EBPG5200 (plus) Linux Workstation Notes

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1.   ABOUT THIS DOCUMENT

1.1   Description

This document explains how to work with the EBPG5200 (Plus) Linux Workstation also referred to as the Master Control Computer (MCC).

Items explained include system specific information, how to maintain applications (BEAMS software) and how to maintain the computer itself.

The internal workings of applications are not discussed. For more details on applications please refer to the documentation on the MCC itself (see also chapter 5).

1.2   History of document B906572 changes

Date	Release #	Description of changes	ECR #
April 1, 2022	V4.0	New release	-
June 29, 2022	V4.1	Note: SATA vs M.2 disks	-

1.3   Symbol and signal words used in this document

Signal word	Description	Symbol
Caution	Obey the instruction. If not, this can cause damage to the system.	
Note	A note gives more information, to make it easier to do the steps in a procedure.	
Reference	Extra information in other documents.	

2. SYSTEM SPECIFIC INFORMATION

Table 1: System specific Information

Hardware	
Base system	Z8
Storage	2*512GB SSD → RAID 1
Memory	16 GB memory
Software	
Operating System	Red Hat Enterprise Linux (RHEL) 7, 64bit
Network Information	
Hostname	a2xx
Account Number	
Subscription key	(see Red Hat Enterprise Linux registration card)
Red Hat login name	
Red Hat password	
User Information	
root	beamwriter
beams	beamwriter
pg	beamwriter

Included with the system is a Red Hat Enterprise Linux workstation registration card (see picture below) giving access to Red Hat software and support for the duration of 1 year.

For more information on subscriptions have a look at the Red Hat subscription model FAQ https://www.redhat.com/en/about/subscription-model-faq

Although systems can receive patches and bug fixes after registration, Raith does not recommend modifying the workstation that controls the EBPG5200. Installing these patches and bug fixes is at the customer's own risk.

3. HOW TO USE PROJECTS

BEAMS commands make use of environment variables which point to directories wherein to write files or wherefrom to read files. Directly after login, these environment variables have these default values:

```
PG_BIN="/home/pg/bin"
PG_JOBS="/home/pg/jobs"
PG_LOG="/home/pg/log"
PG_PATTERNS="/home/pg/patterns"
PG_SCRIPTS="/home/pg/scripts"
```

The default directory is the home directory: /home/pg, of the user 'pg'. The 'pg' environment is created in such a way that the 'pg' user can organize data-files into projects. This is accomplished with the tool "ce" (change environment).

```
[pg@a2xx pg]~> ce service
```

If the project "service" doesn't exist, "ce" first asks for confirmation to create the project then the current directory (pwd) is changed to:

```
/home/pg/users/service
```

Also the environment variables shown above, are changed to:

```
PG_BIN="/home/pg/users/service/bin"
PG_JOBS="/home/pg/users/service/jobs"
PG_LOG="/home/pg/users/service/log"
PG_PATTERNS="/home/pg/users/service/patterns"
PG_SCRIPTS="/home/pg/users/service/scripts"
```

There is also a file ".service" in the "service" project directory that will be executed every time the user executes "ce service". You can include any command in this file to make a default setup when this project is entered.

4. HOW TO MAINTAIN BEAMS

The user 'beams' owns all the BEAMS applications. If the BEAMS software has to be upgraded, logon as the 'beams' user.

4.1 Beams-script

A script called "beams" exists in the home-directory of the user 'beams'. With this script the releases of BEAMS can be maintained. This includes: downloading new BEAMS releases, installing/extracting releases and even downgrading.

Go to the "beams" directory:

```
[beams@a2xx ~]$ cd ~
```

In this directory the script "beams" can be executed:

```
[beams@a2xx ~]$ beams

Usage:

  beams <version> [-ghixs]

Type "beams --help" for detailed help.
```

As the bottom line says, type "`beams --help`".

Read this detailed help carefully.

4.2 Upgrading BEAMS

The first step in upgrading BEAMS is to look for available releases and check which release is currently installed. The option "`--show`" does all of this:

```
[beams@a2xx ~]$ beams --show
```

If a new BEAMS release is available, e.g. "v09_13a", install/upgrade it by typing:

```
[beams@a2xx ~]$ beams v09_13a --get --install
```

Although a new BEAMS release can be downloaded and installed in a single action as shown above, it is recommended to do this in two separate steps.

First download the release v09_13a from the RAITH ftp server:

```
[beams@a2xx ~]$ beams v09_13a --get
```

Then extract and install BEAMS release v09_13a:

```
[beams@a2xx ~]$ beams v09_13a --install
```

That's all to upgrading BEAMS.

5. DOCUMENTATION

The BEAMS software includes documentation files in html format and manual-pages. To get a full list of available "pg" commands, enter the next command:

```
[pg@a2xx pg]~> man pg
```

For detailed help on a particular "pg" command see the header "SEE ALSO" in the above manual page, e.g.:

```
[pg@a2xx pg]~> man pg adjust
```

Also for the HILL-SHELLY programming interface and "gpf" functions, manual pages are available. Unfortunately a complete list of all HILL-SHELLY functions is not available, but a HILL-SHELLY function can be found by appending a corresponding "pg" command after "hill_", e.g.

```
[pg@a2xx pg]~> man hill_adjust
```

The list of "gpf" functions can be displayed by:

```
[pg@a2xx pg]~> man gpf
```

For both of these types of functions see the header "SEE ALSO" to get detailed help on a particular function.

Exactly the same text, but in html format is also available. The home page in the browser looks something like this:

RAITH
NANOFABRICATION

A2xx Home Page

2016 Raith nanofabrication

Documentation on A2xx

BEAMS
SPLC
PG notes
Linux Know How
Bash Shell Scripts

Documentation outside A2xx

Red Hat
CATS at Synopsys
Beamer at Genisys
Apache
Mozilla
The Linux Kernel Archives
vim text editor
Python Tutorial
Advanced Bash

Made by R. Pijnenburg

In the left column reside the links to documentation on the Master Control Computer itself.

6. NETWORK

To change the network settings (e.g. when the EBPG5200 is relocated), execute:

```
[root@a2xx ~]# nm-connection-editor
```

The next window appears:
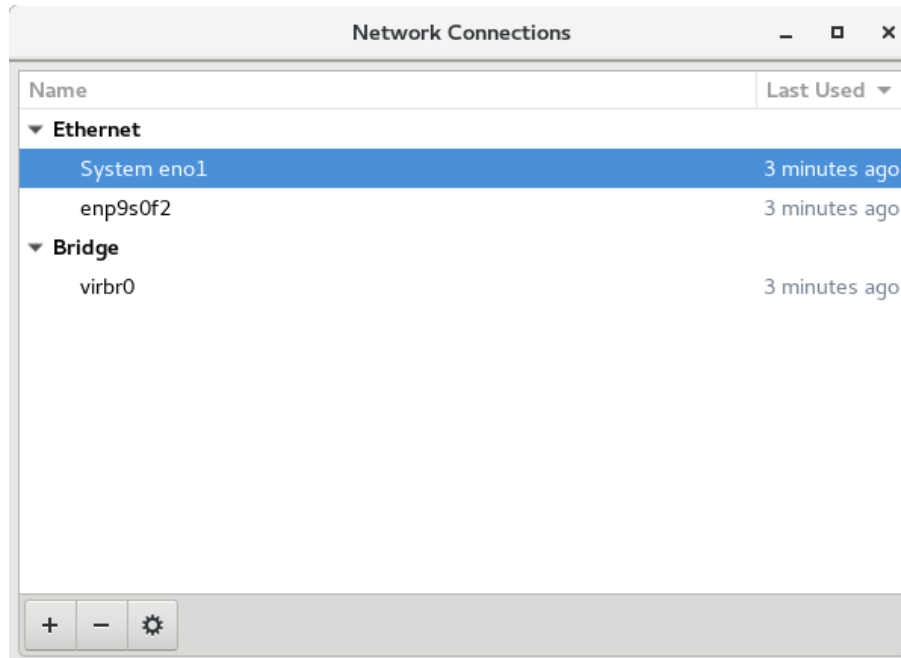
Only change the settings of device "eno1" (click the sprocket). Ask the local network manager for the details (IP address, Name servers and Domain) to get the MCC connected to the Internet/Local network.

After changing the settings, restart the network:

```
[root@a2xx ~]# service network restart
```

NOTE: If a firewall is required: See:

```
[root@a2xx ~]# firewall-config
```

7. CONNECTIONS

- Connect the monitors, the keyboard and the mouse as illustrated in the picture
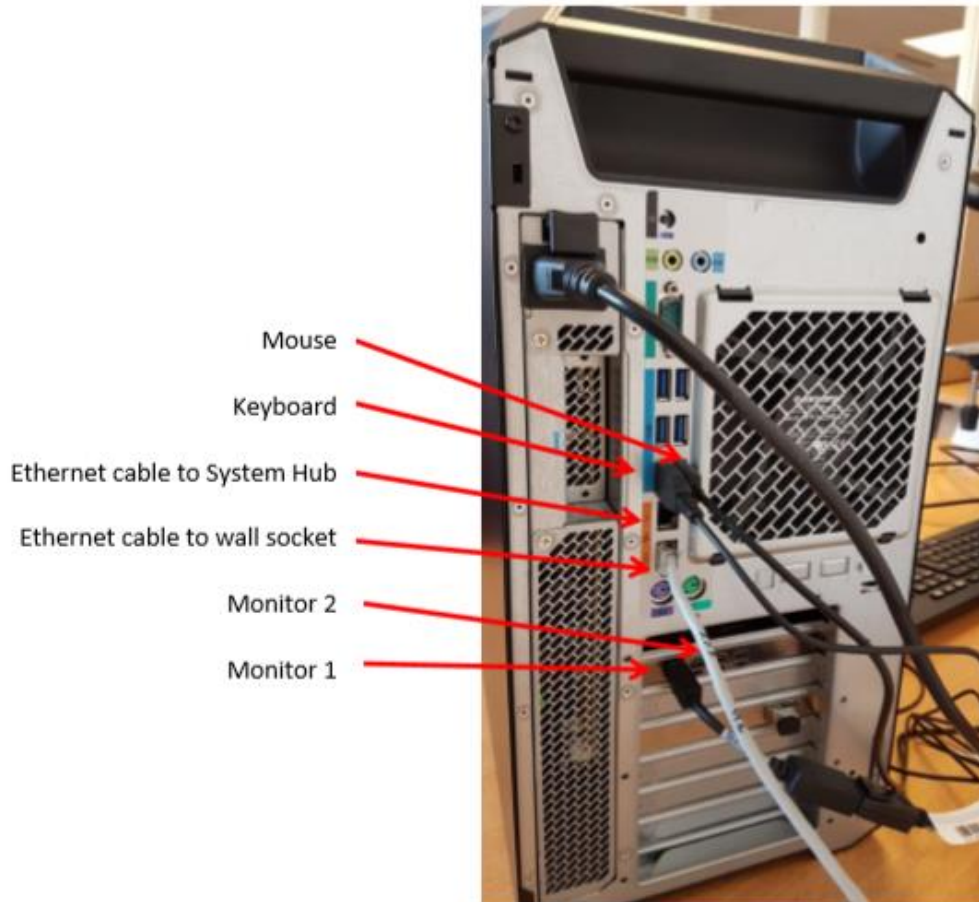
8. RAID 1 STORAGE

The MCC is delivered with a hardware RAID 1 implementation, which consists of a controller on the motherboard and 2 512GB SSD-disks. These two disks make, together one 512GB storage volume. With RAID 1, a storage volume exists of 2 disks, which are identical mirrored. If one disk fails, the computer still keeps on running with the other disk.

8.1 Prepare RAID-1: disk mirror

Note:

This paragraph is applicable for systems with *SATA-disks* only.
For systems with *M.2-disks*, continue with the next paragraph. M.2-disks are configured automatically with software RAID 1 during installation of the Operating System.

- Turn on the computer and press <ESC>, in the Startup Menu, select BIOS setup (F10).
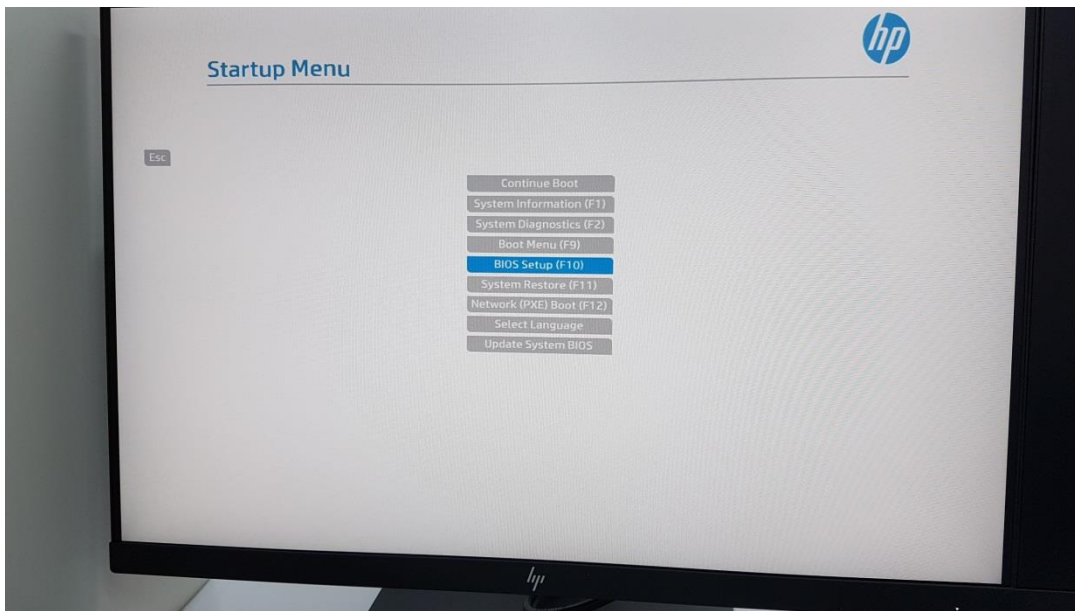
- Go to the UEFI Drivers tab and select the Intel(R) VROC SATA Controller
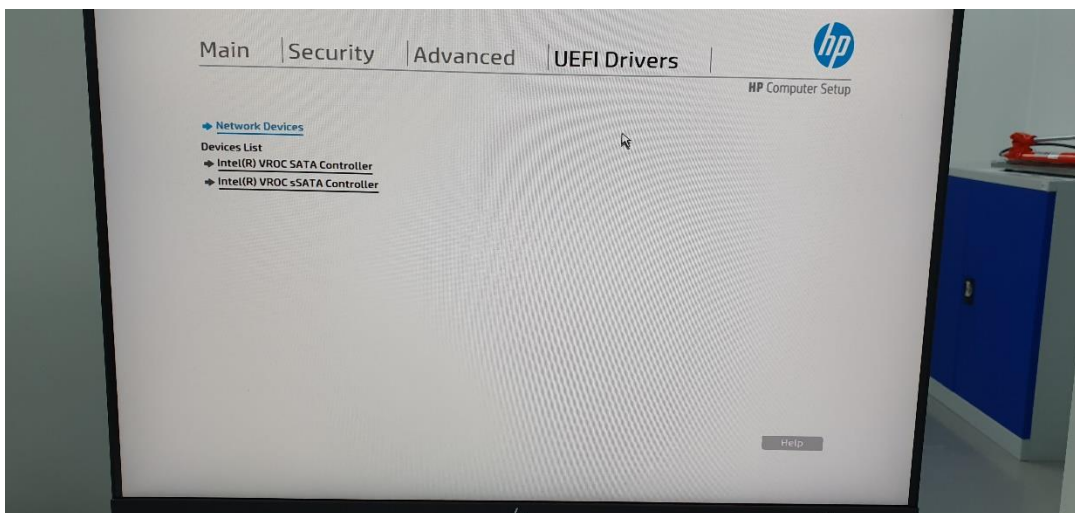
- Select Create RAID Volume
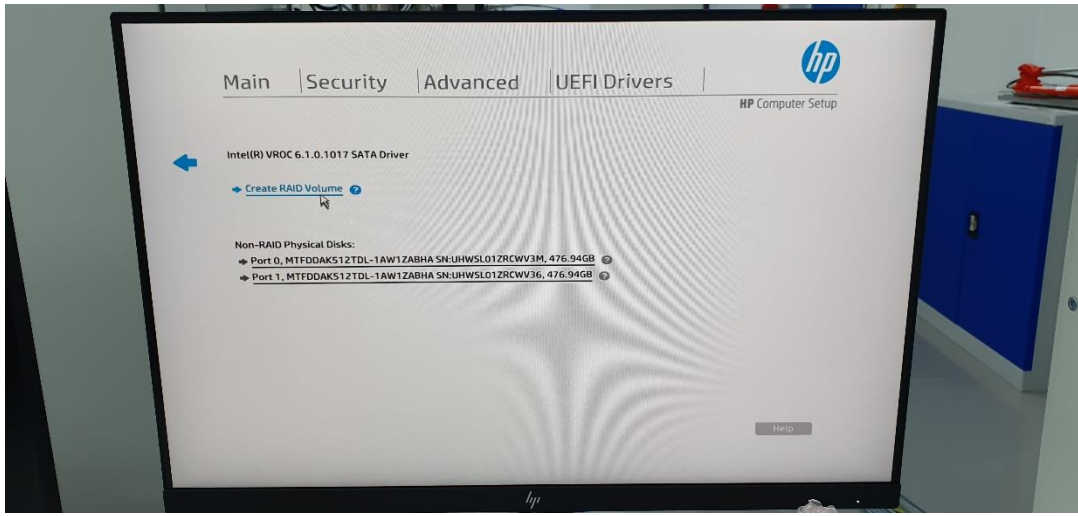
- Select RAID1 (Mirror)
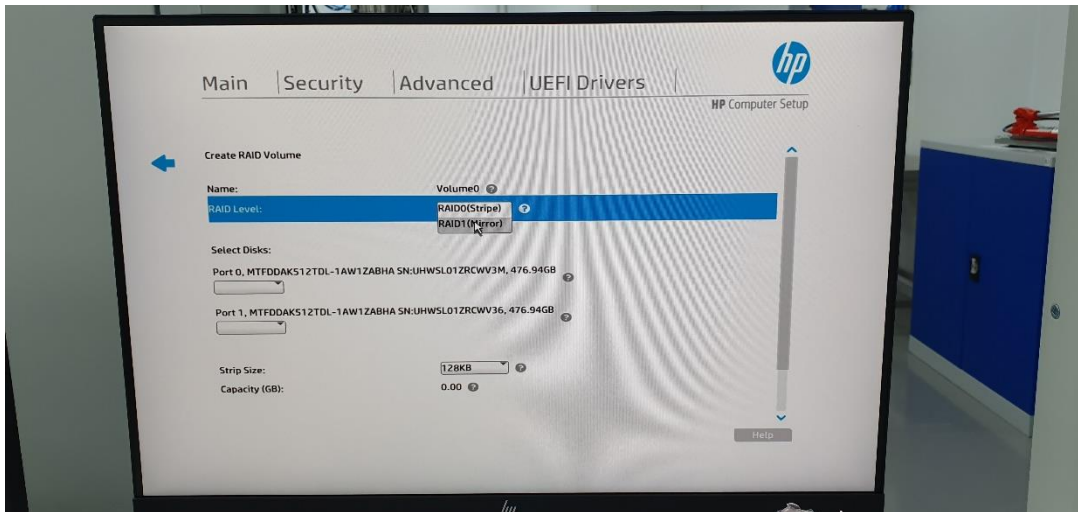
- Select the drives to add to the RAID Volume
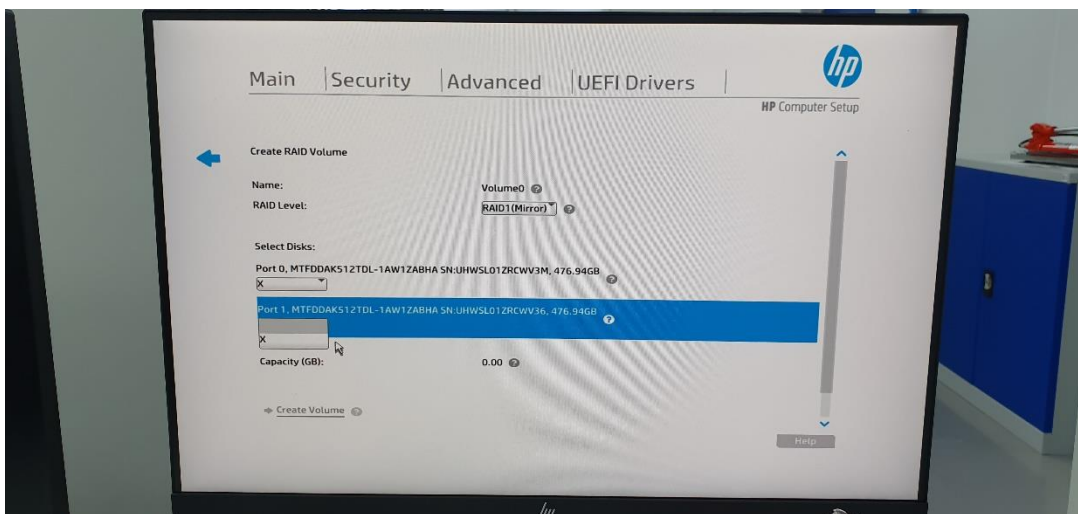
- Click on Create Volume
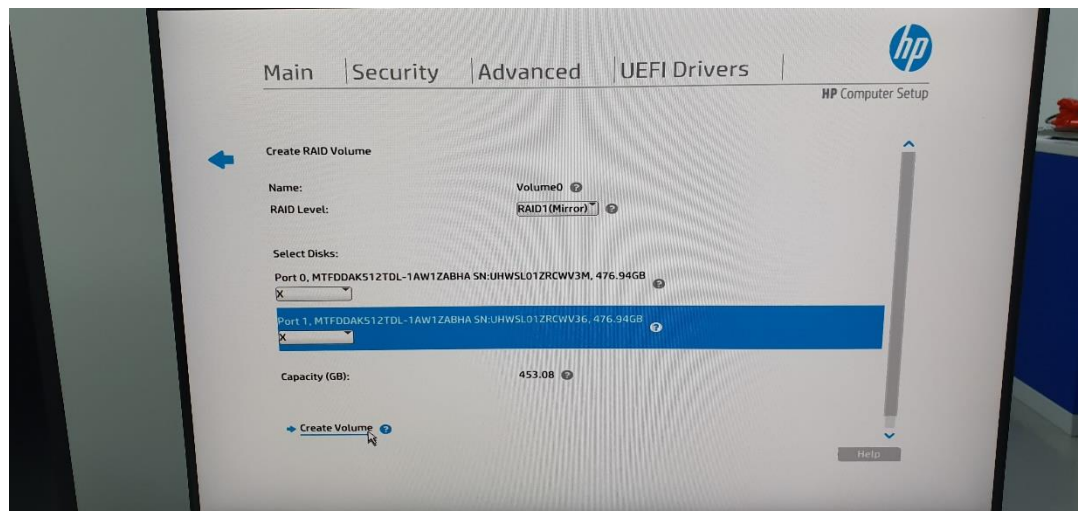
- The BIOS should now show the following Volume details
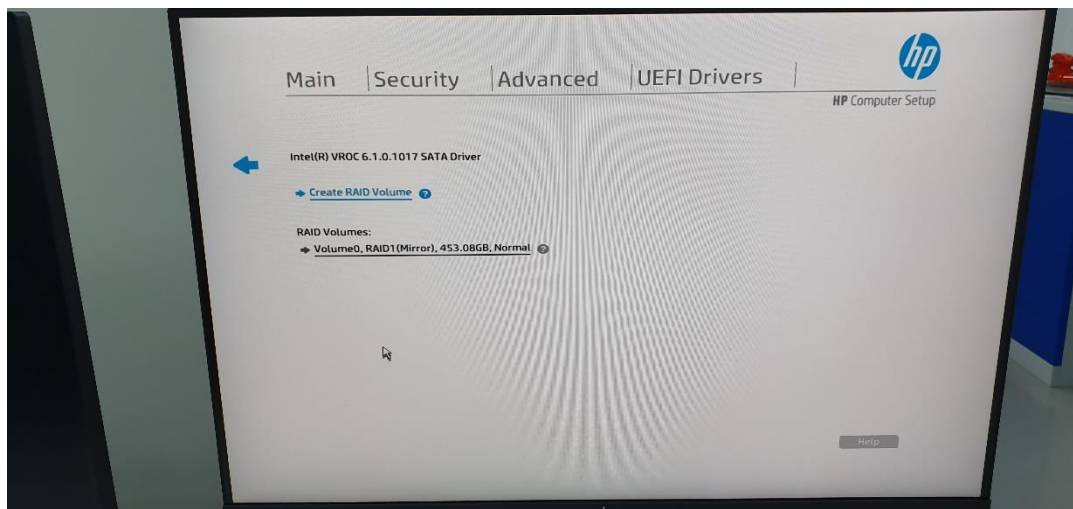
- Go back to the Main tab and select Save Changes and Exit
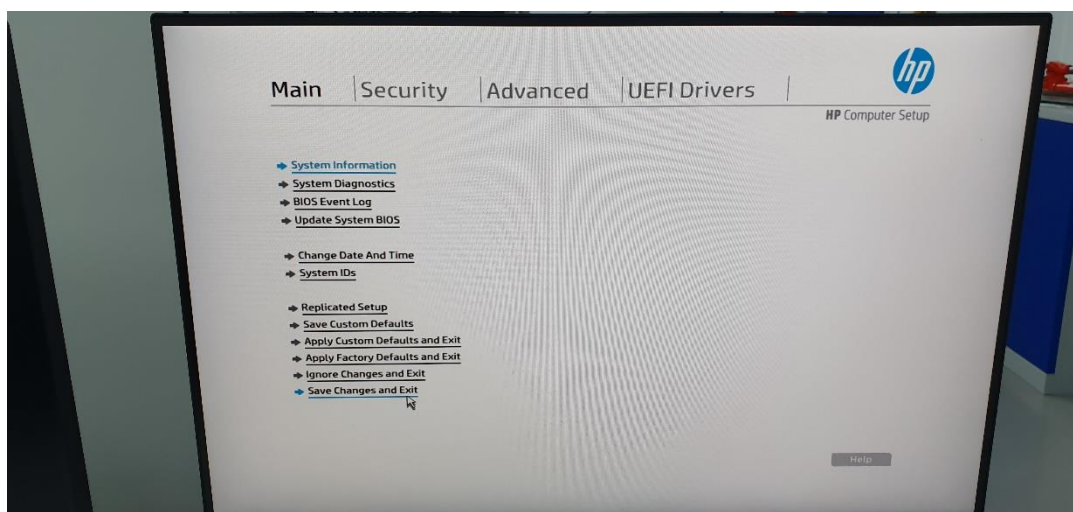
- In the next screen, select Yes.
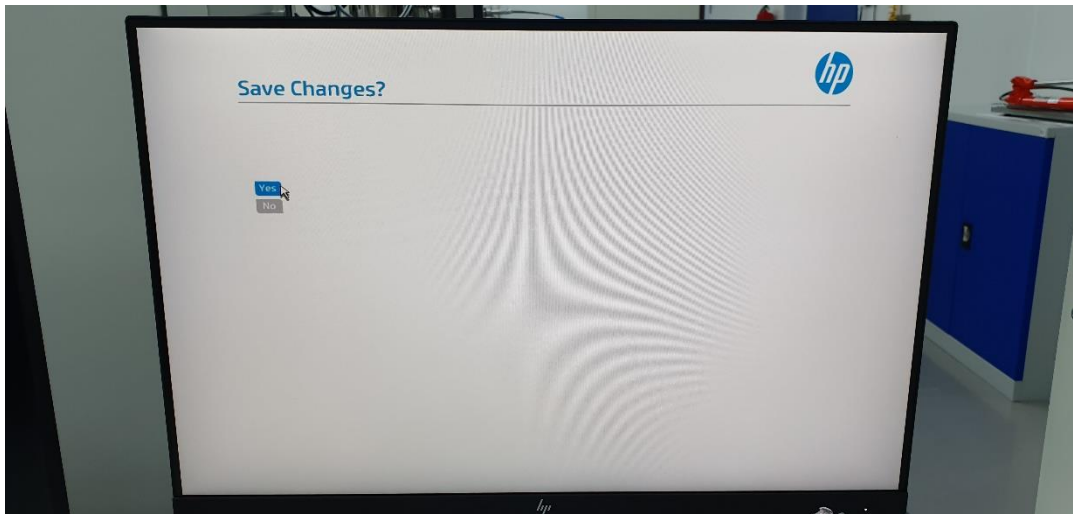
- The system will now power off and switch on again. Make sure, the installation media (USB stick or DVD) is inserted.
- The computer will boot from the installation media.
- If not, check the boot order in the BIOS setup Advanced tab. Normally the boot order should be correct.
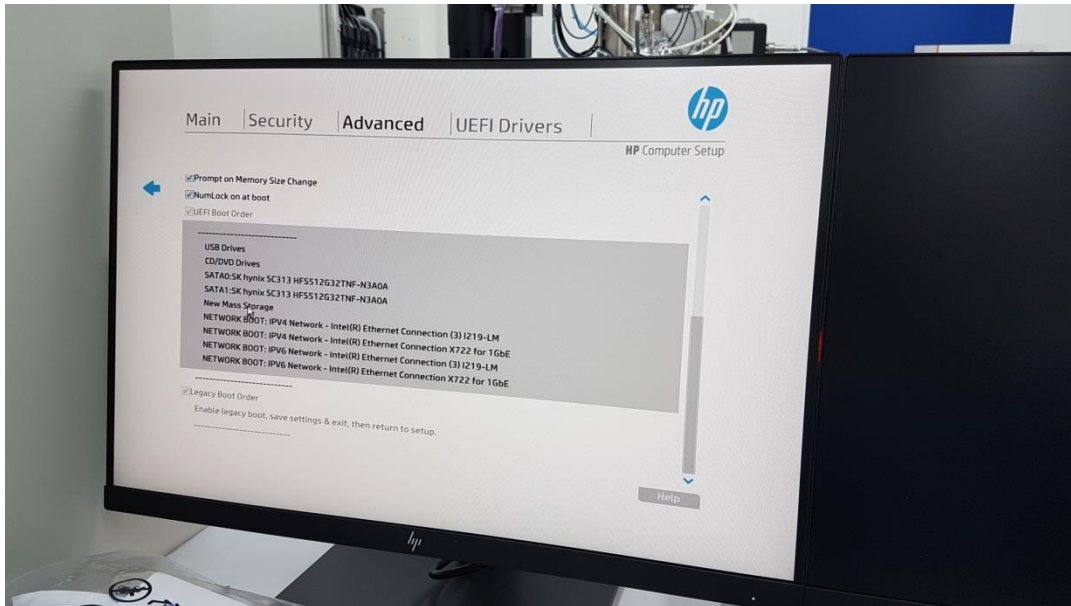
8.2 <u>Install Linux with created Installation Media</u>

The Installation Media has a "kickstart" file which contains the entire installation of the system as how it is delivered. This includes packages from the Linux distribution as well as some extra required packages.

When the boot menu appears on the screen select the option: "Install A2xx (MCC)" with the up/down arrow keys and press 'Enter'. Mind that "Install A2xx (MCC)" is just an example

The automatic standard installation procedure starts and will install all required software with the user accounts etc. When this option is chosen, everything will be installed automatically without any interaction of the user.

8.3 <u>raid-status</u>

Login as the 'root' user and check the status of the storage volume with "raid-status".

```
[root@a2xx ~]# raid-status
```

/dev/mapper/rhel_a2xx-root:

Version : 0.90

Raid Level : raid1

Array Size : 52428800 (50.00 GiB 53.69 GB)

Used Dev Size : 475088896 (453.08 GiB 486.49 GB)

Raid Devices : 2

Total Devices : 2

Preferred Minor : 126

Persistence : Superblock is not persistent

State : clean

Active Devices : 2

Working Devices : 2

Failed Devices : 0

Spare Devices : 0

Number	Major	Minor	RaidDevice	State
0	8	0	0	active sync /dev/sda
2	8	16	1	active sync /dev/sdb

To monitor the raid status, the command mdadm is executed in the background. Any status equal to "Fail" generates an email to the "root" user. The user can be changed by editing /etc/mdadm.conf and modifying the line:

```
 MAILADDR root
```

```
For more info on the mdadm command see the manual pages.
```

```
 [root@a2xx ~]# man mdadm
```

8.4 <u>Failing disk</u>

If one disk has failed for whatever reason, replace the failed disk with a disk which is at least as large as the original disk. The disks are hot swappable. The RAID-controller should automatically start to rebuild/synchronize the replacement disk. Use the utility raid-status again to see if the volume is rebuilding.

If no replacement disk is available the failed disk can also be removed but a replacement disk must be inserted as soon as possible.

9. MAIL SETUP

To send an email, the system settings may have to be changed. To see whether changes have to be done, send a test email as follows:

```
[pg@a2xx pg]~> mail -s "1st test from a2xx" user@domain.com
bla bla
ctrl/d
Cc: <return>
[pg@a2xx pg]~>
```

Replace *user@domain.com* with a valid email address.

If the email is not received check the IP-address of the hostname `a2xx` in:

```
/etc/hosts
```

like:

```
127.0.0.1   localhost.localdomain localhost
127.0.0.2   a2xx
```

The localhost IP-address of 127.0.0.2 for `a2xx` is valid, but it is better to change this to the real IP-address of the computer.

Next setup *postfix*, login as root and edit the file:

```
/etc/postfix/main.cf
```

and append the next line to it:

```
relayhost = <IP-address>
```

wherein *<IP-address>* is the IP-address of the mail server. In case the system is moved, change this IP-address accordingly. Ask the local network manager for the proper IP-address of the SMTP mail-server.

Finally append at least one of the next lines to *main.cf*:

```
mydomain = <domain_name>    (e.g. raith-litho.com)
```

and/or

```
myhostname = a2xx.<domain_name>    (e.g. a2xx.raith-litho.com)
```

After these lines are added, save and close this file.

Now startup the *postfix* service and let it startup after every reboot:

```
[root@a2xx ~]# service postfix start
[root@a2xx ~]# chkconfig postfix on
```

Do the mail test again:

```
[pg@a2xx pg]~> mail -s "2nd test from a2xx" user@domain.com
```

```
bla bla
ctrl/d
Cc: <return>
[pg@a2xx pg
```

Possible other reasons for the email not being received are that no MX records exist in the (internal) DNS-server and/or clients are not allowed to directly send mail via SMTP. Contact the local network manager to verify these settings.

10. LINUX TOOLS

On the MCC a set of tools are installed. These tools can be displayed by the command "tools":

```
[pg@a2xx pg]~> tools

RAITH Linux tools V02.02 (28-OCT-2015)

  astyle             backup             bye                cs
  dump_nfs           evaluate           fbfiles            findf
  gnome              listpath           lo                 preference
  purge              rar                search             selinux
  spaces2underscores systools           tar_gz_disk        tar_gz_ftp
  tar_gz_nfs         tools              tree               val2var2lists
  vms2linux          Xcommands

For more detailed help, type:
  tools <command>
[pg@a2xx pg]~>
```

To get more detailed help (as mentioned in the bottom of above output) enter:

```
[pg@a2xx pg]~> tools <tool>
```

11. BACKUP

Although the MCC has a RAID 1 storage system, creating backups is always recommended.

Backups must always include at least the critical files. These are all the files in the /home/pg and /home/beams directories.

The Linux-tools package, which is described briefly in the previous chapter, provides a couple of different backup facilities, see the command "backup"

```
[root@a2xx ~]# backup

Backup procedures

See:

  tar_gz_ftp --help
  tar_gz_nfs --help
  dump_nfs --help

[root@a2xx ~]#
```

With these "backup" facilities the selected critical files/directory trees can be backed up and transferred over the network to another computer.

When shipped the tar_gz_ftp is automatically running once a week creating backup files in the /home/tar.gz directory. These files can be manually copied to external media for safeguarding or transferred over the network to another computer.The name of the target computer to which the backup has to be transferred using the FTP protocol can be set by replacing the line TARHOST=$HOSTNAME in the editable section of the tar_gz_ftp.cron file. Replace the variable $HOSTNAME with the name of the host to receive the backup files. Also don't forget to modify username and password (TARUSER and TARPASS respectively). The file tar_gz_ftp can be found in the /opt/linux_tools/backup directory.

12. LINUX (RE)INSTALLATION

In the event the Linux operating system has to be reinstalled for whatever reason, Installation Media in the form of a DVD or USB thumb drive is included with the computer system. This installation media contains a distribution of Red Hat Enterprise Linux plus additional software (BEAMS, drivers, etc.). A backup of at least the directories: /home/beams and /home/pg must exist for a full recovery of the system.

To reinstall Red Hat Enterprise Linux, put the DVD into the DVD-drive or insert the USB thumb drive into a free USB port and (re)boot the computer. Be sure the boot order in the BIOS/UEFI settings are to boot from the DVD-drive or USB thumb drive first (before the internal hard drive).

From the installation media, two types of installation are possible:

- Automatically using a kickstart file
- Manual Linux installation

12.1 Automatically using a kickstart file

The installation media has a kickstart file (automatic answer file) which installs all the software without interaction from the user. The only requirement is that the system is a Z8 as described in the chapter "System Specific Information".

When the welcome screen with the installation options appears on the screen, select the option "a2xx" with the up/down arrow keys and press enter.

By selecting "a2xx", the automatic installation procedure begins and will install everything that is needed to control the EBPG5200, including the BEAMS software with the user accounts etc. etc. This will be a clean installation without any machine specific data (Global Data)

12.2 Manual Linux installation

Once the Welcome screen with the installation options appears on the screen, select the default installation option: "Install or upgrade an existing system" and press enter:

After a while, the graphical installation procedure appears on the screen.

There are only 4 installation issues which have to be taken care of:

1) Make the swap-space at least twice as large as the installed memory. However, if a lot of memory is required, then make it for example 16000 MB.

2) When the firewall is enabled at least Ethernet device eth1 has to be trusted. Further to be able to access interactively at port 22-tcp (=ssh) has to be trusted as well. When RGS will be used port 42966-tcp must also be trusted.

3) Network setting for eth1: = 192.168.2.200, netmask = 255.255.255.0

There is no need to create a user account during the installation of Linux.

After the reinstallation of Red Hat Enterprise Linux, the backed up home directories must be restored. Transfer the backup files: a2xx_beams_<date>.tar.gz and a2xx_pg_<date>.tar.gz to the reinstalled system and extract them:

```
[root@a2xx ~]# cd /home
[root@a2xx home]# tar -xzf a2xx_beams_<date>.tar.gz
[root@a2xx home]# tar -xzf a2xx_pg_<date>.tar.gz
```

To setup the "beams" and "pg" environments, execute these commands:

```
[root@a2xx ~]# cd /home/beams/.beams/setup
[root@a2xx setup]# ./setup_mcc a2xx --upg
```

13. VIDEO DRIVER

The MCC is shipped with a nVidia graphics card and two monitors. The driver for this card is already installed. If security patches and updates are installed, the situation can occur that one of these patches or upgrades is a Linux Kernel update. If this is the case one of the monitors may not switch on after a reboot of the MCC. This is because the pre-installed nVidia driver is a so-called proprietary driver and needs to be rebuild/linked for the new kernel.

This task can be performed by the driver installer using the following steps:

1) When sitting behind the MCC computer simultaneously press <CTRL>,<ALT>,<F2>. This will cause the dispay to switch to a text console (the graphical console is still available when pressing <CTRL>,<ALT>,<F1>). This step is not required when accessing the MCC remotely (SSH)

2) Log on as the "root" user (password is shown in table 1).

3) Change to the nVidia directory (cd nVidia)

4) Run the installer with the upgrade option (./nv.install -u)

This will close the graphical console and re-install the nVidia driver).
After installation is finished the graphical console should be started again with both monitors activated.

14. SPLC (RE)INSTALL

14.1 Flash CFast card

The MCC has a complete setup for configuring and flashing the CFast card. To create the CFast card, follow next steps:

- Login as "root" on `a2xx`'s MCC.

```
[pg@a2xx ~]$ su - root
```

- Go to the "CompactFlash" directory:

```
[root@a2xx ~]$ cd CompactFlash
```

- Put a USB CFast-reader into a free USB port of the MCC and enter next command:

```
[root@a2xx CompactFlash]$ sh create_compact_flash

1st parameter must be an APC configuration:

  APC810_00
  APC810_01
  APC810_11
  APC910_06
```

This command will need a valid APC-configuration. With above command the possible APC-configurations are displayed.

Then:

```
[root@a2xx CompactFlash]$ sh create_compact_flash APC910_06

Delete all partitions on /dev/sdc
Copy Master Boot Record of first partition: /dev/sdc1
Copy System partition to first partition
Create other partitions
Format partition 2-4
Mount partition 2-4 and copy stuff to it

  Next questions need only an answer:
    "yes" (=true=1) or
    "no" (=false=0)
```

Two options have to be set for the specific machine. These are:

"Pneumatic Loader" (=0) or "Servo Loader" (=1)

"2 position cassette"(=0) or "10 position cassette" (=1)

For `a2xx`:

```
Has servo loader: no

Has 10 positions: no
```

- Once the prompt is back, take out the CFast card from reader and put it in slot "CFast" of the APC910.

- Turn on the APC910

15. RAITH ACCESS TO THE MACHINE

For the best and quickest support by the RAITH engineers access to the machine: `a2xx` with SSH is required. SSH (Secure Shell) is a TCPIP protocol for creating a secure connection over an unsecure network by means of data encryption. The most important functions of ssh are:

- Secure Interactive login (`ssh`)

- Secure file transfer (`sftp`)

- Secure tunnelling (`ssh -L<port>:<host>:<port>`)

An extra security item is to only allow the RAITH IP-address to get through the local networks firewall and access the machine. The IP-addresses of RAITH are:

Best (nl)	`62.132.232.130`
Troy (us)	`66.109.51.51`

16. RGS

HP Remote Graphics Software (RGS) is a high-performance remote desktop connection protocol. The sender part is already installed on a2xx and is ready to be used. To make use of RGS a sender and a receiver is needed. The sender installed on the a2xx computer system can be accessed by a receiver for which a Linux and a Windows version are included on the Installation Media delivered with the MCC. The receiver must be installed on another system in the network which can "see" the a2xx computer system.

Windows version:

```
raith/rgs/receiver/win32/Setup.exe
```

Execute this file in a Windows environment and follow the steps to install it.

Linux 64bit version

```
raith/rgs/receiver/x86_64
```

Execute in this directory install.sh and follow the steps to install it.

16.1 RGS through a ssh tunnel

To be able to setup a RGS session through a ssh tunnel, be sure the next items are set correctly.

- o /etc/hosts

  The hostname "a2xx" is default in the line of localhost：

  ```
  127.0.0.1   a2xx   localhost.localdomain localhost
  ```

  Be sure the hostname "a2xx" is on a separate line with the IP-address of the machines internet/local network connection:

  ```
  192.168.1.20     a2xx
  ```

  ```
  The IP-address in the above line is only an example.
  ```

- o Create a tunnel from another ssh client system as follows:

  ```
  [user@host ~]$ ssh pg@a2xx -L<port>:<ip|name>:<port>
  ```

  Like

  ```
  [user@host ~]$ ssh pg@a2xx -L42966:a2xx:42966
  ```

- o As host in the RGS receiver (=client) put the local host IP-address. NOT localhost itself:

  ```
  127.0.0.1
  ```