

GRASI 2.0

- Gradient and Shim Interface Unit
User Manual
Version 002

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This manual describes the units as they are at the date of printing. On request, the manufacturer shall supply circuit diagrams, lists of components, descriptions, calibrating instructions and any other information for use by qualified personnel of the user, in charge of repairing the parts of the unit which have been stated by the manufacturer to be "repairable". Such supply shall in no event constitute permission to modify or repair the units or approval of the same.

All rights reserved for the units, circuits, processes and appellations mentioned herein.

This unit is not designed for any type of use which is not specifically described in this manual. Such use may be hazardous.

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Contents

	Contents	3
1	Introduction	5
2	Safety	7
2.1	Instructions	7
2.2	Labels	7
	Identifying plate	7
	Manufacturer's nameplate	8
	Warning signs	9
2.3	.. Empowerment	9
3	Installation	11
3.1	Initial inspection	11
	Mechanical check	11
	Claim for damage	11
	Reshipment and repackaging requirements	11
	Environment requirements	12
3.2	Installation requirements	12
3.3	System check	12
3.4	Initial turn on procedure	12
4	Operation	13
4.1	General fonctions	13
	Amplifier selection	14
	Gradient coil code selection	14
	Shim coil code selection	14
	Powering up	14
	Initialisation process	14
	Calibration	15
4.2	Error messages	15
5	Technical description	17
5.1	General description	17
5.2	Power requirements	17
	Main characteristics	17
5.3	Status indicator	18
5.4	Gradient amplifier connectors	18
	Monitor X, Y, Z	18
	X, Y, Z	18
	Coil code	19
	High voltage control	19

	Clock monitor	20
5.5	Shim amplifier connectors	20
	Control status	20
	RS232	21
	Shim amplifier connector	21
5.6	Coil connector	22
	Gradient and shim coil code	22
	Gradient and shim coil temperature	23
5.7	Shim iron heating connector	24
	Temperature	24
	Out	25
5.8	Interlock connector	25
	IN	25
	OUT	26
5.9	CAN bus connector	26
	CAN	26
	Ethernet 10/100 connector	27
5.10	Universal Serial Bus connectors	28
	USB Type A	28
	USB Type B	28
6	<i>Servicing the GRASI</i>	29
6.1	Accessing the GRASI unit	29
6.2	Sub Toolbar Information	30
	Device Information	30
	Device Status	31
	BIS Content	32
	Temperature check	33
6.3	Sub Toolbar Basic Operations	34
	Reset Error	34
6.4	Sub Toolbar Maintenance	35
	Settings Update	35
	Firmware Update	36
	Device Reset	37
6.5	Sub Toolbar Diagnostics	38
	Event Log	38
7	<i>Specification</i>	39
7.1	General specifications	39
	<i>Figures</i>	41
	<i>Tables</i>	43

Introduction

1

The GRASI Unit (**GR**radient **And** **S**him Interface) is an interface device designed to drive several gradient amplifiers. Its main function is to lead the gradient pulse sequence signals coming from the Gradient Control Unit to the different amplifiers (X, Y, Z and B0 channels). The integrated power control function protects the gradient set connected to the amplifiers from over_voltage, over_current and the duty cycle is controlled to avoid any power excess on the loads.

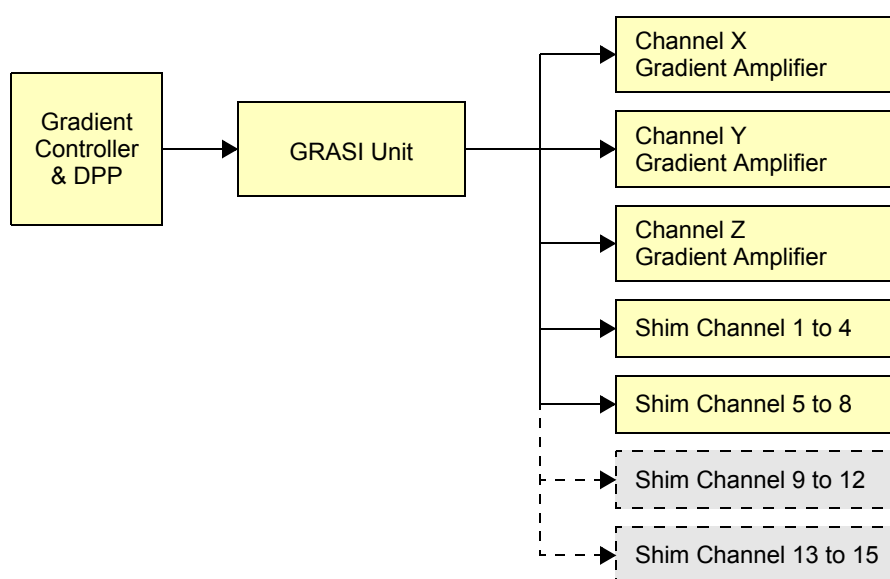


Figure 1.1. GRASI Unit diagram



Figure 1.2. GRASI Gradient and Shim Unit



The GRASI is in accordance with the standard IEC/EN 61010-1:2001 safety Requirements for Electrical Equipments.

Instructions

2.1

The GRASI Unit contains live parts. Using the device with cover removed is forbidden.

Risk of electrical shocks! Be sure of voltage absence before every intervention on the device.

The protection of the device may be impaired if the device is not used according to the instructions.

The different wirings must be done by an authorized and qualified technician. Use only the provided cables. Never disconnect any cable during the use of the device.

Sprinkling or pouring liquids on the device is forbidden. Use a wet or alcohol soaked rag to clean the EMB.

For corrective actions contact the BRUKER BIOSPIN representative in your country.

Labels

2.2

Labels are provided to alert operating and service personnel to conditions that may cause personal injury or damage to the equipment from misuse or abuse. Please read the labels and understand their meaning.

Identifying plate

2.2.1

The GRASI can be identified by an identifying plate at the front panel of the unit that has following information.

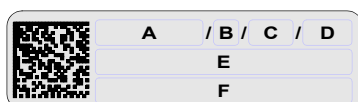


Figure 2.1. Identifying plate

- **(A) Part Number**
This field indicates the part number of the product.
- **(B) Variant**
This field indicates the variant number that identifies the production category of the product. The default variant is 00.
- **(C) ECL**
This field indicates the revision number that identifies the product configuration. The initial revision is 0.00.
- **(D) Serial Number**
This field indicates the serial number of the product.
- **(E) Type**
This field contains the designation of the product.
- **(F) Information**
This field contains additional information about the product.

Manufacturer's nameplate

2.2.2

The GRASI can be identified by a manufacturer's nameplate at the back panel of the unit that has following information:

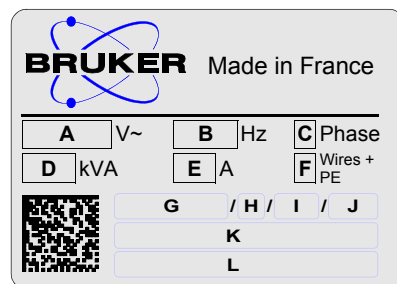


Figure 2.2. Manufacturer's nameplate

- **(A) Voltage**
This field indicates the input mains voltage of the product.
- **(B) Frequency**
This field indicates the input mains frequency of the product.
- **(C) Phases**
This field indicates the number of phases of the mains.
- **(D) Power**
This field indicates the absorbed power of the product.
- **(E) Current**
This field indicates the absorbed current of the product.
- **(F) Wires**
This field indicates number of wires with the ground in the mains cord.
- **(G) Part Number**
This field indicates the part number of the product.

- **(H) Variant**
This field indicates the variant number that identifies the production category of the product. The default variant is 00.
- **(I) ECL**
This field indicates the revision number that identifies the product configuration. The initial revision is 0.00.
- **(J) Serial Number**
This field indicates the serial number of the product.
- **(K) Type**
This field contains the designation of the product.
- **(L) Information**
This field contains additional information about the product.

Warning signs

2.2.3

Table 2.1. Danger



DANGER !

Please disconnect line cord before opening or prevent potential hazards such as :

Electric shock on power supply

Contact burn with heatsink



DANGER !

Hot surface

Empowerment

2.3

Every intervention on the device must be carried out by an authorized and qualified person. Any failure due to a non-respect of the following instructions will not be attributable to BRUKER BIOSPIN and will not be covered by the guarantee clauses.

Installation

3

The installation of the device must be done only by an authorized and qualified technician, in total accordance with the running standards. Every breakdown due to a non-respect of the following instructions will not be attributable to Bruker and will not be covered by the guarantee clauses.

Initial inspection

3.1

Mechanical check

3.1.1

If damage of the shipping cardboard is evident, request the carrier's agent to be present when the instrument is unpacked. Check the equipment for damage and inspect the panel surfaces for dents and scratches.

Claim for damage

3.1.2

If the unit is mechanically damaged or fails to meet specifications upon receipt, notify BRUKER or our representative immediately. Retain the shipping cardboard and packing material for the carriers inspection as well as for subsequent use in re-turning the unit if necessary.

Reshipment and repackaging requirements

3.1.3

Whenever possible, the original cardboard and packing material should be used for reshipment. If the original packing material is not available, wrap the instrument in heavy paper or plastic. Use a strong shipping container. If a cardboard is used, it should be at least 200 lbs. test material.

Use shock absorbing material around all sides of the instrument to provide a firm cushion and to prevent from movements inside the container wall on each side. Protect the front panel by means of cardboard spacers inserted between the front panel and the shipping cardboard. Make sure that the instrument cannot move in the container during shipping. Seal the cardboard box with a good grade of shipping tape and mark the container :

" FRAGILE ELECTRONIC INSTRUMENT. "

Environment requirements

3.1.4

This GRASI unit is build for inside use only on a maximum high level of 2000m above sea level (6600 feet).

No specific cooling or ventilation is required.

Be sure that the GRASI unit has enough area around so that the free air flow into and out of the GRASI unit is not obstructed.

It should, however, be in an environment which conforms, the 5°C - 45°C (41°F - 113°F) thermal specifications, a 80% maximum relative humidity of air and a contamination level of 2 (means a normal, only non conductive contamination, temporary conductivity due to condensation is possible).

Installation requirements

3.2

No special precautions are necessary. Mount the equipment in an area which is relatively free of vibration, and has sufficient room for cable connections.

The GRASI unit is a class II of installation category.

System check

3.3

Before applying power for the first time the following items should be checked:

- The AC input voltage 208-230VAC range must be compatible with.
- All the necessary cables are connected regarding the labels.

Initial turn on procedure

3.4

The following list describes how to turn on the GRASI unit and what should be seen as this occurs.

Before starting this procedure, make sure that you have properly followed instructions in the section **"System check"**.

1. Connect the device to the AC line.
2. Observe the indicator on the panel.
3. After approximatively one minute, the green LED turns off. The GRASI unit is ready for use.
4. If the LED does not turn off, see more information at chapter **"Servicing the GRASI" on page 29.**

Operation

4

General fonctions

4.1

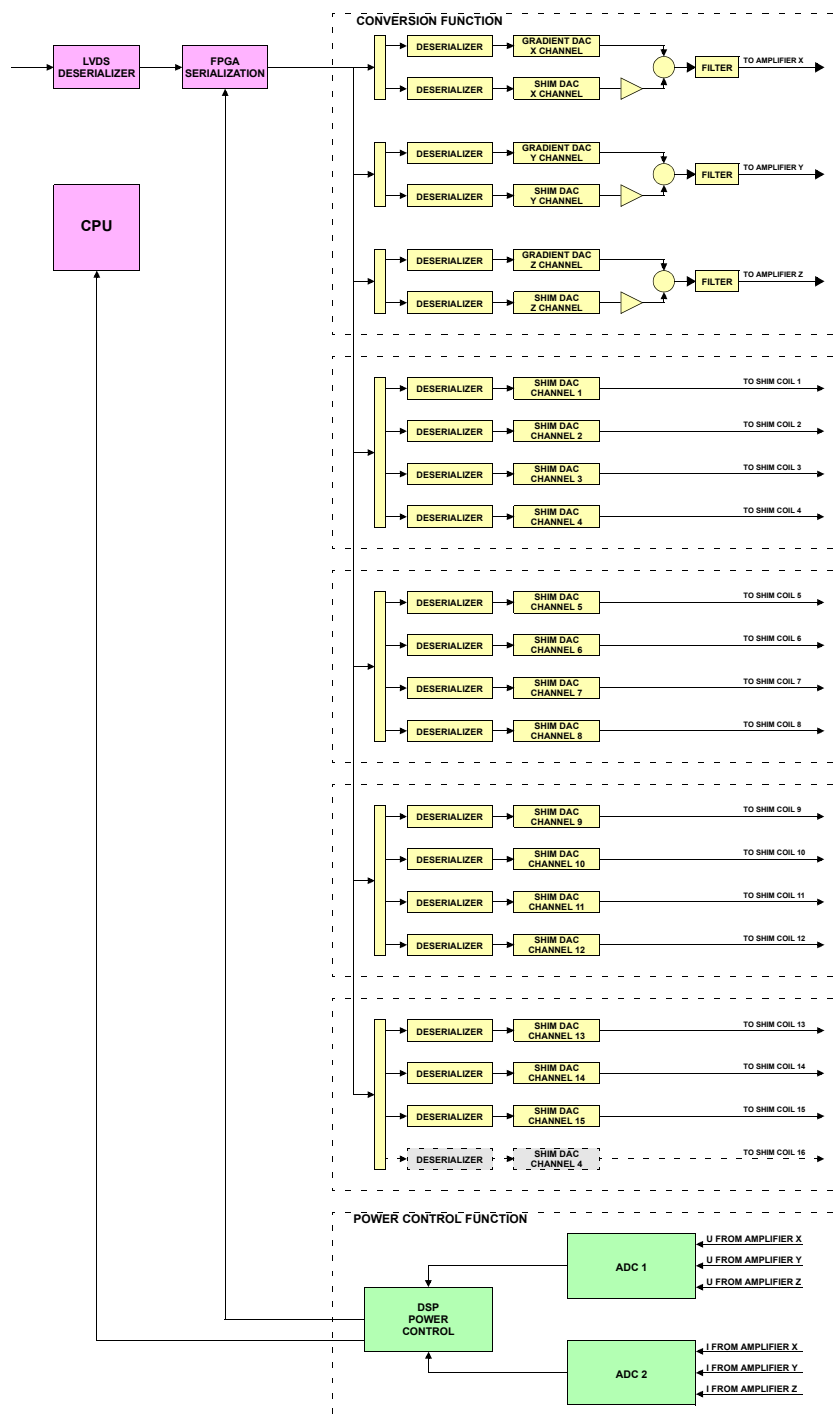


Figure 4.1. Functional block diagram

Amplifier selection

4.1.1

The first step before starting is to select the type of amplifier used with the GRASI unit. This selection is performed using a dedicated Web page. This action should be done only by Bruker trained personnel. Choosing a wrong amplifier type can lead to irreversible damage of the entire spectrometer. The selection is done once at the first switch on. Once this selection is made, there should be no reason to select another type of amplifier. If for any reason a change of amplifier type is made, the type of the previously selected amplifier will be saved for safety reasons.

Gradient coil code selection

4.1.2

The Gradient coil code selection occurs automatically when the SUB-D 37 connector is inserted. The code is detected and in accordance with the selected amplifier, the different limit values for the power control are set. The control function supported by the DSP uses these values to check if a limit is overridden.

Shim coil code selection

4.1.3

The Shim coil code selection occurs automatically when the SUB-D 37 connector is inserted.

Powering up

4.1.4

The GRASI Unit is automatically switched "ON" when the "AC" line is connected.

Initialisation process

4.1.5

The initialisation process needs about one minute to be completed. During the initialisation process, the output channels are calibrated and the offset corrected.



Important : Please note that during initialisation process, no commands should be sent to the GRASI Unit.

Calibration

4.1.6

Before the device can be used for imaging application, all calibration steps must be done according to the ParaVision/TopSpin tune-up procedure.



Warning : *Danger hardware damage. Missing or wrong calibration settings can lead to destruction of gradient hardware and insufficient image quality.*

Error messages

4.2

When an error occurs, this is announced by the green front panel LED. The detail of the error(s) is given in the embedded Web pages at chapter **"Servicing the GRASI" on page 29.**

Technical description

5

General description

5.1

The GRASI is a 19" unit with following dimensions :

- Height : 3U
- Width : 19"
- Depth : 460mm
- Weight : 10kg

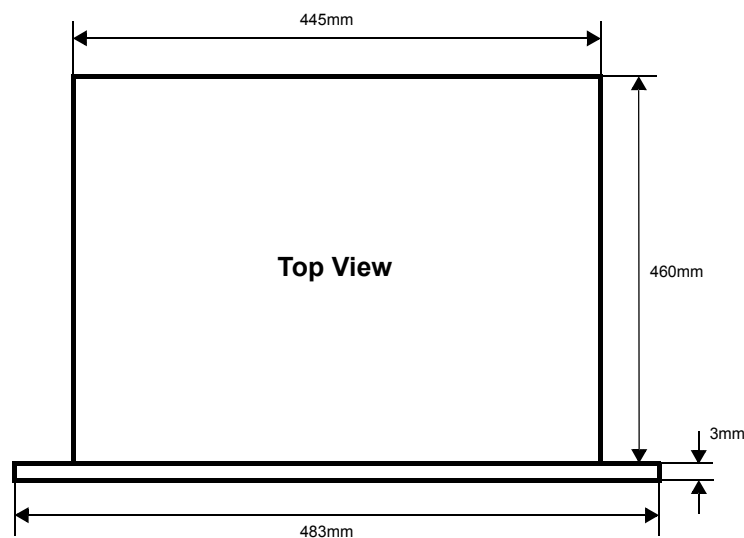


Figure 5.1. Housing dimensions

Power requirements

5.2

The GRASI Unit is powered by the mains input.

Main characteristics

- AC input voltage range : 208-230VAC, single phase 50-60Hz
- AC inrush current : 40A @ 230VAC
- Power consumption max. : 130VA (0.7A @ 230VAC)
- Fuses : 2 x 250V / T1.6A L

Technical description

Status indicator

5.3

The front panel is equipped with one green LED to indicate the status of the device.



Figure 5.2. Green LED indicator

Gradient amplifier connectors

5.4

Monitor X, Y, Z

5.4.1

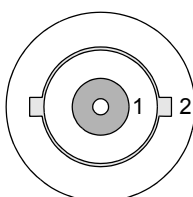


Figure 5.3. Figure 7 : BNC female monitor X, Y, Z connector

Table 5.1. Monitor X, Y, Z connector definition

Pins	Descriptions
1	MONITOR
2	MONITOR_GND

X, Y, Z

5.4.2

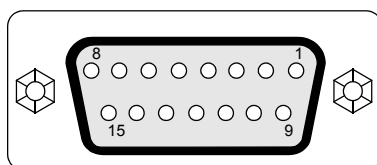


Figure 5.4. Sub-D 15 pin female X, Y, Z connector

Table 5.2. X, Y, Z connector definition

Pins	Descriptions		Pins	Descriptions	
1	Shield 1	Gnd	9	Out+	Analog out
2	Out-	Analog out	10	NC	
3	NC		11	RESET	TTL out

Pins		Descriptions		Pins		Descriptions	
4	U mon in	Analog in		12	U mon ref	Analog ref	
5	Enable+	TTL ouot		13	I mon in	Analog in	
6	Enable-	Gnd		14	Normal	TTL in	
7	I mon ref	Analog ref		15	Clk	TTL in/out	
8	Shield 2	Gnd					

Coil code

5.4.3

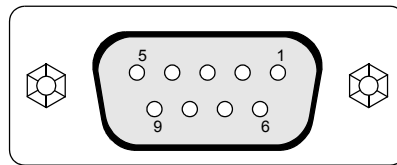


Figure 5.5. Sub-D 9 pin female coil code connector

Table 5.3. Coil code connector definition

Pins		Descriptions		Pins		Descriptions	
1	+5V	+5V out		6	+5V	+5V out	
2	GccOut0	TTL out		7	GccOut1	TTL out	
3	GccOut2	TTL out		8	GccOut3	TTL out	
4	GccOut4	TTL out		9	NC		
5	Gnd	Gnd					

High voltage control

5.4.4

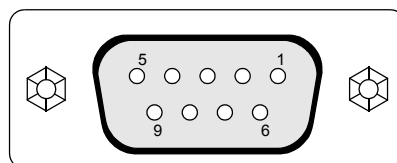


Figure 5.6. Sub-D 9 pin female high voltage control connector

Table 5.4. High voltage control connector definition

Pins		Descriptions		Pins		Descriptions	
1	HVen	Dig out		6	NC		
2	NC			7	NC		

Technical description

Pins	Descriptions		Pins	Descriptions	
3	NC		8	NC	
4	NC		9	NC	
5	Gnd	Gnd			

The dig out is a 15V output with a 2K7 serial resistor.

Clock monitor

5.4.5

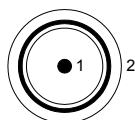


Figure 5.7. Figure 7 : SMB male clock monitor connector

Table 5.5. Clock monitor connector definition

Pins	Descriptions	
1	Clk Mon	TTL out
2	Gnd	Gnd

Shim amplifier connectors

5.5

Control status

5.5.1

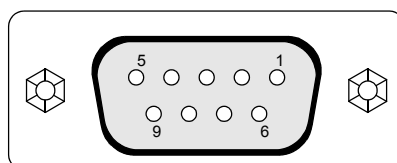


Figure 5.8. Sub-D 9 pin female control status connector

Table 5.6. Control status connector definition

Pins	Descriptions		Pins	Descriptions	
1	Status+	+5V input	6	Status-	-5V input
2	+5V	+5V out	7	+5V	+5V out
3	RESER_a	Contact out	8	ENABLE_a	Contact out

Pins		Descriptions		Pins		Descriptions	
4	RESET_b	Contact out		9	ENABLE_b	Contact out	
5	Gnd	Gnd					

RS232

5.5.2

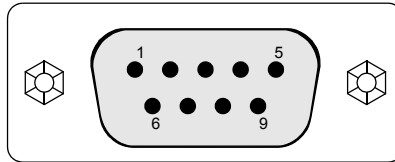


Figure 5.9. Sub-D 9 pin male RS232 connector

Table 5.7. RS232 connector definition

Pins		Descriptions		Pins		Descriptions	
1	NC			6	NC		
2	Rx	Rs in		7	NC		
3	Tx	Rs out		8	NC		
4	NC			9	NC		
5	Gnd	Gnd					

Shim amplifier connector

5.5.3

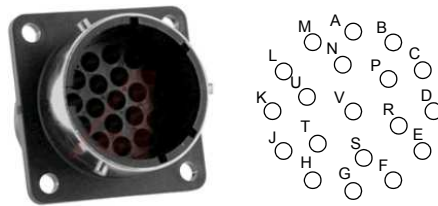


Figure 5.10. 19 pin shim amplifier connector

Table 5.8. Shim amplifier connector definition

Pins	Descriptions	
A	Z2	Analog out
B	Z4	Analog out
C	ZY	Analog out
D	ZX	Analog out

Technical description

Pins	Descriptions	
E	ZXY	Analog out
F	2XY	Analog out
G	Z3	Analog out
H	Z0	Analog out
J	XZ2	Analog out
K	YZ2	Analog out
L	X2-Y2	Analog out
M	Z(X2-Y2)	Analog out
N	X3	Analog out
P	Z5	Analog out
R	Y3	Analog out
S	NC	
T	NC	
U	NC	
V	NC	

Coil connector

5.6

Gradient and shim coil code

5.6.1

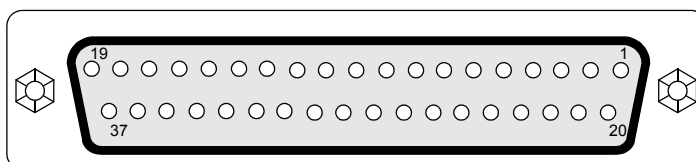


Figure 5.11. Sub-D 37 pin female gradient and shim coil code connector

Table 5.9. Gradient and shim coil code connector definition

Pins	Descriptions		Pins	Descriptions	
1	GND	gnd	20	Gcc0	Dig input
2	Gcc1	Dig input	21	Gcc2	Dig input
3	Gcc3	Dig input	22	Gcc4	Dig input
4	Gcc5	Dig input	23	Gcc6	Dig input

Pins		Descriptions		Pins		Descriptions	
5	Gcc7	Dig input		24	Gnd	Gnd	
6	GccDetect	Dig input		25	NC		
7	NC			26	NC		
8	NC			27	NC		
9	NC			28	NC		
10	NC			29	NC		
11	GND	Gnd		30	Scc0	Dig input	
12	Scc1	Dig input		31	Scc2	Dig input	
13	Scc3	Dig input		32	Scc4	Dig input	
14	Scc5	Dig input		33	Scc6	Dig input	
15	Scc7	Dig input		34	GND	Gnd	
16	SccDetect	Dig input		35	NC		
17	NC			36	NC		
18	NC			37	NC		
19	NC						

Gradient and shim coil temperature

5.6.2

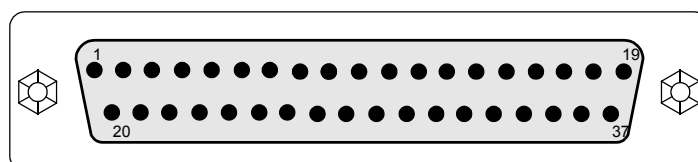


Figure 5.12. Sub-D 37 pin female gradient and shim coil temperature connector

Table 5.10. Gradient and shim coil temperature connector definition

Pins		Descriptions		Pins		Descriptions	
1	GradPt100_1_I+			20	GradPt100_1_S+		
2	GradPt100_1_S-			21	GradPt100_1_I-		
3	GradPt100_2_I+			22	GradPt100_2_S+		
4	GradPt100_2_S-			23	GradPt100_2_I-		
5	GradPt100_3_I+			24	GradPt100_3_S+		
6	GradPt100_3_S-			25	GradPt100_3_I-		
7	GradPt100_4_I+			26	GradPt100_4_S+		

Technical description

Pins	Descriptions		Pins	Descriptions	
8	GradPt100_4_S-		27	GradPt100_4_I-	
9	GradPt100_5_I+		28	GradPt100_5_S+	
10	GradPt100_5_S-		29	GradPt100_5_I-	
11	GradPt100_6_I+		30	GradPt100_6_S+	
12	GradPt100_6_S-		31	GradPt100_6_I-	
13	ChillerPt100_IN_I+		32	ChillerPt100_IN_S+	
14	ChillerPt100_IN_S-		33	ChillerPt100_IN_I+	
15	ChillerPt100_OUT_I+		34	ChillerPt100_OUT_S+	
16	ChillerPt100_OUT_S-		35	ChillerPt100_OUT_I+	
17	ShimPtc_S+		36	ShimPtc_S-	
18	NC		37	TempDetect	Dig input
19	Gnd	Gnd			

The dig input is internally pulmed-up. The input is activated by connecting it to Gnd.

Shim iron heating connector

5.7

Temperature

5.7.1

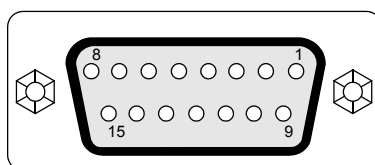


Figure 5.13. Sub-D 15 pin female temperature connector

Table 5.11. Temperature connector definition

Pins	Descriptions		Pins	Descriptions	
1	SiPt1000_1_S+		9	SiPt1000_1_S-	
2	SiPt1000_2_S+		10	SiPt1000_2_S-	
3	SiPt1000_3_S+		11	SiPt1000_3_S-	
4	SiPt1000_4_S+		12	SiPt1000_4_S-	
5	NC		13	NC	
6	NC		14	NC	

Pins	Descriptions		Pins	Descriptions	
7	NC		15	SiDetect	Dig out
8	Gnd	Gnd			

The dig input is internally pulmed-up. The input is activated by connecting it to Gnd.

Out

5.7.2

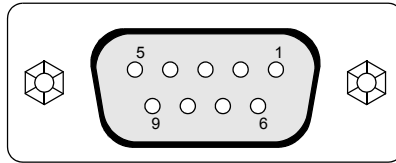


Figure 5.14. Sub-D 9 pin female out connector

Table 5.12. Out connector definition

Pins	Descriptions		Pins	Descriptions	
1	Target1	Analog out	6	Gnd	Gnd
2	Target2	Analog out	7	Gnd	Gnd
3	Target3	Analog out	8	Gnd	Gnd
4	Target4	Analog out	9	Gnd	Gnd
5	Gnd	Gnd			

Interlock connector

5.8

IN

5.8.1

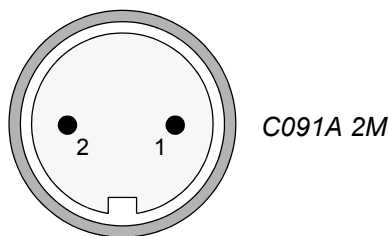


Figure 5.15. Binder 2 pin female interlock input connector

Technical description

Table 5.13. Interlock input connector definition

Pins	Descriptions	
1	Gnd	Gnd
2	IntIn	Dig input

The diginput is internally pulmed-up. The input is activated by connecting it to Gnd.

OUT

5.8.2

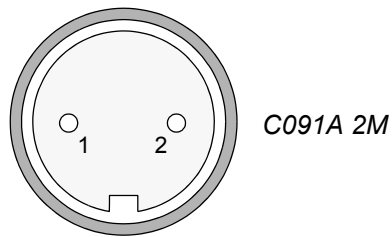


Figure 5.16. Binder 2 pin female interlock output connector

Table 5.14. Interlock output connector definition

Pins	Descriptions	
1	InterlockOut_a	Contact out
2	InterlockOut_b	Contact out

CAN bus connector

5.9

CAN

5.9.1

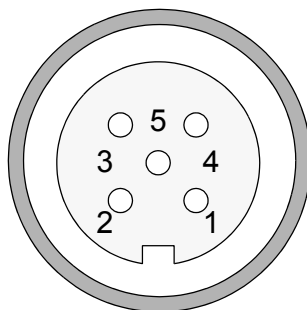


Figure 5.17. Binder 5 pin female CAN bus connector

Table 5.15. CAN bus connector definition

Pins	Descriptions	
1	Gnd	Gnd
2	CAN_Vcc	+5V input
3	CAN_0V	0V ref
4	CAN_H	
5	CAN_L	

CAN_Vcc can also provide the 5V power, by placing the internal JP2 jumper. The CAN_0V is then connected to Gnd.

Ethernet 10/100 connector

5.9.2

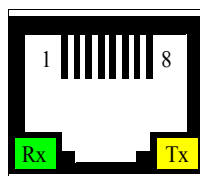


Figure 5.18. RJ45 8 pin female Ethernet 10/100 connector

Table 5.16. Ethernet 10/100 connector definition

Pins	Descriptions	
1	Transmit + (Tx+)	
2	Transmit - (Tx-)	
3	Receive + (Rx+)	
4	N/A	
5	N/A	
6	Receive - (Rx-)	
7	N/A	
8	N/A	

Technical description

Universal Serial Bus connectors

5.10

USB Type A

5.10.1

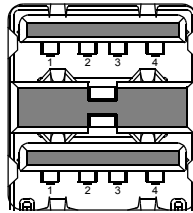


Figure 5.19. USB Type A dual 4 pin connector

Table 5.17. USB Type A dual 4 pin connector definition

Pins	Descriptions	
1	Vcc	+5V
2	Data -	
3	Data +	
4	Ground	DGND

USB Type B

5.10.2

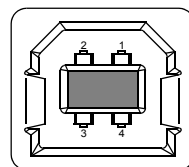


Figure 5.20. USB Type B 4 pin connector

Table 5.18. USB Type B 4 pin connector definition

Pins	Descriptions	
1	Vcc	+5V
2	Data -	
3	Data +	
4	Ground	DGND

Servicing the GRASI

6

Diagnosis and servicing access to the GRASI unit relies on HTTP, allowing service access with any web browser.

Accessing the GRASI unit

6.1

The GRASI Gradient and Shim Interface Unit is accessible via the CPU-A board with its IP address.

The IP address is given during "cf" by using TOPSPIN 2.xx software under PARAVISION 5 on the workstation.

In case of problems :

- Check the RJ45 cabling between GRASI, Ethernet switch and workstation.
- Check the Ethernet switch power.
- Check if the green LED on the GRASI RJ45 connector lights up.

To access the GRASI unit, type "ha" in TOPSPIN 2.xx and choose the GRASI that should be accessed or start your favourite web browser and type the given IP address as URL.

Some of these pages are only status pages to inform the operator, some other pages allow to modify several parameters of the GRASI unit.

You should get the following start screen.

This page shows the main information of the device.

On the left frame, the operator can choose a submenu to get the remaining information concerning the device.

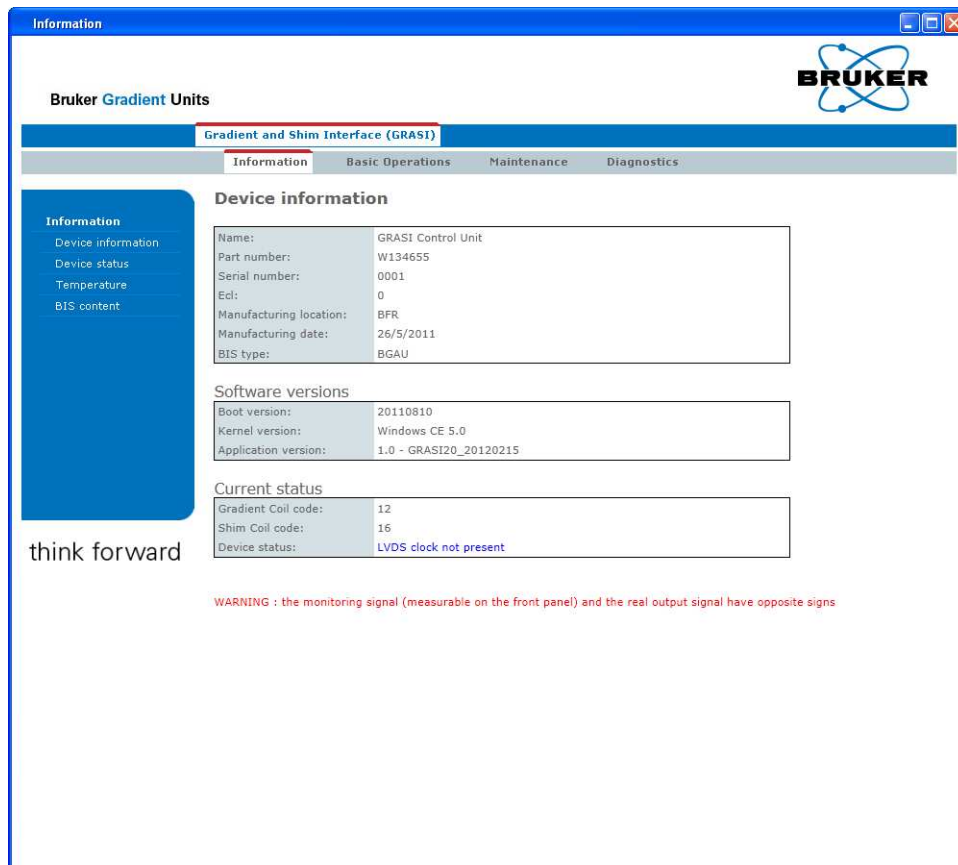


Figure 6.1. Device Information

Select the tab "Information", then the item "Device status".

This page shows the device status.

When a fault is detected, the corresponding item is in red color.

Information

Bruker Gradient Units

Gradient and Shim Interface (GRASI)

Information Basic Operations Maintenance Diagnostics

Information

- Device information
- Device status
- Temperature
- BIS content

Device Status

LVDS clock not present
(see "Event log" for more detail, click "Reset error" to unlock the device)

CPU	Control	Auxiliary
Board initialization error	Board initialization error	Board initialization error
Board hardware error	Board hardware error	Board hardware error
Amplifiers USB data not valid	Internal temperature error	Internal error
	Power monitoring stopped	Gradient coil error
	DSP not ready	Shim coil error
	LVDS clock not present	Temperature sensor fault
	Safety parameters not set	Temperature too high
		Chiller interlock
		Chiller temp. too low

think forward

Gradient-X	Gradient-Y	Gradient-Z
Board initialization error	Board initialization error	Board initialization error
Board hardware error	Board hardware error	Board hardware error
Board not ready	Board not ready	Board not ready
No normal signal	No normal signal	No normal signal
Duty cycle error	Duty cycle error	Duty cycle error
Overcurrent error	Overcurrent error	Overcurrent error
Overvoltage error	Overvoltage error	Overvoltage error

Shim-1	Shim-2
Board initialization error	Board initialization error
Board hardware error	Board hardware error
Board not ready	Board not ready
No normal signal	No normal signal

Figure 6.2. Device Status

This page shows the BIS content of the different GRASI channels. It also shows the BIS content of the CPU board and the Controller board.

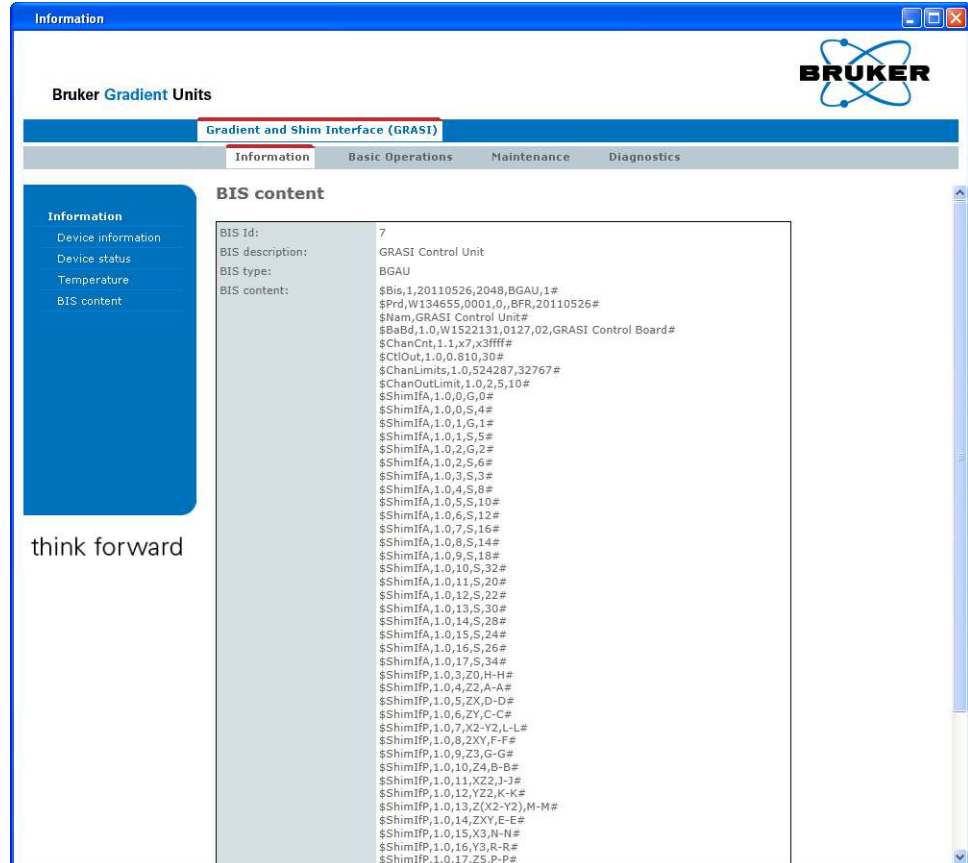


Figure 6.3. BIS Content

On this page, the operator can check the different temperatures of the system.

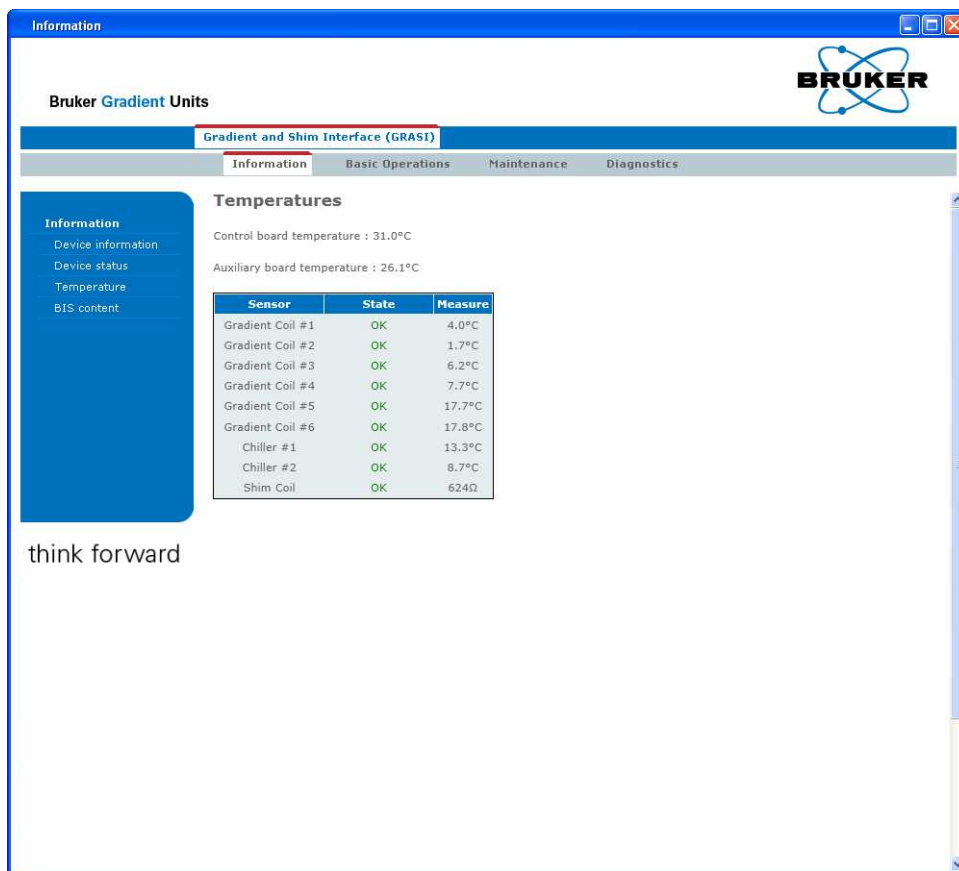


Figure 6.4. Temperature check

Select the tab "Basic Operations".

If necessary, click the item "Reset error" on the left menu.

This has the same effect as the "Reset error" button on the GRASI front panel.

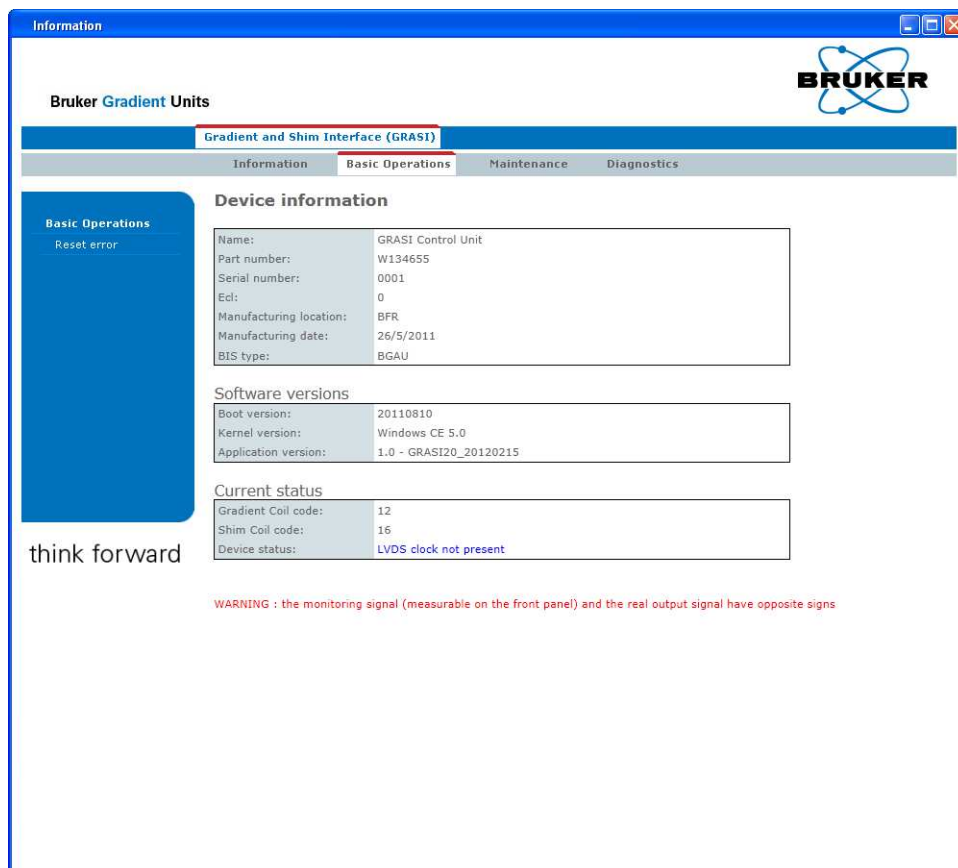


Figure 6.5. Reset Error

When necessary, some settings may be updated or upgraded via BRUKER data files. In this case, select the tab "Maintenance", then the item "Settings update" in the left menu.

Select the settings file with the browser, then click the "**Update**" button to start the update process.

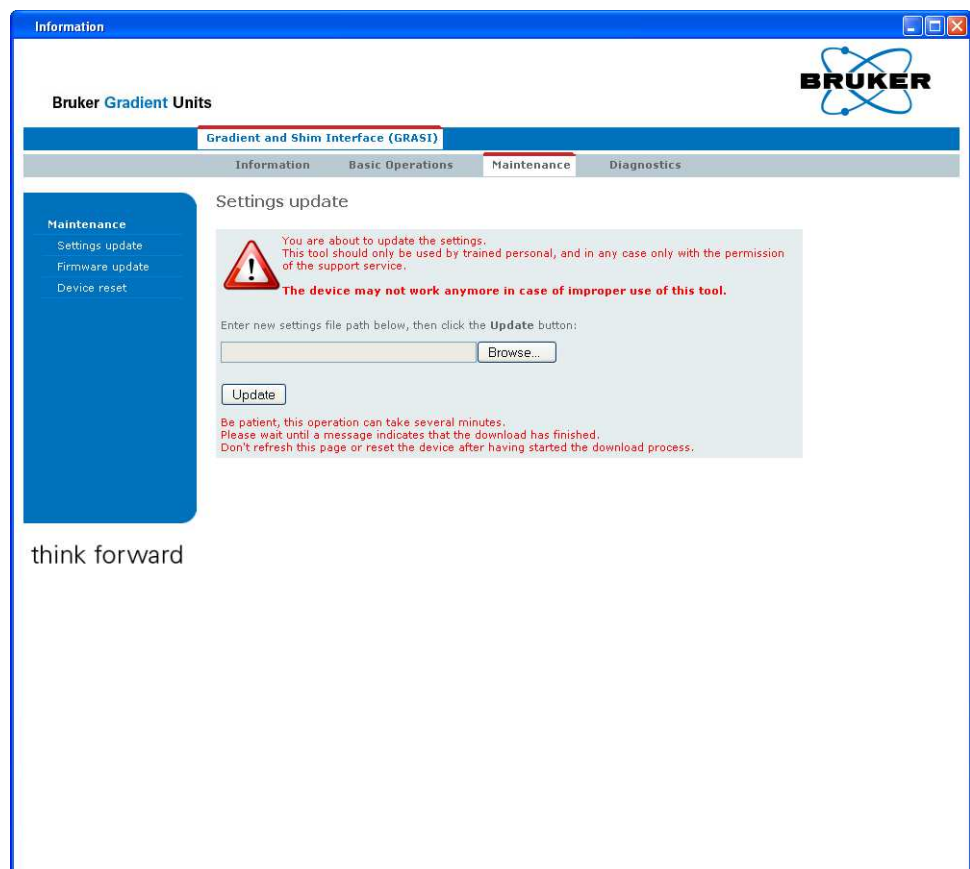


Figure 6.6. Settings Update

Select the tab "Maintenance", then the item "Firmware update" in the left menu.

This page allows the operator to update the firmware of the internal CPU of the device.

The operator will have to choose the correct file using the "**Browse...**" button and then click the "**Update**" button to start the update process. This process may request several minutes. Please do not quit before the window changes and informs that the update was successful. The two windows are the following:

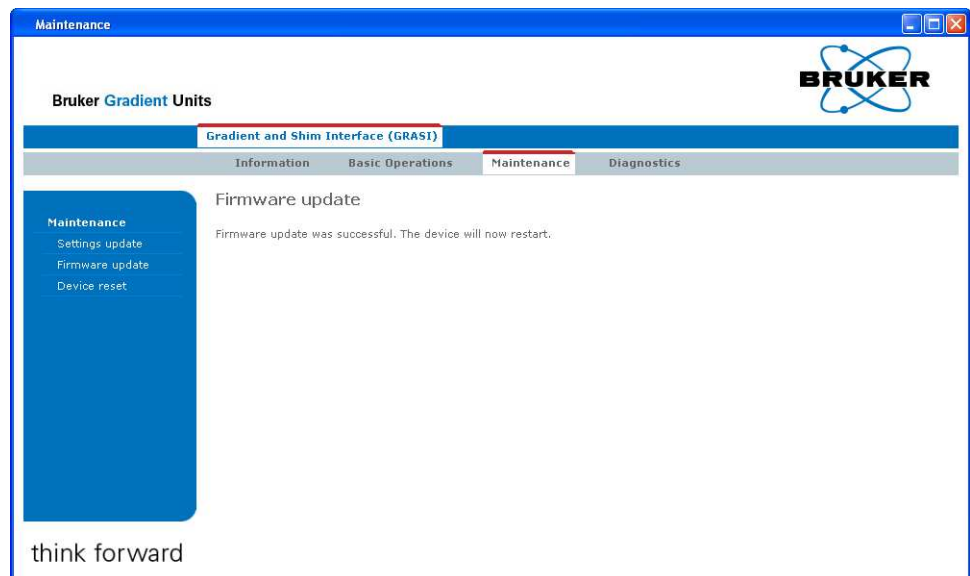
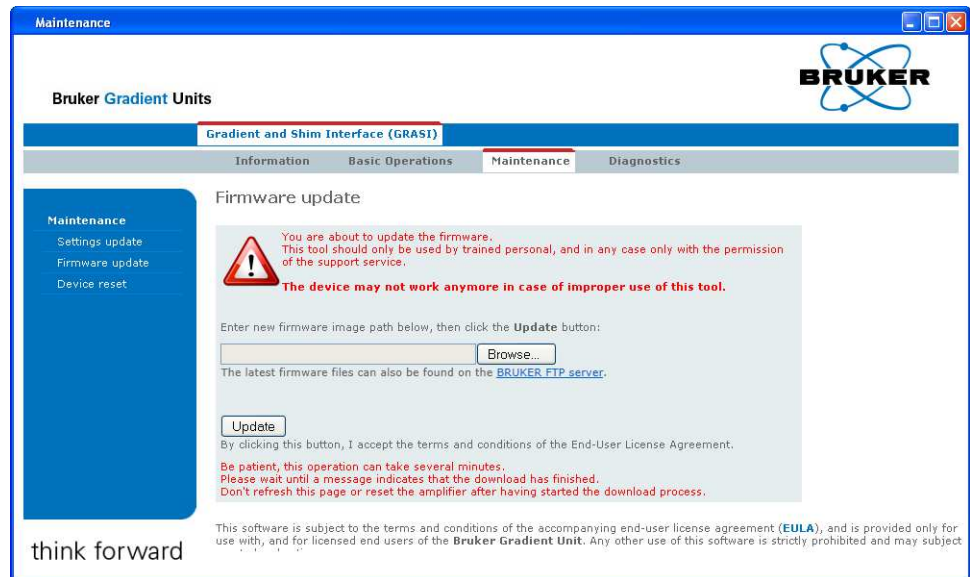


Figure 6.7. Firmware Update

Select the tab "Maintenance", then the item "Device reset" in the left menu.

On this page, the operator is allowed to reset the GRASI unit.

In order to avoid an undesired reset, the operator will have to confirm by clicking the "**Perform Software Reset**" button.

Resetting the device sets it into the same state as after the first turn on.

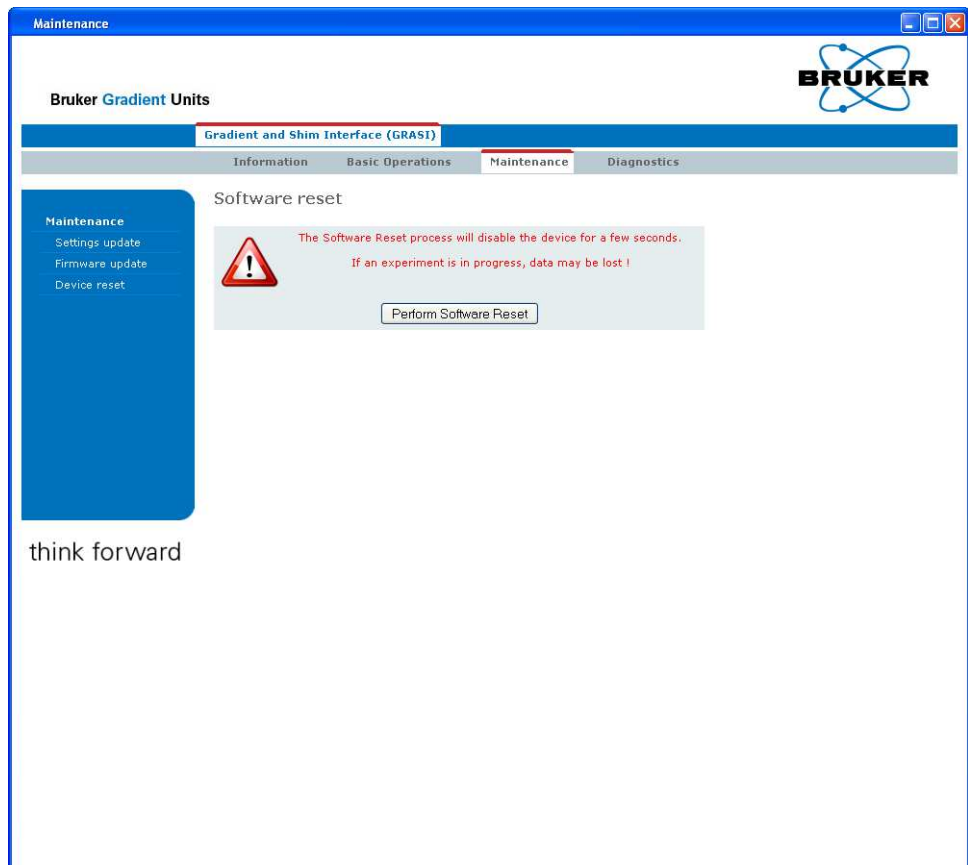


Figure 6.8. Device Reset

Select the tab "Diagnostics", then the item "Event log" in the left menu.

On this page, the operator can verify which actions have been performed and which events happened since the unit has been switched on.

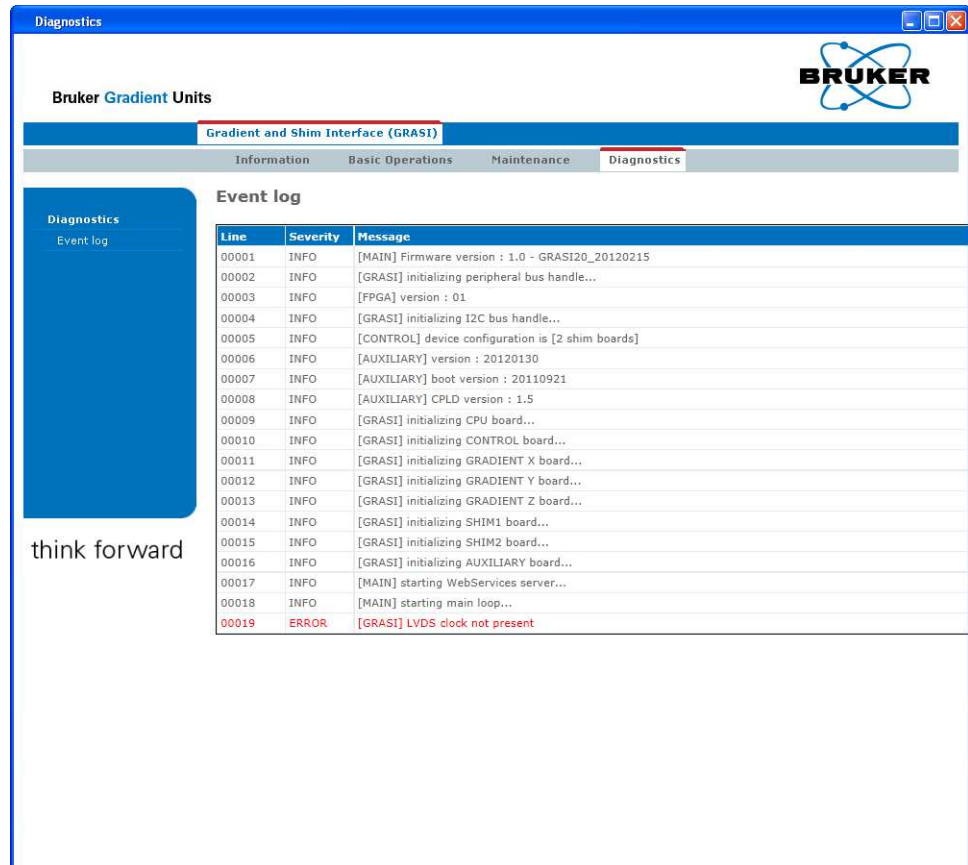


Figure 6.9. Event Log

Specification

7

General specifications

7.1

Table 7.1. GRASI Unit Specifications

Constant Internal Protection	Overcurrent , Overvoltage and Duty Cycle Overriding detection on the 3 Gradient channels
Front Panel Indicators	Status LED Ethernet status LEDs
Front Panel Connectors	3 x BNC, Input Monitor for channel X, Y, Z LVDS 48 bit from GCON or DPP Ethernet 10/100 Base T Tx
Cooling System	Natural Convection
Size	19" rack cabinet x 3U height x 460mm depth
Weight	10kg
Power requirements	AC input voltage range : 208-230VAC, single phase 50-60Hz AC inrush current : 40A @ 230VAC Power consumption max. : 130VA (0.7A @ 230VAC) Fuses : 2 x 250V / T1.6A L

Table 7.2. GRASI unit Inputs / Outputs specifications

Ouputs	±10 VDC on set value for channel X, Y, Z ±10 VDC on set value for shim channel 1 to15
Inputs	±10 VDC for I monitoring on channel X ±10 VDC for U monitoring on channel X ±10 VDC for I monitoring on channel Y ±10 VDC for U monitoring on channel Y ±10 VDC for I monitoring on channel Z ±10 VDC for U monitoring on channel Z
Open or Closed Contacts	Interlock to GPSCU (on 2 pin BINDER Interlock Connector) Gradient and Shim Coil Code (on SUB-D 37 Connector)

Figures

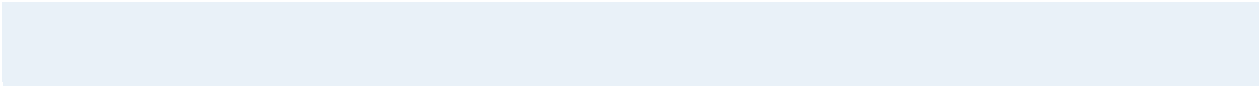
1 Introduction	5
Figure 1.1. GRASI Unit diagram	5
Figure 1.2. GRASI Gradient and Shim Unit	5
2 Safety	7
Figure 2.1. Identifying plate	7
Figure 2.2. Manufacturer's nameplate	8
3 Installation	11
4 Operation	13
Figure 4.1. Functional block diagram	13
5 Technical description	17
Figure 5.1. Housing dimensions	17
Figure 5.2. Green LED indicator	18
Figure 5.3. Figure 7 : BNC female monitor X, Y, Z connector	18
Figure 5.4. Sub-D 15 pin female X, Y, Z connector	18
Figure 5.5. Sub-D 9 pin female coil code connector	19
Figure 5.6. Sub-D 9 pin female high voltage control connector	19
Figure 5.7. Figure 7 : SMB male clock monitor connector	20
Figure 5.8. Sub-D 9 pin female control status connector	20
Figure 5.9. Sub-D 9 pin male RS232 connector	21
Figure 5.10. 19 pin shim amplifier connector	21
Figure 5.11. Sub-D 37 pin female gradient and shim coil code connector	22
Figure 5.12. Sub-D 37 pin female gradient and shim coil temperature connector	23
Figure 5.13. Sub-D 15 pin female temperature connector	24
Figure 5.14. Sub-D 9 pin female out connector	25
Figure 5.15. Binder 2 pin female interlock input connector	25
Figure 5.16. Binder 2 pin female interlock output connector	26
Figure 5.17. Binder 5 pin female CAN bus connector	26
Figure 5.18. RJ45 8 pin female Ethernet 10/100 connector	27
Figure 5.19. USB Type A dual 4 pin connector	28
Figure 5.20. USB Type B 4 pin connector	28
6 Servicing the GRASI	29
Figure 6.1. Device Information	30
Figure 6.2. Device Status	31
Figure 6.3. BIS Content	32
Figure 6.4. Temperature check	33
Figure 6.5. Reset Error	34
Figure 6.6. Settings Update	35

Figure 6.7. Firmware Update	36
Figure 6.8. Device Reset	37
Figure 6.9. Event Log	38

7 Specification **39**

Tables

1 Introduction	5
2 Safety	7
Table 2.1. Danger	9
3 Installation	11
4 Operation	13
5 Technical description	17
Table 5.1. Monitor X, Y, Z connector definition	18
Table 5.2. X, Y, Z connector definition	18
Table 5.3. Coil code connector definition	19
Table 5.4. High voltage control connector definition	19
Table 5.5. Clock monitor connector definition	20
Table 5.6. Control status connector definition	20
Table 5.7. RS232 connector definition	21
Table 5.8. Shim amplifier connector definition	21
Table 5.9. Gradient and shim coil code connector definition	22
Table 5.10. Gradient and shim coil temperature connector definition	23
Table 5.11. Temperature connector definition	24
Table 5.12. Out connector definition	25
Table 5.13. Interlock input connector definition	26
Table 5.14. Interlock output connector definition	26
Table 5.15. CAN bus connector definition	27
Table 5.16. Ethernet 10/100 connector definition	27
Table 5.17. USB Type A dual 4 pin connector definition	28
Table 5.18. USB Type B 4 pin connector definition	28
6 Servicing the GRASI	29
7 Specification	39
Table 7.1. GRASI Unit Specifications	39
Table 7.2. GRASI unit Inputs / Outputs specifications	39





End of Document



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