PHILIPS

Healthcare, Information Supply Chain, MR

Explanation document

MR9150 Introduction DDAS

MR9150

version: 2.2

Table of contents:

1 INTRODUCTION

1.1 Objectives

In this document you are introduced to the **DDAS** hardware, another step in the evolution of our MR scanner.

1.2 Scope

DDAS hardware will be introduced first on systems with dStream (at the time of writing: all Ingenia systems). The Initial software release for these systems with DDAS is **R5.1.9** (R4.1.9 in China).
Systems without dStream (Achieva, Multiva) will follow later. This document will already explain the changes so you are prepared.

1.3 History

The first Philips MR systems had a data acquisition system called DAS. It was the place where the data was acquired and digitized. Newer MR generations came with improved data acquisition hardware and new names: ADAS, BDAS and CDAS. DDAS is a logical new name for the new hardware. You will see that data acquisition has become more decentralized.

1.4 Silent customer introduction

Systems with DDAS will be silently introduced to the customer. A silent introduction is possible when customer specs do not change.
Application software will not change and therefore no application training is required.

1.5 System codes

The system codes of systems with DDAS remain as they are for systems with CDAS. Use the SRN to recognize a system that is initially delivered systems with DDAS.

1.6 New hardware

- Single Host/Recon
- DNA-NIC end
- Scan control computer: **SCC**
- DNA-NIC hub
- Transmit control interface: **TCI**
- integrated gradient control interface: **iGCI**
- digital multiple receiver: **dMRX** (non dStream systems only)

1.7 New software

- Service application: Philips SupportConnect: **PSC**
- Health viewer

1.8 New procedures

- auto SPT spec updates
- optimized SPT procedures
- SRN confirmation
- Automation of STT tests
- log file size reduction by 25%

1.9 Summary

- The function of the **CDAS** rack is taken over by the **SCC** and **TCI**.
- The host and recon computers are combined into one **Host/Recon** computer.
- The service application **FSF** (Field service framework) is replaced with **PSC** (Philips SupportConnect).
- CDAS self-tests are replaced with the **health viewer**.
- For non dStream systems, digitization takes place in the **dMRX** board(s) in the PFEI. The coils are stil analog so we still have multiple coax cables from the PICU up to the PFEI. After the PFEI the signals travel via a fiber.

1.10 Water cooled RF amplifier and LCC-2B

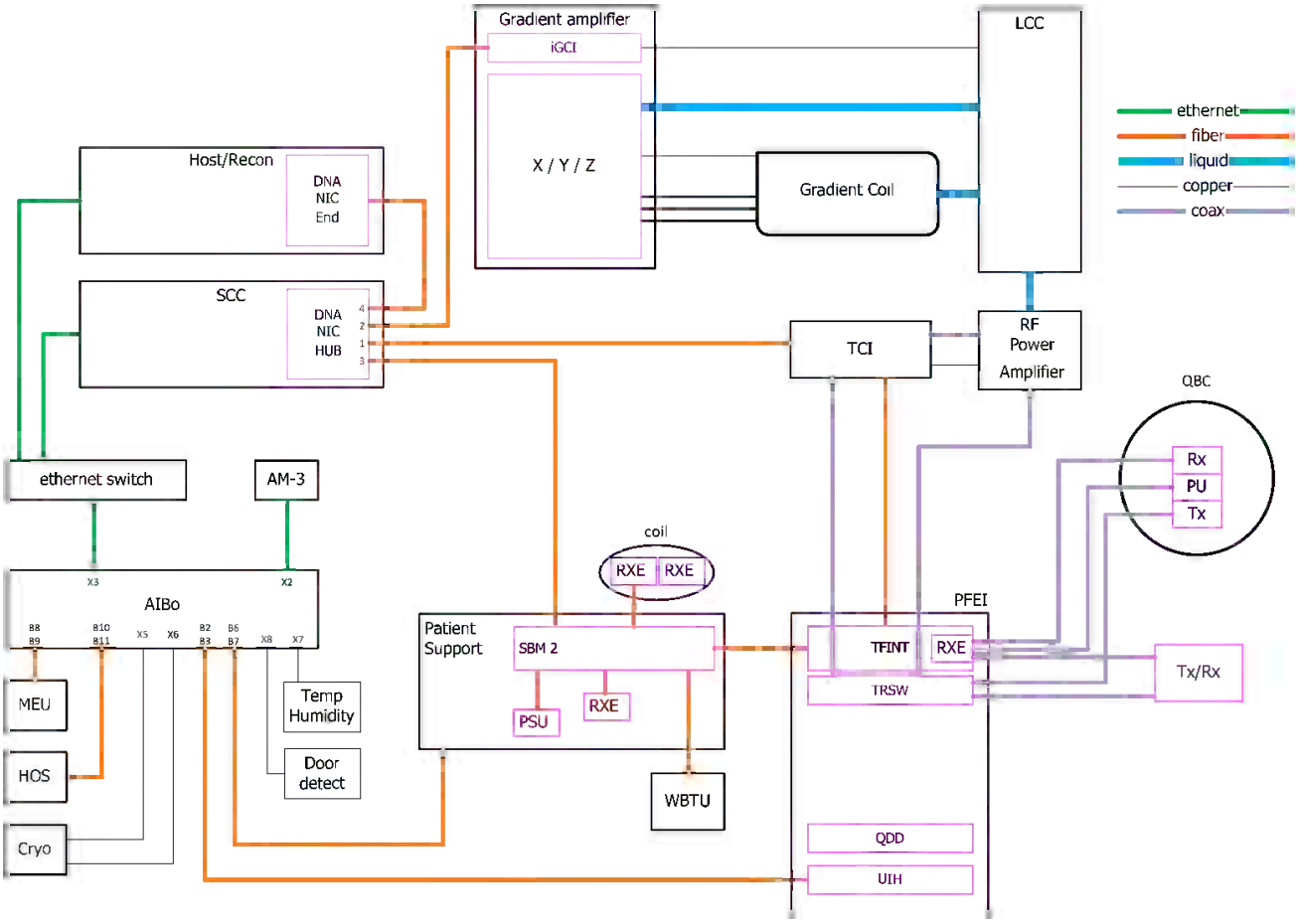
- DDAS systems will be shipped with water cooled RF amplifiers and LCC2B.
- For 3T: The 2 RF amps and circulator are replaced by one unit which is located in the DACC **eliminating the ACC2** (not for China)
  Please refer to SB-275 Introduction of Software release R5.1.7 and WCRF.

2 DIAGRAMS

2.1 Functional diagram dStream systems

dStream system design in general:
The dStream systems have been designed around digital receive coils; the MR (response) signal is digitized directly by RXE modules in the coils (except QBC and coils connected via the dStream interface). The digitized signals of multiple coils/elements are combined in the SBM.

dStream system design with DDAS:
When your system is equipped with DDAS, the output of the SBM is connected to the SCC as shown in the diagram below. The transmit functionality is controlled by the TCI.

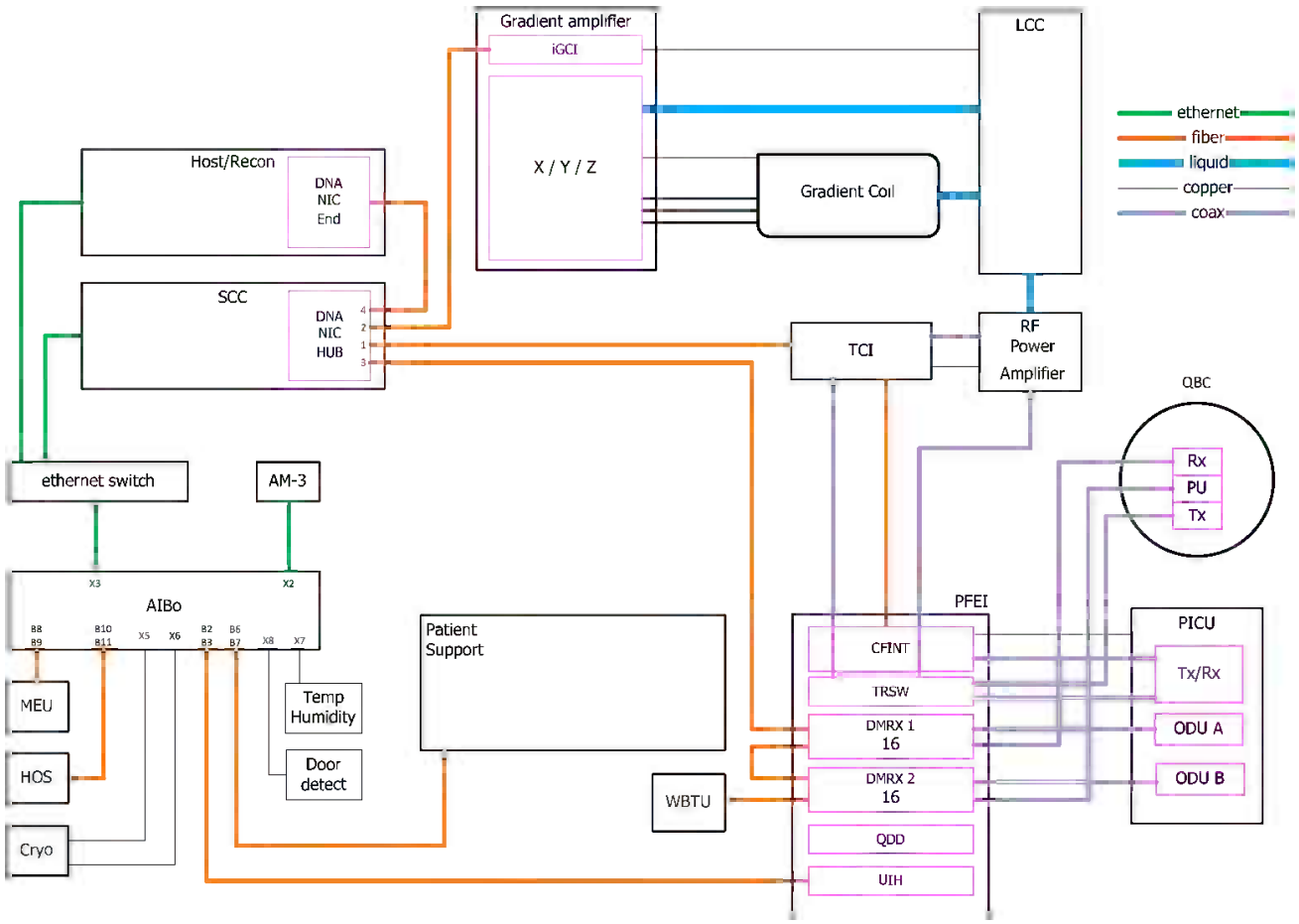


note: SBM will be replaced by SBM 2

2.2 Functional diagram non dStream systems

non-dStream system in general:
The non-dStream systems have been designed around analogue coils; the MR (response) signal is digitized in the CDAS.

non-dStream system design with DDAS:
When your system is equipped with DDAS, this digitization takes place by the dMRX in the PFEI and transported via one optical fiber to the SCC as shown in the diagram below. The transmit functionality is controlled by the TCI.



3 HARDWARE

3.1 SCC

The heart of an MR system with DDAS is the SCC. It provides real-time control of the scanner communicating with other DDAS components via the DNA network.

The SCC is a PC style computer. It runs VXWorks (the operating system). The software is uploaded and installed automatically from the Host/Recon (like the CDAS-SBC) and normally needs no user attention. An external monitor can be connected for faultfinding (using the SPD). Its main function is to control the DNA-NIC HUB.

3.2 DNA-NIC HUB

The DNA-NIC HUB is a PCI card located in the SCC. It is the central point (hub) of the DNA network and communicates with all the other DDAS components.

The DNA-NIC HUB also provides the central **system clock** that serves as an accurate and stable time basis for all DDAS components

DNA stands for **digital network architecture**. It is a low-latency, high-bandwidth network with integrated signaling and clock distribution.
Just remember: DNA is a fiber optic connection between two units.

3.3 Host/Recon combined

The function of the reconstructor has been integrated into the host computer. The location of the Host/Recon combined is, at the moment, in the operator equipment cabinet (OEC). A future change will move the computer into the technical room, eliminating the OEC completely. The host/recon combined communicates with the rest of the system via an optical fiber and an ethernet connection. See the block diagrams below.

3.4 DNA-NIC END

The DNA-NIC END is a PCI card located in the host/recon. It provides access to the DNA network via a fiber optic link.

3.5 iGCI

The **iGCI** is the interface to the gradient amplifier; it is connected to the SCC via a fiber optic link. The DDAS iGCI hardware is the same as the CDAS iGCI. The firmware (software) of DDAS iGCI is different and not compatible with CDAS: it has a different 12NC.

3.6 TCI

The **TCI** controls one or two RF power amplifiers and the TFINT. It is also connected to the SCC via a fiber optic link.
The most important functions are:

- Control the RF power amplifier(s) (settings, control and status).
- Generate the RF signals for the input of RF power amplifier.
- Generate the RF tune signal for the tune coils.
- Monitor forward and reflected power at the output of the power amplifier(s) for diagnostic and control purposes.
- Provide DNA loop-through capability.
- Control the TFINT.

3.7 dMRX

The **dMRX** provides a DNA interface to 20 RF receive channels. One dMRX is required for an 8-channel system and 2 dMRXs are required for 16-channel or 32-channel systems. The dMRX also provides the receivers for the body coil and pick-up coils for both single channel and dual channel transmit.

The main features of the dMRX are:

- 16 1H receive channels to coil interface: Enables 8-channel configurations with one dMRX board and 16-channel and 32-channel configurations with two dMRX boards.
- Two power monitor RF receive inputs: 2 of the 20 receive channels can monitor power with a power trip-level circuit. These channels are typically fed by PU coils.
- Two body coil receive channels: Enables single and dual channel transmit body coil operation.
- Specific versions of the dMRX are available for each field strength.
- 7.0 T enabled: The dMRX is capable of operating at 7.0T. A 7.0 T version of the dMRX is only required if 7T systems will upgrade to DDAS without upgrading to iRF/dStream.
- Achieva compatible coil interface – The 1H ODU coil interface of Achieva (PICU connectors A & B) will remain unchanged with the dMRX. This enables exploiting the Achieva coil portfolio on DDAS configurations.
- Eliminate PFEI to DAS RF cabling – All RF coaxial cables from the PFEI through the SFB to the DAS will be replaced by a single optical fiber. This reduces cost, increases reliability and reduces installation time.

3.8 Aibo

The Aibo is not new with DDAS; it has been introduced earlier with release 5.1. At that time not all interfaces were used. The DDAS systems no longer have a clock-board or a CBH2-board. The connections from these boards have been moved to the Aibo:

- door detect
- temperature sensor
- cryo control and monitoring
- fMRI
- BTU
- HOS

3.9 Various

The combined Host/Recon communicates via a fiber optical link with the SCC.

The SCC is sometimes referred to as DDAS. The diagrams show that SCC and TCI together replace the CDAS rack; the SCC and the TCI are two separate devices making up the new architecture of our MR systems.

3.10 ACC

3.10.1 View of the 1.5T ACC

SCC

TCI

Water-cooled RF Amp

3.10.2 View of the 3.0T ACC

Aibo

Network switch

Scan control computer

TCI

HOS

Water cooled RF amplifier

4 SOFTWARE

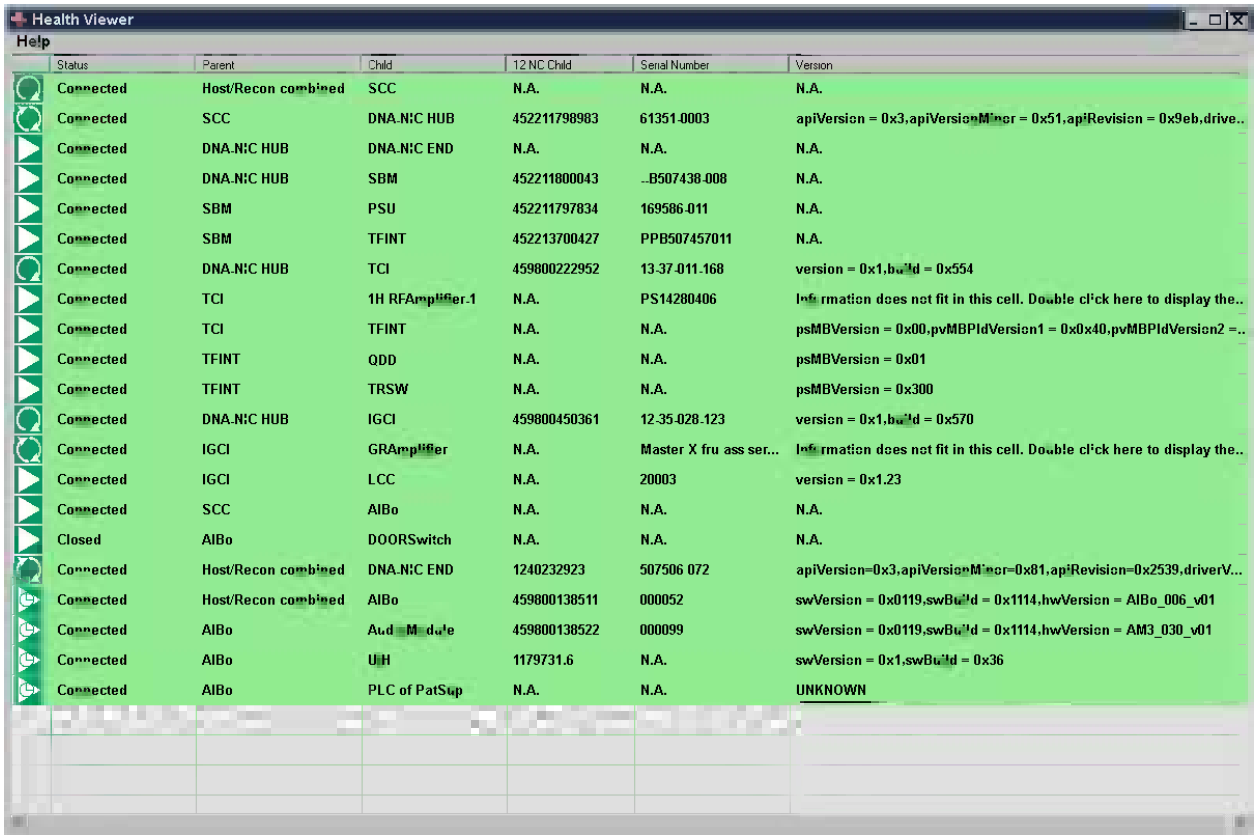
4.1 Health viewer

4.1.1 Introduction

In DDAS systems we do not have a DDAS self-test, but a **real time** software tool showing status information of the most important FRU's. This tool is called **the health viewer**.

The health viewer shows the status of the connection between two FRU's.

The health viewer is designed as a first step in diagnosing and fault finding the MR system. In case of trouble the health viewer can point to a suspected connection or FRU.



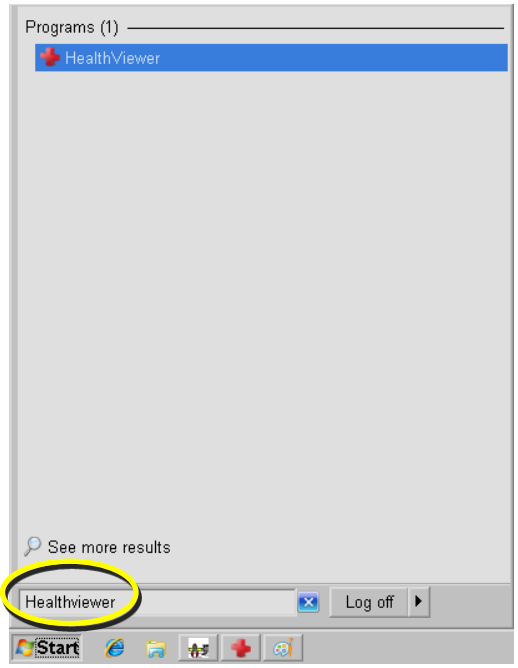
NOTE

The health viewer shows the status of the connection to an FRU.
It **does not diagnose** the FRU itself!

4.1.2 Start the Health viewer

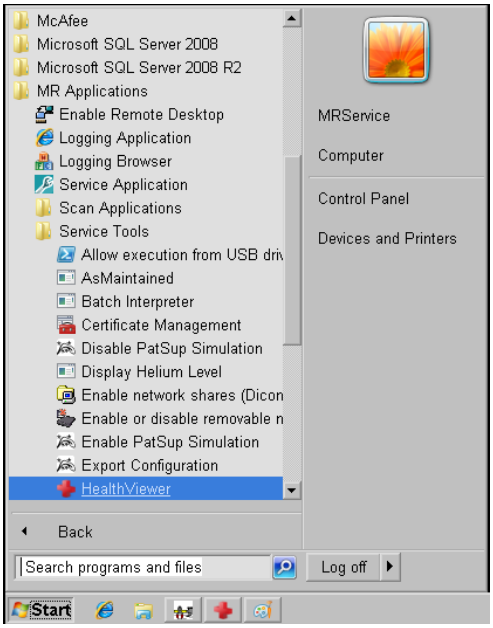
There are 2 ways to start up the Health viewer:

Press the Windows key on the keyboard and enter the word Healthviewer in the **Search programs and files box**.



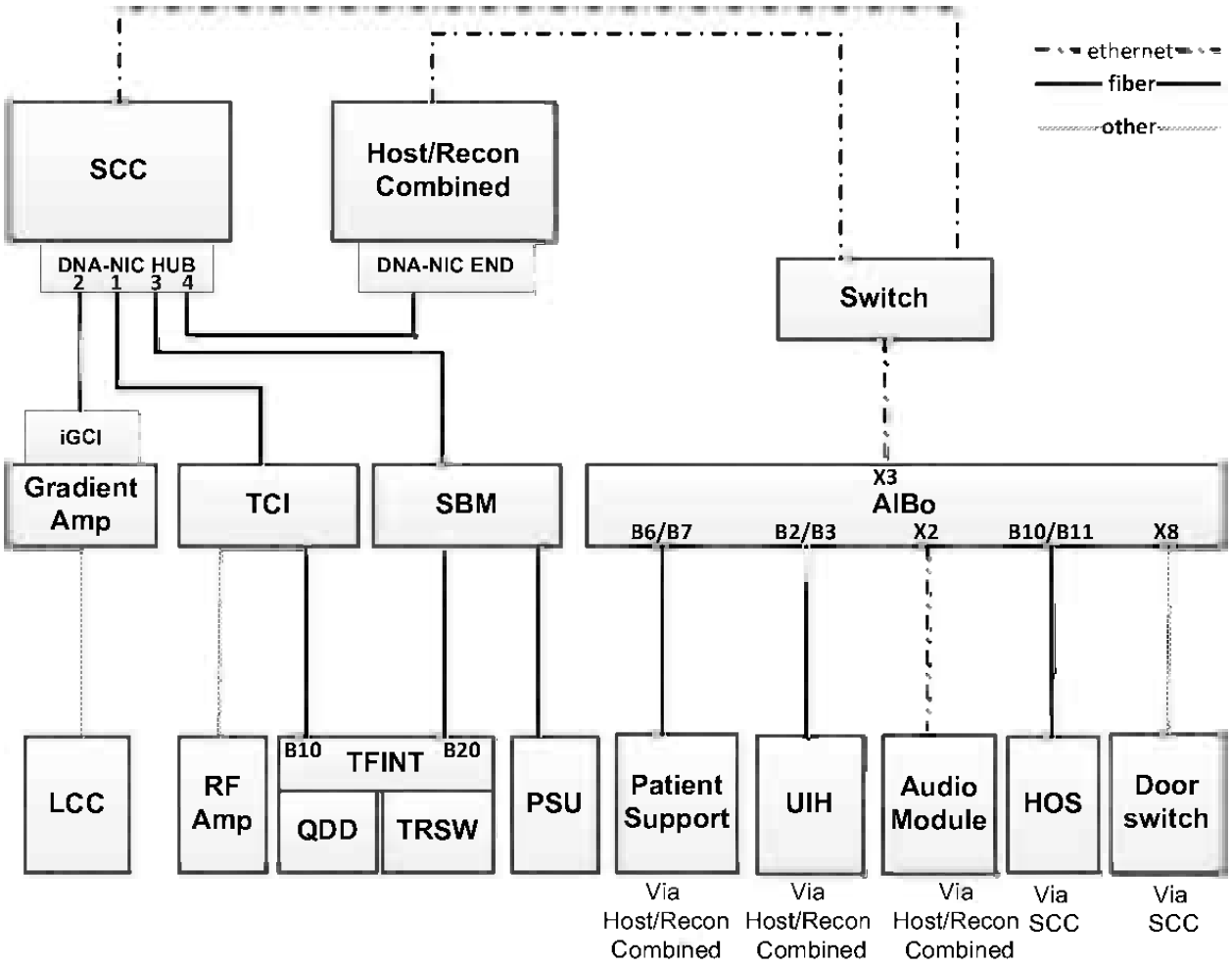
or browse via the Start menu:

select: **Start > All Programs > MR Applications > Service Tools > Healthviewer**



4.1.3 Diagnostics

To diagnose the system with the health viewer, you need to know how the FRU's are connected to each other.
In this version of the health viewer, a diagram[1] is available via the help menu.



In some cases, when more than one path is possible, additional text is added below the FRU to indicate from where it is controlled.

Example: UIH and HOS are both connected to the Aibo but controlled by different parents:

Connections:	text in health viewer:
Host/Recon--- Switch------Aibo----- UIH	via Host/Recon
SCC---------- Switch------Aibo----- HOS	via SCC

[1] Tip: Save this image and open it next to this document in a separate window for easy reference.

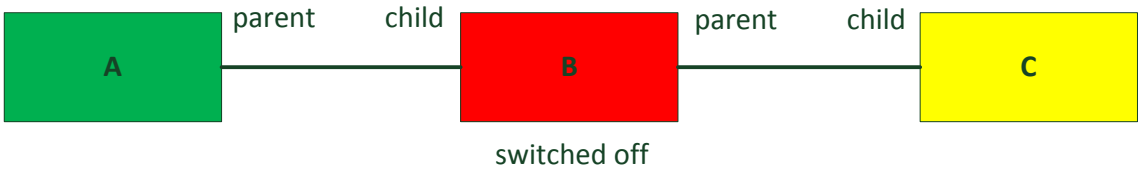
4.1.4 Parent - Child

The FRUs shown in the health viewer are called **parent** and **child**. A child can have one or more parents. Each parent itself can be the child of another parent. Use the diagram to visually determine the parent of the child.

The health viewer lines can have 3 colors depending on the status of the connection between parent and child:

1. a green line — the status of the child can successfully be read by the parent
2. a red line — the child is not connected
3. a yellow line — the parent of the child is not connected so the status of the child is unknown

The yellow status can be explained as follows:



A is switched on and OK
B is switched off

In this situation, the status of **C** is unknown because **B** is switched off

the status of **C** will be **Status Unknown : Parent: <Parent FRU Name> Not Connected.**
the status of **B** will be **Not Connected.**

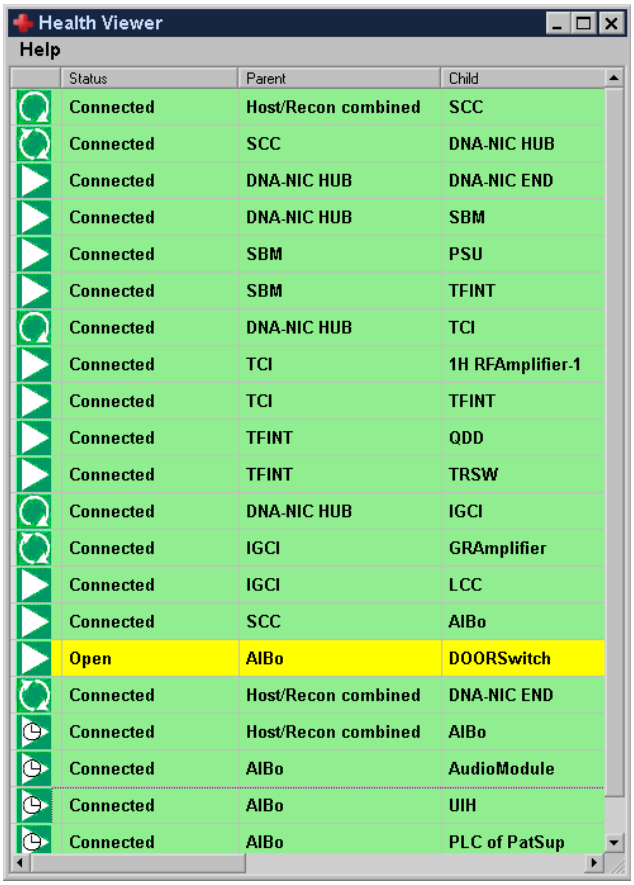
IMPORTANT

Solve the RED lines first!

The relation between the available FRU status, severity and UI color is shown in the table below:

Status	Severity	Color
Connected	OK	Green
Not Connected	Error	Red
Downloading Firmware...	Warning	Yellow
Download Failed!	Error	Yellow
Loopback Detected!	Warning	Yellow
Initializing...	Warning	Yellow
Open	OK	Green
Closed	OK	Green
Status Unknown: Parent: <Parent FRU name> Not Connected	Warning	Yellow
Status Unknown: No Connection with CoilState	Warning	Yellow
Status Unknown: Monitoring file not found!	Warning	Yellow

4.1.5 Icons



The icon on each line explains what happens when that FRU gets connected or disconnected.

Only FRU's with  react immediately.

Other FRU's react after some time.

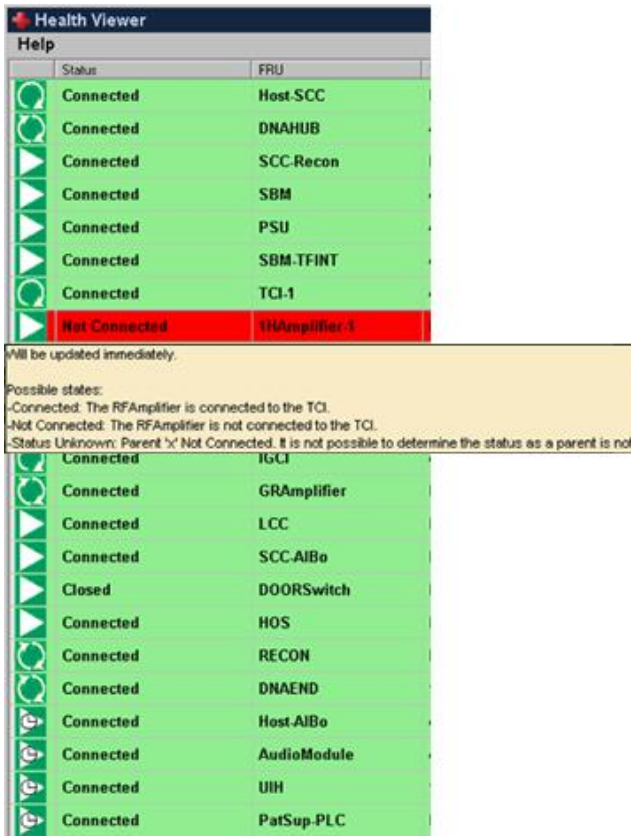
See the table below for the behavior as indicated by the icon.

NOTE

Resize the health viewer to a compact window
and
Open and resize the block diagram

Icon	Description
	When this FRU is disconnected or connected, the Scan Control Computer reboots automatically. After the reboot the new status is visible.
	The new status will be shown immediately.
	After a change in the network, it may take up to ½ minute before the new status is visible. No manual or automatic reboot is needed.
	After a manual reboot the new status is visible. Reboot the SCC or the Host/Recon combined. Read the tooltip for additional information.

4.1.6 Tooltips

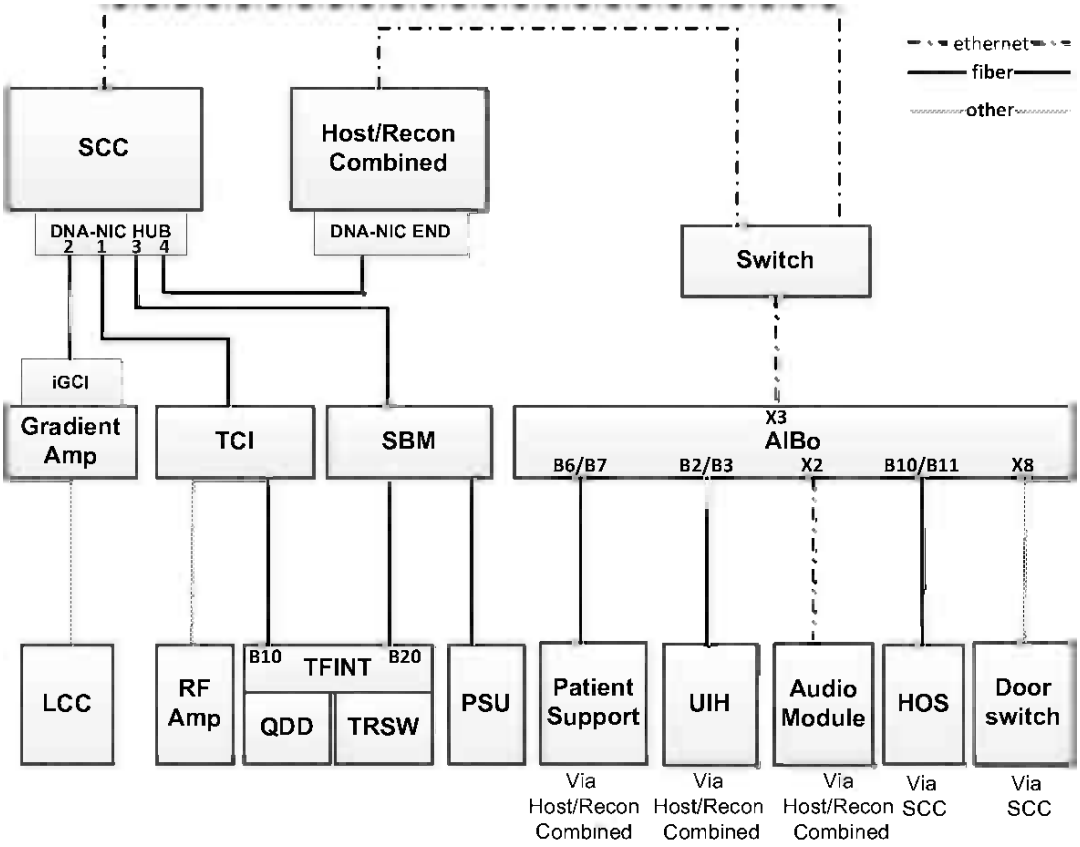


For each line, additional text is available as tooltip:

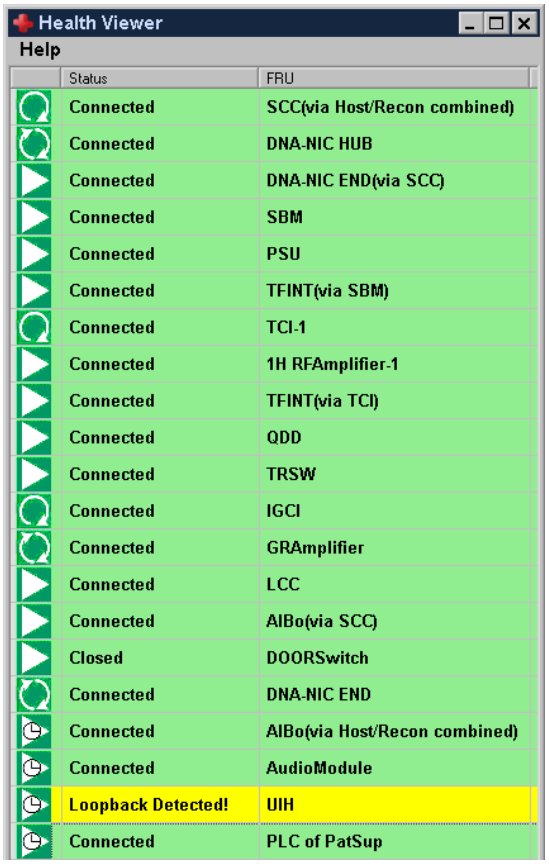
Make sure the Heath viewer window is active: the Title bar is dark blue.

Hold the mouse over an icon.

< A tip about the status appears.



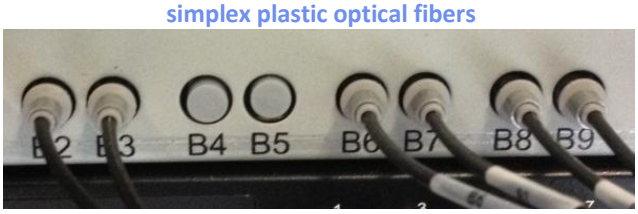
4.1.7 Loopback



The Health viewer can be used as a real-time fiber loopback tool.

Following types are supported:

simplex plastic optical fibers



duplex plastic optical fibers

In this example, a loopback fiber was placed on ports B2 and B3 of the Aibo.

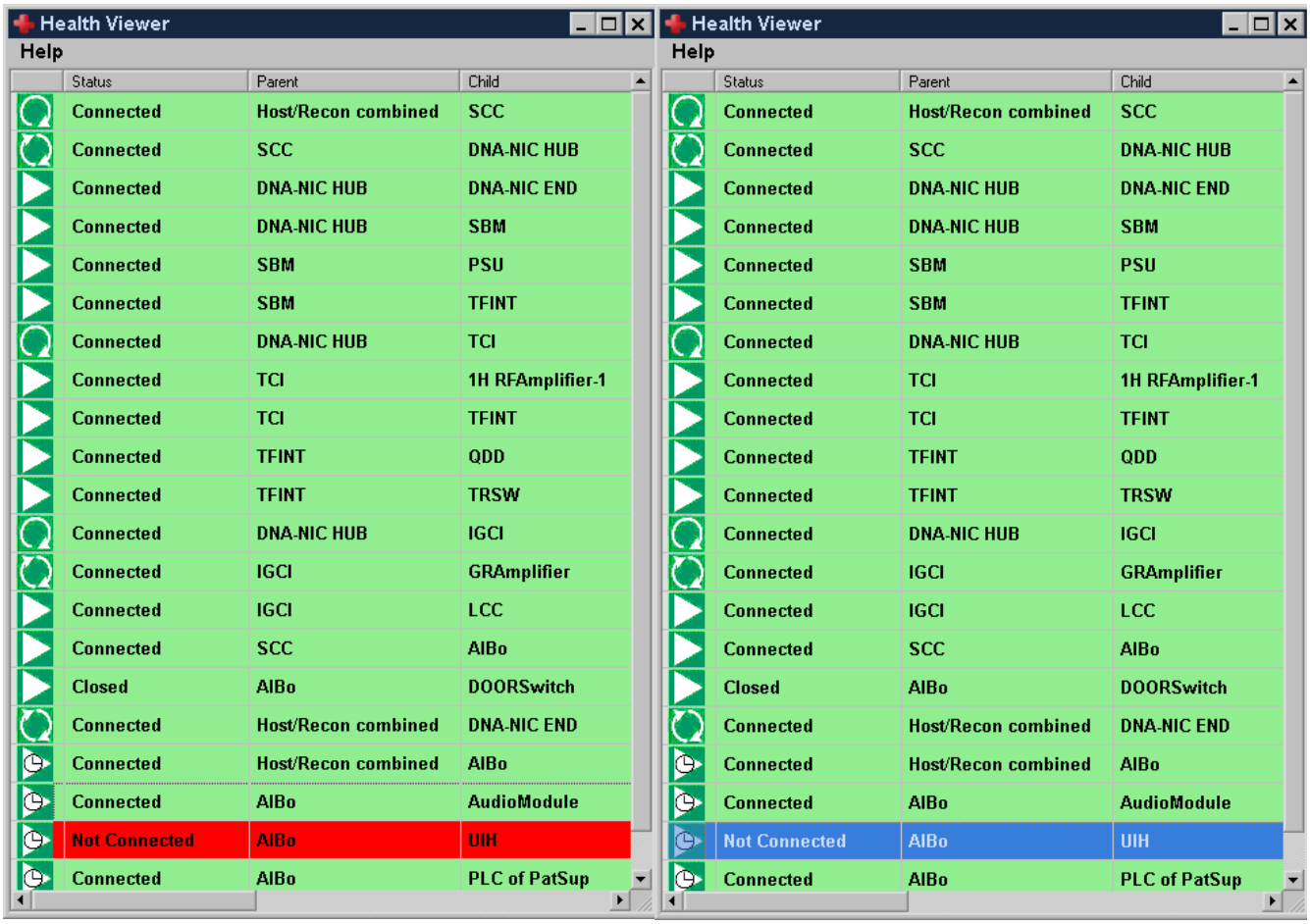
You can use the loopback fibers and the loopback connectors for the supported types of fiber to diagnose a problematic connection.

NOTE

The Health viewer does not support loopback testing for **glass fiber** connections (like in the picture below)

4.1.8 Clicking inside the Health viewer

Be careful not to click inside the health viewer, see these examples:



On the left:
the Aibo – UIH line is displayed in red.

On the right:
When you click on the line it will show up in blue.
This can be cause for mis-interpretation

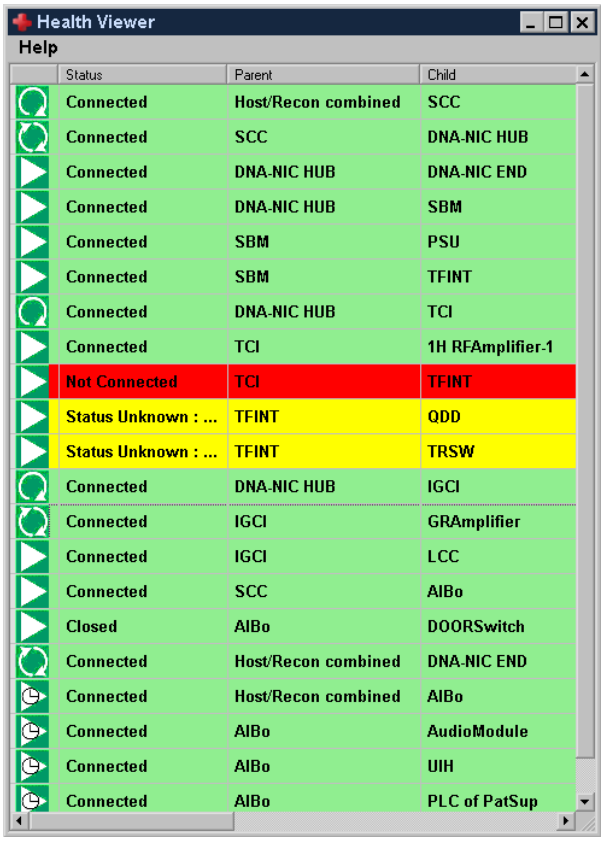
.

NOTE

Do not click on the health viewer lines!

4.1.9 Examples

4.1.9.1 Status unknown



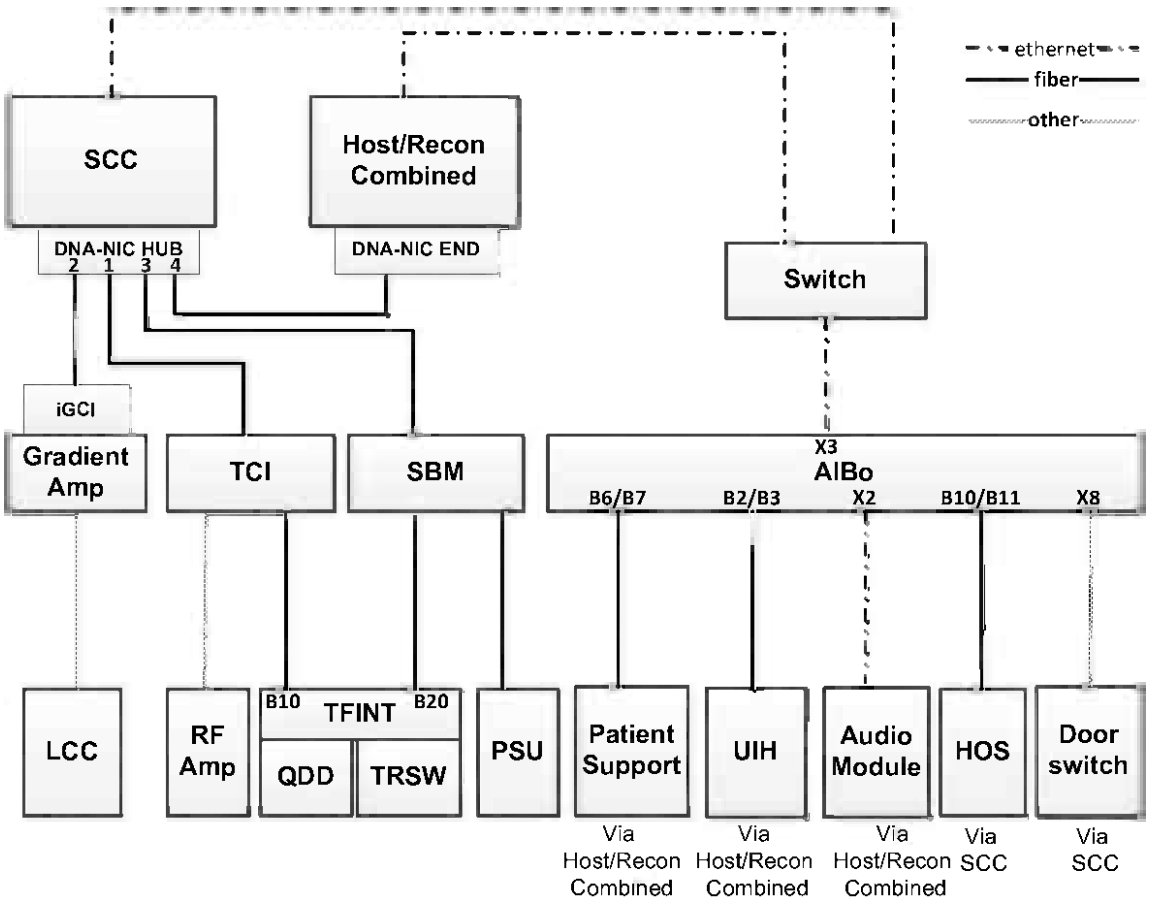
In this scenario, the connection between the TCI and the TFINT is colored RED. The status is Not Connected.

The help drawing shows that a fiber connects the TCI and the TFINT.

Because the TRSW and the QDD are connected to the TFINT they are colored YELLOW.

The status of the QDD and the TRSW cannot be determined because of the error in the connection to the TFINT.

Faultfinding this scenario starts with investigating the communication between the TCI and the TFINT.



4.1.9.2 Rebooting of computers

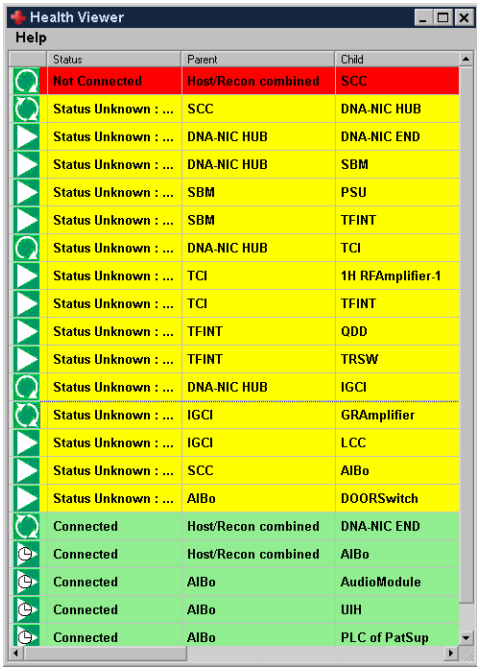
NOTE

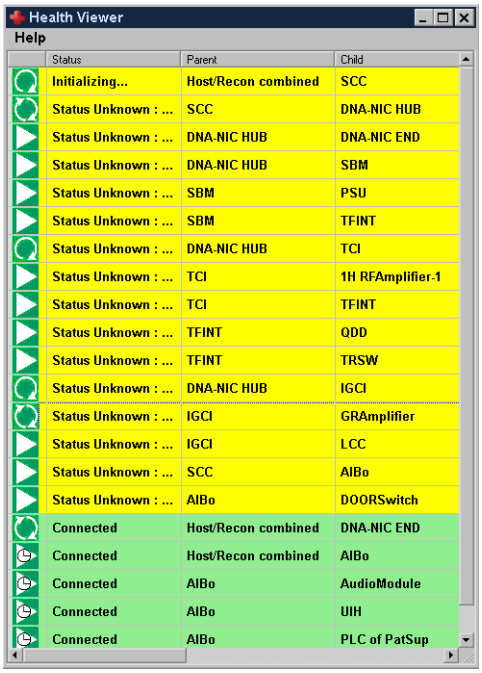
Be aware that the **SCC** reboots automatically in certain situations.
While the **SCC** reboots, the status of the **SCC** changes from

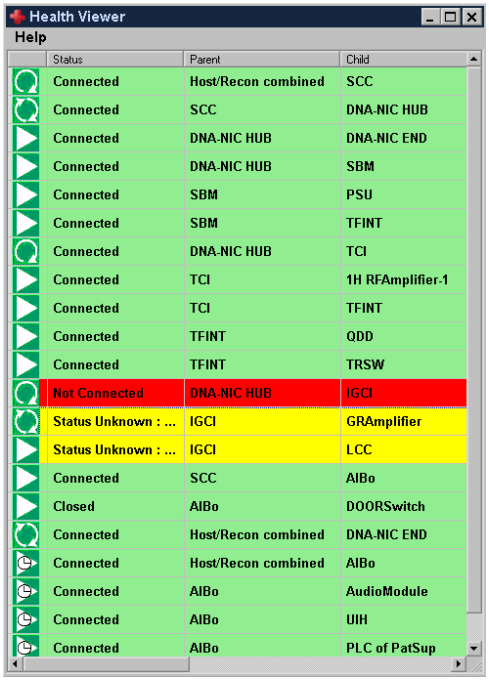
Not Connected to Initializing to Connected

All FRUs connected will be shown as Status unknown during this time.

The views below show the status during the reboot of the SCC (because of a gradient problem):



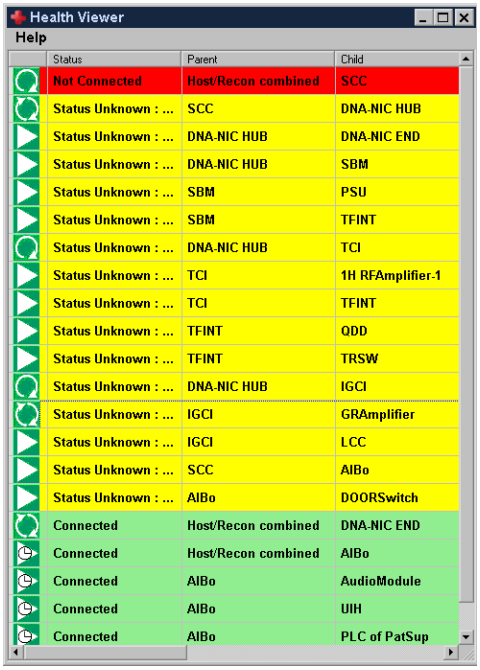


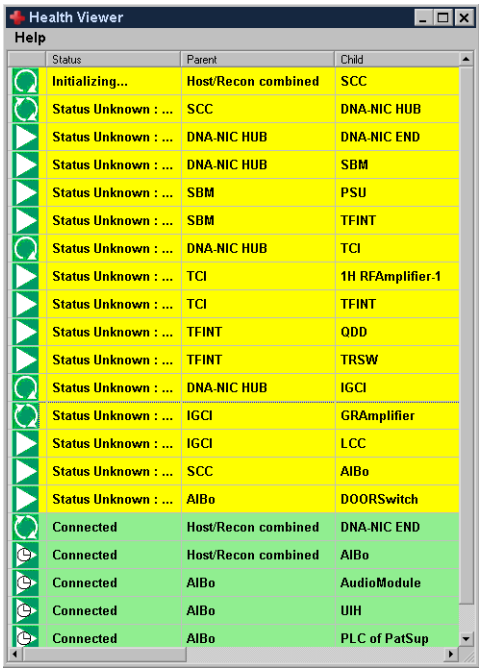


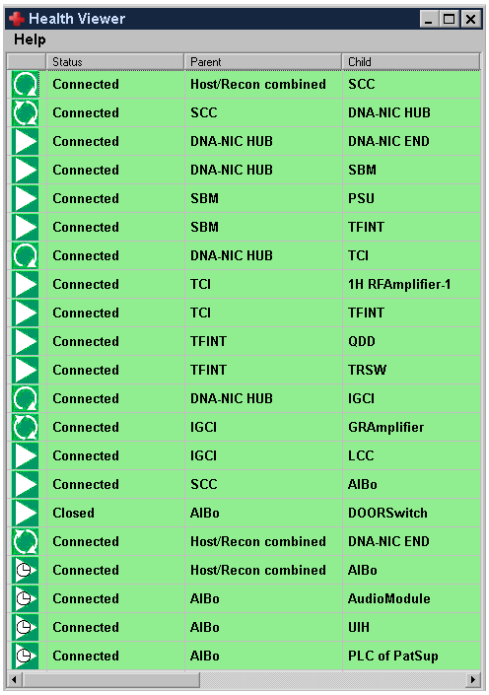
The fiber link to the IGCI (gradient amplifier) was removed.

The icon on the IGCI line in the health viewer is  meaning: When this FRU is disconnected or connected, the Scan Control Computer reboots automatically. After the reboot the new status is visible.

The views below show the status during the reboot of the SCC (after fixing the gradient problem):







The fiber link to the IGCI was re-inserted.

Again, the Scan Control Computer reboots automatically. After the reboot the new status is visible.

All is well.

4.1.9.3 The network switch

NOTE

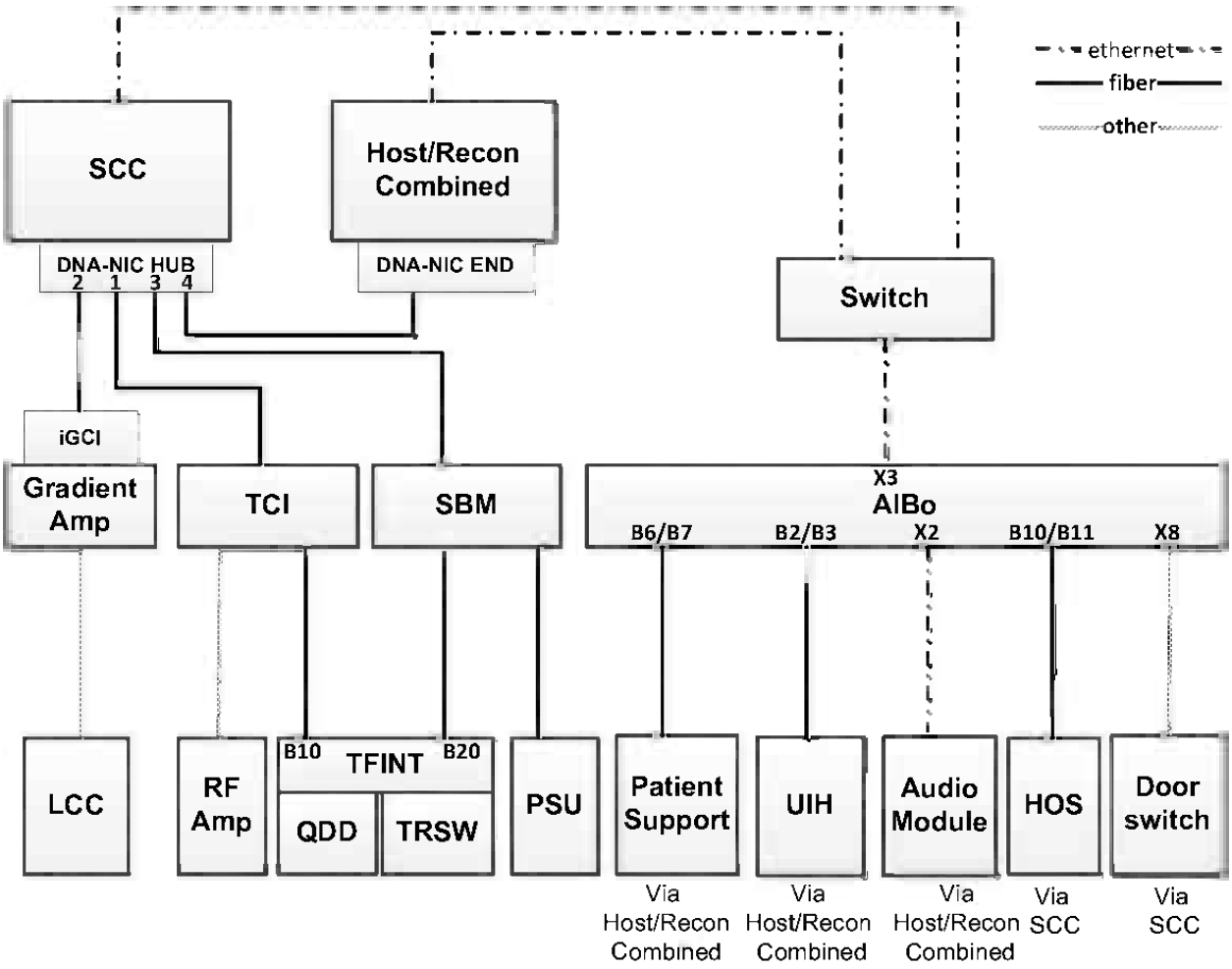
The **network switch** is an important FRU because it connects:

Host/recon to Aibo
and
Host/recon to SCC

Unfortunately the health viewer cannot read the status of the network switch.
For this reason it does not appear in the overview.

The correct functioning needs to be reasoned by observation.

If both SCC and Aibo show up as **Not Connected** it could be due to a problem with the network switch.



4.2 PSC

4.2.1 Intro

The service application in this release is called **Philips SupportConnect** or **PSC**. It has been introduced in MR because it is the new preferred service application for all modalities.

4.2.2 Details

You select the main tasks via the large buttons at the top of the screen (see end of document for screen shots).

The Installation button contains all actions to be performed during the initial system install. They are listed in the same order as in the SMI. So, start at the top and work down. When you are at the bottom, you are finished. After the system handover this button no longer needs to be used, all tests can be found under the following buttons.

The Corrective Maintenance button gives access to all Diagnostics tools, Replacement procedures and Logging information.

The Planned Maintenance button gives access to all PM sessions.

The Configuration button gives access to System Information, System Configuration, Software Licenses, Connectivity settings, Parameter Administration and Service Functions.

PSC also supports automatic login with the hardware dongle, for more information see the document **MR9148 Introduction of release 5.1** (on Incenter)

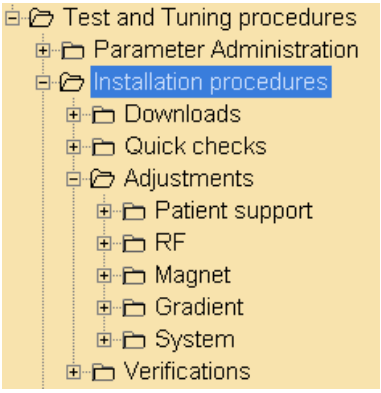
4.3 New and improved procedures

4.3.1 SRN confirmation

Assigning a system reference number to a new system can only be done once. If a wrong number is entered, it is not possible to correct this, other than reloading the software. In this release an extra confirmation has been added to make sure the correct number is used.

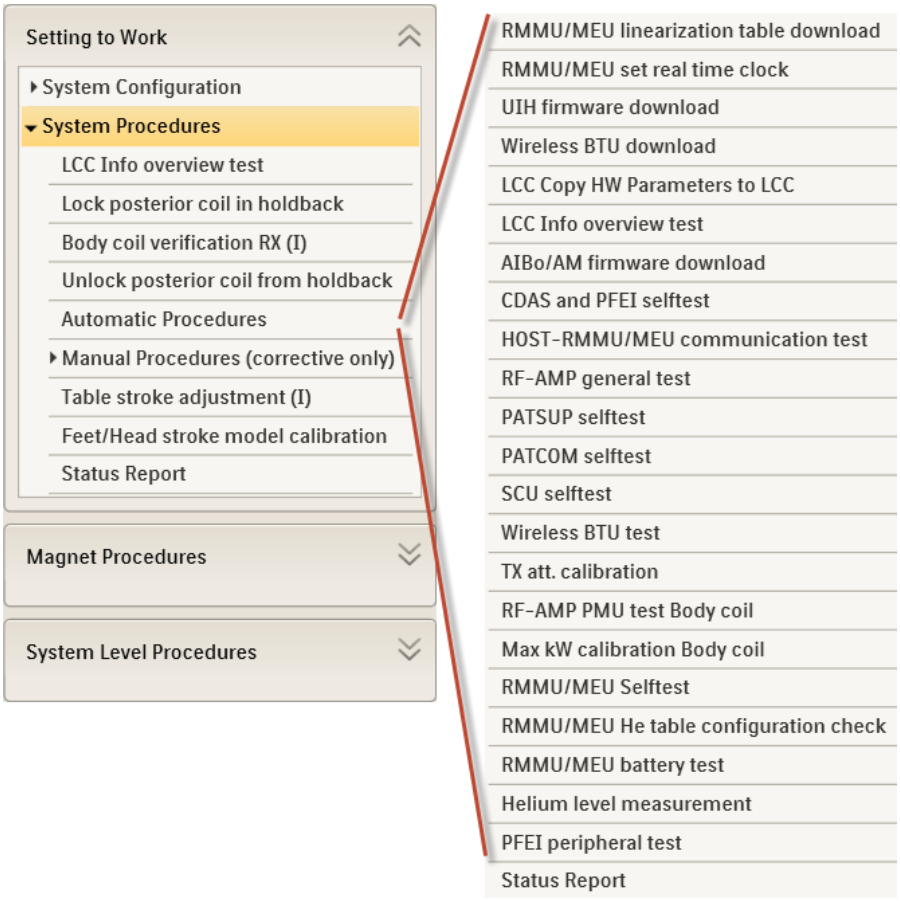
4.3.2 Automation of STT tests

In previous releases many tests had to be started from the submenus (Downloads, Quick checks and Adjustment) under Installation procedures.



These test all have to be started manually.

Starting with this release, the tests have been re-ordered and optimized for automatic execution.
Under System procedures a new entry; Automatic Procedures contains these automated tests that run without user input. This saves time and reduces the possibility for user mistakes. In case one or more automatic tests fail, they can be repeated in the entry Manual Procedures (corrective only).



4.3.3 Auto SPT spec updates

It happens that RF coils are replaced because the IQT test is out of spec. In some cases, when newer spec files are available on Incenter with other values, these coil replacements could have been prevented, saving time and money. Starting with this release, systems connected to PRS will get automatic SPT updates.
With this automatic update procedure, the FSE does not have to check for new specs each time a test is performed.

4.3.4 Optimized SPT procedures

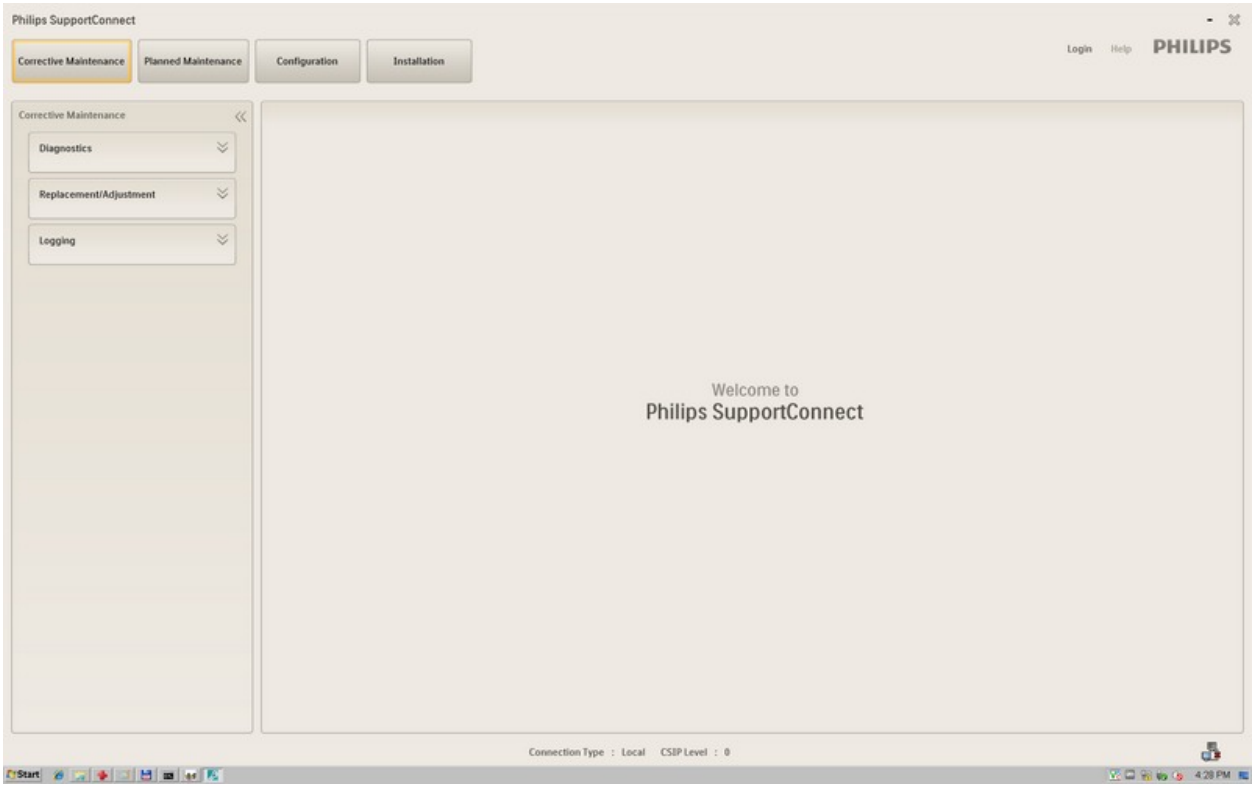
The performance measurements in the chapter Acceptance have been optimized. Only measurements that include specifications have to be performed. This reduces their number saving time. The SMI, chapter Q, has been updated to reflect the changes.

4.3.5 Log file size reduction by 25%

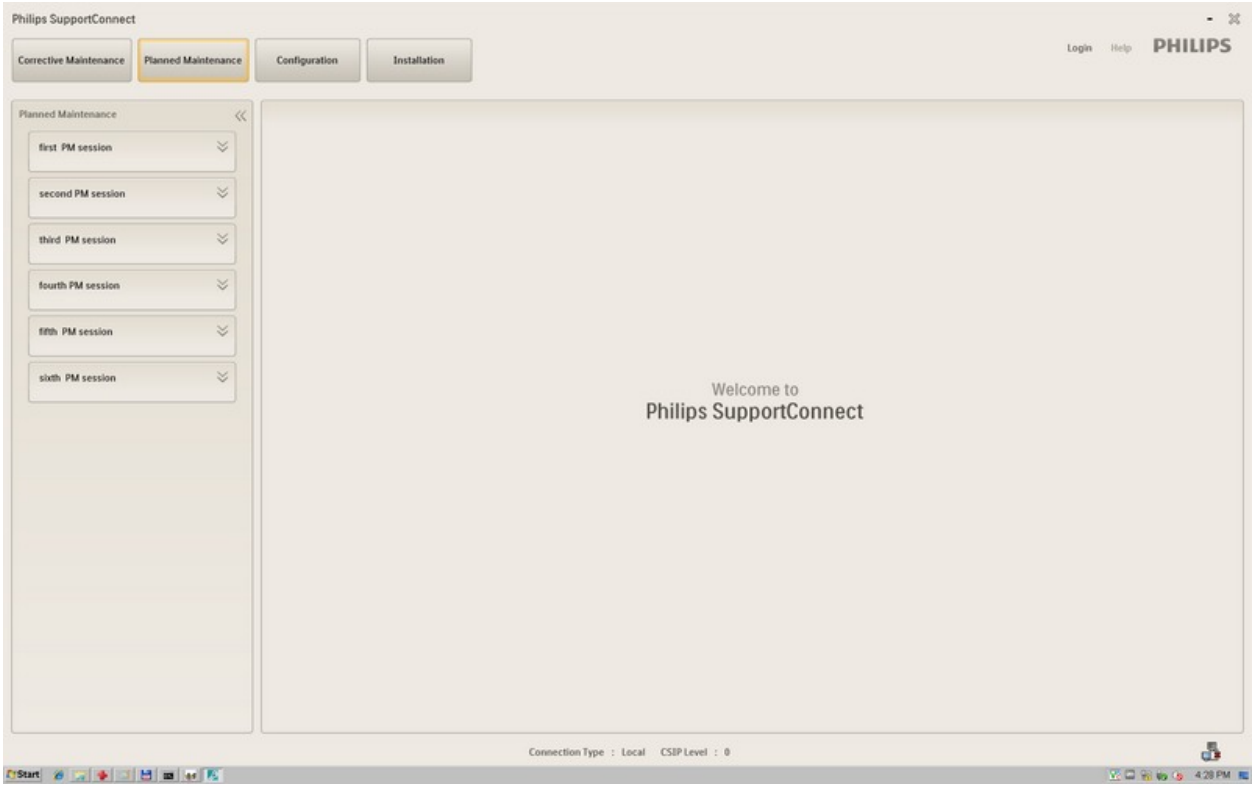
Study of the top 50 log file entries showed that these produced 30% of all logging. Many have been cleaned up, resulting in an overall reduction of the log file of 25 – 30 %.

4.4 PSC screenshots

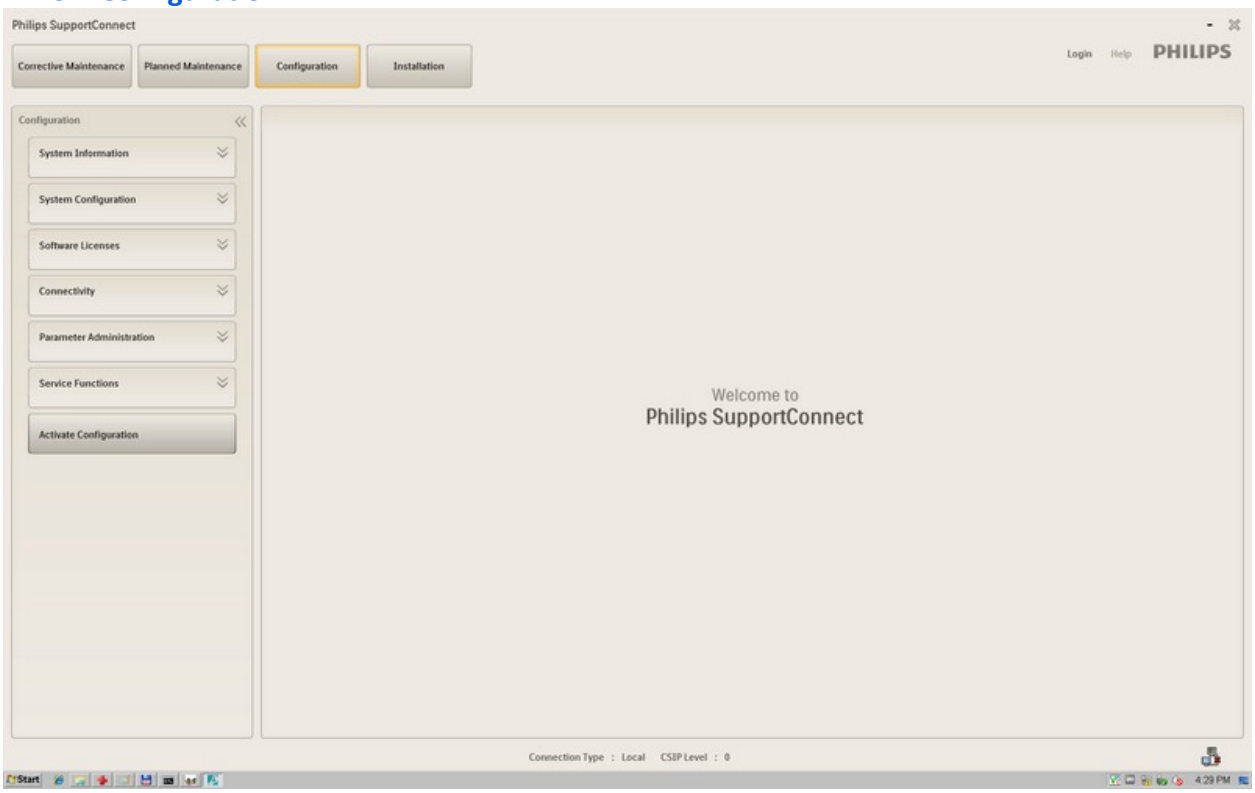
4.4.1 Corrective maintenance



4.4.2 Planned maintenance



4.4.3 Configuration



4.4.4 Installation