1. Establish connection with the RTU. These use the same dialogs as establishing SCADAPack E Configurator connection with RTUs. For more information see the SCADAPack E Configurator User Manual.
2. Choose a compressed firmware image (.BIP or .BIZ file) when prompted.

### 7.3.2 Online Firmware Updates

Online update of the RTU's Operating System firmware is achieved using an RTU firmware compressed binary image.

## **NOTICE**

### **UNEXPECTED EQUIPMENT OPERATION**

Reloading RTU Firmware interrupts the operation of the RTU during the Flash re-programming process, and resets the RTU configurations. Offline firmware updates clear the RTU configuration, including IEC 61131-3 application(s).

Before reloading the firmware, save a copy of the RTU configuration information, user-created applications, logs and other data to an external drive so it can be reloaded when then the firmware reloading is complete.

**Failure to follow these instructions can result in equipment damage.**

Typically, compressed binary files will be used to upgrade from a lower SCADAPack E firmware version number to a higher firmware version number, though re-programming can also operate in the reverse direction (from a higher version number to a lower version number) provided an appropriate “.BIZ” or “.BIP” file is available.

- SCADAPack ES, SCADAPack ER and SCADAPack 300E RTUs support **.BIN**, **.BIZ** and **.BIP** files.
- SCADAPack 530E and RTUs support **.BIZ** files only. They do not support **.BIN** or **.BIP** files.

Section [“Binary Difference” and “Compressed Binary” Files](#)<sup>[14]</sup> describes the Schneider Electric utility for generating these files.

Typically a **.BIP** file, being the compressed changes for a firmware image, is a smaller size than a **BIZ** file. On lower-speed network links the time to transfer a **.BIP** file can be considerably shorter than a **.BIZ** file.

Online firmware update will save and restore the configuration of the RTU as part of the upgrade process. When upgrading by way of Firmware Patch, this includes preservation of ISaGRAF retained-variable values. The ISaGRAF application state, ISaGRAF I/O lock states, and SCADAPack E RTU output states are not preserved during an upgrade.

## **⚠ WARNING**

### **UNEXPECTED EQUIPMENT OPERATION**

Before updating firmware, make sure you are connected to the correct SCADAPack E RTU. Verify the CPU ID displayed in the SCADAPack E Configurator matches the CPU ID of the RTU that firmware is intended to be updated on.

**Failure to follow these instructions can result in death or serious injury.**

**⚠ WARNING****UNEXPECTED EQUIPMENT OPERATION**

Evaluate the operational state of the equipment monitored and controlled by the SCADAPack E RTU before performing a firmware update. Hazardous situations can occur if system state is not confirmed prior to performing a firmware update.

**Failure to follow these instructions can result in death or serious injury.**

In the case of SCADAPack 300E RTUs, it takes longer to update the firmware from a **.BIP** file than a **.BIZ** file. This is to establish update integrity in case of RTU power interruption during the update process.

RTU configurations are restored following an online firmware *update*.

Following the remote issuing of a “RESTART PATCH” command, the RTU stores the following information in the Boot Monitor Flash (non-volatile) memory:

- IEC 61131-3 (target 3 and target 5) kernel application files (if used)
- IEC 61131-3 Retained Variable values (For Target/Resource 1 & Target/Resource 2 if in use)
- RTU point database configuration including derived variable values
- RTU communication configuration parameters
- Profile Files
- NTP configuration file (ntp.conf)

The following information is NOT separately saved and restored following a remote firmware update, but should persist in the RTU Flash file system:

- Trend sample Files (SF & SAMP files)
- Other files in the RTU file system

The following information is NOT restored following a remote firmware update:

- RTU Diagnostic mode settings (e.g. SYSDIAG, DNPDIAG, PLCDIAG, TCPDIAG, etc.)
- ISaGRAF application internal program states
- ISaGRAF application I/O Lock status

### 7.3.3 Updating Firmware by Manual Commands

The Operating System firmware can be upgraded online by manual commands. A Master Station may also use this method.

This method can be carried out either locally or remotely. The compressed firmware image file needs to first be transferred into the file system of an operational SCADAPack E RTU. This file transfer can be done in one of 2 ways:

- FTP (File Transfer Protocol) – if IP connection to the RTU is available and FTP is enabled on the RTU.
- DNP File Transfer.

**NOTICE**

**UNEXPECTED EQUIPMENT OPERATION**

Legacy DNP3 file transfers using Group 70 Variation 1 objects are not communication-loss tolerant.

If file transfers are required in an environment that may experience communication loss, consider using a more tolerant transfer mechanism such as the new DNP3 file transfer (Group 70 Variation 2, 3, 4, 5, 6, 7 objects.)

**Failure to follow these instructions can result in equipment damage.**

A firmware update will save and restore the configuration of the RTU as part of the upgrade process. The ISaGRAF application state, ISaGRAF I/O lock states, and SCADAPack E RTU output states are not preserved during an upgrade.

**⚠ WARNING****UNEXPECTED EQUIPMENT OPERATION**

Before updating firmware, make sure you are connected to the correct SCADAPack E RTU.

**Failure to follow these instructions can result in death or serious injury.**

**⚠ WARNING****UNEXPECTED EQUIPMENT OPERATION**

Evaluate the operational state of the equipment monitored and controlled by the SCADAPack E RTU before performing a firmware update. Hazardous situations can occur if system state is not confirmed prior to performing a firmware update.

**Failure to follow these instructions can result in death or serious injury.**

**To Remotely Reprogram Operating System Firmware**

The following steps should be performed to remotely reprogram the RTU Operating System firmware:

1. Use FTP or SCADAPack E Configurator to transfer the compressed firmware image (.BIZ or .BIP) file to the RTU.
  - If you are using FTP, set the transfer mode to binary before transferring the file.
  - If you are using SCADAPack E Configurator DNP file transfer, select Transfer > Write File from the main menu.
2. Access the SCADAPack E RTU's command line facility to activate the Firmware re-programming process. Enter the following command:

```
restart patch filename.biz
```

or

```
restart patch filename.bip
```

The RTU's command line facility can be accessed in one of several ways (listed as follows):

- direct connection to CMD LINE serial port (or ISaGRAF port via Command Line Shell when IEC 61131-3 Target 3 is enabled. Command line shell is not available with Target 5.)
- Remote Command Line
- TELNET connection

OR

1. From SCADAPack E Configurator menu bar, select **Commands | Execute Command | Other ...**
2. Check DNP Address is set to RTU's DNP address
3. Enter **restart patch filename.biz** or **restart patch filename.bip** in the **Execution Line** field
4. Click on **OK** to send the restart request.

The RTU will then restart and the firmware re-programming process is managed by the RTU Boot Monitor.

The Boot Monitor will automatically restart the RTU operating system once the re-programming is successfully.

Programming the FLASH EEPROMs may take up to 3 mins during which time communications with the RTU will not be available.

Once the firmware patch is complete, re-establish communication with the RTU and use SCADAPack E Configurator to read the **General / Controller Status** page to confirm that the firmware version number reports the upgraded version number.

After a successful firmware update, the RTU configuration and ISaGRAF applications, etc., should be properly restored. These should be checked.

Once the Operating System firmware memory is erased, the contents of the Flash EEPROM is invalid until the re-programming process is complete. If an interruption occurs during the Operating System Flash re-programming process, the Boot Monitor should not be affected. However, an [Offline Firmware Update](#)<sup>[28]</sup> may then be required to load a valid operating system into the RTU. If re-programming is unsuccessful and the SCADAPack E RTU will not boot, consult the [Boot Monitor Diagnostics](#)<sup>[12]</sup>. If this does not restore the firmware, contact [Schneider Electric Technical Support](#)<sup>[6]</sup>.

## 7.4 Firmware Update System Status Codes

Unsuccessful firmware updates using compressed binary images may be reported via the System Status Code system point (system analog point 50020).

[Table 6.1](#) below lists status codes that may result from updating firmware.

**Table 6.1: Firmware Update Status Codes**

Status Code Value	Name	Description
1050	Remote I/O Main Firmware Mismatch	The main firmware version number of the relevant SCADAPack ES Remote I/O RTU is different to that of the Main Unit
1051	Remote I/O Boot Monitor Firmware Mismatch	The Boot Monitor firmware version number of the relevant SCADAPack ES Remote I/O Unit is different to that of the Main Unit
1052	Main Firmware Model Mismatch	An attempt was made to patch the main firmware with a compressed image (*.biz or *.bip) which had a different hardware ID to that required
1053	Boot Monitor Firmware Model Mismatch	An attempt was made to patch the Boot Monitor firmware which had a different hardware ID to that required.
1054	Main Firmware Patch Unsuccessful	This indicates that the Boot Monitor could not patch the main firmware with a compressed image (*.biz or *.bip). A possible cause for this status code is that the *.bip file was not generated using the correct "old" firmware binary image.
1055	Main OS Firmware Patch Incompatible	This indicates that the SCADAPack 350E or SCADAPack 357E RTU has an incompatible hardware version for the OS firmware patch used. <ul style="list-style-type: none"> <li>• For hardware versions 7.00 and later firmware version 7.85 and later is required.</li> <li>• For hardware versions 6.00 and earlier firmware version 7.84 and earlier is required.</li> </ul> Use the command line VER command to determine the hardware version.
3015	6000 Series I/O Firmware Update Incomplete	Reported when there is an unexpected issue during the firmware update on a 6000 series I/O expansion module.  For example, this code may be reported if the firmware binary image file was corrupted during the file transfer.

## 8 Updating rPAC or RTU Boot Monitor Firmware

The RTU Boot Monitor may be upgraded in one of the following ways:

- Using SCADAPack E Configurator Boot Monitor Update Wizard connected to the Boot Monitor Port for a local offline update. See [Offline SCADAPack E Configurator Boot Monitor Update Wizard](#)<sup>[33]</sup>. This method is not supported by SCADAPack 300E, SCADAPack 530E and SCADAPack 535E RTUs.
- Requesting the main Operating System Firmware to update the Boot Monitor (online local or remote update possible). See [Online Update of Boot Monitor Firmware](#)<sup>[37]</sup>.

The Boot Monitor firmware image includes a Hardware Identification field that indicates the target hardware for the respective Boot Monitor firmware image file. Each supported hardware platform requires its own Boot Monitor image for correct operation.

The supported hardware types are:

- SCADAPack 350E (with hardware version 7.00 or greater only Boot Monitors 2.30 and higher are supported).
- SCADAPack 357E (with hardware version 7.00 or greater only Boot Monitors 2.30 and higher are supported).
- SCADAPack 330E
- SCADAPack 333E (only Boot Monitors 2.31 and higher are supported).
- SCADAPack 334E
- SCADAPack 337E (only Boot Monitors 2.31 and higher are supported).
- SCADAPack 312E (only Boot Monitors 2.31 and higher are supported).
- SCADAPack 313E (only Boot Monitors 2.31 and higher are supported).
- SCADAPack 314E
- SCADAPack ES
- SCADAPack ER
- SCADAPack 530E
- SCADAPack 535E

Use the VER command from the command line to check the hardware version of your RTU.

The following table lists the hardware types and the Boot Monitor filename syntax (for the appropriate hardware).

Hardware Type	Boot Monitor Filename Syntax*
SCADAPack 350E SCADAPack 357E	mon_VVV_35xE.bin
SCADAPack 330E SCADAPack 333E SCADAPack 334E SCADAPack 337E	mon_VVV_33xE.bin
SCADAPack 312E SCADAPack 313E SCADAPack 314E	mon_VVV_31xE.bin
SCADAPack ES	mon_VVV_586e.bin
SCADAPack ER	mon_VVV_586m.bin
SCADAPack 530E SCADAPack 535E	mon_VVV_53xE.bin

\* where VVV represents the version number of the Boot Monitor, e.g. the filename of version 2.12 of the SCADAPack ES Boot Monitor is "mon\_212\_586e.bin".

The recommended method for updating the Boot Monitor Firmware is the SCADAPack E Configurator online method (see [Online SCADAPack E Configurator Boot Monitor Update Wizard](#)<sup>[38]</sup>). This method provides protection against inadvertent loading of the incorrect Boot Monitor Firmware image for the given hardware type. This protection is not available when using the "local" update methods for SCADAPack ES and SCADAPack ER RTUs.

## 8.1 Offline SCADAPack E Configurator Boot Monitor Update Wizard

### Offline Boot Monitor update is not available for SCADAPack 300E, SCADAPack 530E and SCADAPack 535E RTUs.

The following information applies to SCADAPack ES and SCADAPack ER RTUs.

The SCADAPack E Configurator Boot Monitor Update Wizard transfers a Boot Monitor Binary Image (.BIN file) to the RTU locally through the PC's serial port via the RTU's Boot Monitor port. See [Boot Monitor Port](#)<sup>11</sup> for more information.

#### WARNING

##### UNEXPECTED EQUIPMENT OPERATION

Before updating the boot monitor, make sure you are connected to the correct SCADAPack E RTU.

**Failure to follow these instructions can result in death or serious injury.**

#### WARNING

##### UNEXPECTED EQUIPMENT OPERATION

Evaluate the operational state of the equipment monitored and controlled by the SCADAPack E RTU before performing a boot monitor update.

Hazardous situations can occur if system state is not confirmed prior to performing a boot monitor update.

**Failure to follow these instructions can result in death or serious injury.**

### Using the Boot Monitor Update Wizard for Offline Updates

Start the Wizard through the SCADAPack E Configurator "Transfer" menu by selecting "Update Boot Monitor".

Select the *Local Serial Port* update method and follow the Wizard instructions, which will guide you through setting up the link to the RTU and starting the Boot Monitor update process.



**Figure 7.1: SCADAPack E Configurator Boot Monitor Update Wizard (Offline)**

For more information see the *SCADAPack E Configurator User Manual*.

## Local Boot Monitor Re-Programming

Local Boot Monitor firmware upgrade on the SCADAPack ES and SCADAPack ER RTUs uses special Hex Switch setting "F9".

If Boot Monitor update is inadvertently activated through the "F9" hex-switch settings, the Boot Monitor update mode will not affect the Flash memory unless user activates the SCADAPack E Configurator "Update Boot Monitor" Wizard and commences the erasing and re-programming sequence.

To recover from accidental activation of the Boot Monitor update mode, power off the RTU processor (check that the hex-switches not set in a special "Fx" mode - typically set them to "00"), power on the RTU, and it will restart normally.

Once the Boot Monitor Flash memory is erased, the contents of the Flash EEPROM is invalid until the re-programming process is complete. The RTU operating system firmware and configuration will not be affected.

### **NOTICE**

#### **UNEXPECTED EQUIPMENT OPERATION**

If an interruption occurs during the Boot Monitor Flash reprogramming process, **DO NOT** restart the RTU, or power it off. If you restart or power off the RTU, you will have to return it to Schneider Electric for reprogramming.

Start the reprogramming process again. If reprogramming is unsuccessful and the RTU does not boot, power off the RTU and contact [Schneider Electric Technical Support](#)<sup>[6]</sup>.

**Failure to follow these instructions can result in equipment malfunction.**

## 8.2 Online Update of Boot Monitor Firmware

See the following sections describing how to upgrade Boot Monitor firmware online:

- [Online SCADAPack E Configurator Boot Monitor Update Wizard](#)<sup>[38]</sup>
- [Updating Boot Monitor by Manual Commands](#)<sup>[39]</sup>

### 8.2.1 Online SCADAPack E Configurator Boot Monitor Update Wizard

The SCADAPack E RTU may have its Boot Monitor firmware upgraded online using the SCADAPack E Configurator Boot Monitor Update Wizard and selecting DNP3 Connection as the update method.

This transfers a complete binary file (.BIN file) to the RTU through a DNP3 connection. This connection may be local to the RTU, or remote across a communications link.

<b>⚠ WARNING</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b>
Before updating the boot monitor, make sure you are connected to the correct SCADAPack E RTU. Verify the CPU ID displayed in the SCADAPack E Configurator matches the CPU ID of the RTU that the boot monitor is intended to be updated on.
<b>Failure to follow these instructions can result in death or serious injury.</b>

<b>⚠ WARNING</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b>
Evaluate the operational state of the equipment monitored and controlled by the SCADAPack E RTU before performing a boot monitor update. Hazardous situations can occur if system state is not confirmed prior to performing a boot monitor update.
<b>Failure to follow these instructions can result in death or serious injury.</b>

### Using the Boot Monitor Update Wizard for Online Updates

An online firmware update will in most cases save and restore the configuration of the RTU as part of the upgrade process.

Start the Wizard through the SCADAPack E Configurator “Transfer” menu by selecting “Update Boot Monitor”.

Select the DNP3 Connection update method and follow the Wizard instructions, which will guide you through setting up the link to the RTU and starting the firmware update

<b>NOTICE</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b>
Reloading RTU Firmware interrupts the operation of the RTU during the Flash re-programming process, and resets the RTU configurations. Offline firmware updates clear the RTU configuration, including IEC 61131-3 application(s).
Before reloading the firmware, save a copy of the RTU configuration information, user-created applications, logs and other data to an external drive so it can be reloaded when then the firmware reloading is complete.
<b>Failure to follow these instructions can result in equipment damage.</b>



**Figure 7.2: SCADAPack E Configurator Boot Monitor Update Wizard**

For updating RTU Boot Monitor firmware online (i.e. via a local or remote DNP3 connection), select the *DNP3 Connection* option.

Then follow the wizard instructions.

On SCADAPack 300E, SCADAPack 530E and SCADAPack 535E RTUs, the USB Device (peripheral) port may be used. RTUs may use a DNP3 serial port or Ethernet interface for this connection.

- Establish connection with the RTU. These use the same dialogs as establishing SCADAPack E Configurator connection with RTUs. For more information see the SCADAPack E Configurator User Manual.
- Choose the Boot Monitor firmware **.BIN** image file when prompted.

### 8.2.2 Updating RTU or rPAC Boot Monitor Firmware Using Manual Commands

The Boot Monitor can be upgraded by manual commands if necessary. A Master Station may also use this method.

This method can be carried out either locally or remotely. The boot monitor image file needs to first be transferred into the file system of an operational SCADAPack E RTU. This file transfer can be done in one of 2 ways

- FTP (File Transfer Protocol) – if IP connection to the RTU is available and FTP is enabled on the RTU.
- DNP File Transfer.

**⚠ WARNING****UNEXPECTED EQUIPMENT OPERATION**

Before updating the boot monitor, make sure you are connected to the correct SCADAPack E RTU.

**Failure to follow these instructions can result in death or serious injury.**

**⚠ WARNING****UNEXPECTED EQUIPMENT OPERATION**

Evaluate the operational state of the equipment monitored and controlled by the SCADAPack E RTU before performing a boot monitor update. Hazardous situations can occur if system state is not confirmed prior to performing a boot monitor update.

**Failure to follow these instructions can result in death or serious injury.**

## To Remotely Reprogram Boot Monitor Firmware

The following steps should be performed to remotely reprogram the RTU Boot Monitor firmware:

1. Use FTP or SCADAPack E Configurator to transfer the Boot Monitor ".BIN" image file to the RTU.
  - If you are using FTP, set the transfer mode to binary before transferring the file. The size of this file is a multiple of 16k, and is 64k or greater.
  - If you are using SCADAPack E Configurator DNP file transfer, select **Transfer > Write File** from the main menu.
2. Access the SCADAPack E RTU's command line facility to activate the Boot Monitor re-programming process. Enter the following command:

```
restart bootmon filename.bin
```

The RTU's command line facility can be accessed in one of several ways (listed as follows):

- direct connection to CMD LINE serial port (or ISaGRAF port via Command Line Shell when IEC 61131-3 Target 3 is enabled. Command line shell is not available with Target 5.)
- Remote Command Line
- TELNET connection

OR

From SCADAPack E Configurator menu bar,

1. Select **Commands | Execute Command | Other ...**
2. Check DNP Address is set to RTU's DNP address
3. Enter **restart bootmon filename.bin** in the **Execution Line** field
4. Click on **OK** to start the re-programming.

The RTU operating system firmware re-programs the Boot Monitor on-line and then restarts the RTU.

Programming the Boot Monitor Flash EEPROM typically takes around 30 secs.

The status of the update will be indicated to the appropriate command line connection after this period.

The SCADAPack E RTU's Command Line "VER" command and the SCADAPack E Configurator General / Controller Status indication of the Boot Monitor firmware version, will indicate a new version number only after the RTU has been restarted.

## ***NOTICE***

### **UNEXPECTED EQUIPMENT OPERATION**

If an interruption occurs during the Boot Monitor Flash reprogramming process, **DO NOT** restart the RTU, or power it off. If you restart or power off the RTU, you will have to return it to Schneider Electric for reprogramming.

Start the reprogramming process again. If reprogramming is unsuccessful and the RTU does not boot, power off the RTU and contact [Schneider Electric Technical Support](#) <sup>6</sup>.

**Failure to follow these instructions can result in equipment malfunction.**

## 9 Updating I/O Operating System Firmware

This section describes how to update firmware on:

- [SCADAPack ES Remote I/O Units](#) <sup>[42]</sup>
- [SCADAPack ER I/O processors](#) <sup>[45]</sup>
- [Updating 6000 Series I/O Firmware](#) <sup>[47]</sup>

### 9.1 Updating SCADAPack ES Remote I/O Firmware

You can update the operating system and boot monitor firmware on SCADAPack ES Remote I/O Units:

- Automatically on every SCADAPack ES Remote I/O Unit when the firmware on the Main unit is updated.
- Manually, using the **restart patch** command on individual SCADAPack ES Remote I/O Units.

For details, see [Updating SCADAPack ES Remote I/O Firmware](#). <sup>[42]</sup>

You can also update the boot monitor firmware on SCADAPack ES Remote I/O Units using the **restart bootmon** command. For details, see [Updating SCADAPack ES Remote I/O Boot Monitor Firmware](#). <sup>[44]</sup>

#### 9.1.1 Updating SCADAPack ES Remote I/O Firmware

##### Automatic Remote I/O Firmware Update

The Boot Monitor firmware and Operating System firmware on SCADAPack ES Remote I/O Units attached to a SCADAPack ES, SCADAPack ER, SCADAPack 530E or SCADAPack 535E are updated automatically when a firmware update in the Main Unit is initiated. Remote updates are possible via both serial and Ethernet communications to ES Remote I/O Unit(s).

The attached Remote I/O upgrade needs to be of a compatible type for a successful upgrade of units. For example, a mix of ES Remote I/O Unit firmware versions will not successfully upgrade if a specific .BIP version upgrade file is used to upgrade the Main Unit. Similarly a Boot Monitor firmware upgrade to a mix of SCADAPack ES, SCADAPack ER, SCADAPack 530E and SCADAPack 535E models will not be successful.

A range of analog system points has been created in the Main Unit from 54600 to 54704 to display the current version of the Boot Monitor firmware and Operating System firmware for the 15 possible ES Remote I/O Units. These system points will be updated each time an ES Remote I/O Unit is re-configured by the Main Unit. See the Remote I/O Technical Reference Manual for details.

Updating the ES Remote I/O firmware is a transparent operation for the DNP Master station. The Main Unit is responsible for distributing and executing the new binary to attached ES Remote I/O Units. This operates as follows:

The DNP Master station or user downloads the new binary image to the Main Unit as normal. Upon a successful completion of the transfer, a DNP File Exec "**Restart Patch filename.biz**" command is issued to the Main Unit. When the Main Unit receives this command, it will perform some validation checks on the "filename.biz" file and will reply to the Master with a successful response code.

The Main Unit will then begin a DNP file transfer of the new binary to each online ES Remote I/O Unit. As each transfer is complete, the same DNP File Exec command string as was issued by the Master station will be repeated to each ES Remote I/O Unit. After the DNP File Exec command is issued to the last ES Remote I/O Unit, the Main Unit will commence an orderly shutdown and will then begin to reprogram its own Flash memory with the new binary image.

After the Main Unit restarts, it will re-configure the ES Remote I/O Units. Part of this process will be to collect the Boot Monitor and Operating System firmware versions so the user will be able to determine if

the update was successful.

A SCADAPack ES or SCADAPack ER Main Unit compares both sets of firmware version numbers on every SCADAPack ES Remote I/O Unit with those present on the Main Unit. A System Status code is generated should they differ. This allows an alert to be raised at the Master station if an ES Remote I/O firmware update is unsuccessful. However, if the Remote I/O Unit is a Serck 386 eNET model, the firmware version numbers will not raise a System Status code.

The System Status codes are as follows:

Remote IO Firmware Version Mismatch = 1050  
Remote IO Boot Monitor Version Mismatch = 1051

A SCADAPack 530E or SCADAPack 535E Main Unit will not compare the firmware versions of any SCADAPack ES Remote I/O Units with its own and will not raise the above System Status codes.

The firmware update of the Main Unit will proceed regardless of the successful or unsuccessful ES Remote I/O update(s).

If an upgrade to a Main Unit was attempted with firmware of the incorrect model type, a system status code will be generated. The System Status code will be as follows.

Main unit Firmware RTU Model Mismatch = 1052

If the file validity check on the original File Exec command to the Main Unit is unsuccessful, the Main Unit will respond to the command with the File Object Status field set to 1 [DOESN'T EXIST].

## Individual ES Remote I/O Unit Firmware Update

It is also possible to update firmware on a selected ES Remote I/O Unit or on a Main Unit.

The process is the same as above, but the "unit number" is added as an additional parameter to the DNP File Exec command.

The syntax is as follows,

```
restart patch firmware.biz [unit_no.]
```

Where "unit\_no" is optional and has possible values of 0, 1, 2, 3... 15 or "r"

**0** means the Main Unit

**1 .. 15**

Argument "r" updates remotes but does NOT upgrade the Main Unit.

The "unit no." parameter is not supported by SCADAPack 300E RTUs because they do not support SCADAPack ES Remote I/O.

### 9.1.2 Updating SCADAPack ES Remote I/O Boot Monitor Firmware

If there are any connected SCADAPack ES Remote I/O Units, the SCADAPack E Configurator wizard and “**restart bootmon**” commands will also update these connected Remote I/O Units providing they are of the same RTU type.

The “restart bootmon” command also supports an optional parameter as follows:

```
Restart bootmon filename.bin unit_number
```

where “*unit\_number*” is optional and is one of 0, 1, 2, 3... 15 or “r”.

**0** means update the boot monitor on the Main Unit **only**.

**1 .. 15** means update a single Remote I/O Unit of the specified address

**r** means patch Remote I/O Units but leave the Main Unit unpatched.

If the boot monitor patch to the Main Unit was attempted with a boot monitor of the incorrect model type a system status code will be generated. The system status code will be as follows.

```
Main unit Boot Monitor RTU Model Mismatch = 1053
```

Any updated Remote I/O Units will restart following a Boot Monitor firmware update.

## 9.2 Updating SCADAPack ER I/O Processor Firmware

The SCADAPack ER I/O Processor firmware may be re-programmed by requesting the main Operating System Firmware to update the I/O Processor Firmware. Only the SCADAPack ER hardware type is supported.

The following table lists the hardware types and the SCADAPack ER I/O Processor Firmware filename syntax.

Hardware Type	Boot Monitor Filename Syntax
SCADAPack ER	mon_XYZ_586m.bin*

\* where XYZ represents the version number of the I/O Processor Firmware, e.g. the filename of version 1.01 of the SCADAPack ER I/O Processor Firmware is "mon\_101\_586m.bin".

Reloading SCADAPack ER I/O Processor firmware interrupts the operation of the RTU's outputs during the FLASH re-programming process. The FLASH upgrade runs at high priority and so the ISaGRAF scan is stopped from executing during this process. Physical input event data isn't affected and will be processed when the FLASH upgrade is complete.

### **NOTICE**

#### **UNEXPECTED EQUIPMENT OPERATION**

If an interruption occurs during the Flash reprogramming process, **DO NOT** restart the RTU, or power it off. If you restart or power off the RTU, you will have to return it to Schneider Electric for reprogramming.

Start the reprogramming process again. If reprogramming is unsuccessful and the RTU does not boot, power off the RTU and contact [Schneider Electric Technical Support](#) <sup>6</sup>.

**Failure to follow these instructions can result in equipment malfunction.**

The I/O Processor Firmware on the SCADAPack ER can only be reprogrammed by issuing manual commands.

- [Updating I/O Processor Firmware Using Manual Commands](#) <sup>46</sup>

### 9.2.1 Updating I/O Processor Firmware Using Manual Commands

This method of updating firmware may be carried out locally or remotely.

The I/O Processor image file needs to first be transferred into the file system of the SCADAPack ER RTU. This file transfer can be done in one of 2 ways:

- FTP (File Transfer Protocol) – if IP connection to the RTU is available and FTP is enabled on the RTU.
- DNP File Transfer.

The following steps should be performed to re-program the SCADAPack ER I/O Processor firmware:

1. Use FTP or SCADAPack E Configurator to transfer the SCADAPack ER I/O Processor “.BIN” image file to the SCADAPack ER RTU’s file system.
  - If you are using FTP, set the transfer mode to binary before transferring the file.
  - If you are using the SCADAPack E Configurator DNP file transfer, select **Transfer > Write File** from the main menu.
2. Send the command

```
restart iofirm mon_XYZ_586m.bin
```

This can be done through the following methods:

- **Locally.** Enter the above RESTART command through the RTU’s command line.
- **Remotely.** Enter the above RESTART command through either a remote command line connection, or through a FILE EXEC command.

The SCADAPack ER operating system firmware re-programs the I/O Processor online and then restarts the I/O Processor, thereby activating the new I/O Processor image.

Programming the I/O Processor FLASH EEPROM typically takes up to 10 seconds to complete. The status of the update will be indicated to the appropriate command line connection after this period.

## NOTICE

### UNEXPECTED EQUIPMENT OPERATION

Once the SCADAPack ER I/O Processor Flash memory is erased, the content of the Flash EEPROM is invalid until the re-programming process is complete.

If an interruption occurs during the I/O Processor Flash reprogramming process, **DO NOT** restart the RTU, or power it off. If you restart or power off the RTU, you will have to return it to Schneider Electric for reprogramming.

Start the reprogramming process again. If reprogramming is unsuccessful and the RTU does not boot, power off the RTU and remove the I/O Processor Flash memory chip. A replacement chip should be installed, or the I/O Processor chip re-programmed using external programming equipment. Contact [Schneider Electric Technical Support](#) <sup>6</sup>.

**Failure to follow these instructions can result in equipment malfunction.**

### 9.3 Updating 6000 Series I/O Firmware

The operating system firmware on 6000 series I/O modules can be updated locally or remotely, as described below.

I/O Module	Firmware Filename
6601	fw6601.bin

#### WARNING

##### LOSS OF CONTROL

During a firmware update, the 6000 series I/O module does not monitor or control any of the devices to which it is connected. Before updating firmware:

- Confirm that you are connected to the correct rPAC.
- Evaluate the operational state of the devices that are monitored and controlled by the I/O module.

**Failure to follow these instructions can result in death or serious injury.**

#### WARNING

##### UNINTENDED EQUIPMENT OPERATION

Do not remove power from the rPAC during the firmware update.

Do not disconnect the 6000 series I/O module from the rPAC during the firmware update.

If power is interrupted for any reason during the firmware update, contact [Technical Support](#)<sup>64</sup>.

**Failure to follow these instructions can result in death or serious injury.**

#### NOTICE

##### INCOMPATIBLE FIRMWARE VERSIONS

Before installing a firmware update, check the Release Notes for the firmware update to determine the most suitable firmware version for the rPAC firmware version and the functionality you are using.

**Failure to follow these instructions can result in equipment damage.**

### To Update 6000 Series I/O Firmware

1. Use FTP or SCADAPack E Configurator to transfer the file **fw6601.bin** to the rPAC file system.

- If you are using FTP, set the transfer mode to binary before transferring the file.
  - If you are using the SCADAPack E Configurator DNP file transfer capability, select **Transfer > Write File** from the main menu.
2. Access the local or remote command line tool and type the following command:
- ```
restart iofirm fw6601.bin board_number
```
- where *board\_number* is the number of the I/O expansion module.
- For 6601 I/O expansion modules, the board number is a number from 0 to 15.
- Example: `restart iofirm fw6601.bin 1`

## **WARNING**

### **UNINTENDED EQUIPMENT OPERATION**

If the firmware update was unsuccessful, the I/O module will remain in a state where it does not monitor or control any of the devices to which it is connected.

Carefully review the message indicating whether the firmware update was successful or unsuccessful. Unsuccessful firmware updates are also reported through analog system point 50020.

**Failure to follow these instructions can result in death or serious injury.**

3. After the device has restarted, select **Read from Device** in SCADAPack E Configurator, then go to the Controller Status property page and verify that the **6601 I/O Ver.** field was correctly updated.

## 10 Updating 6000 Series I/O Boot Monitor Firmware

The boot monitor firmware on 6000 series I/O modules can be updated locally or remotely, as described below.

| I/O Module | Boot Monitor Filename |
|------------|-----------------------|
| 6601       | bl6601.bin            |

### WARNING

#### LOSS OF CONTROL

During a boot monitor update, the 6000 series I/O module does not monitor or control any of the devices to which it is connected. Before updating the boot monitor on the I/O module:

- Confirm that you are connected to the correct rPAC.
- Evaluate the operational state of the devices that are monitored and controlled by the I/O module.

**Failure to follow these instructions can result in death or serious injury.**

### WARNING

#### UNINTENDED EQUIPMENT OPERATION

Do not remove power from the rPAC during the boot monitor update.

Do not disconnect the 6000 series I/O module from the rPAC during the boot monitor update.

If power is interrupted for any reason during the boot monitor update, contact [Technical Support](#) .

**Failure to follow these instructions can result in death or serious injury.**

### NOTICE

#### INCOMPATIBLE FIRMWARE VERSIONS

Before installing a boot monitor update, check the Release Notes for the boot monitor update to determine the most suitable I/O module boot monitor version for the rPAC firmware version and the functionality you are using.

**Failure to follow these instructions can result in equipment damage.**

## To Update 6000 Series I/O Boot Monitor Firmware

1. Use FTP or SCADAPack E Configurator to transfer the file **bl6601.bin** to the rPAC file system.
  - If you are using FTP, set the transfer mode to binary before transferring the file.
  - If you are using the SCADAPack E Configurator DNP file transfer capability, select **Transfer > Write File** from the main menu.
2. Access the local or remote command line tool and type the following command:

```
restart iofirm bl6601.bin board_number
```

where *board\_number* is the number of the I/O expansion module.

For 6601 I/O expansion modules, the board number is a number from 0 to 15.

Example: `restart iofirm bl6601.bin 1`

### **WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

If the boot monitor update was unsuccessful, the I/O module will remain in a state where it does not monitor or control any of the devices to which it is connected.

Carefully review the message indicating whether the boot monitor update was successful or unsuccessful. Unsuccessful boot monitor updates are also reported through analog system point 50020.

**Failure to follow these instructions can result in death or serious injury.**

## 11 Hardware Specific Features

### Boot Monitor Firmware

Each type of SCADAPack E RTU requires a specific Boot Monitor firmware.

The required version will be indicated in the binary filename.

*mon\_VVV\_3xxE.bin* indicates that this is the Boot Monitor for one of the SCADAPack 300E RTUs.

*mon\_VVV\_586e.bin* indicates that this is the Boot Monitor for the SCADAPack ES.

*mon\_VVV\_586m.bin* indicates that this is the Boot Monitor for the SCADAPack ER.

*mon\_VVV\_53xE.bin* indicates that this is the Boot Monitor for the SCADAPack 530E or SCADAPack 535E.

See section [Updating Boot Monitor Firmware](#)<sup>[33]</sup> for more information on updating the Boot Monitor.

### Operating System Hardware Identification

The compressed binary image (main OS firmware biz file) is identified internally for the target hardware, i.e. SCADAPack 300E, SCADAPack ES, SCADAPack ER, SCADAPack 530E or SCADAPack 535E.

The Boot Monitor checks this hardware type before overwriting the flash memory, and if the hardware type does not match, the firmware is NOT applied.

If the incorrect firmware was applied using a “restart patch” command, the command would be unsuccessful, presenting an appropriate diagnostic to the caller, or an unsuccessful status response if issued via a DNP file exec command.

The operating system firmware includes a signature for the hardware type but only when the firmware is in compressed binary format, i. e. **.biz** file. Therefore it is recommended that firmware updates are issued using the compressed binary (**.biz** file.)

## 11.1 SCADAPack ES & SCADAPack ER Dynamic RAM Test

The Bootloader Monitor for the SCADAPack ES and SCADAPack ER RTUs has the ability to run self-diagnosis test on the Dynamic RAM (SDRAM).

The SDRAM test will not affect the RTU's loaded configurations or ISaGRAF applications, but the main Operating System will not be booted while the RTU is in "Memory Test" mode.

### To perform a SDRAM memory test for SCADAPack ES and SCADAPack ER :

- Change the RTU's Hex "Service Mode" switches to 'F8' and either hardware reset or power-up the RTU.
- The memory tester outputs serial diagnostics out Port 4 at 57600 bps, but it is optional to view these diagnostics.
- Diagnostic output will be similar to below:
  - >Flash Monitor Loaded - Version 2.15
  - Memory Tester loaded
  - Test start address: 0x80000
  - Passed data bus test
  - Address bus test passed
  - Memory increment/decrement test passed
  - Memory tests complete

When the RTU powers up, the Red "Run" LED should flash to indicate the test is running. After about 1 to 2 minutes, one of the other LED's should light up constantly. If a Red LED lights, there was a memory fault detected. The diagnostic output should provide further information. The "detected memory fault" indication LED on the SCADAPack ER is labeled as "ERR" or "UTIL" on the front panel.

If the Yellow LED lights, then the tester detected 64 MB of SDRAM and it tested ok. If the RTU under test actually had 128 MB SDRAM loaded, then this would indicate a detected memory fault.

If the Green LED lights, then the tester found 128 MB of SDRAM, which tested ok.

- Once one of the LED's is on steady, the test is completed. Change the Hex switches back to '00' and power cycle the RTU to end the memory test mode.

## Schneider Electric

415 Legget Drive, Suite 101, Kanata, Ontario K2K 3R1 Canada

Direct Worldwide: +1 (613) 591-1943

Fax: +1 (613) 591-1022

Toll Free within North America: 1 (888) 267-2232

[www.schneider-electric.com](http://www.schneider-electric.com)

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