

Firmware / FPGA Update via the Ethernet interface of the EN100 module

Installation and activation

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1 Important Note

This document describes the firmware update (FW) of the module firmware of the EN100 Ethernet module over its Ethernet interface. The FW / FPGA update process over the serial front interface remains unchanged and is not affected by this document.

2 System requirements for firmware / FPGA update over the Ethernet interface

- EN100 firmware versions newer or equal to 4.08. FW update of versions lower than V4.08 will be supported the over front interface (serial or USB) by **FWUpdate** only. For special support please contact Customer Care. The serial loaders for FW 4.08 can be downloaded from the Internet for each device.
- Internet Explorer version 6 or newer has to be installed on your notebook or desktop PC for updating the firmware.
- Optionally Netview could be installed on your notebook. With the substation configuration file (SCD-file) of the DIGSI IEC 61850 project you are able to read out the network configuration and to check afterwards the update of the whole configuration. Otherwise the configuration must be checked for each individual device over the device display or over the module homepage of the device.
See Netview manual for using Netview:
Program and manual download: http://siemens.siprotec.de/download_neu/html_soft/soft_Netview_m.htm
- A notebook / PC with Ethernet interface. After PRP is installed on the EN100 module a PC with a PRP – network card is required or the PC must be connected to the PRP – network by use of an external Redbox which converts non-PRP-telegrams of the PC to PRP-telegrams used in the PRP-network from SIPROTEC 4 devices and other PRP – network participants (e.g. SICAM PAS).

3 Contents of the Consignment / Installation

- This document is an alternative method of the serial loader via **FWUpdate**.
 - Pck - files – firmware/FPGA files for EN100 modules which can be used for all SIPROTEC 4 devices independent of SIPROTEC ordering code. (Available at the SIPROTEC download area)
http://siemens.siprotec.com/download_neu/index_d.htm English
http://siemens.siprotec.de/download_neu/index_d.htm German
- Attention:** There are two different files for FW-update and FPGA-update over the Ethernet interface available.
- The first one is for device independent upload via EN100 homepage (Example: **IEC61850_81_04.10.00.pck**). The second one is for the update of the FPGA – chip on the EN100 module (Example: **EN100_FPGA_555.pck**). Both files are required to update the module with PRP – functionality.
 - A firmware reboot and activation for the module firmware may be possible over Web Monitor on EN100 module homepage. Please verify with the DIGSI 4 setting, that Web monitor have read and write access (Required option is **Full access**) and the Module homepage must be ON. Required settings are shown in fig. 3-3. Activating the FPGA – update requires to switch the device OFF for min. 20 seconds. After the restart of the device the FPGA – update will be activated.

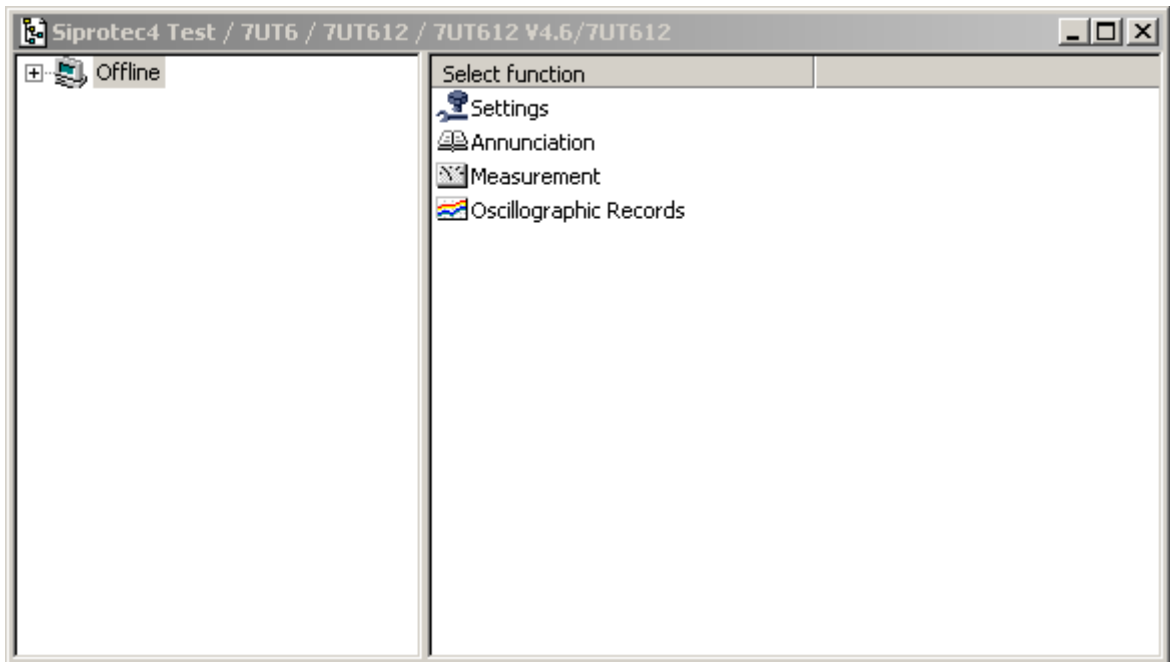


Figure 3-1 DIGSI device window -> Select settings

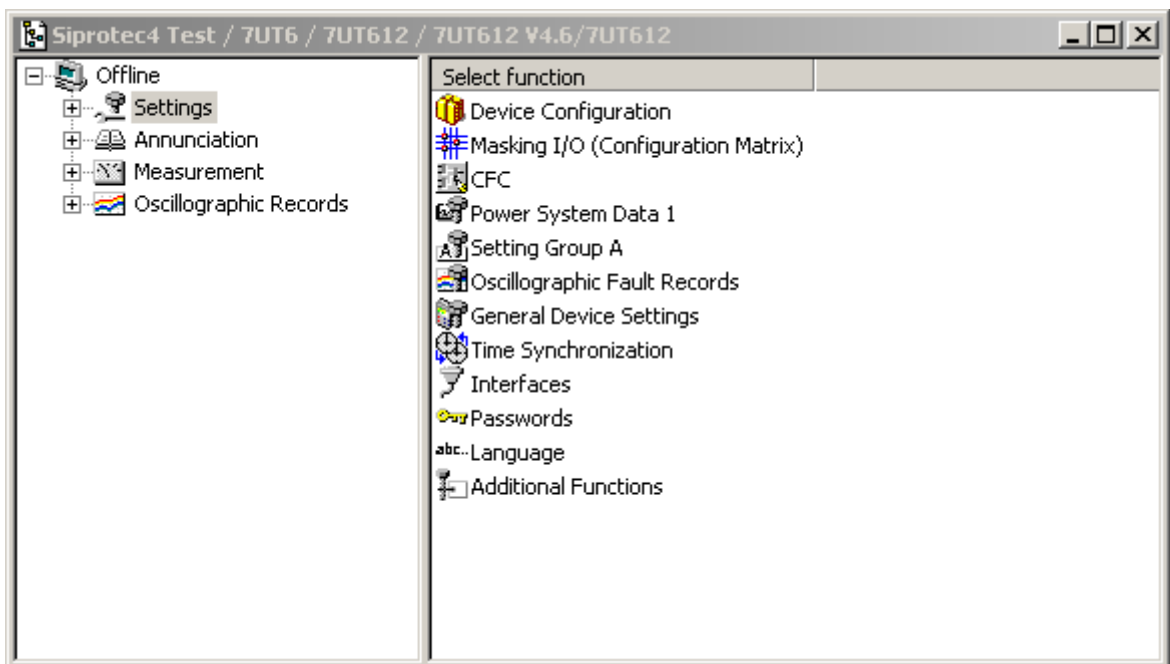


Figure 3-2 DIGSI device settings -> Select Interfaces

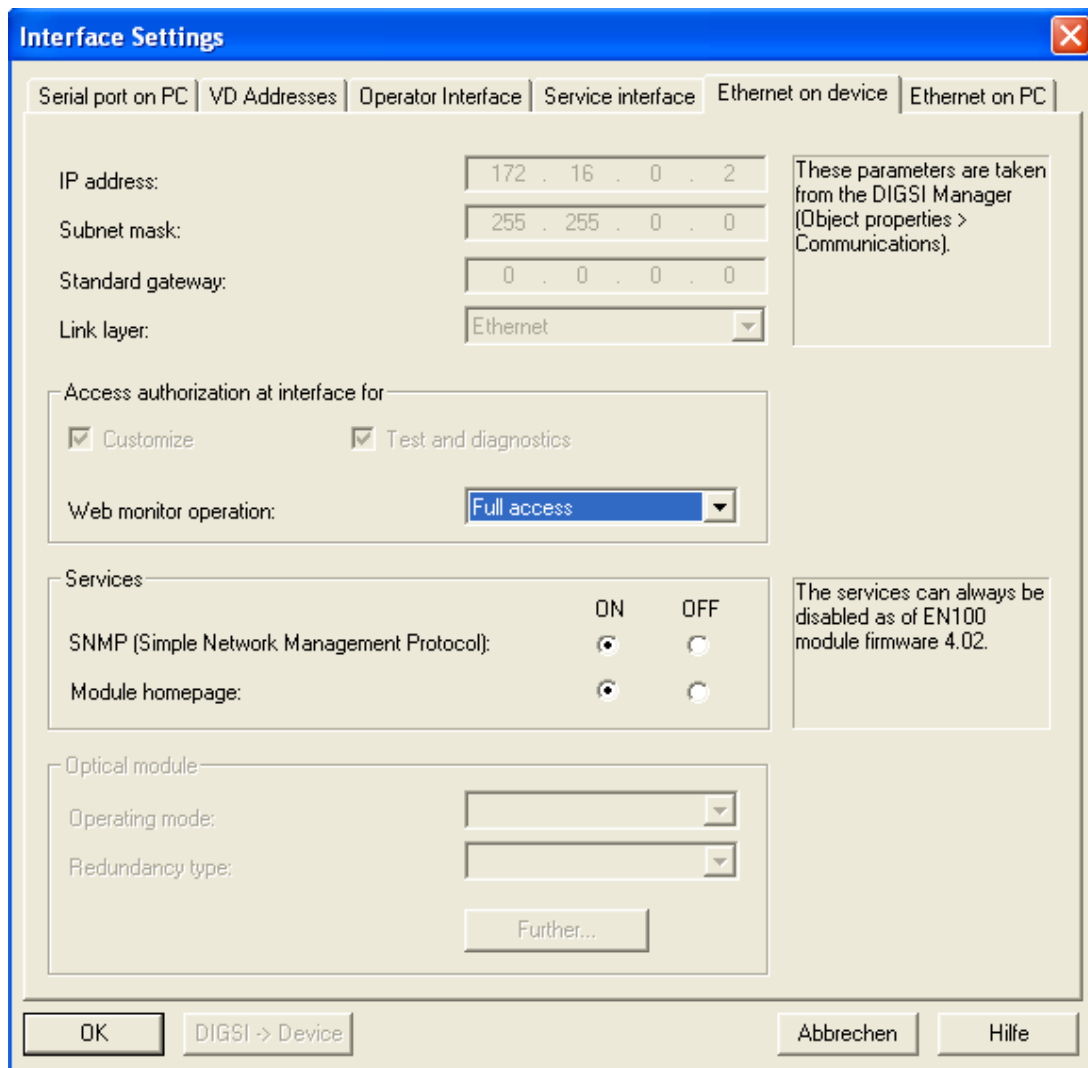


Figure 3-3 DIGSI device interface settings necessary for the firmware update over the Ethernet interface

For more information please see:

http://siemens.siprotec.de/download_neu/devices/1_General/System_Manual/SYSTEM_MANUAL_B3_SIP_ROT4_DIGSI4_EN.pdf

4 Installation and activation of the EN100 firmware

4.1 General Procedure

Install the recommended Internet Explorer browser and optionally Netview on your Service PC. Connect the service PC with one of the Ethernet switches used in the PRP - network. Switch OFF all switches in the B – network branch to make the update via the A – network branch. Use the SCD file of the installed IEC 61850 project to start Netview in order to see the connected SIPROTEC devices. Find all update capable devices. Make the update for every device via the Ethernet network over the A – network branch.

If **one** EN100 module in the device is **updated with a new module firmware** (chapter 4.2.2.1), you have to **activate** (4.2.2.2) the firmware. The activation procedure for the module firmware depends on the device firmware version (check with chapter 5.1).

If the EN100 module is updated with a new FPGA image (required for PRP) you have to switch OFF the power supply for at least 20 seconds. The firmware will be activated if you switch the device OFF and ON, which is anyhow required for activation of the FPGA – update for PRP.

4.2 Firmware / FPGA update

4.2.1 Preconditions

1. Connect the service PC to an electrical port of the switch in the A – network branch. All switches in the B – network branch must be switched OFF, so only Port 1 (optical connection with LC – fiber optical cable) of the Ethernet module is connected to active switch ports of A – network branch.

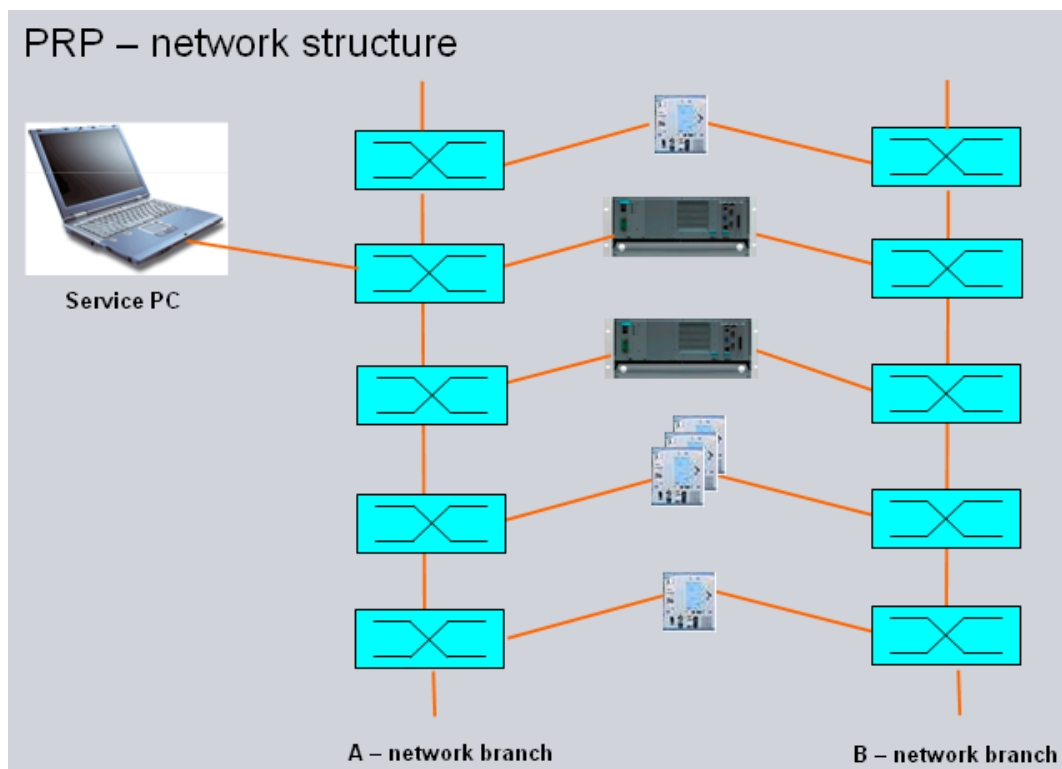


Figure 4-1 Configuration example for a PRP – network. Connection of a Service PC to A-network branch.

- The module firmware version for upload of module firmware or FPGA image via Ethernet is V04.08 or higher. The file format has to be a PCK file (name extension **.pck**).
- A downgrade of a version V04.08 or newer to a version <V04.08 can be done by the firmware update via front port only (**Setup_<Device-type>_IEC61850_81_<Version>.EXE**). Once the FPGA update is ready the module can not be downgraded to operation without PRP.

4.2.2 Firmware update

4.2.2.1 Upload and flashing of the module firmware

- Connect all devices with the EN100 module via Ethernet (Fig. 4-1)
- Store the file **IEC61850_81_xx.yy.pck** e.g. IEC61850_81_04.10.00.pck (includes the new EN100 firmware) in a local folder on your PC/notebook.
- Give your Service PC a free IP - address in the sub network where the devices are installed. Please be sure that no IP - address already used by devices or other components in this network will be used by your Service PC.
If you update the module firmware of a single device the IP address don't need to be set before. The EN100 default IP address is 192.168.0.55.
- Connect the Notebook / PC with one of the Ethernet switches used in the system.
- Start **Netview** to browse through all the connected devices of the SCD file.
Select the device you want to update with a mouse single click on the IED **hyperlink**

Nr.	IED Name	IP address	Subnet mask	Gateway	MAC address	Description	UpTime	Mode	Type	Ch1	Ch2	Active	NTP Master
1	RUG_SW1	172.16.1.1	255.255.0.0	0.0.0.0	Unknown								
2	IED5364k	172.16.2.1	255.255.0.0	0.0.0.0	00-09-8E-FF-A8-CD	SIPROTEC4 EN100_0 V04.02.02_01	145h 13m 8s	switch	rstp	Up	Up	Ch1	172.16.1.1
3	IED5380	172.16.2.2	255.255.0.0	0.0.0.0	00-09-8E-FF-A8-CF	SIPROTEC4 EN100_0 V04.02.02_01	145h 13m 9s	switch	rstp	Up	Up	Ch1	172.16.1.1
4	IED75K80	172.16.2.3	255.255.0.0	0.0.0.0	00-0F-BB-23-1E-17	SIPROTEC4 EN100_0 V04.02.02_01	145h 13m 13s	switch	rstp	Up	Up	Ch1	172.16.1.1
5	IED5364g	172.16.3.1	255.255.0.0	0.0.0.0	08-00-06-86-50-D2	SIPROTEC4 EN100_0 V04.03.01_01	145h 13m 10s	-	-	Up	Down	Ch1	172.16.1.1
6	Netview	172.16.4.1	255.255.0.0	0.0.0.0	Unknown								

Green: device answers to a ping within the expected reply time
 Yellow: device answers to a ping not within the expected reply time
 Red: no reply to a ping

Figure 4-2 - Netview in operation. Overview of all SIPROTEC 4 devices in the network

Note:

Within the Netview generated webpage you can see additionally in the **Description section** the installed firmware version of the devices.

Alternatively you can also connect directly to the module homepage of a device by using the IP - address of the device (<http://<IP-address>/home>). In this case Netview is not required and the update is done direct over the module homepage.

Change the displayed link in the opened new browser window from **/home** to **/upload** and press Enter → the upload page appears:

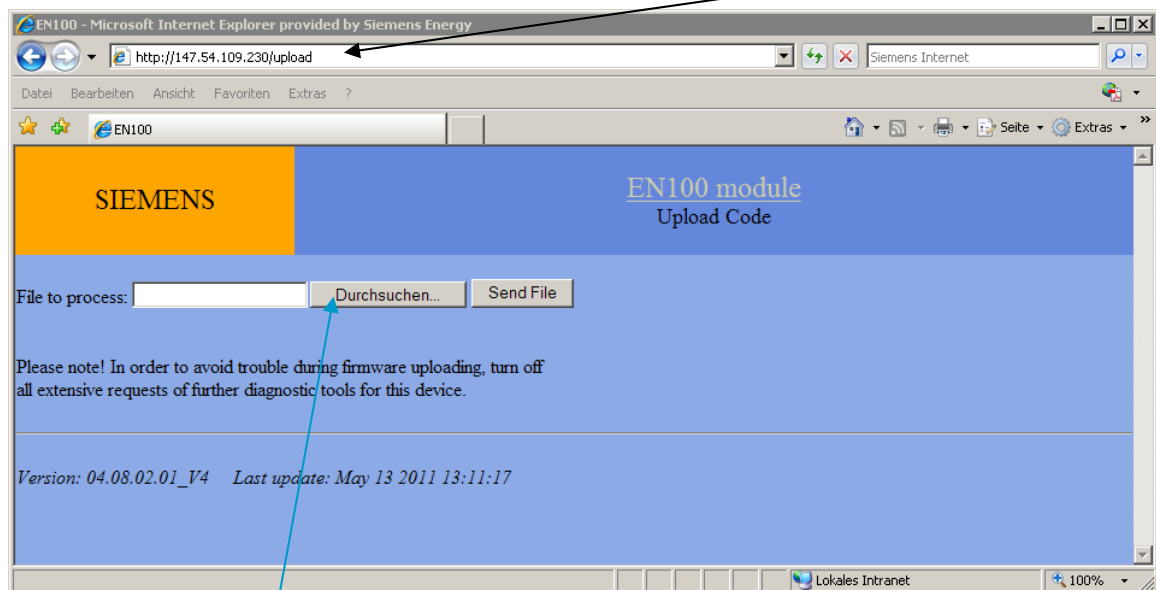


Figure 4-3 - Web site for file uploading

6. Press the button "Durchsuchen..." or "Browse..." and choose the file **IEC61850_81_04.xx.yy.pck** stored on your notebook / PC (in step 2).

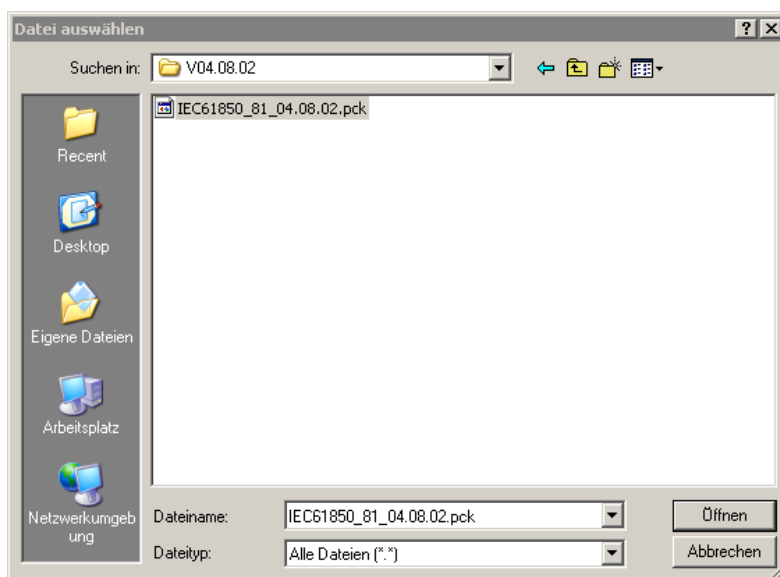


Figure 4-4 - Choosing the file for uploading the module firmware (Note: Shown for version 4.08 here)

Warning! Please ensure you have selected the right file, downloaded from the SIPROTEC download area (http://siemens.siprotec.de/download_neu/index_d.htm) or received from Customer Care. A wrong file uploaded to the module will be rejected by EN100 firmware, and the connection may be reset. Please see system log for more information if the upload fails for any reason.

7. Press the button „**Send File**“ to upload the firmware file to the EN100 module. After successful upload of the firmware the update process shows automatically the page “**firmware update status**” and the flashing of the uploaded code into the FLASH is started automatically.

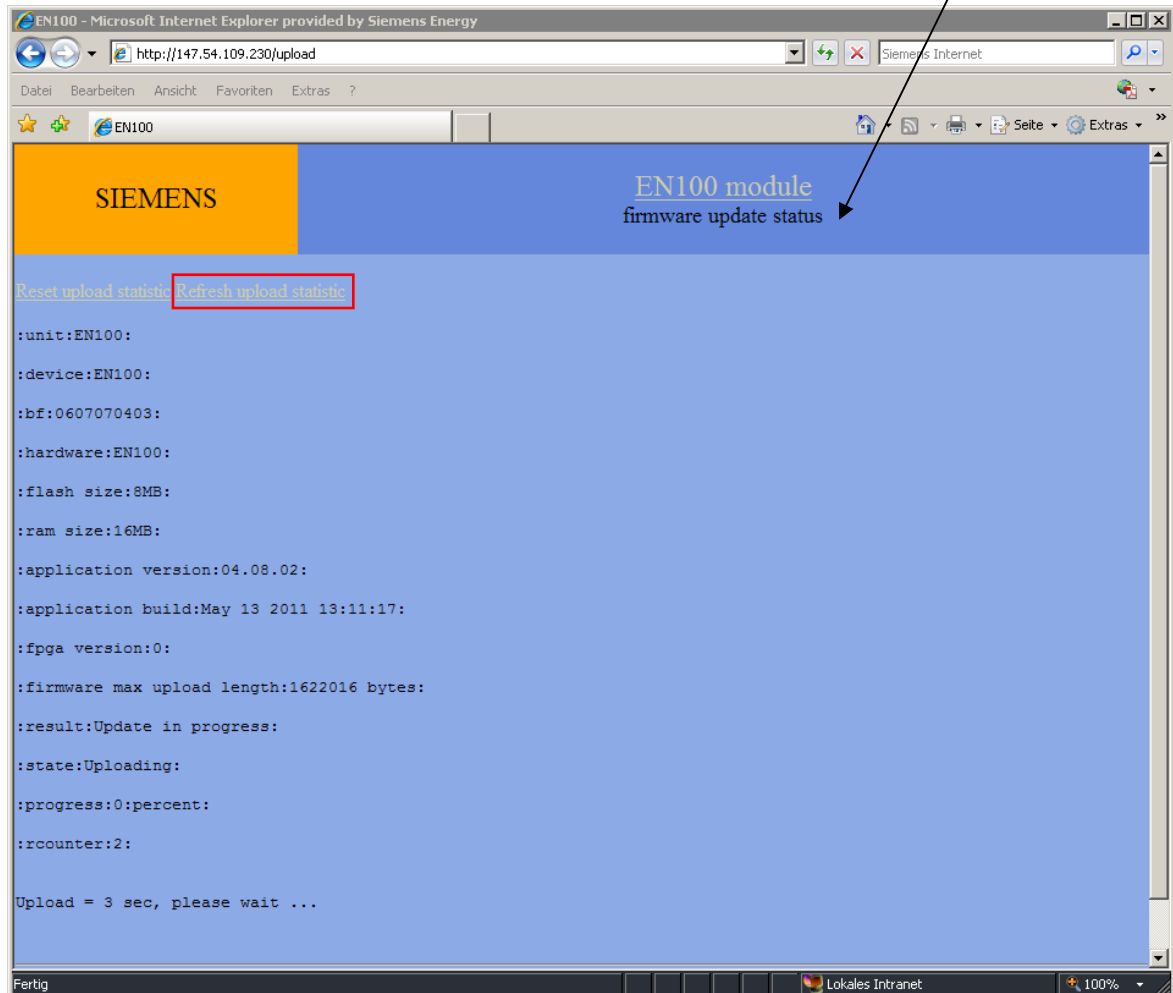


Figure 4-5 - Web site for firmware update status

The average duration of the upload time is depending on the network connection speed. Within a 100 MBit network and low processor load the upload time is less than 5s. The Service PC should be in the same network as the devices. The upload speed could be quite low when you control the upload from remote via a telecommunication network (not recommended). To avoid problems the FW checks the time between two firmware data telegrams. If this time exceeds 5 s the upload process will be aborted.

8. By pressing of the “**Refresh upload statistics**” link you can observe the flash progress.

The flashing time is depending on the processor load. The supervision time for the flashing is 2 minutes. After this time a warning is indicated but the flashing will be continued.

Attention! The power supply of the device **shall not be switched off during upload and flashing**.

If the reboot link “Now restart EN100 and wait 60 seconds” appears you may verify whether an upload was successful with the system log site (<http://<ip-address>/printf>).

```
:firmware max upload length:1622016 bytes:
:result:Update in progress:
:state:Writing flash:
:progress:30:percent:
:rcounter:2:
Flash in progress = 30 percent, please wait ...

Version: 04.08.02.01_V4 Last update: May 13 2011 13:11:17
```

Figure 4-6 - Web site for firmware update status - flashing

9. You need to press the **“Refresh upload statistics”** Button to know if the flashing is finished. After successful flashing the **activation** link **“Now restart EN100 and wait 60 seconds...”** is visible in the bottom of the page. For further actions please read chapter 4.3. For firmware activation please see chapter 4.2.2.2.

```
:progress:100:percent:
:rcounter:3:
Upload successful 3 + 17 sec 1510828 bytes
Note! A new FPGA update needs a power off of at least 15 seconds for activation.
For application update activation a restart of EN100 is sufficient only in the most cases.
For more information please refer the Device-FW compatibility list in the firmware / FPGA update description.
Now restart EN100 and wait 60 seconds...

Version: 04.08.03.03_V4 Last update: Jun 28 2011 15:05:01
```

Figure 4-7 - Web site for firmware update status – flashed, waiting for activation

NOTE: The flashing will be finished in every case independent if the flashing supervision time exceeds. So the module firmware will be valid after flashing. Caused by the exceeded flashing time there are error messages in the system log (refer chapter 5.2).

NOTE: It is always possible to repeat uploading files before resetting and activation firmware.

4.2.2.2 Firmware activation

In general the module firmware can be activated by reset and restart of the EN100 – module.

Note: Depending on the device firmware there are two different ways for activation required (please refer the table in chapter 5.1).

- After module FW upload and flashing the device has to be reset by power off or device restart.
Advantage: This procedure is possible for all device firmware versions (no need to care about). This procedure succeeds always. If a disabled protection for activation of the EN100-FW can be accepted, this type of reset is the preferred method in the commissioning process.
Disadvantage: All device functions (e.g. protection functions) are disabled during device reset.
- The activation button at the module homepage can be used. In this case just the EN100 restarts.
Advantage: The protection is available during module firmware activation.
Disadvantage: Not for all device firmware versions applicable.
Attention: The correct assignment of the process data objects has to be checked after module firmware activation.

Background of the different required activation methods is the information synchronization between the device firmware and the module firmware. With the table in chapter 5.1 you can check which devices includes the necessary synchronization mechanisms and which one does not.

In general it is recommended always to activate the module firmware via device reset. So problems regarding process data assignment are avoided from beginning on.

The Table in chapter 5.1 lists all software reset capable devices.

4.2.2.2.1 Activation via devices reset

1. Restart the device to activate the uploaded EN100 firmware.

Please note that the protection is disabled during the “Device Reset”. A password is required for this operation.

This can be done in 3 different ways:

- a) via **power off**
 - b) via **the front display menu.**
 - c) via **DIGSI 4**
- a. Remove the power supply of the device via power off for about 20 seconds.

b. Front display

Change by clicking on the keys “Menu”, then “5” and “1” on the device it will shown this menu

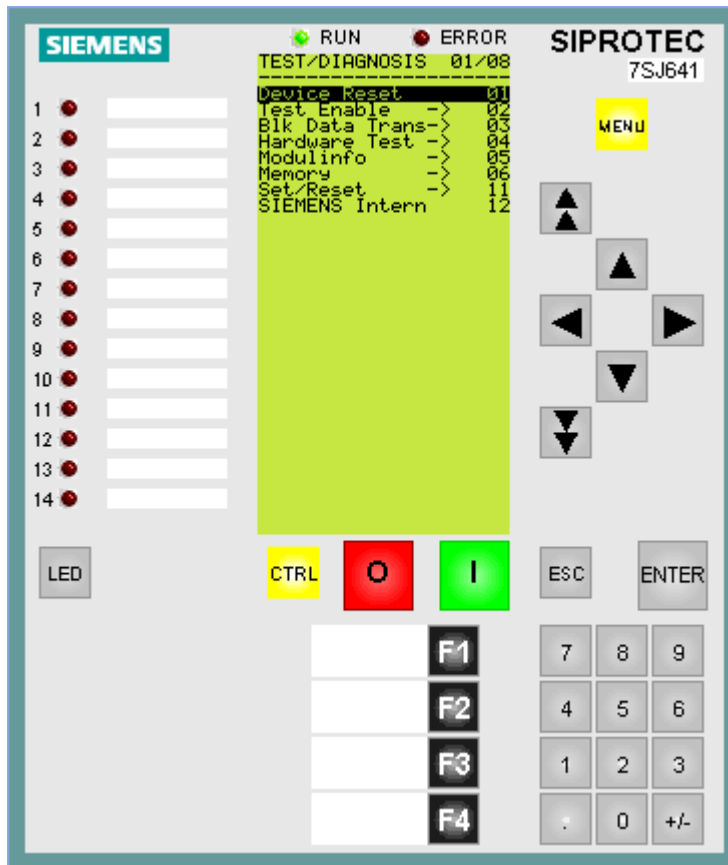


Figure 4-8 - Activation over Device menu

c. Via the use of DIGSI 4 for the hardware reset. This requires an Ethernet connection of DIGSI 4 with the device. Open the device with DIGSI online via Ethernet. Click on “Restart” in the menu “Device”.

Note: A device restart will delete the content of all buffers. Please save the content before with DIGSI 4 if this data are required for further analysis.

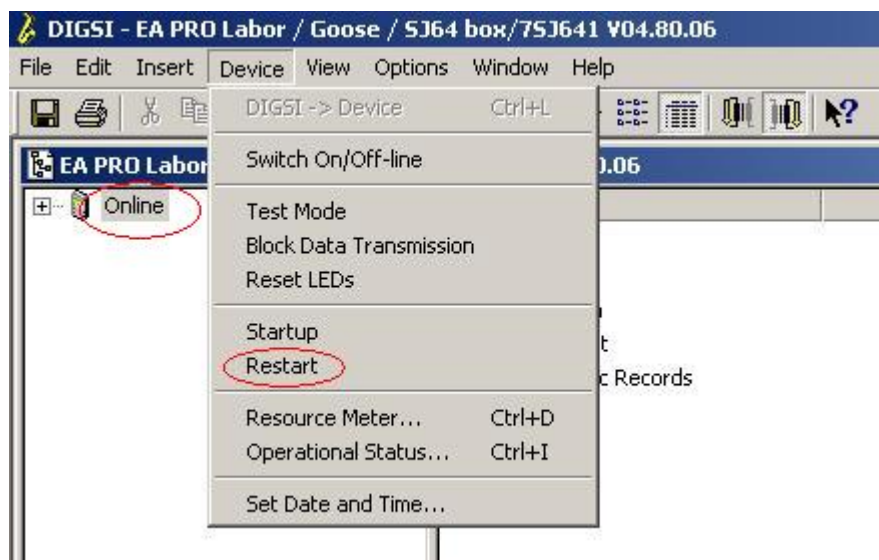


Figure 4-9 - firmware reset over DIGSI 4 with device restart

- Check, that the firmware is installed correctly. Open the Internet Explorer insert the IP-address of the device followed by "/home", e.g. http://172.16.2.1/home. Refresh that page (reload with F5) and check that the correct firmware is activated. There should be shown the FW version you have uploaded e.g. Version: 04.10.00.00_V4.

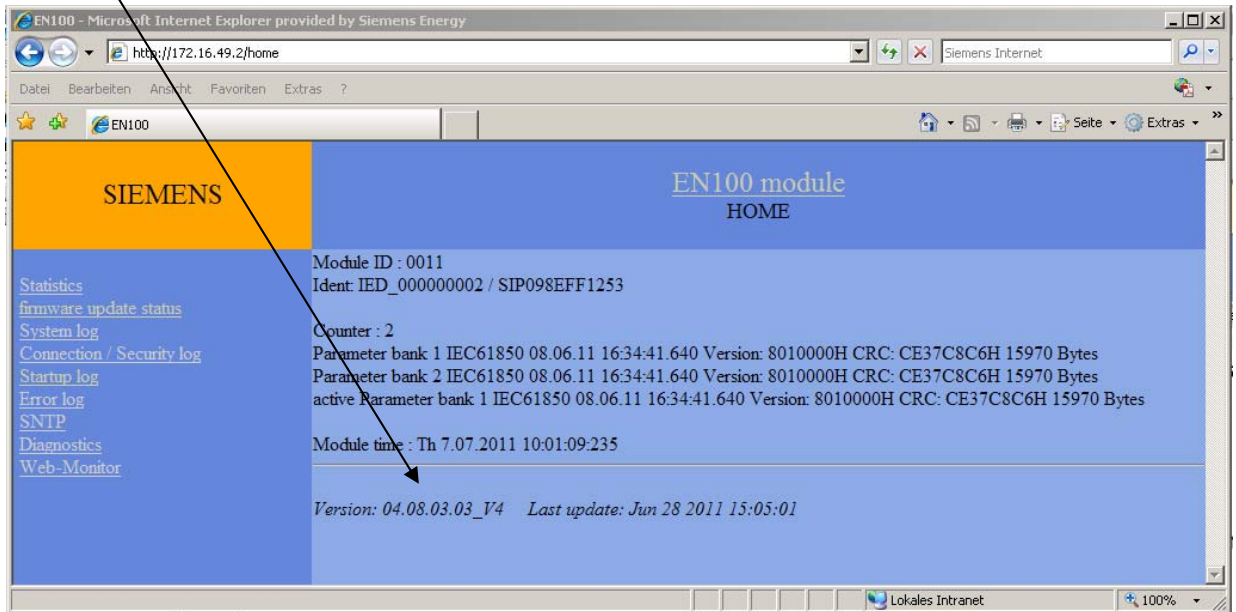


Figure 4-10 - Version check on EN100 module homepage (Note: Shown for version 4.08 here)

Or have a look on the section "Description" within the Netview homepage for the updated devices:

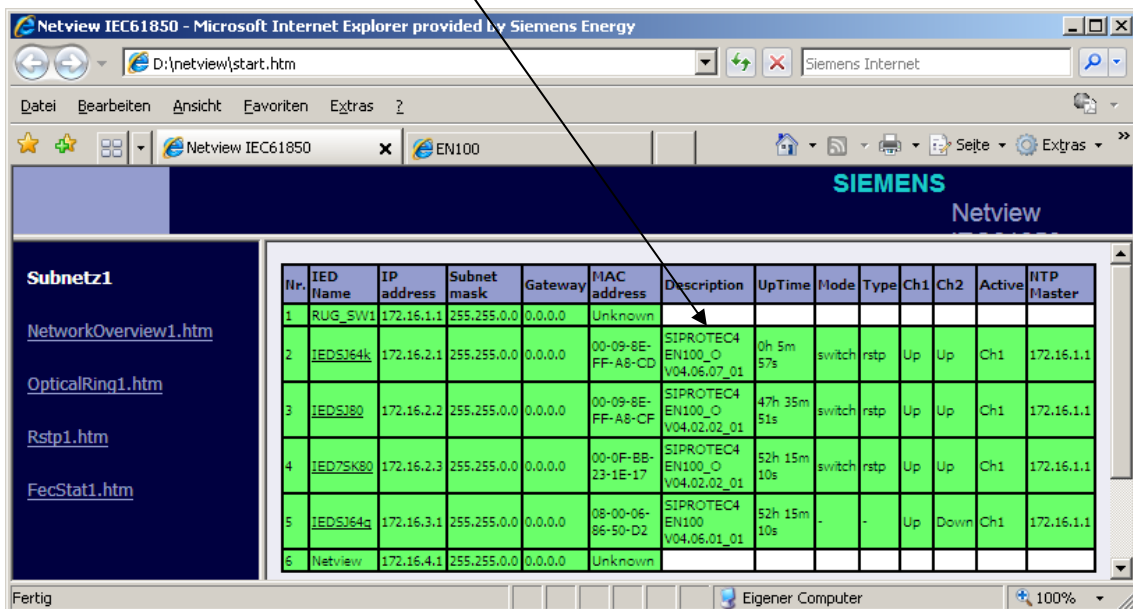


Figure 4-11 - Version check in Netview

4.2.2.2 Activation via module homepage

Please click link to reset the EN100 Firmware. See Figure 4-7 in 4.2.2.1 point 9.

Attention!

It is not possible with some devices and some device firmware versions. Please check chapter 5.1.

Please check that the firmware 4.1 for PRP has been flashed and activated in all SIPROTEC 4 devices before you continue with the FPGA – update for the devices.

4.2.3 FPGA Upload

4.2.3.1 Overview

FPGA and EPLD will be used as synonyms. EPLD is the older technology and substituted by FPGA today.

With the firmware version V04.08 or newer the upload of the FPGA is possible too. The FPGA image to be uploaded will be checked against the FPGA hardware used on the EN100 module. If the image is incompatible the flashing will be prevented. The FPGA image file name is EN100_O_PRP_555.pck.

The FPGA image upload over Ethernet is similar to EN100 firmware upload over Ethernet. But there are following **distinctions**:

- 1. A FPGA - image upload is a very critical process. If the power supply of the device is switched OFF during the upload procedure the module hardware may be damaged. In this case the module have to send back to repair. Please contact customer support if this happens.**
- 2. After successful FPGA upload you must always (!) restart the device with switching Off and ON the power supply. The device must be switched off for minimal 20 seconds.**

The FPGA images are unique for each EN100 hardware. For each HW there is a own version range. The current EN100-E (Electrical module) don't have a FPGA. There is following compatibility given:

Modul-Type	Detection via	xxx
EN100-E	Prozessor type	
EN100-O	FPGA Version No. ==	4xx (Optical module with ST connectors)
EN100-O_d2c	FPGA Version No. ==	50x (Optical module with LC connectors)
EN100-O_PRP	FPGA Version No. ==	55x (xx connectors, spezial version for PRP)

4.2.3.2 Upload and flashing

There will be executed all the steps like for the firmware update. Please refer chapter 4.2.2.1. The chapter contains the differences to the firmware upload only.

If your .pck file is correctly and compatible to your EN100 device HW you are able to update your EN100 module:

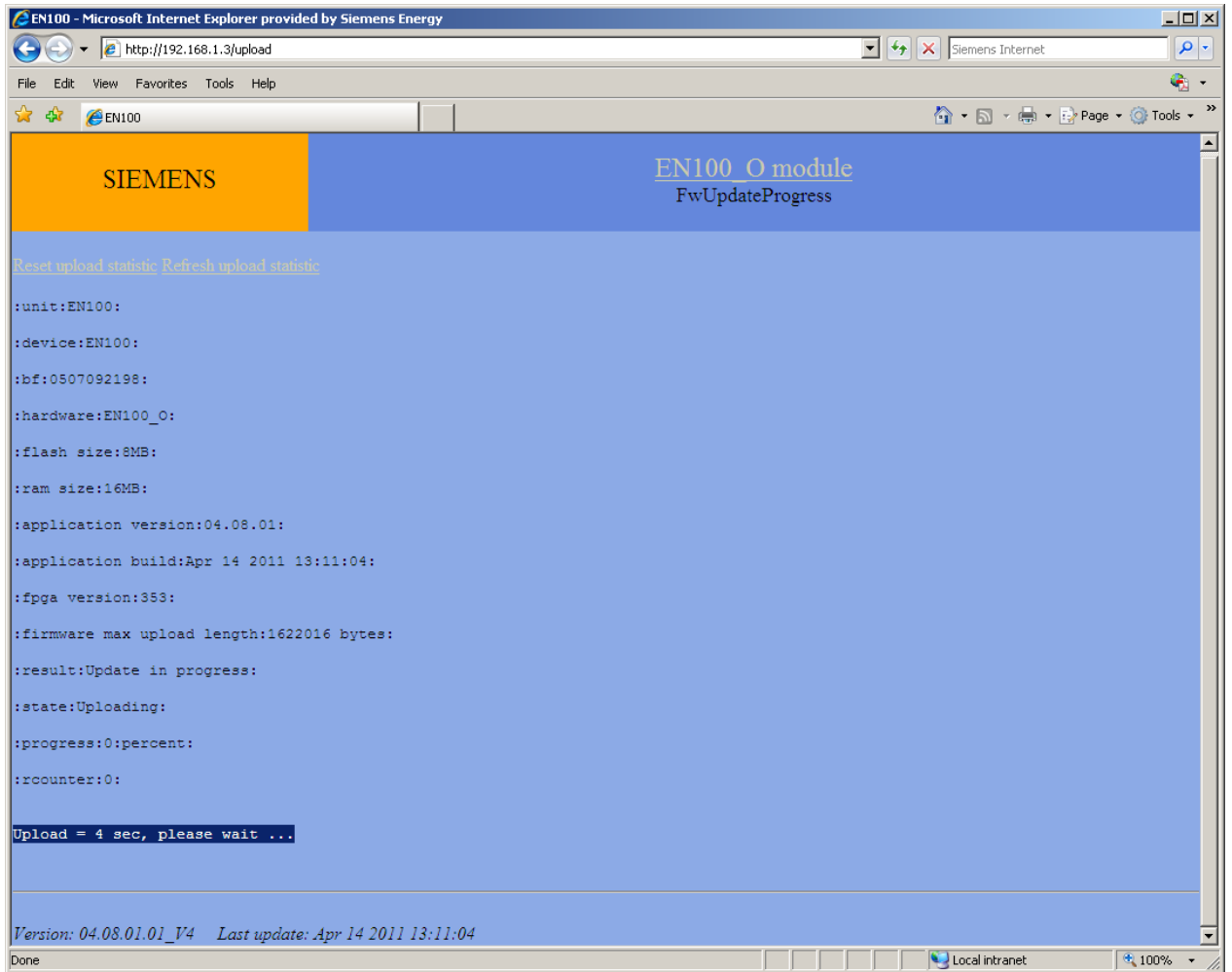


Figure 4-12 - Web site for FPGA update status

After successful update, you will get this status site. Please refresh the status site with the “Refresh upload statistic” to get a current status site.

If the reboot link “Now restart EN100 and wait 60 seconds” appears you may verify whether an upload was successful with the system log site (<http://<ip-address>/printf>).

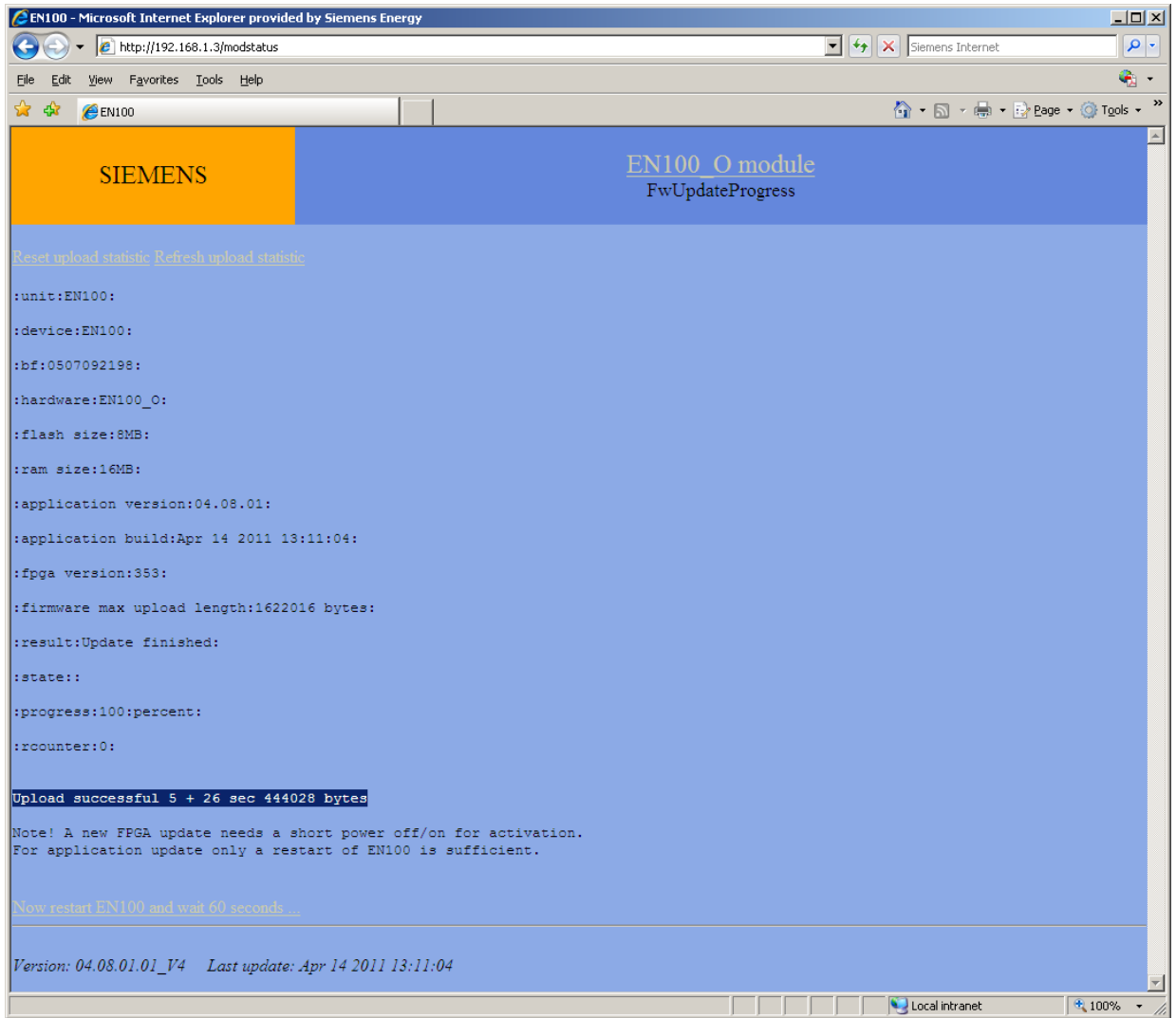


Figure 4-13 - Web site for FPGA update status – flashed, waiting for activation



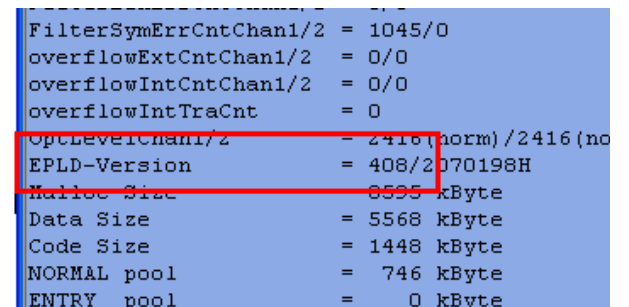
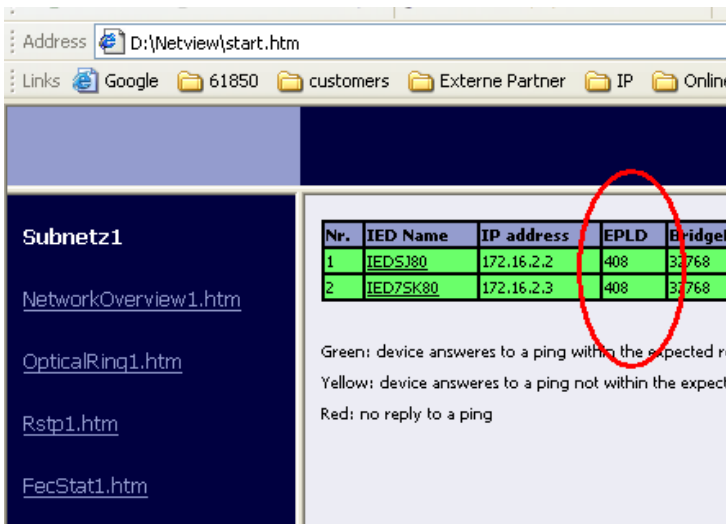
Figure 4-14 - Flash check in system log

To launch new FPGA firmware you have to switch off the power supply for at least 20 seconds and switch it on again. The device restart and activate the new FPGA – image which activates PRP.

NOTE: You may always repeat an upload of a file (EN100 or FPGA) before reboot on the device or EN100 firmware or power supply abruption.

The successful update can be checked with Netview
 Page "RSTP1.htm" column "EPLD" -> Must be 555
 for PRP

Or with module homepage
 (http://<ip-address>/home e.g.)
 Page "FEC-statistics"



If the FPGA – image is flashed and activated in all SIPROTEC 4 devices the devices can be used in the PRP – network. Switches in the network branch B can be switched ON. Both ports of the module now send equal PRP-telegrams and receive PRP telegrams from the network. If the network card of your Service PC can receive oversized PRP – Ethernet frames you can access to the device over Ethernet via A or B-network branch.

Full control over the PRP – network from a Service PC require a special PRP-software driver in the PC which support sending and receiving PRP – telegrams over two Ethernet interfaces in the PC. Alternative is the use of a Redbox which is connected to the PRP – network. Non – PRP telegrams of the Service PC are converted into PRP – telegrams used in the PRP – network. All commissioning programs are available on the Service PC when connecting to the PRP – net.

Access to one branch of the PRP-network can be done with a PC with a network-card which supports so called 'Jumbo Frames'. This access allows a view to one branch of the PRP-network only. A device which can not be reached over this branch may be accessible over the other branch.

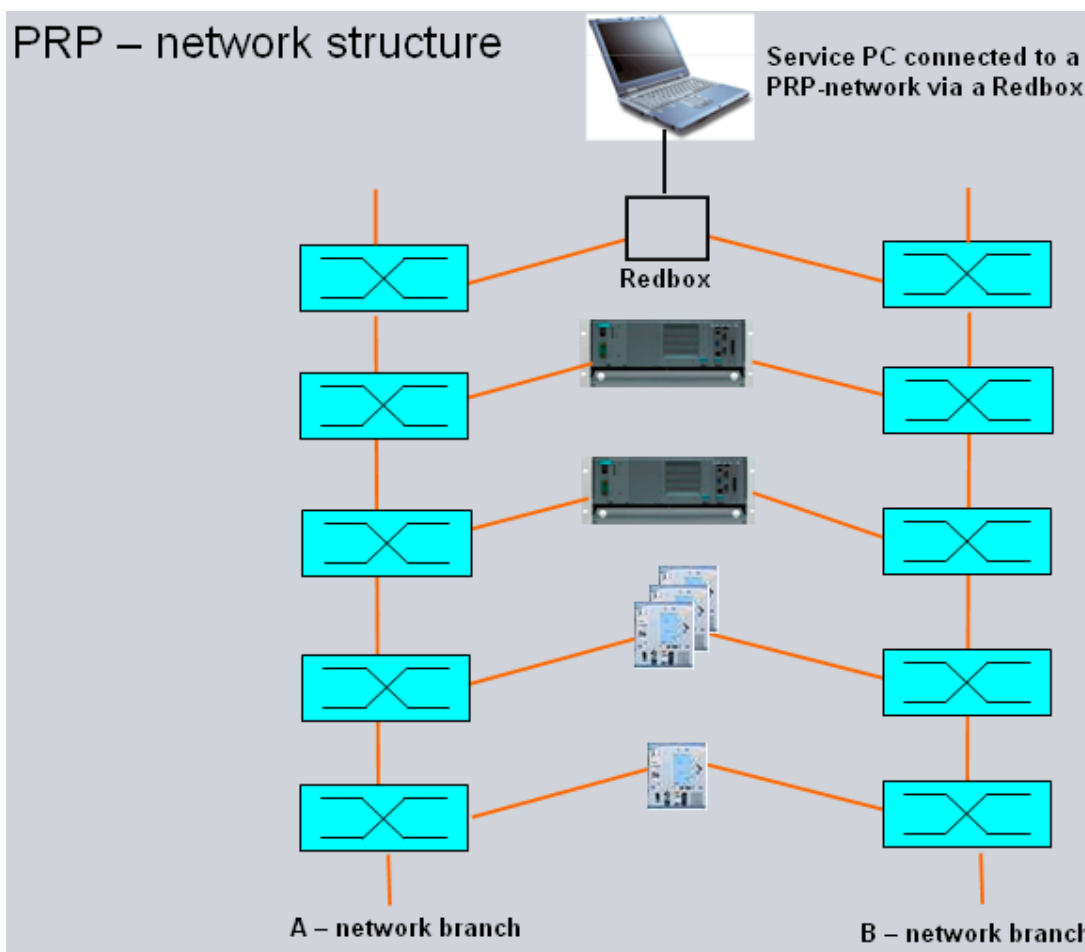


Figure 4-15 – Service PC connected to a PRP-network via a Redbox

5 Appendix

5.1 Software reset capable devices

The software reset feature of the EN100 module is only available for a set of devices greater a specific device firmware version. E.g. the software reset is possible at device 7SJ80 together with the application software version equal or greater V04.60.16.

device	possible equal or grater device application firmware version
6MD61	V04.02
6MD63	not possible
6MD66x	V04.71.01
6MD665	not possible
7SA522	V04.65
7SA6xx	V04.65
7SD52x / 53x	V04.60.07
7SD610	V04.60.07
7SJ61	V04.70
7SJ61 ACPU ¹	not possible
7SJ62	V04.70
7SJ62 ACPU	not possible
7SJ63	not possible
7SJ64	V04.70
7SJ80	V04.60.16
7SJ683	V04.70.04
7SK80	V04.60.16
7SS52x	V04.70.09
7UM61	not possible
7UM62	V04.63.02
7UT612	V04.60.07
7UT613-63x	V04.61.04
7UT68x	V04.70.03
7VE6xx	V04.60.04
7VK61x	V04.60.03

Table 5-1 Compatibility list

¹ can be identified by device firmware-version <V04.70

5.2 Error handling during upload

5.2.1 FW upload

- The power supply of the device **shall not be switched off during upload**. If the power supply fails you get an inconsistent state of EN100 module firmware. The EN100 may not be boot again. **At this point it is possible to upload the EN100 Firmware over front interface with the device specific FW setup only.**
- The EN100 firmware beginning from V04.08.01 contains measures to prevent the flashing of a wrong binary file. The file format, the size (lower than a maximum) and the content will be checked. When uploaded a wrong file selected from your hard disk the upload goes back to the home page of EN100 firmware or the website can't be shown.

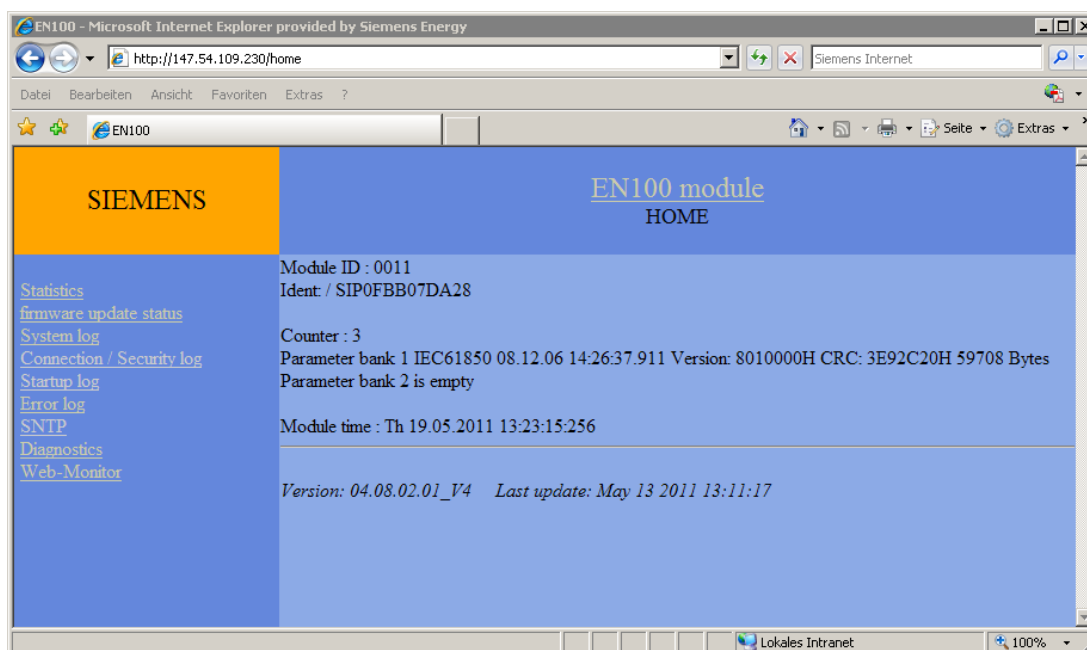


Figure 5-1 – Return page after failed download

Attention! In most cases you will not see this page, because the firmware resets the connection to the web browser. You will see an empty page in place of an error page instead.

In the system log you can find different entries when you chose a wrong file. If it occurs try to choose the right EN100 Firmware file with *.pck ending.

```
+++ 00029 00134959 Th 7.07.2011 11:19:50:459 HGP active
+++ 00030 00134959 Th 7.07.2011 11:19:50:459 MAP: GI device - module started
+++ 00031 00135029 Th 7.07.2011 11:19:50:530 MAP: GI device - module completed
+++ 00032 00238237 Th 7.07.2011 11:21:34:030 start firmware upload from client 172.016.000.001:3568
+++ 00033 00238239 Th 7.07.2011 11:21:34:032 HTTP: Start Upload max. 1622016 Bytes
+++ 00034 00238241 Th 7.07.2011 11:21:34:034 Upload: unknown content type
end of system log

Version: 04.08.03.03_V4 Last update: Jun 28 2011 15:05:01
```

Figure 5-2 – System log after failed download of an unknown file type

```
Clear buffer Update buffer

+++ 00000 00482629 Th 7.07.2011 11:25:38:426 ***** System log cleared from client 172.016.000.001:3594 *****
+++ 00001 00506961 Th 7.07.2011 11:26:02:757 start firmware upload from client 172.016.000.001:3594
+++ 00002 00506961 Th 7.07.2011 11:26:02:757 HTTP: Start Upload max. 1622016 Bytes
+++ 00003 00509943 Th 7.07.2011 11:26:05:739 HTTP: binary not flashed, len = 1510832
end of system log

Version: 04.08.03.03_V4 Last update: Jun 28 2011 15:05:01
```

Figure 5-3 – System log after failed download of a wrong binary file

- If you try to upload a too big file (e.g. a newer version with a lot of enhancements for an updated hardware), the connection will be closed by the EN100 firmware. A PCK file may not be greater than allowed by the firmware. Maximal file size to be uploaded is visible in system log entries after beginning uploading

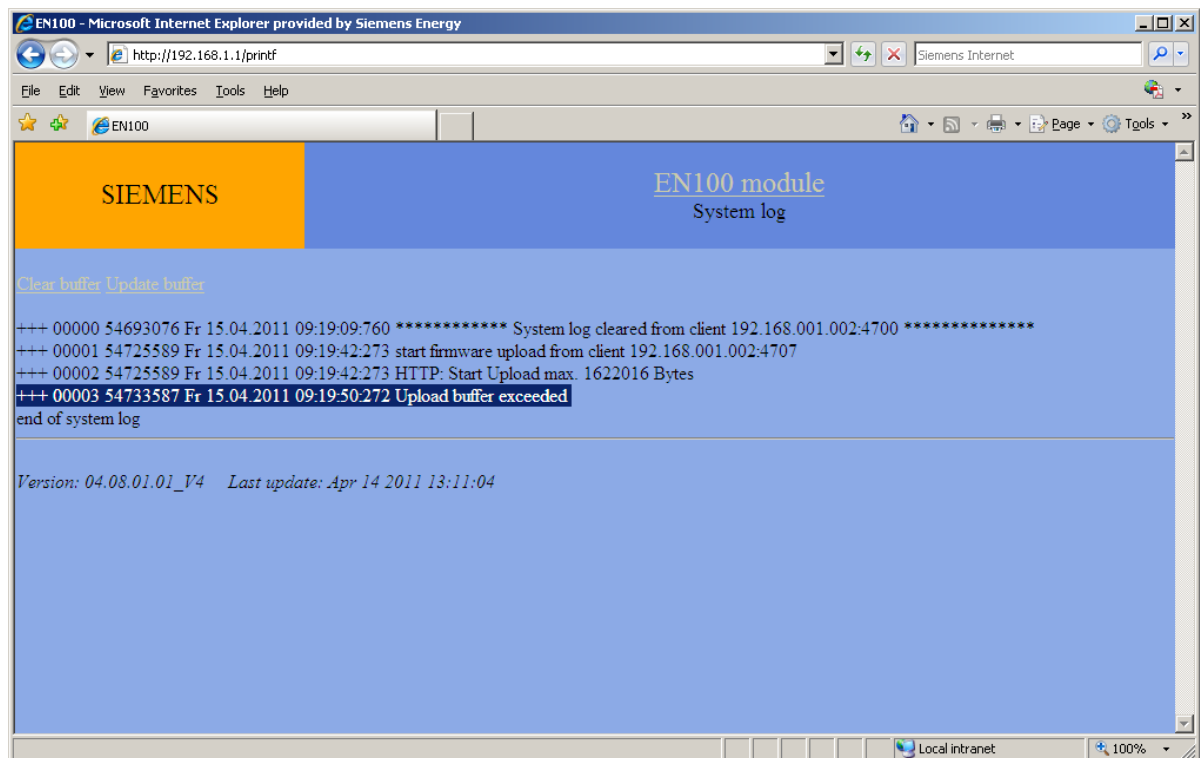


Figure 5-4 – System log after failed download of a too large file

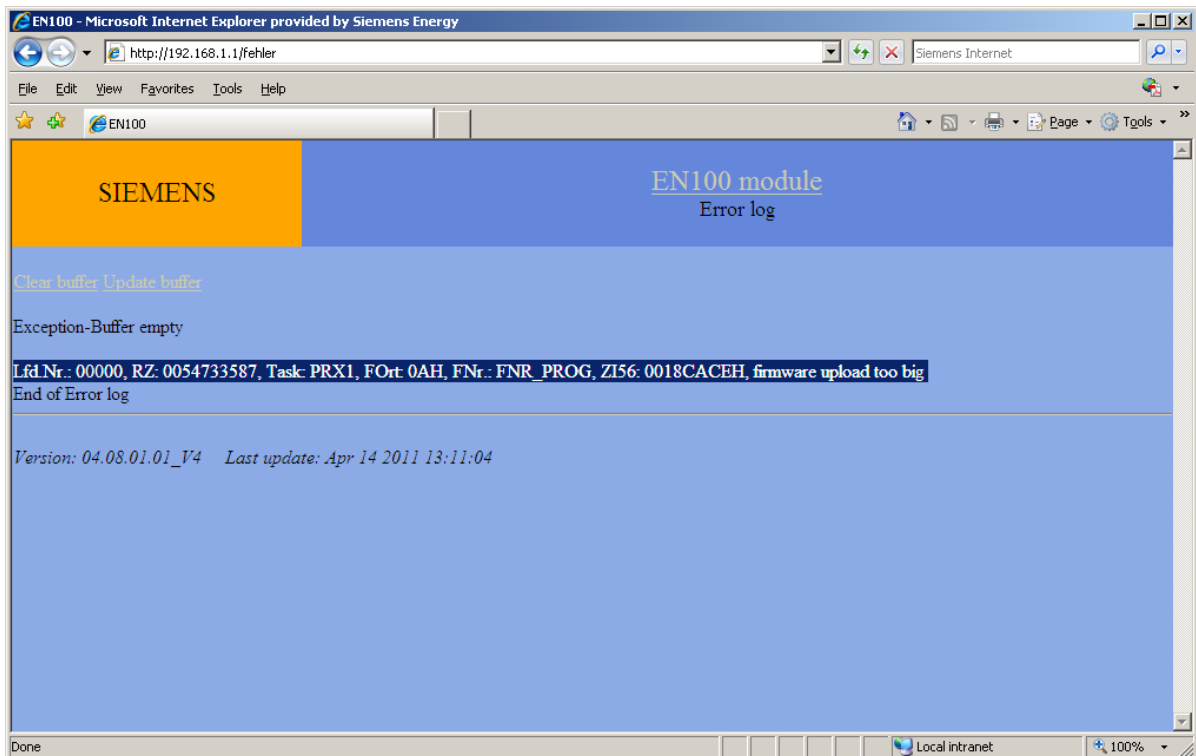


Figure 5-5 – Error log after failed download of a too large file

- When the upload speed is too low the time between two firmware data telegrams could be larger than 5 s. In this case the upload will be canceled and an indication in the **system log** is announced.

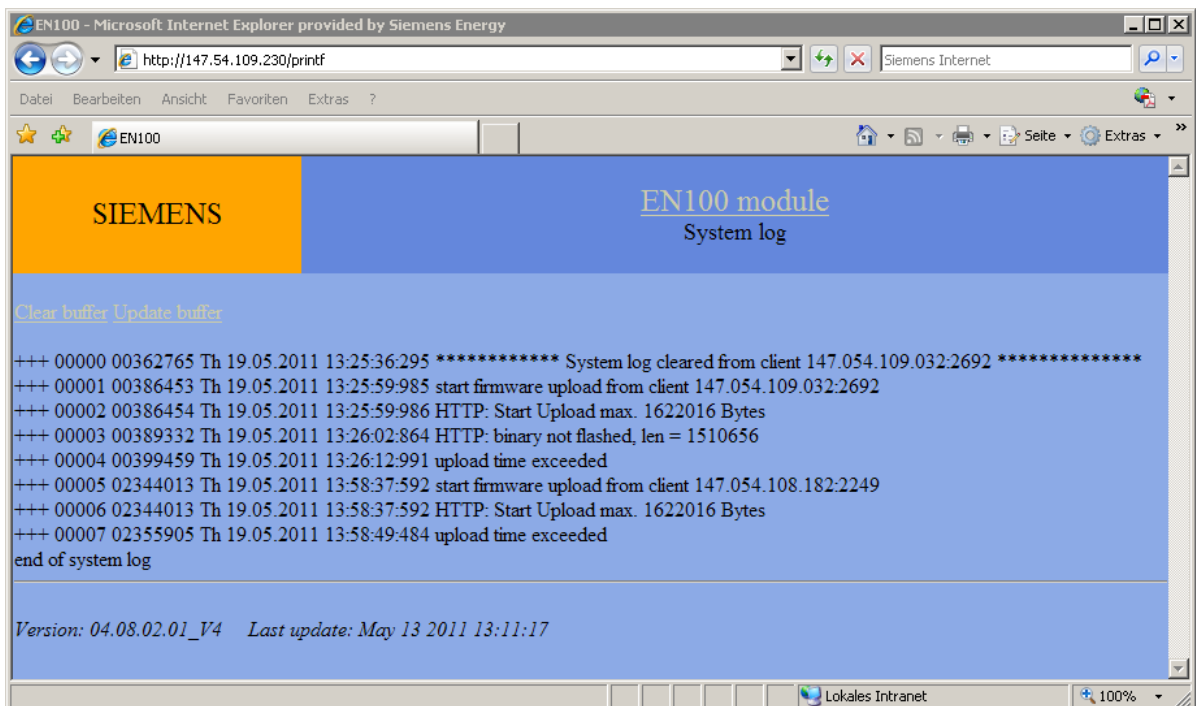


Figure 5-6 – System log after failed download caused by too slow connection

5.2.2 FPGA upload

- If you try to load FPGA on electrical EN100 module, you get a note at the site **firmware update status**, because it is not possible to upload an FPGA on an electrical EN100 module.

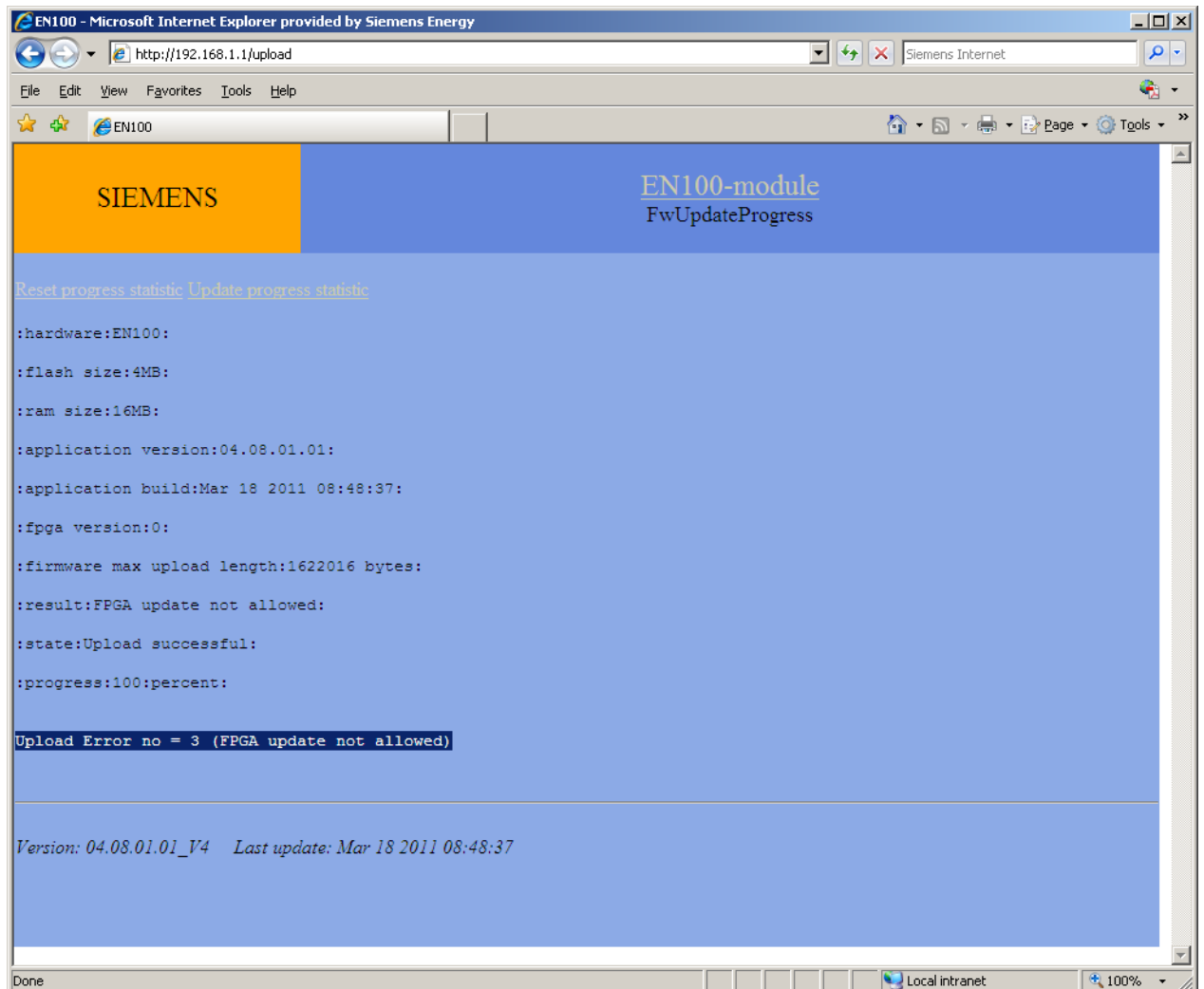


Figure 5-7 – FW update progress page after failed download – wrong FPGA image

For more Information you may consult the system log site, where in this case some information available if the update fails.

Note: After a device reboot the information logs are lost.

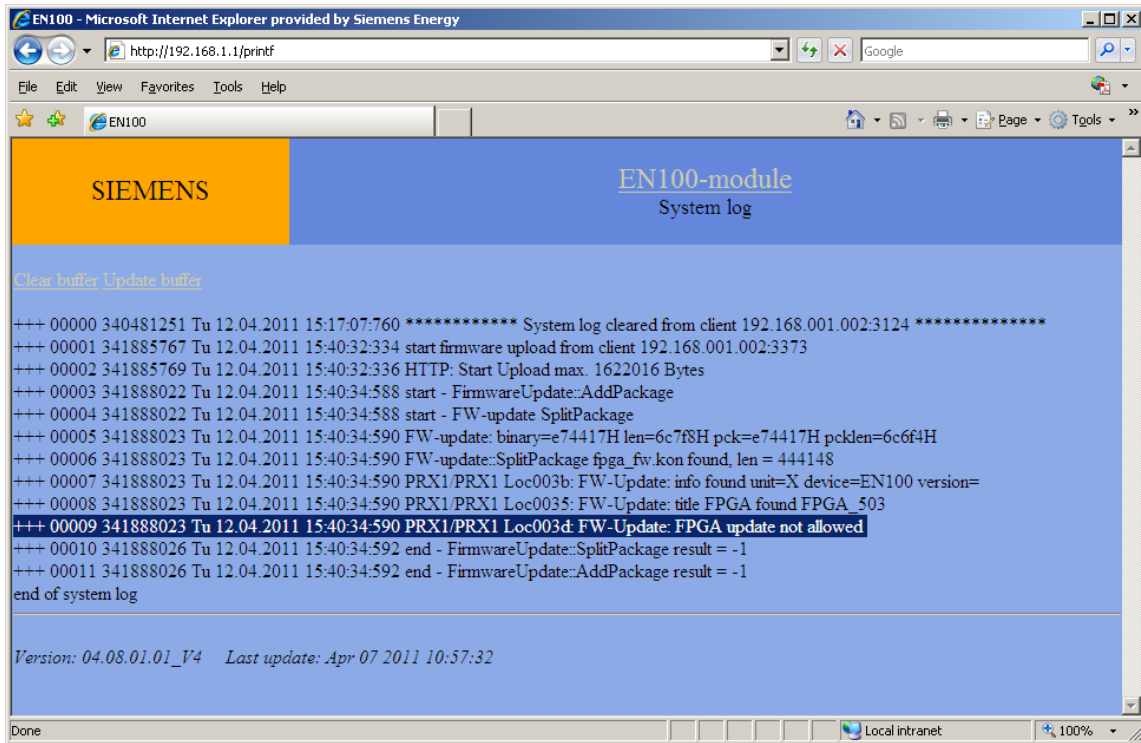


Figure 5-8 – System log after failed download – wrong FPGA image

- If you try to load a wrong binary file, you will get the following site, means the upload is prevented:



Figure 5-9 – Module home page after failed download of a wrong binary file

In the system log file there is some information about upload process. Binary file with a wrong format e.g. .rbf files will not be flashed.

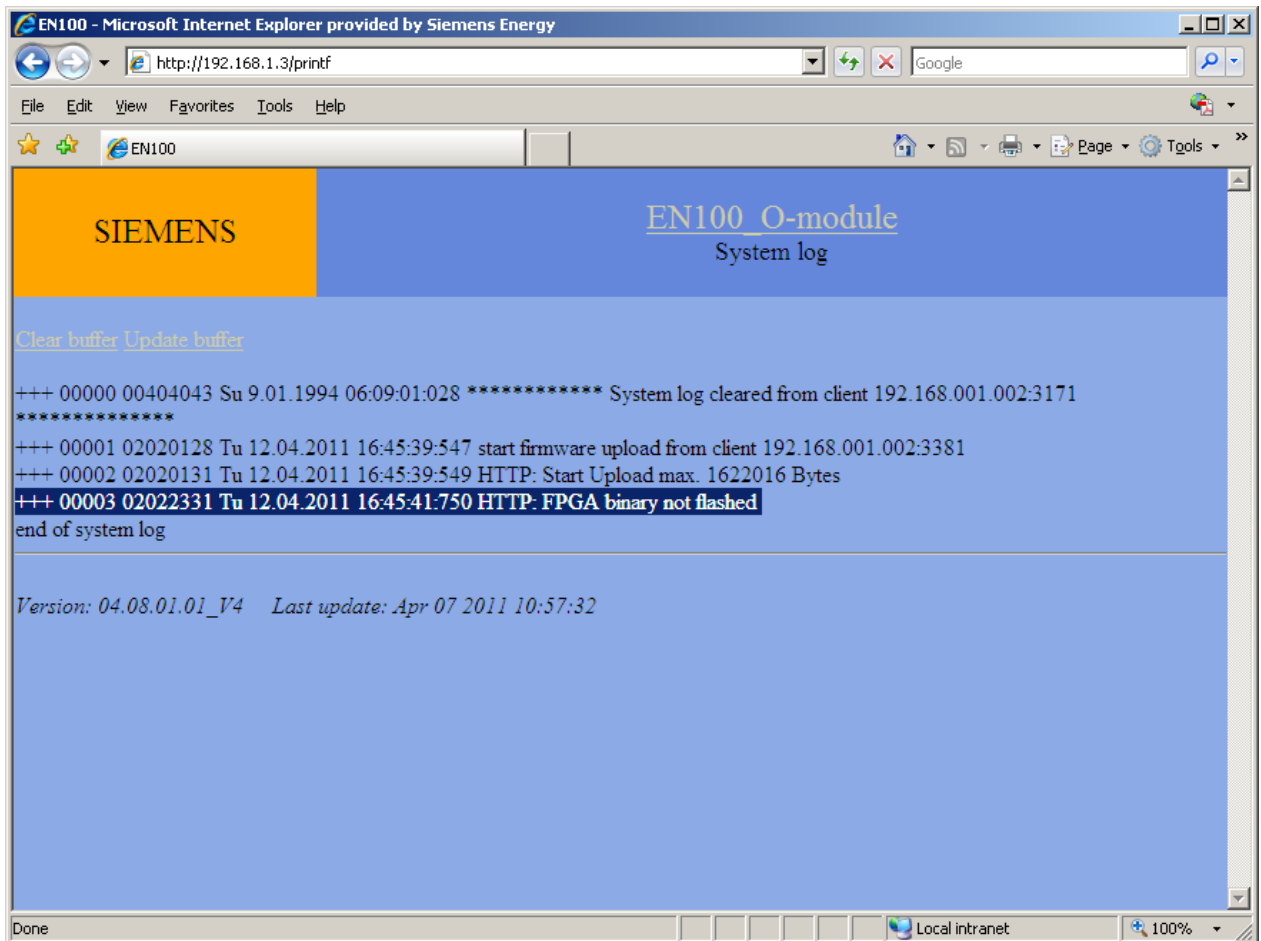


Figure 5-10 – System log after failed download – wrong binary format

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- This page will be shown when you load a wrong FPGA image file. It's not possible to load a wrong FPGA - image into the module.

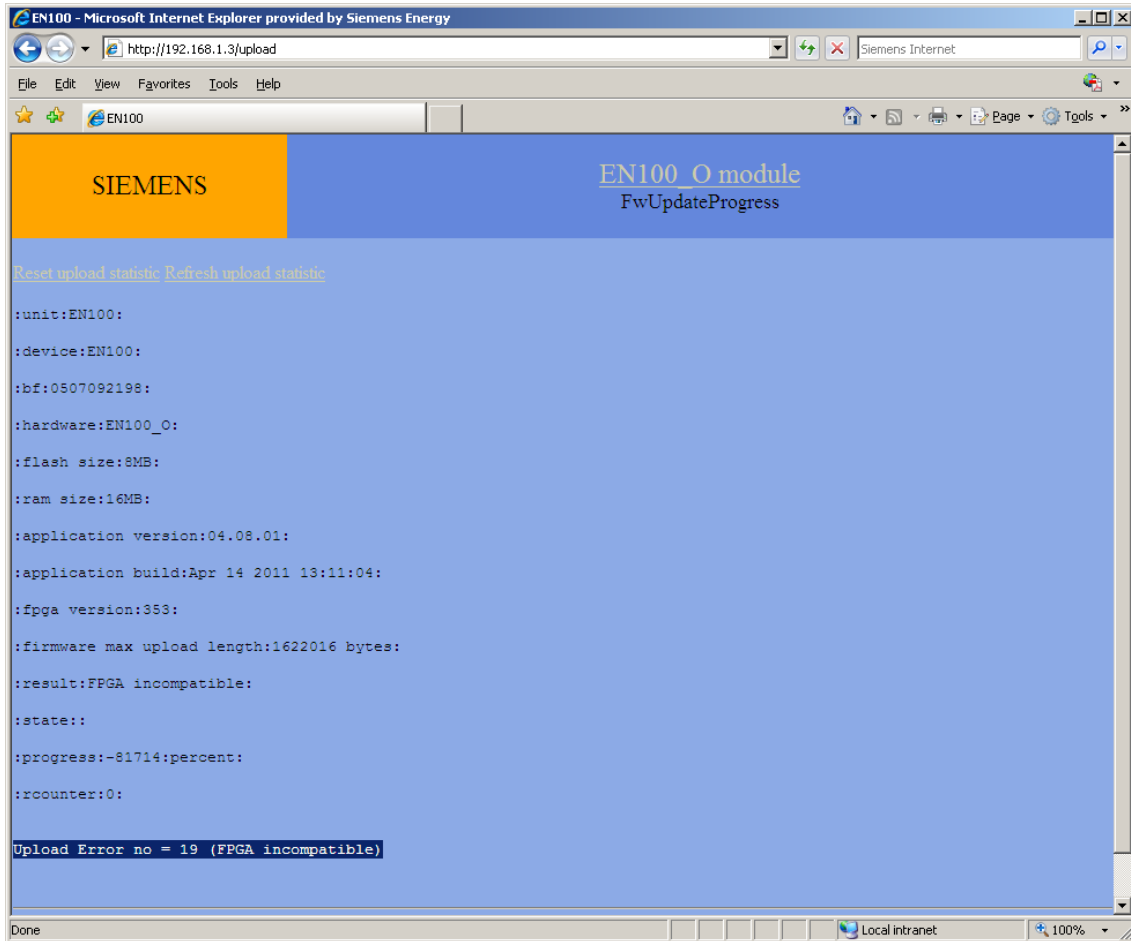


Figure 5-11 – FW update progress page after failed download – incompatible FPGA image for this hardware

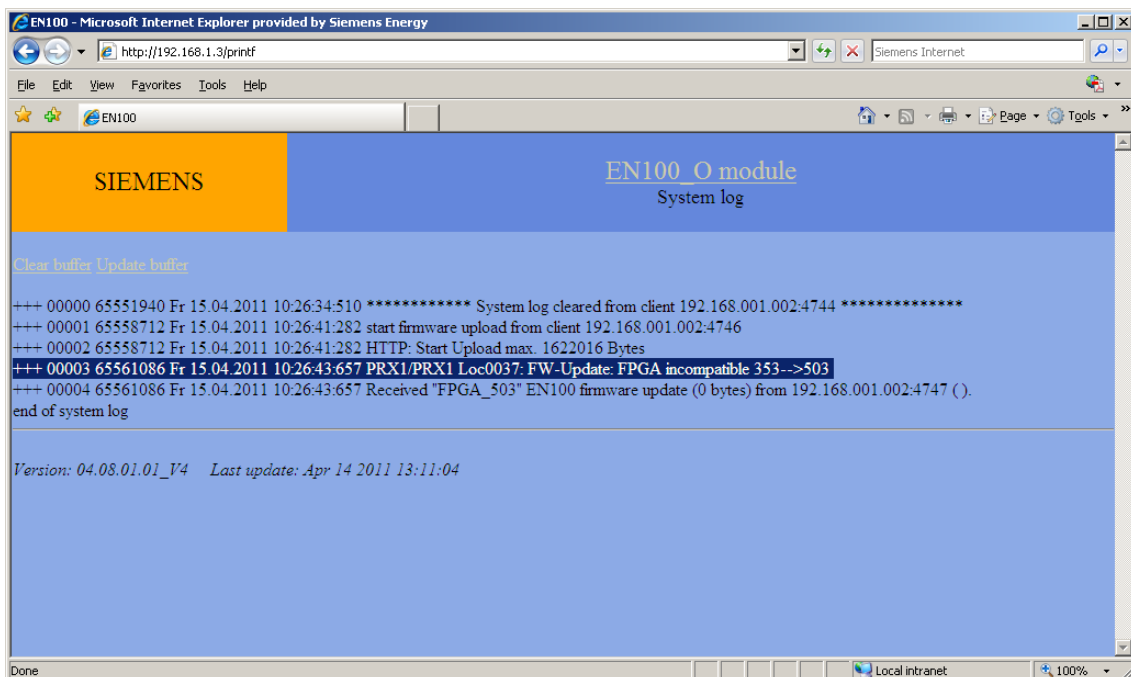


Figure 5-12 – System log after failed download – incompatible FPGA image for this hardware

5.3 EN100 firmware update procedure via serial or USB-interface

For the update procedure via the serial front interface or USB - interface please use the following description:

http://siemens.siprotec.de/download_neu/devices/1_General/FW_UPDATEINFORMATION/Readme_fwup_06-10.pdf

5.4 FPGA and firmware versions of EN100

Current released versions of EN100 module firmware and FPGA images can be found at the download area.

http://siemens.siprotec.de/download_neu/index_d.htm

5.5 Hotline

If you have any trouble during update procedure you can contact the Energy Hotline by email <mailto:support.energy@siemens.com> or by phone +49 180 524 70 00

5.6 Abbreviations

EPLD Erasable Programmable Logic Device, today substituted by **FPGA**

FPGA Field Programmable Gate Array

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