

DNP-NMR

- DNP Control System Console
Service Manual
Version 002



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This manual was written by

Reto Bader

© January 20, 2014: Bruker Corporation

Fällanden, Switzerland

P/N: Z31942

DWG-Nr.: Z4D11335B

For further technical assistance on the DNP-NMR, please do not hesitate to contact your nearest BRUKER dealer or contact us directly at:

BRUKER BioSpin AG
Industriestrasse 26
CH-8117 Fällanden
Switzerland

Phone: + 41 44 825 9111
FAX: + 41 44 825 9696
E-mail: nmr-support@bruker.de
Internet: www.bruker.com

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1 About

1.1 This Manual

This manual is intended to be a reference guide for service engineers. It provides detailed information about installation, maintenance, and debugging of the Bruker device.

The figures shown in this manual are designed to be general and informative and may not represent the specific Bruker model, component or software/firmware version you are working with. Options and accessories may or may not be illustrated in each figure.

Carefully read all chapters before working on the device!

This manual describes parts and procedures relevant to the device version it is delivered with. For older hardware, please refer to the manual supplied at the time.

User interface, system messages, and manuals require a good understanding of the English language.

Warnings and danger alerts are printed in English.

1.2 Policy Statement

It is the policy of Bruker to improve products as new techniques and components become available. Bruker reserves the right to change specifications at any time.

Every effort has been made to avoid errors in text and figure presentation in this publication. In order to produce useful and appropriate documentation, we welcome your comments on this publication. Service engineers are advised to regularly check with Bruker for updated information.

Bruker is committed to providing customers with inventive, high quality products and services that are environmentally sound.

1.3 Symbols and Conventions

Safety instructions in this manual are marked with symbols. The safety instructions are introduced using indicative words which express the extent of the hazard.

In order to avoid accidents, personal injury or damage to property, always observe safety instructions and proceed with care.



⚠ DANGER

This combination of symbol and signal word indicates an immediately hazardous situation which could result in death or serious injury unless avoided. On the equipment, the symbol implies also a danger and alerts the user. It is necessary for the user to refer to the manual prior to the use of marked items.



HIGH VOLTAGE

Throughout this manual, this symbol indicates necessary actions which imply a risk of death or being injured by high voltages. On the equipment, the symbol indicates dangerous voltages. Do not open a cover with this label!



⚠ WARNING

This combination of symbol and signal word indicates a potentially hazardous situation which could result in death or serious injury unless avoided.



⚠ CAUTION

This combination of symbol and signal word indicates a possibly hazardous situation which could result in minor or slight injury unless avoided.

SAFETY INSTRUCTIONS

This combination of color and signal words are used for control flow and shutdowns in the event of an error or emergency.

NOTICE




This combination of symbol and signal word indicates a possibly hazardous situation which could result in damage to property or the environment unless avoided.



This symbol highlights useful tips and recommendations as well as information designed to ensure efficient and smooth operation.

1.3.1 Other Symbols on Devices

Table 1.1. Symbols used on the equipment or in this manual

	<p>Hot device: On the equipment, the symbol indicates hot surfaces and alerts the user.</p>
	<p>Electrostatic sensitive device: Observe precautions for handling.</p>
	<p>Protective ground (earth) terminal: Used to identify any terminal which is connected to the external protective conductor for protection against electrical shock in case of fault.</p>

2 Introduction

The DNP CONTROL SYSTEM CONSOLE is part of the BRUKER solid-state DNP-NMR system. It controls and supervises the unique high power microwave source (high power gyrotron) and its infrastructure (high voltage source, beam control, cooling, temperature control, hardware interlocks).

For simplicity, the DNP CONTROL SYSTEM CONSOLE is abbreviated with CONSOLE in the context of this manual.

2.1 Limitation of Liability

All specifications and instructions in this manual have been compiled taking account of applicable standards and regulations, the current state of technology and the experience and insights we have gained over the years.

The manufacturer accepts no liability for damage due to:

- Failure to observe this manual
- Improper use
- Deployment of untrained personnel
- Unauthorized modifications
- Technical modifications
- Use of unauthorized spare parts

The actual scope of supply may differ from the explanations and depictions in this manual in the case of special designs, take-up of additional ordering options, or as a result of the latest technical modifications.

The undertakings agreed in the supply contract as well as the manufacturer's Terms and Conditions and Terms of Delivery and the legal regulations applicable at the time of conclusion of the contract shall apply.

2.2 Copyright

This manual is protected by copyright and solely for internal use.

This manual must not be made available to third parties, duplicated in any manner or form – whether in whole or in part – and the content must not be used and/or communicated, except for internal purposes, without the written consent of the manufacturer.

Violation of the copyright will result in legal action for damages. We reserve the right to assert further claims.

2.3 Warranty Terms

The warranty terms are included in the manufacturer's Terms and Conditions.

2.4 Before You Begin

This manual contains information and safety information that are necessary for the safe operation, installation and maintenance of the device.

Consider all safety references!

Information for ordering spare parts is available in the spare parts section for from the Bruker Service Center (see contacts).

2.5 Minimum Qualifications for Service Engineers

Type of Task	Personnel	Training and Experience
Installation / Servicing	Bruker personnel only.	Only personnel which have passed an appropriate training provided by Bruker Billerica is allowed to install or maintain the CONSOLE.

Table 2.1 Overview Installation and Operation Requirements for Personnel

2.6 Transport to Manufacturer

When parts of the CONSOLE must be returned to the manufacturer for a major repair, use the original packaging for transportation.

 CAUTION
Service and repair must be done by authorized Bruker service personnel.

2.7 Manufacturer and Conformity

Manufacturer

The individual units of the CONSOLE system are manufactured at different BRUKER production sites. The manufacturer can be identified by the part number prefix according to the following table.

Part No. Prefix	Z.....	H.....	W.....
Manufacturer Address	Bruker BioSpin AG Industriestr. 26 8117 Fällanden Switzerland	Bruker BioSpin GmbH Silberstreifen 4 76287 Rheinstetten Germany	Bruker BioSpin S.A. 34, rue de l'industrie 67166 Wissembourg Cédex France
Phone	+41 (44) 825 91 11	+49 (721) 5161 - 0	+33 (3) 88 73 68 00
Fax	+41 (44) 825 96 96	+49 (721) 5171 01	+33 (3) 88 73 68 79
E-Mail	sales@bruker-biospin.ch	nmr@bruker-biospin.de	bruker@bruker.fr
Internet	www.bruker.com		

Table 2.2 Manufacturer Identification

2.8 SI to US Conversion Factors

The following conversion factors can be/were used to convert the units used within this manual:

Measure	SI Units	U.S. Standard Units	Conversion Factor (rounded to nearest hundredth)
Linear	meter (m) centimeter (cm)	feet (ft.) inch (in.)	1 m = 3.28 ft. 1 m = 39.37 in. 1 cm = 0.394 in.
Area	square meter (m ²)	square foot (ft. ²)	1 m ² = 10.76 ft. ²
Volume	cubic meter (m ³) liter (l)	cubic foot (ft. ³) quart (qt.)	1 m ³ = 35.32 ft. ³ 1 l = 1.06 qt. (liquid)
Weight	kilogram (kg)	pounds (lbs.)	1 kg. = 2.21 lbs.
Pressure	bar	pounds/square inch (psi) atmosphere (ATM)	1 bar = 14.51 psi 1 bar = 0.99 ATM (standard)
Temperature	°C	°F	F = C × 1.8 + 32 C = (F - 32) / 1.8
Magnet Field Strength	Tesla (T)	Gauss (G)	1 T = 10 ⁴ G

Table 2.3 SI to U.S. Conversion Factors

3 Safety

This section provides an overview of all the main safety aspects involved in ensuring optimal personnel protection and safe operation.



DANGER

Non-compliance with the action guidelines and safety instructions contained in this manual may result in serious hazards.

3.1 Intended Use

The CONSOLE has been designed and constructed solely for the intended use described here. The CONSOLE is dedicated only for the Solid-State DNP-NMR Spectrometer of BRUKER

Intended use also includes compliance with all specifications in this manual.

Any use which exceeds or differs from the intended use shall be considered improper use.



WARNING

Do not use the DNP control system for a purpose other than the described “Intended Usage”.



DANGER

Operation of the CONSOLE in a manner not consistent with the instructions as described and recommended in this document may expose the user or service personnel to unsafe conditions and may result in damage to the instrument. Service calls that arise from a failure to observe these recommendations are NOT covered by the instrument warranty

3.2 Service Engineer's Responsibility

Service Engineer

The term 'Service Engineer' refers to the person who perform system installation, maintenance and repair.

Service Personnel's Obligations

- The service engineer must obtain all the installation instructions provided by this manual.
- After the installation the owner/user have to be trained in safety instructions which are defined in the user manual.
- A printed version of the latest user manual needs to be hand over to owner/user.
- In addition to the safety instructions in this manual, the safety, accident prevention and environmental protection regulations governing the operating area of the device must be observed.



WARNING

The service engineer must perform a risk assessment on site, in particular hazardous situations caused by unsuitable wiring need to be revealed.

- The service engineer must perform the maintenance procedures according to the instructions in this manual.

3.3 Personnel Requirements

3.3.1 Qualifications



DANGER

Only trained Bruker service personnel are allowed to mount, retrofit, repair, adjust and dismantle the unit!

3.3.2 Unauthorized Persons

⚠ WARNING



Risk to life for unauthorized personnel due to hazards in the danger and working zone!

Unauthorized personnel who do not meet the requirements described in this manual will not be familiar with the dangers in the working zone. Therefore, unauthorized persons face the risk of serious injury or death.

3.4 Important Safety Considerations

These safety instructions refer to the whole DNP control system including its subunits.

The gyrotron operation requires a high voltage power supply which generates voltages up to 20kV.

HIGH VOLTAGE



Because of the high voltage levels (up to 20kV) it is essential to follow the instructions in this manual. In particular the high voltage cables and the ground connections must be free of damage.

⚠ WARNING



Separate the Console from mains supply (Switch 1) before changing the wiring - wait 1 minute in minimum.

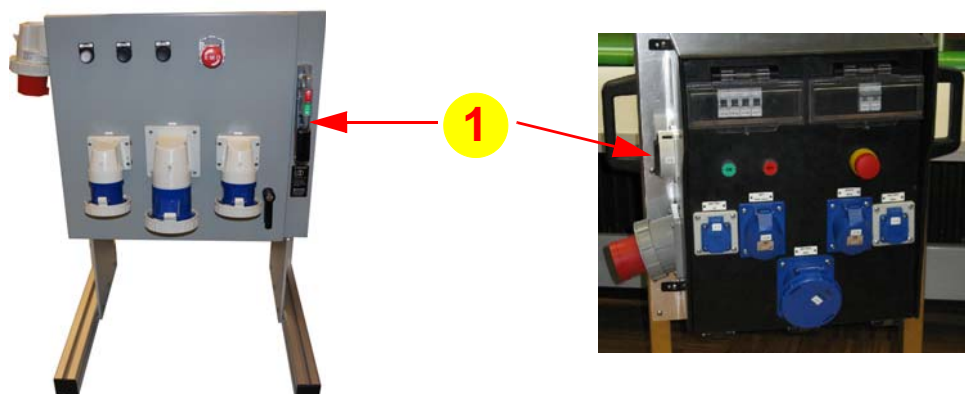


Figure 3.1 Main Switch



⚠ WARNING

Cryogen liquids (helium and nitrogen) mustn't be refilled if the system is active. Prior to filling liquids settle the system to state <OFF> and verify that the yellow light bulb (high voltage supply = active) is dark.



⚠ WARNING

The gyrotron high voltage supply weighs approximately 40 kg. Therefore two people are required to lift the power supply.

3.5 Basic Dangers

The following section specifies residual risks which may result from using the device and have been established by means of a risk assessment.

In order to minimize health hazards and avoid dangerous situations, follow the safety instructions specified here as well as in the following chapters of this manual.

3.5.1 General Workplace Dangers

Dirt and Scattered Objects



⚠ CAUTION

Danger of injury from tripping over dirt and scattered objects!

Dirt and scattered objects may cause people to slip or trip. A fall may result in injuries.

- ▶ Always keep the work area clean.
- ▶ Remove objects which are no longer required from the work area and particularly from the floor.
- ▶ Indicate unavoidable hazards using marking tape.

S

4 Technical Data

4.1 General Information

Data	Value	Unit
Weight with subunits (typical configuration)	190	kg
Depth	92	cm
Width	69	cm
Height (without light tower)	130	cm
Height (with light tower)	204	cm

Table 4.1 Technical Data: General Information

4.2 Connection Values

4.2.1 Power Supply System

The CONSOLE is designed as a subsystem of the DNP spectrometer. For further environmental conditions outside the cabinet please refer to the appropriate BRUKER site planning guide of the spectrometer system.

Europe

Three phase 400 ± 5% VAC phase to phase (230 V phase to neutral), plus neutral, plus ground (5 wire), 50 Hz, 50 amps.

North America

Three phase 208 ± 5% VAC phase to phase (120 V phase to neutral), plus neutral, plus ground (5 wire), 60 Hz, 60 amps.

CAUTION

In addition to the ground wire of the regular line cord a separate connection to protective ground is necessary. Further information about this topic is available in chapter [7.1.2 "Power Supply System"](#).

4.3 Operating Conditions

Environment

Data	Value	Unit
Temperature range (operation)	17 to 25	°C
Temperature range (storage)	5 to 40	°C
Permissible altitude (above sea level)	< 2000	m
Relative humidity at 31 °C, maximum	< 80	%
Decreasing linear till relative humidity < 50% at 40 °C, maximum		

Table 4.2 Operating Environment



5 Design and Function

5.1 Introduction

This chapter will be part of the next version of this manual

6 Transport, Packaging and Storage

6.1 Symbols on the Packaging

The following symbols are affixed to the packaging material. Always observe the symbols during transport and handling.

Top



The arrow tips on the sign mark the top of the package. They must always point upwards; otherwise the content may be damaged.

Fragile



Marks packages with fragile or sensitive contents. Handle the package with care; do not allow the package to fall and do not allow it to be impacted.

Protect Against Moisture



Protect packages against moisture and keep dry.

6.2 Transport

The DNP control system console contains a large amount of sensitive parts and assemblies, therefore it must be handled with care and protected against mechanical shock.



⚠ WARNING

Move the console slowly to prevent from cant over.

6.3 Inspection at Delivery

Upon receipt, immediately inspect the delivery for completeness and transport damage. In particular review the Tiltwatch™ and Shockwatch™ labels.

Proceed as follows in the event of externally apparent transport damage:

- Do not accept the delivery, or only accept it subject to reservation.
- Note the extent of the damage on the transport documentation or the shipper's delivery note.
- Initiate complaint procedures.



Issue a complaint in respect to each defect immediately following detection. Damage compensation claims can only be asserted within the applicable complaint deadlines.

6.4 Packaging

About Packaging

The individual packages are packaged in accordance with anticipated transport conditions. Only environmentally friendly materials have been used in the packaging.

The packaging is to protect the individual components from transport damage, corrosion and other damage prior to assembly. Therefore do not destroy the packaging and only remove it shortly before assembly.

Handling Packaging Materials

Dispose of packaging material in accordance with the relevant applicable legal requirements and local regulations.

6.5 Storage

Storage of the Packages

Store the packages under the following conditions:

- Do not store outdoors.
- Store in dry and dust-free conditions.
- Do not expose to aggressive media.
- Protect against direct sunlight.
- Avoid mechanical shocks.
- Storage temperature: 5 to 40 °C.
- Relative humidity: max. 80%.

If stored for longer than 3 months, regularly check the general condition of all parts and the packaging. If necessary, top-up or replace preservatives.

7 Installation

7.1 Introduction

7.1.1 Site Planning

- The CONSOLE has to be placed outside the 5Gauss-Line, please refer to the according site planning manual of the DNP SYSTEM.
- Avoid pitfalls by appropriate wiring.

7.1.2 Power Supply System

Protective Ground

In addition to the ground wire of the regular line cord a separate protective ground terminal is required. The customer must provide this terminal which has to be connected to protective ground of the mains supply by a wire of AWG#4 in minimum.

Protective Ground Checkpoints

- Visual inspection of the ground terminal: Check if the protective ground wire from the console can be properly connected.
- Double-check the wire gauge: AWG#4 in minimum.
- Look for ground terminal inside the facility power distribution.
- Perform a resistance measurement from the protective ground to one of ground pins provided by the EMO/PDU.



CAUTION

Be sure that the mains supply fulfils the requirements as defined in the precedent chapters, in particular double check the additional protective ground wire.

7.1.3 System Types / Approved Devices



⚠ WARNING

Bruker has approved a couple of high voltage supplies for usage in DNP systems. Other types must not be used!

1	Bruker Identification	B132734 Power Supply 25kV Fil 5A 12VAC Spellman
	Spellman Identification	Model No: DF25N4X4489 Part No: X4489
2	Bruker Identification	B134579 PWR SPLY 20KV 200MA, FIL 5A 12VAC SPELLMAN
	Spellman Identification	Model No: DF20N4X4500 Part No: X4500
3	Bruker Identification	B6533 PWR SPLY, 20KV, 200MA, FIL 3.5A 12VAC, SPLMN
	Spellman Identification	Model No: DF20N4X3880 Part No: X4500
4	Bruker Identification	Z146129 DNP POWER SUPPLY GUN HV 20KV/5A/4KW
	Spellman Identification	Model No: DF20N4X4500 Part No: X4500

Table 7.1 Approved High Voltage Supplies

7.1.4 Device Configuration



⚠ CAUTION

Before connecting to the mains supply, the system needs to be configured according to the information below.

Unit	Configuration
DNP CONTROL UNIT Z113292	The mains selector on the rear side of the DNP Control Unit needs to be configured according to the actual power supply system (208/230V)

Table 7.2 Configuration

7.2 Wiring

7.2.1 Warnings



! DANGER

Not following these instructions may lead to serious injuries or death. Several connections are part of the personnel safety measures, therefore it is essential to establish them exactly as described in this manual.

7.2.2 High Voltage Plugs

High voltage plugs need to be handled with care, in particular mechanical shock or pollution may lead to malfunction. There are two types of high voltage plugs in use, both are shown on the pictures below.



Figure 7.1 High Voltage Connectors

7.2.3 Internal Connections

Most of the internal connections are made during the manufacturing process of the CONSOLE, nevertheless is useful to have a comprehensive description of all the necessary connections, in particular for debugging purposes.

An overview is available in the schematic diagrams below, more detailed information follows afterwards.

7.2.4 Console Versions

Different versions of the AVANCEIII 1BAY CONSOLE WIRED (H03128OB) lead to minor changes in the wiring concept. Without notice pictures are valid for all versions. If necessary the following abbreviations are used to distinguish between the different types:

Part name	Part no	ECL	Abbreviation
AVANCEIII 1BAY CONSOLE WIRED	H03128OB	<= 04.00	CONSOLE TYPE A
AVANCEIII 1BAY CONSOLE WIRED	H03128OB	>= 05.00	CONSOLE TYPE B

Table 7.3 Console Types

7.2.5 Magnet System Versions

The gyrotron magnets are frequency specific, therefore differences in wiring and connectors exist. In these cases the types are shown separately.

Part name	Part no	ECL	Abbreviation
MAGNET SYSTEM BZH 9.7T/89/120 GYROTRON	Z107186	All	MAGNET 263 GHZ
395 GHz GYR TUBE MAGNET 50 Hz/480 V	B140712	All	MAGNET 395 GHZ
MAGNET SYSTEM GYR 4.8T CF	Z144808	All	MAGNET CF
MAGNET SYSTEM GYR 7.2T CF	Z143057	All	MAGNET CF
MAGNET SYSTEM GYR 9.7T CF	Z133024	All	MAGNET CF

Table 7.4 Magnet Types

7.2.6 Emergency OFF / Power Distribution Unit Versions

The Emergency Off / Power Distribution Units are different for USA/Canada (208V/60Hz,) and Europe (230V/50Hz).

Part name	Part no	ECL	Abbreviation
DNP EMO/PDU VARIANT EU	Z115284	All	EMO/PDU EU
DNP EMO/PDU, 208V L-L 3-PH, W/POWER CONN	B136784	All	EMO/PDU US

Table 7.5 Emergency Off Power Distribution Unit Types

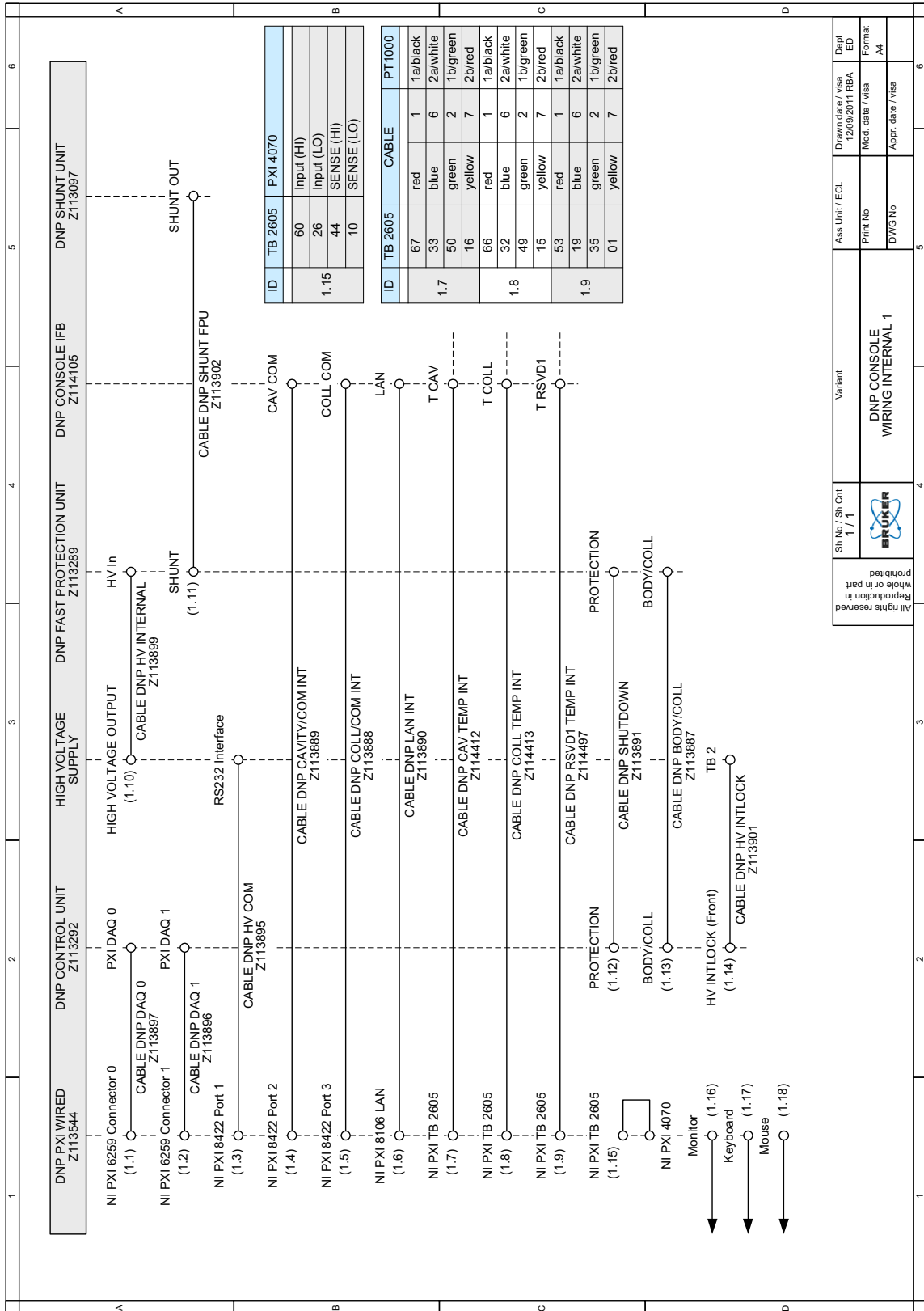


Figure 7.2 Wiring Internal 1

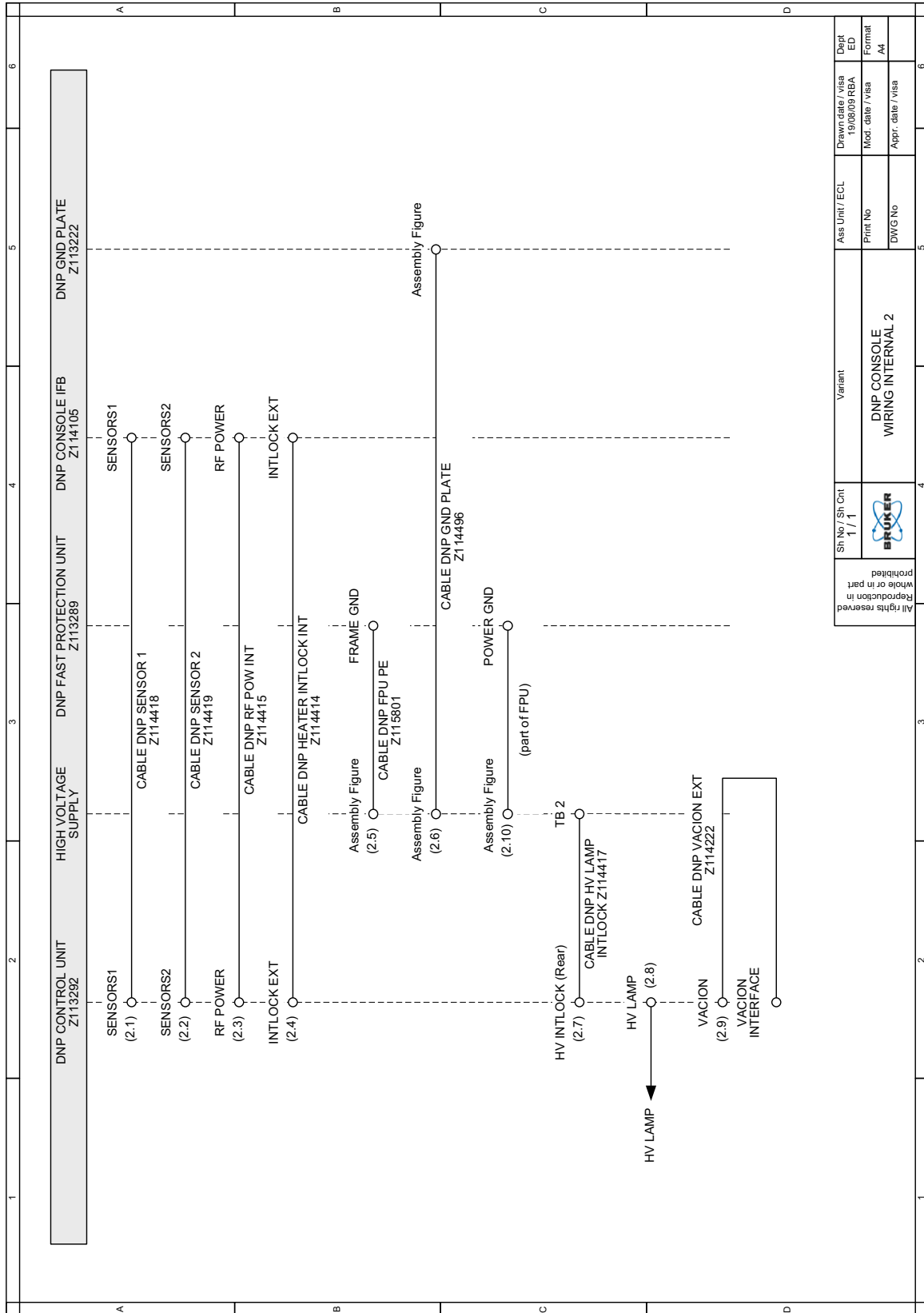



Figure 7.3

All rights reserved Reproduction in whole or in part prohibited 	Sht No / Sht Cnt 1 / 1	Variant DNP CONSOLE WIRING INTERNAL 2	Ass Unit/ ECL Print No DWG No	Drawn date / visa 19/08/09 RBA	Draft ED
				Mod. date / visa	Format A4
				Appr. date / visa	

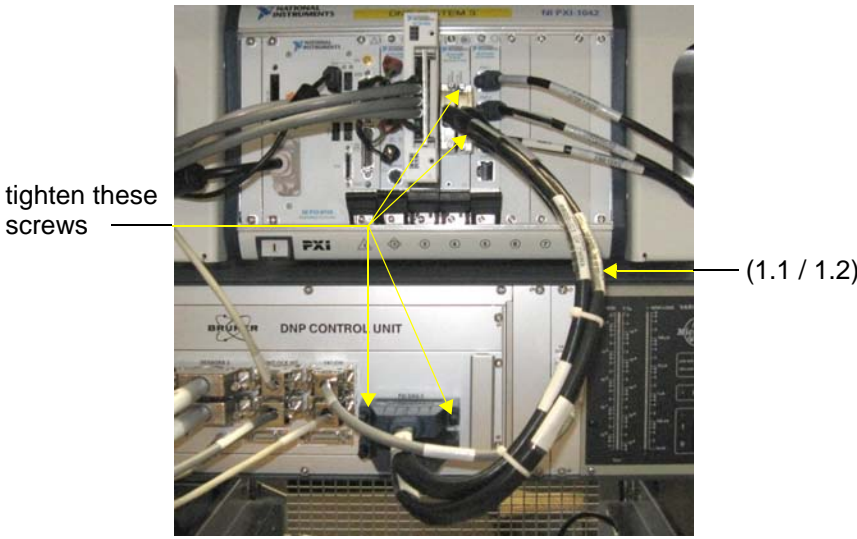


Figure 7.4 Connection 1.1 / 1.2

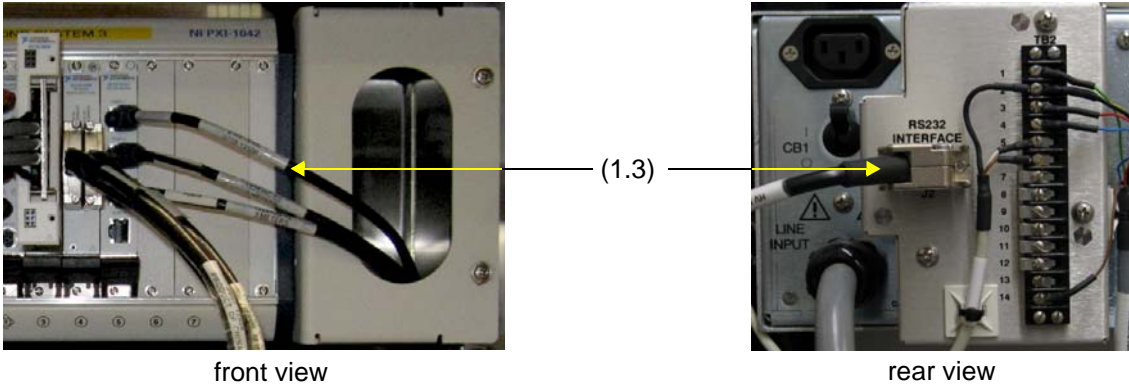


Figure 7.5 Connection 1.3

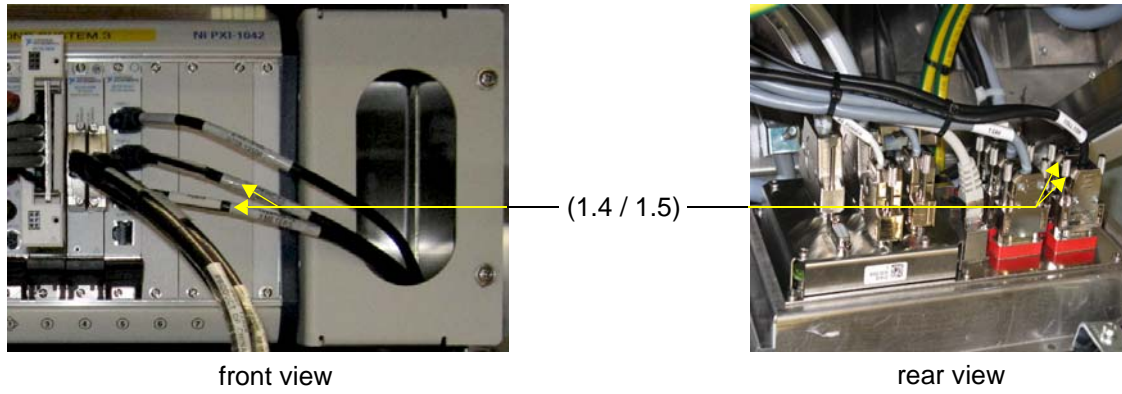


Figure 7.6 Connection 1.4 / 1.5

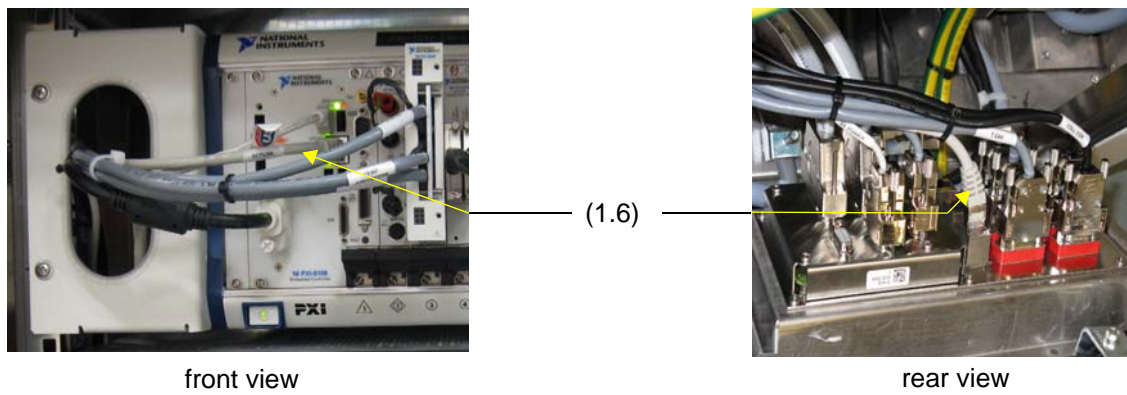
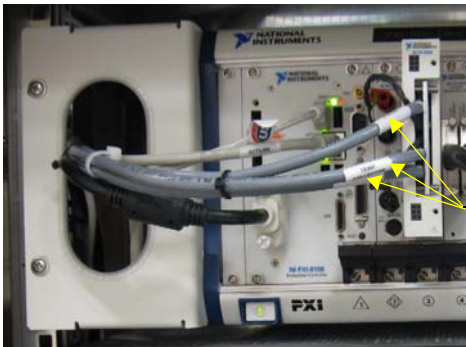


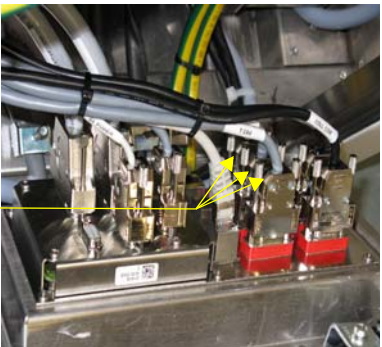
Figure 7.7 Connection 1.6



front view

CONSOLE TYPE A

(1.7 -1.9)



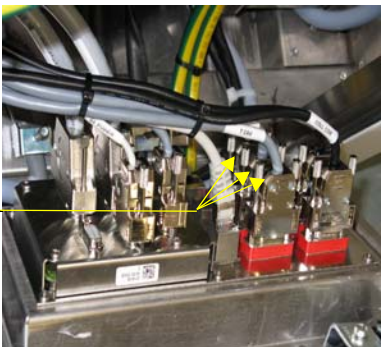
rear view



front view

CONSOLE TYPE B

(1.7 -1.9)



rear view

Figure 7.8 Connection 1.7 - 1.9

HIGH VOLTAGE WIRING

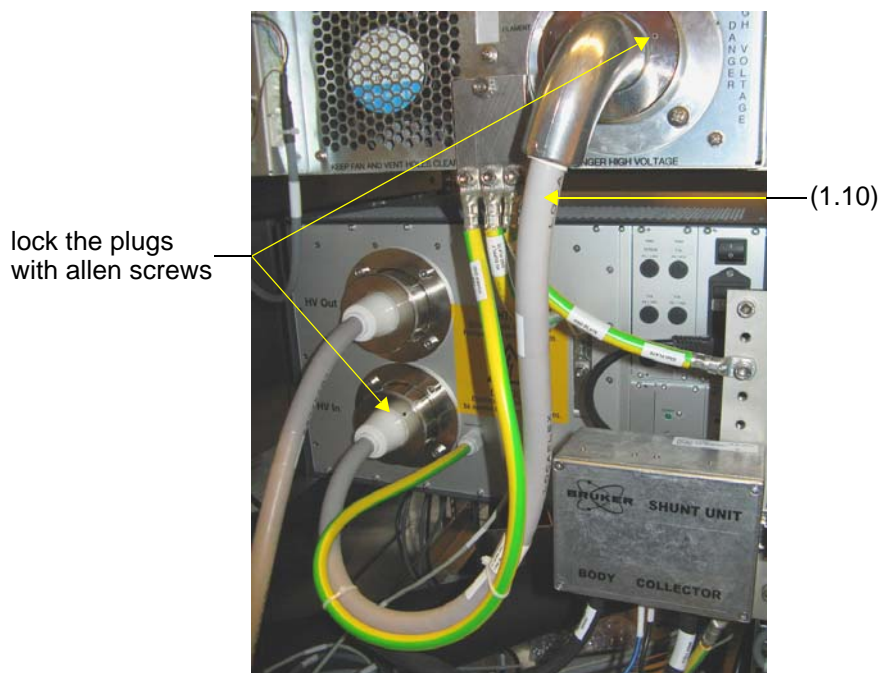


Figure 7.9 Connection 1.10

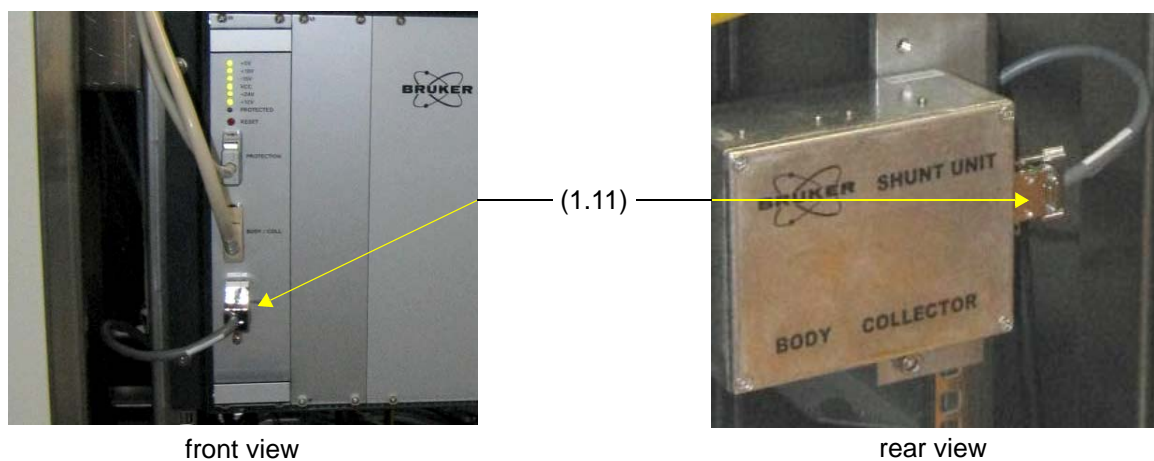


Figure 7.10 Connection 1.11

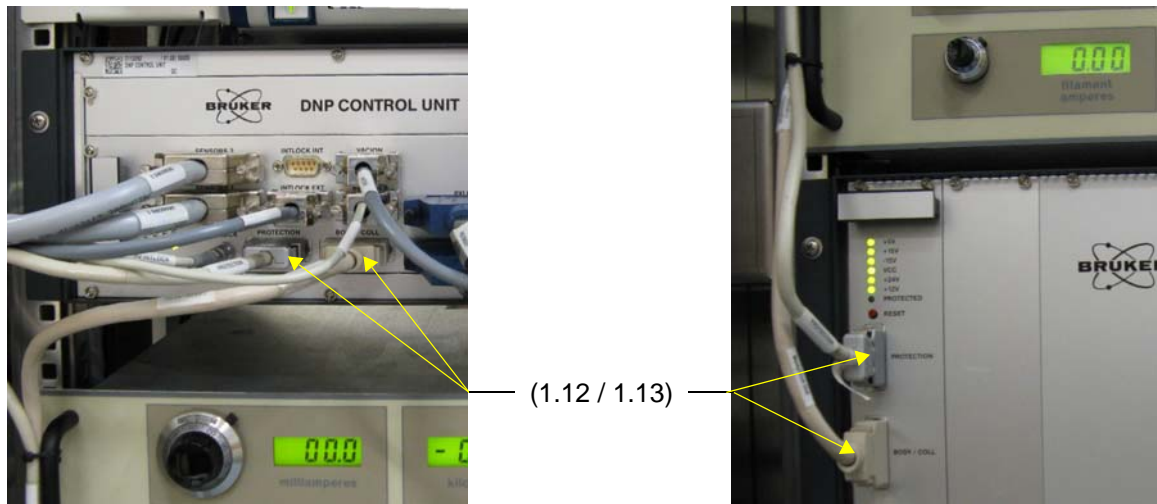


Figure 7.11 Connection 1.12 / 1.13

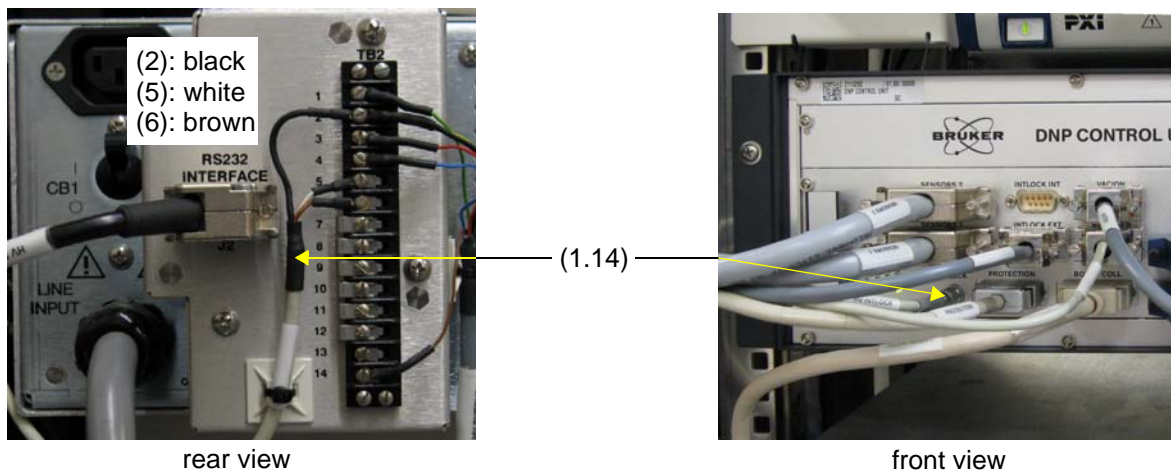
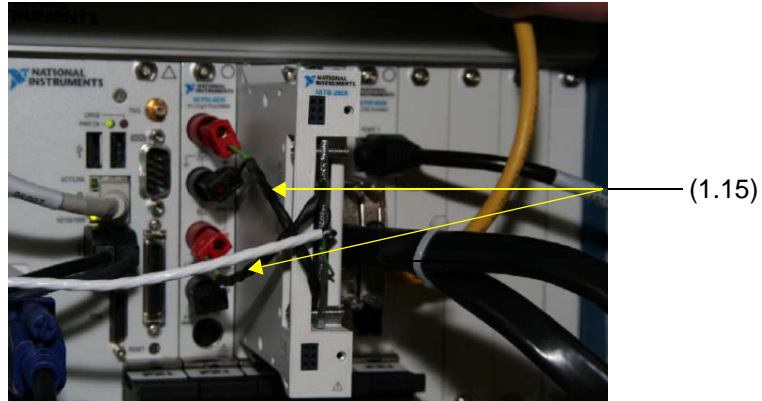


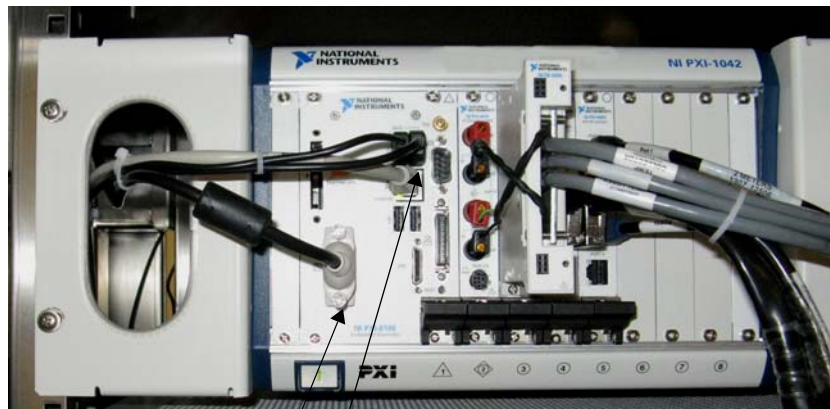
Figure 7.12 Connection 1.14



Note:

Please refer to [Figure 7.2 "Wiring Internal 1"](#) for mapping information, the picture may differ from the one above

Figure 7.13 Connection 1.15



(1.16) ———
(1.17 / 1.18) ———

Figure 7.14 Connection 1.16 - 1.18

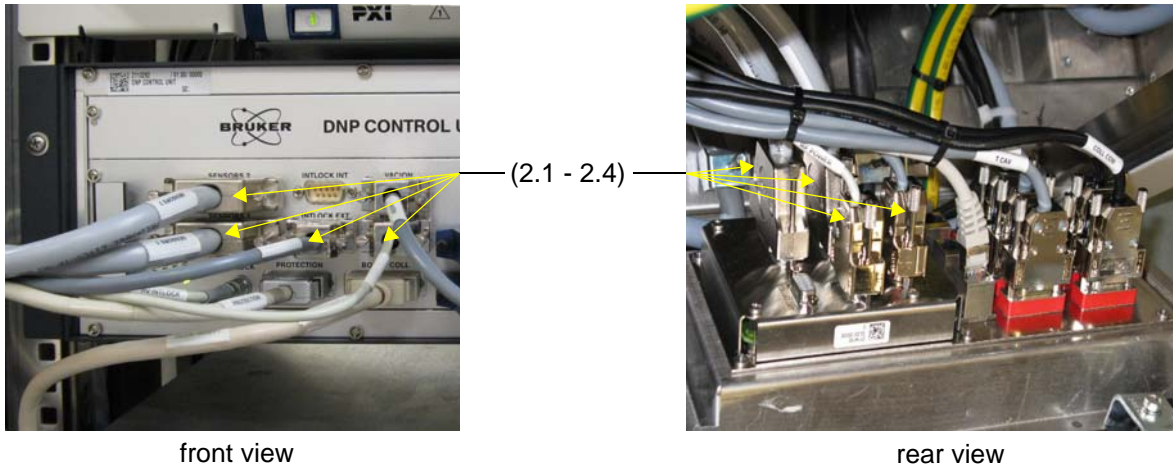


Figure 7.15 Connection 2.1 - 2.4

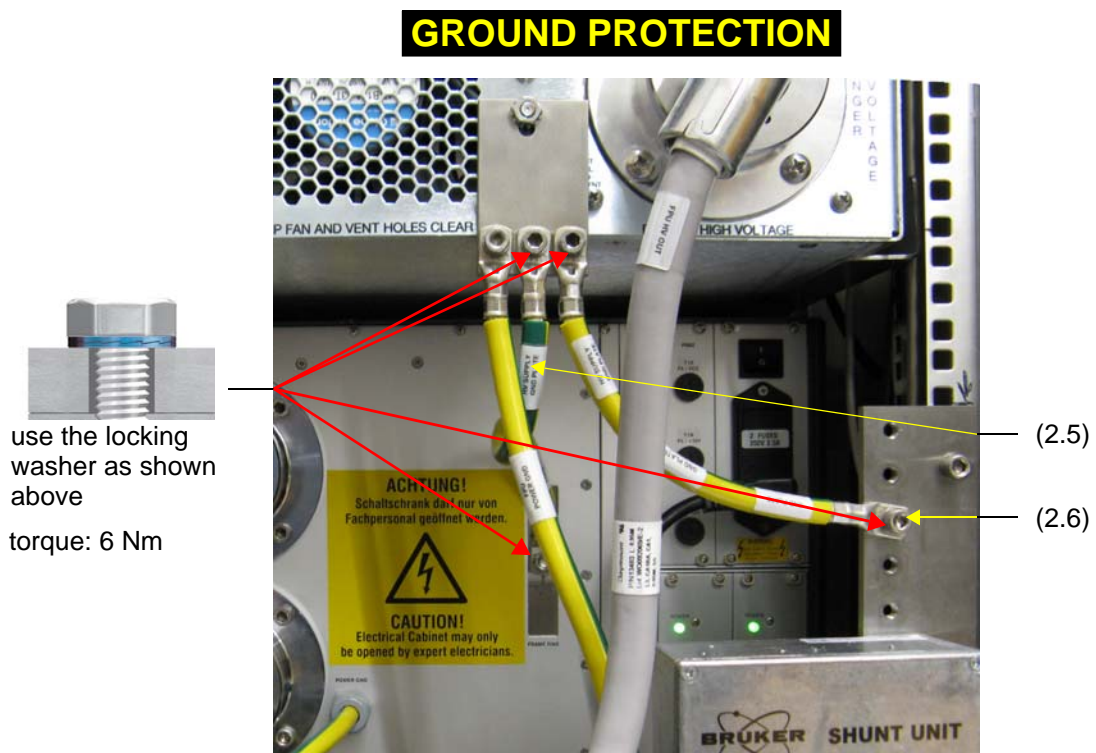


Figure 7.16 Connection 2.5 - 2.6

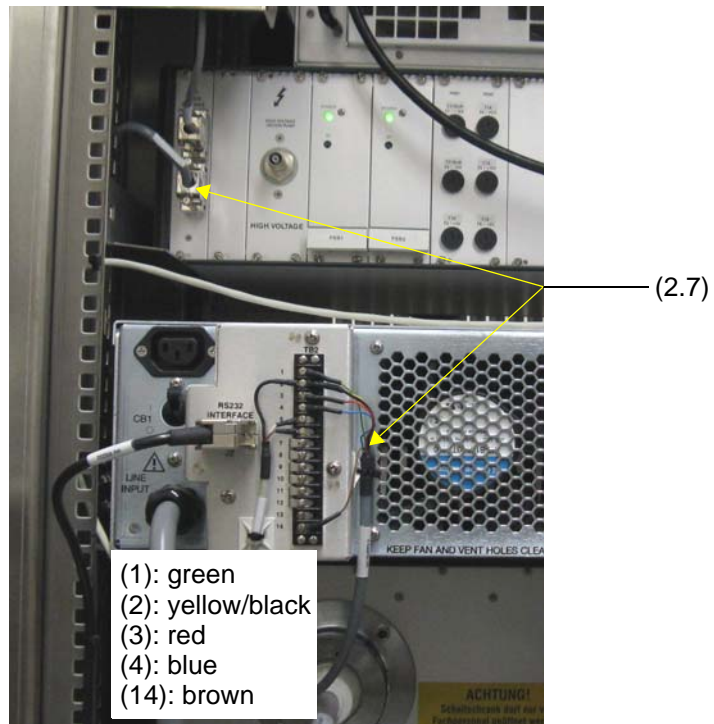


Figure 7.17 Connection 2.7

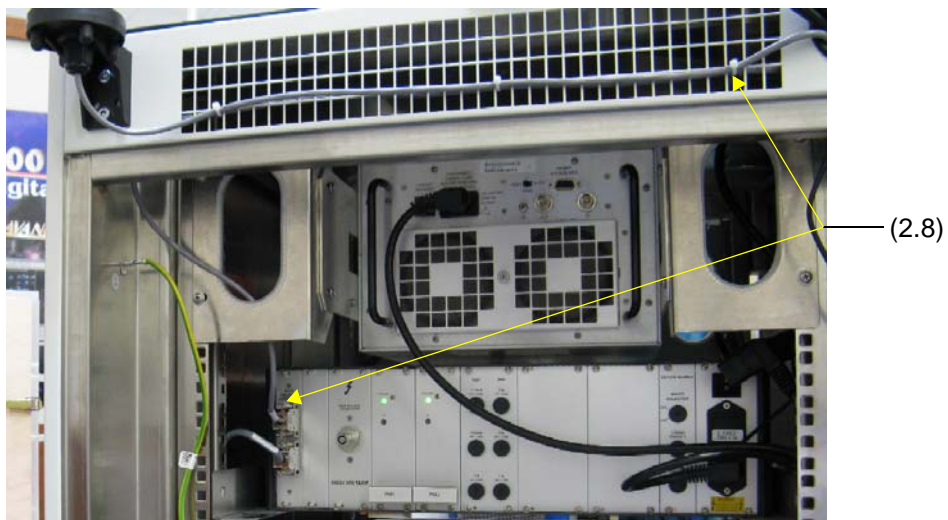


Figure 7.18 Connection 2.8

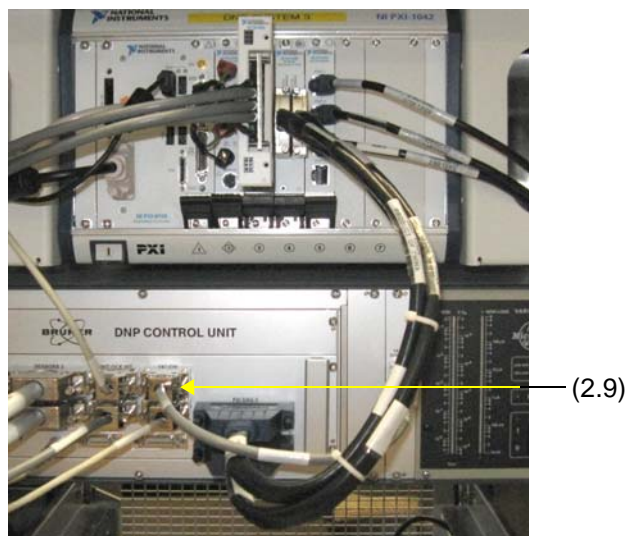


Figure 7.19 Connection 2.9

GROUND PROTECTION

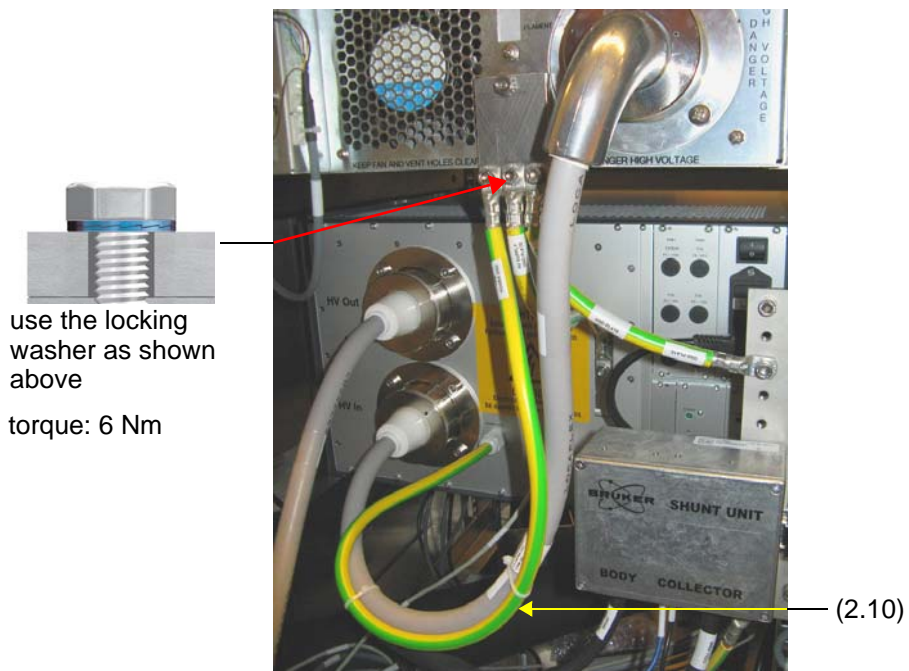


Figure 7.20 Connection 2.10

7.2.7 External Connections

Some of the external cables are not part of the CONSOLE, nevertheless assembling instructions for these connections are available in this manual - for more detailed information, please refer to the according manuals and documents of the DNP SYSTEM.

Initial Tests

A few pre-tests need to be performed before the starting the assembling process. These checks are intended to verify that the cables have not been damaged during manufacturing or transportation.

Identifier	Part No	Test
CABLE DNP BODY PWR/TEST	Z113885	Measurement of the electrical resistance between the plugs. The value must not exceed 1Ohm.
CABLE DNP COLL PWR/TEST	Z113886	
CABLE DNP MAGNET PE	Z113892	
CABLE DNP PROTECT GND	Z113893	Verify that the cables are not damaged by visual inspection.
CABLE DNP FPU PE	Z115801	
CABLE DNP GND PLATE	Z114496	

Table 7.6 Important cables

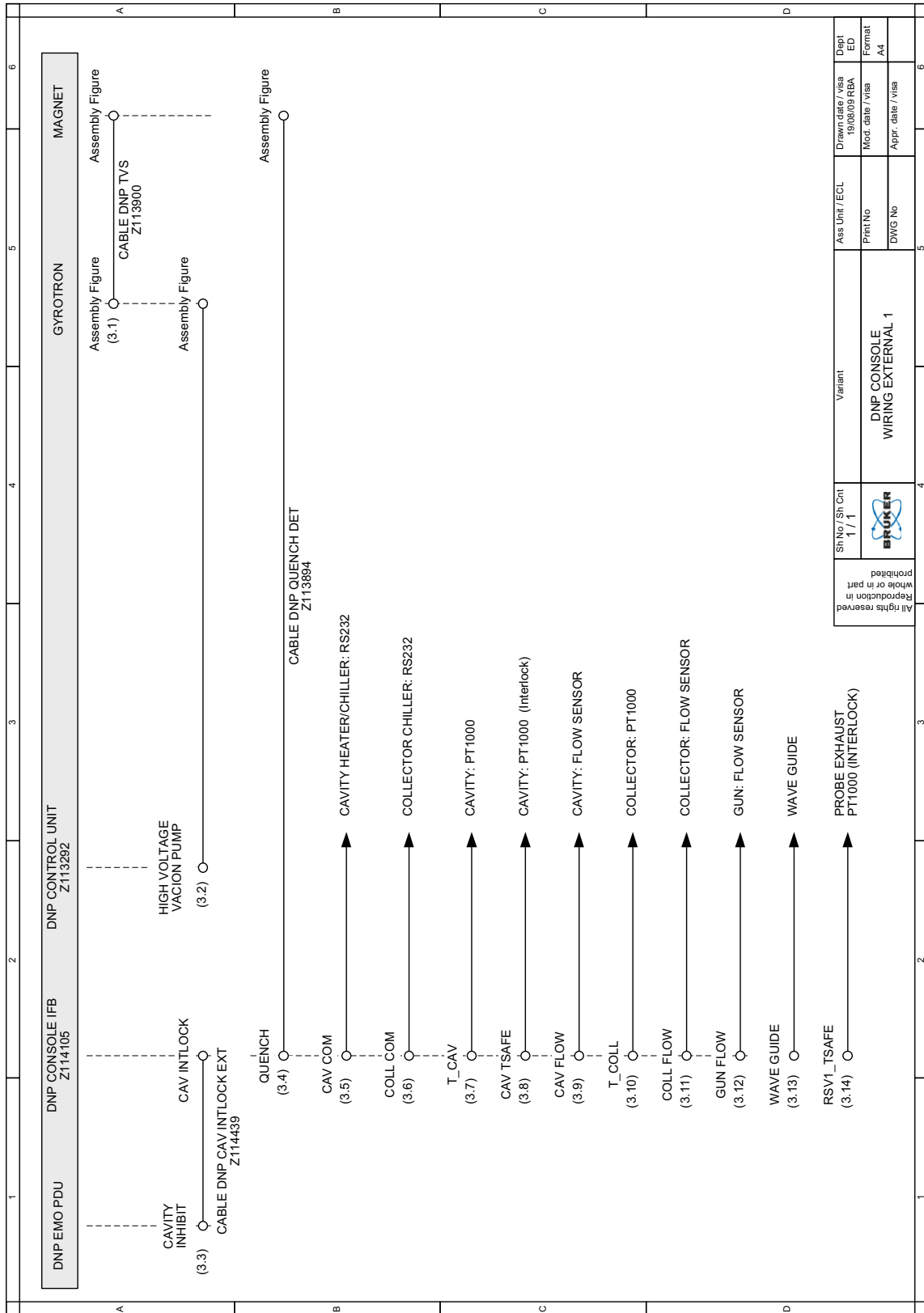
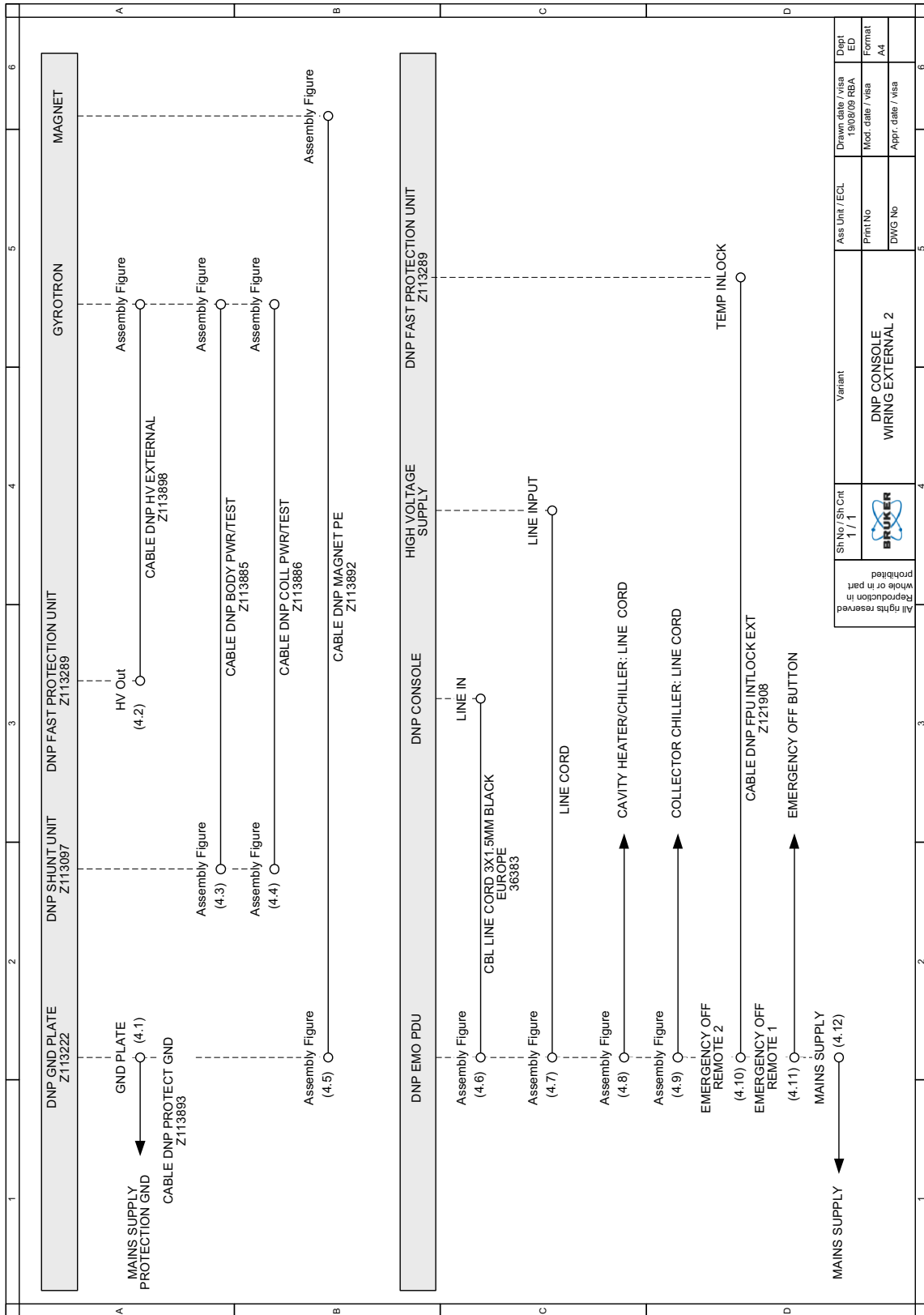


Figure 7.21 Wiring External 1



Sh No / Sh/Crit 1 / 1 	Variant DNP CONSOLE WIRING EXTERNAL 2	Ass Unit / ECL	Drawn date / visa 19/08/09 FBA	Dept ED
		Print No	Modr. date / visa	Format A4
		DWG No	Appr. date / visa	

Figure 7.22 Wiring External 2

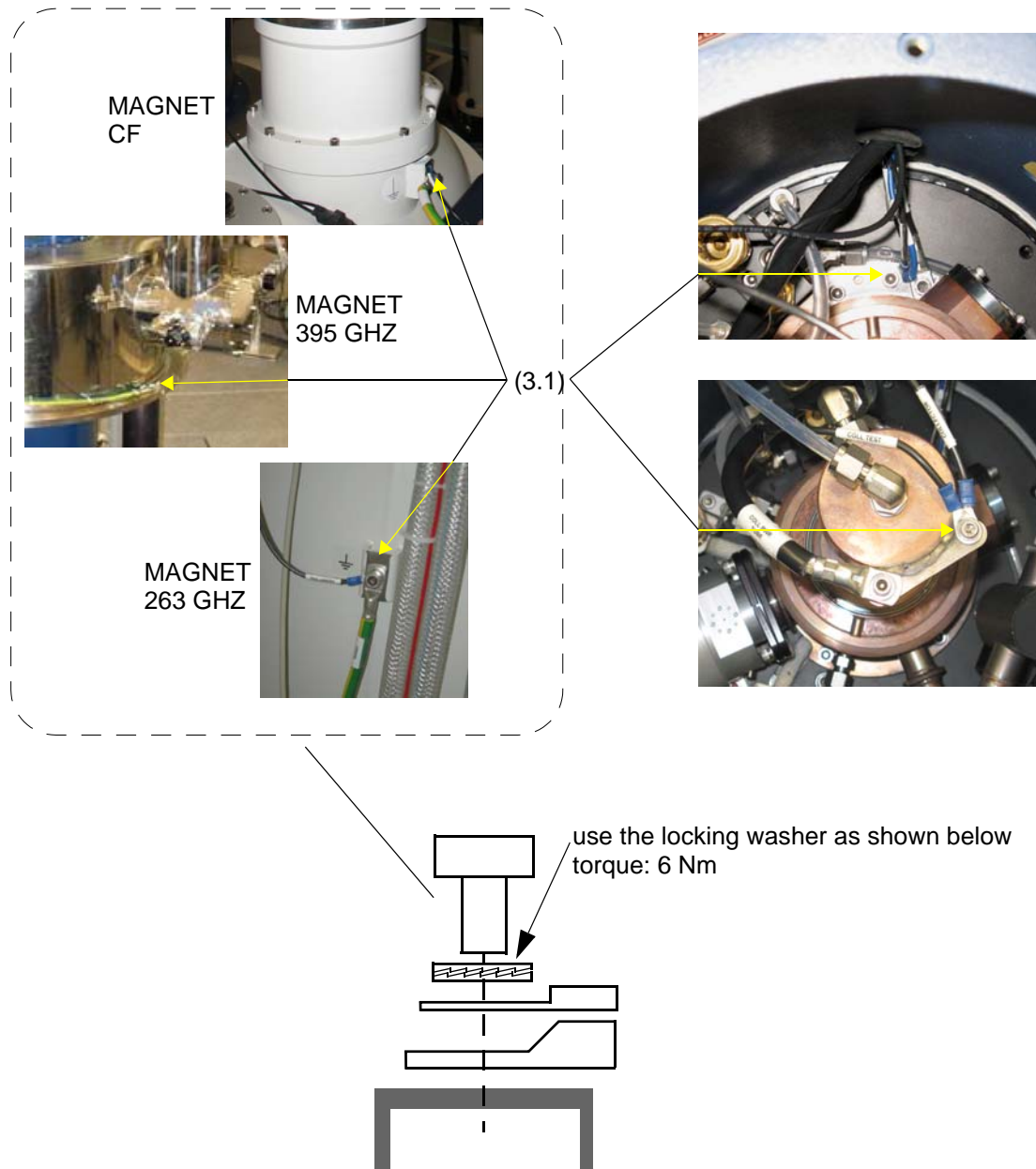
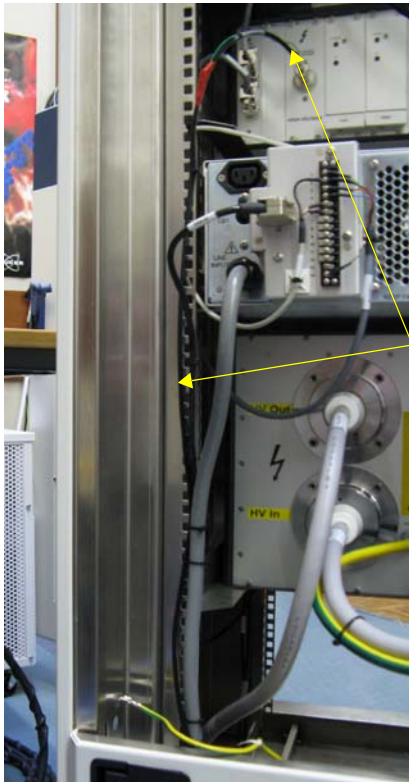
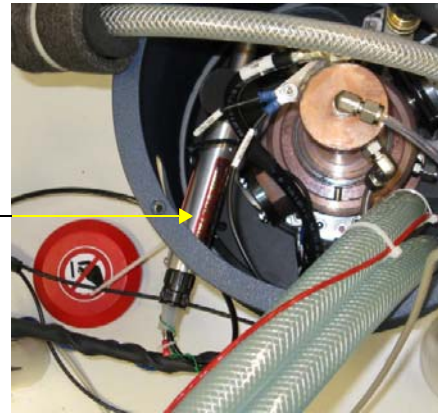


Figure 7.23 Connection 3.1



(3.2)



Stick the green interlock cable on both ends to the main wire by using insulation tape - it must not make contact with anything.

Figure 7.24 Connection 3.2

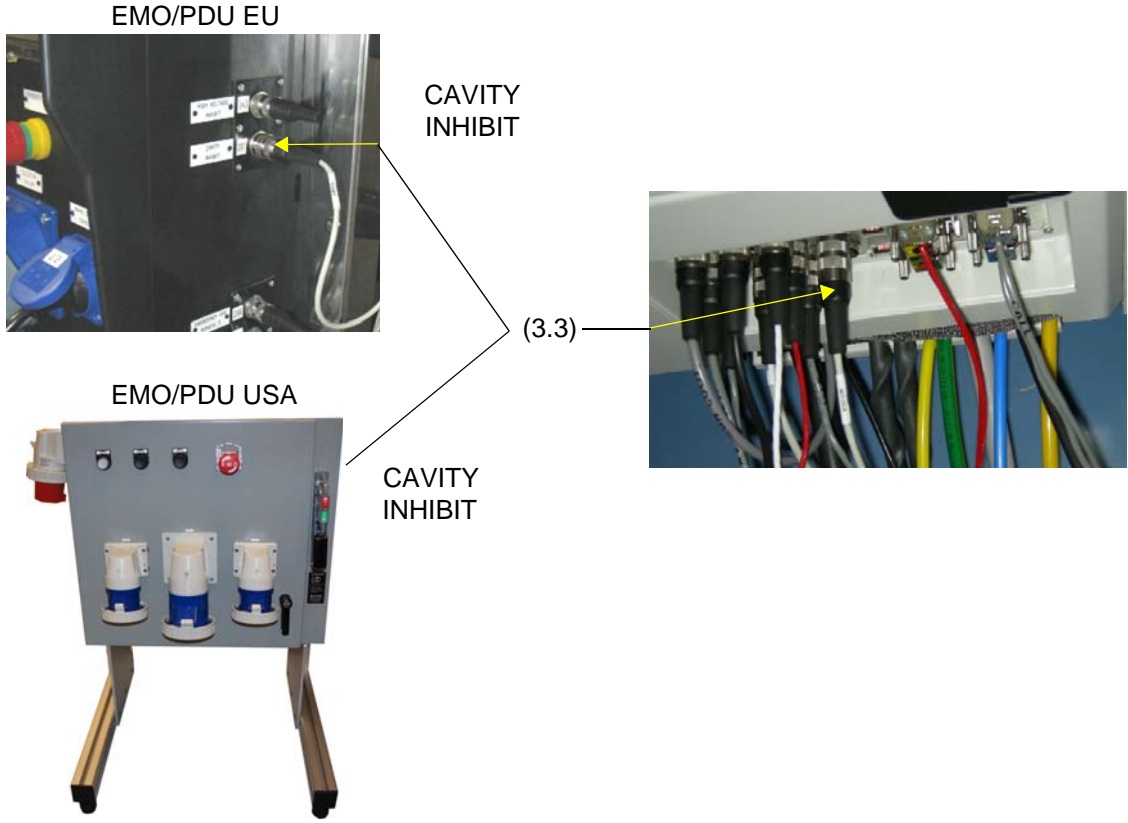
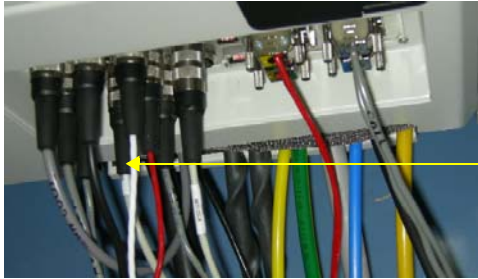
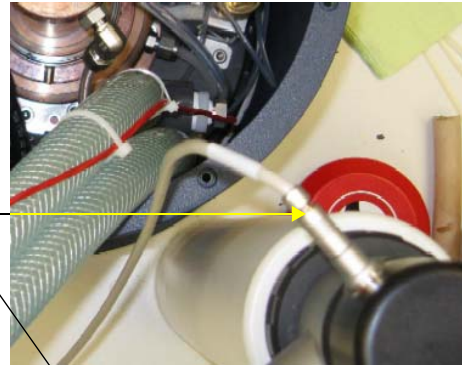


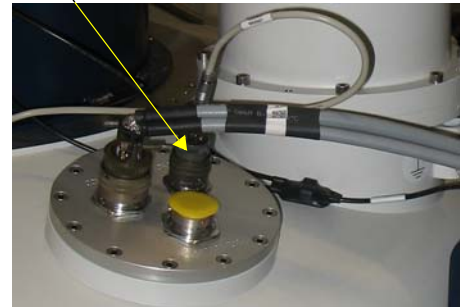
Figure 7.25 Connection 3.3



Note:
Quench detection is not available
on MAGNET 395 GHZ



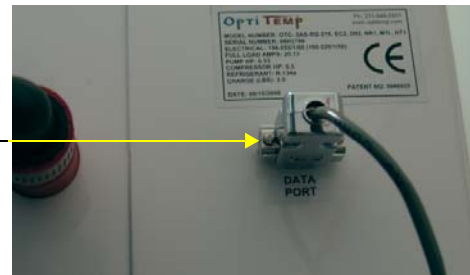
MAGNET 263GHZ



MAGNET CF

(3.4)

Figure 7.26 Connection 3.4



(3.5)

Figure 7.27 Connection 3.5

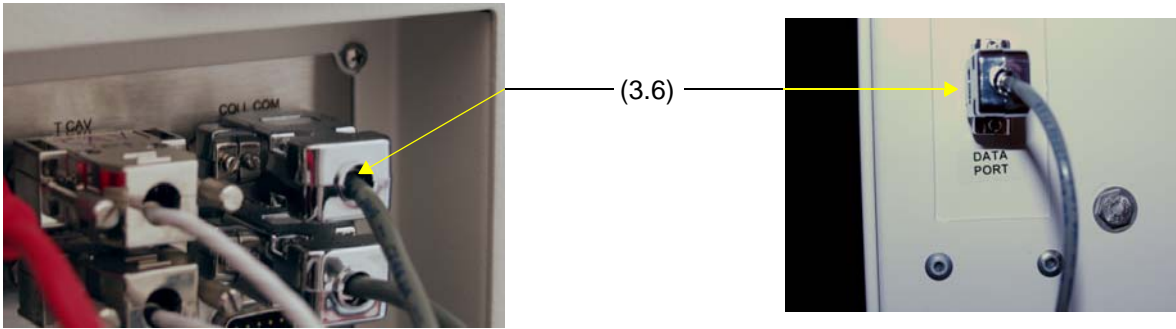


Figure 7.28 Connection 3.6

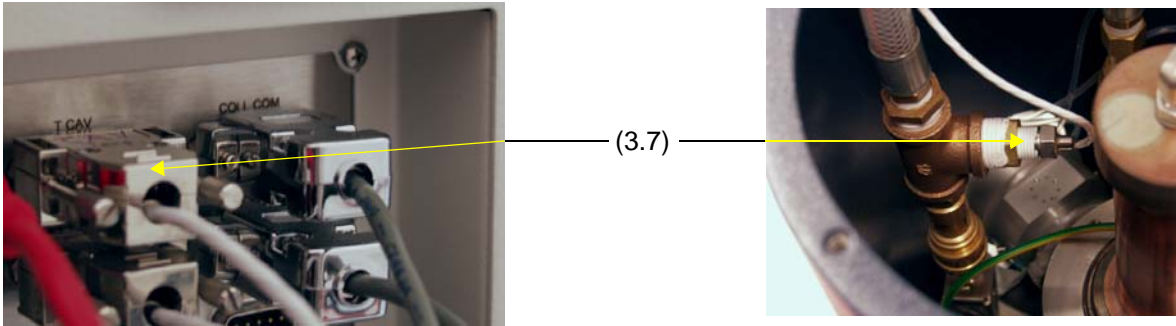


Figure 7.29 Connection 3.7

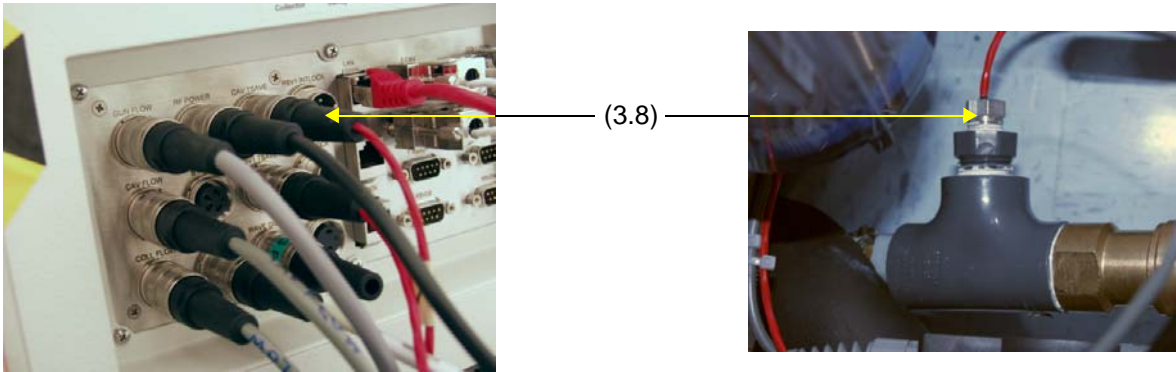
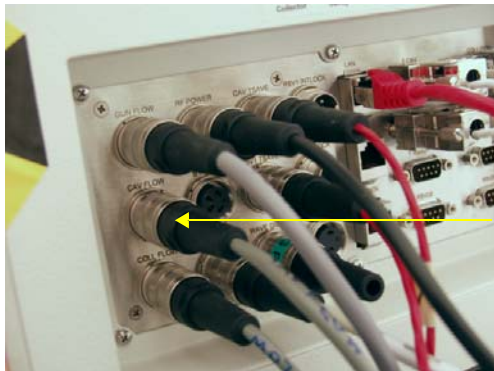


Figure 7.30 Connection 3.8



(3.9)

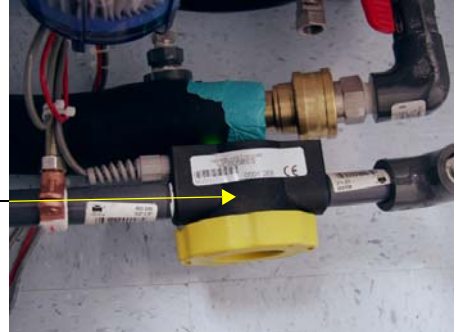


Figure 7.31 Connection 3.9



(3.10)

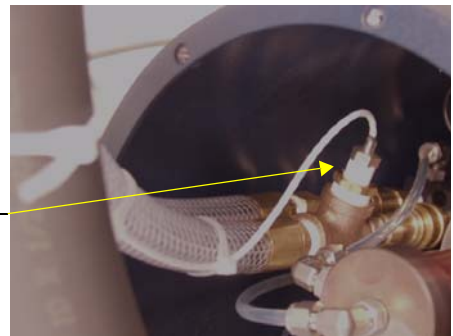
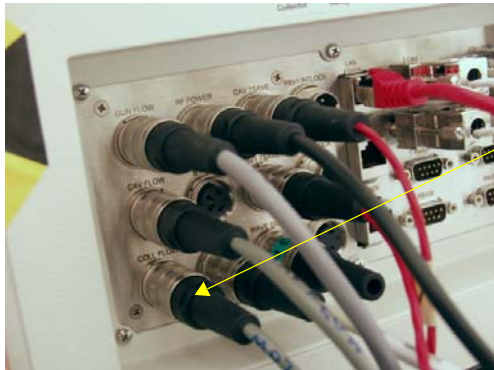


Figure 7.32 Connection 3.10



(3.11)

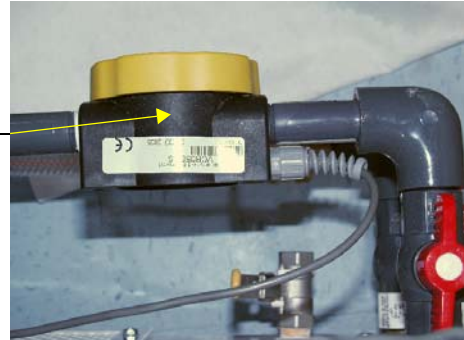
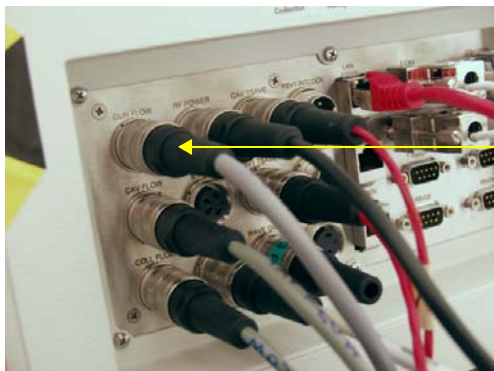


Figure 7.33 Connection 3.11



(3.12)

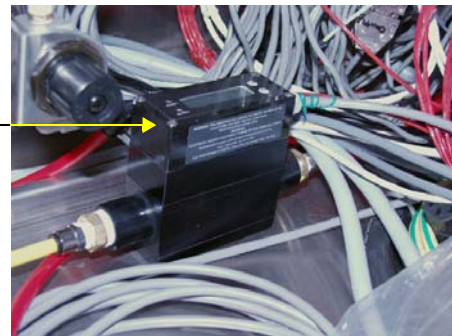


Figure 7.34 Connection 3.12

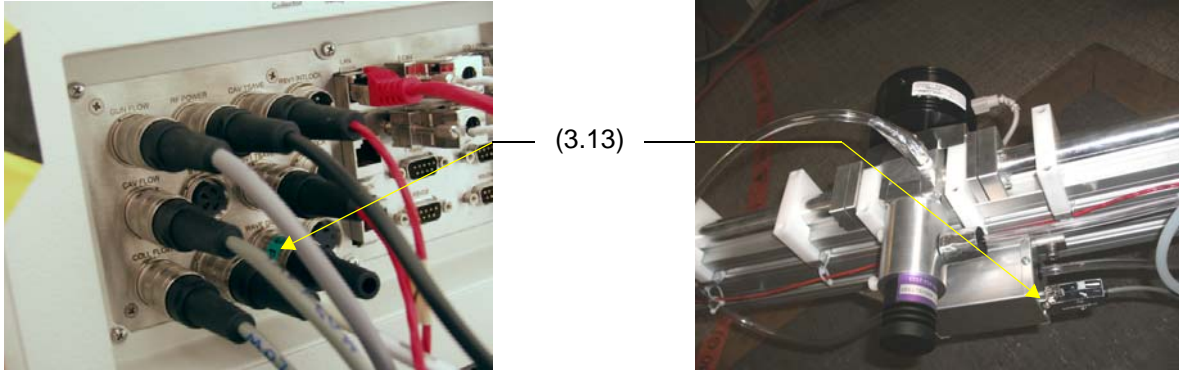


Figure 7.35 Connection 3.13

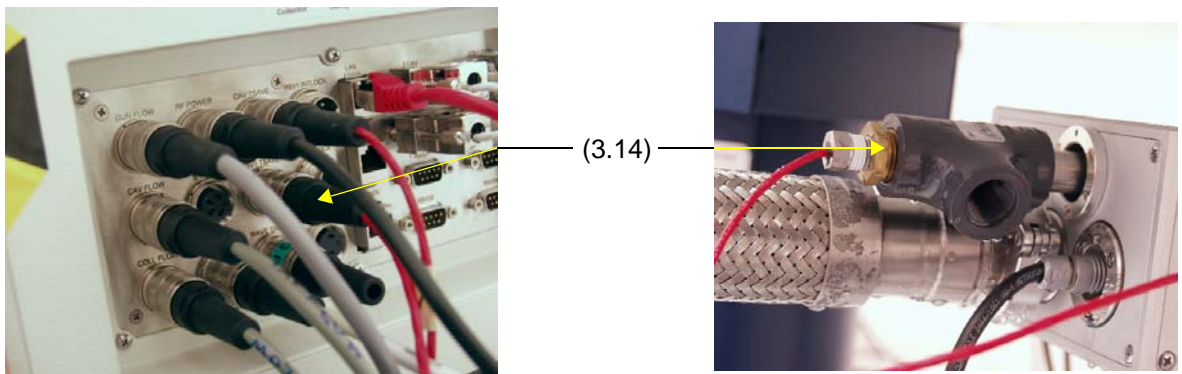
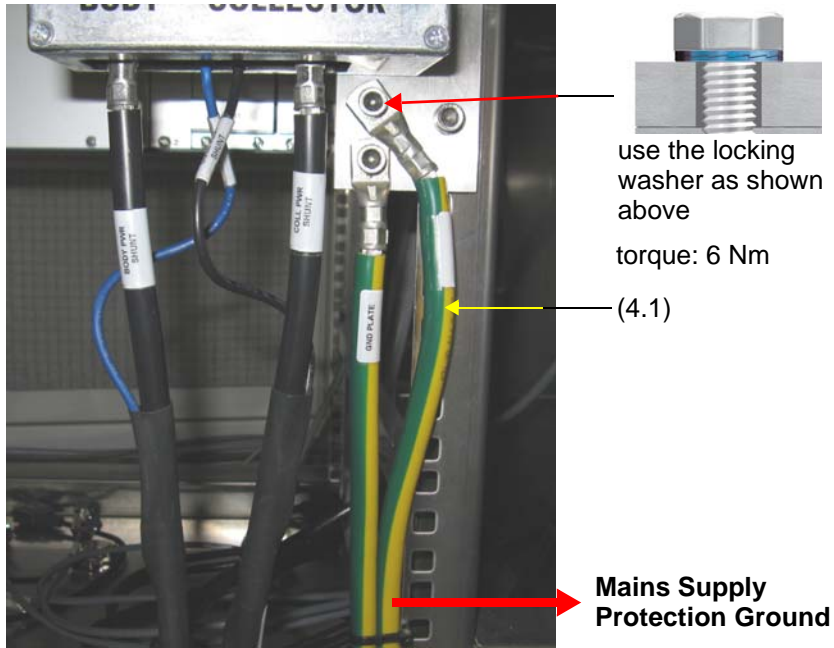


Figure 7.36 Connection 3.14

GROUND PROTECTION

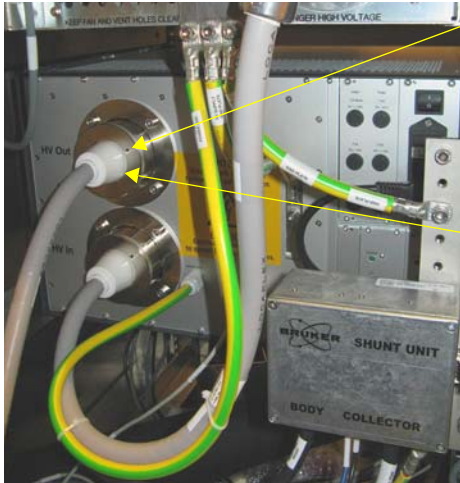


Strain relief is shown in [Figure 7.45](#)

Figure 7.37 Connection 4.1



HIGH VOLTAGE WIRING



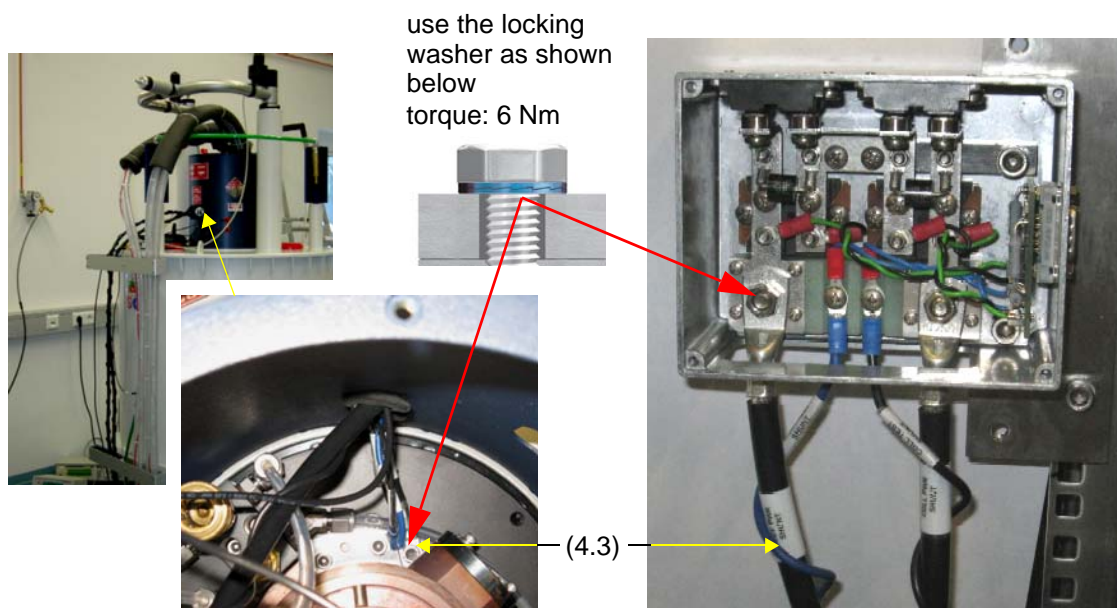
lock the plugs
with allen screws

(4.2)



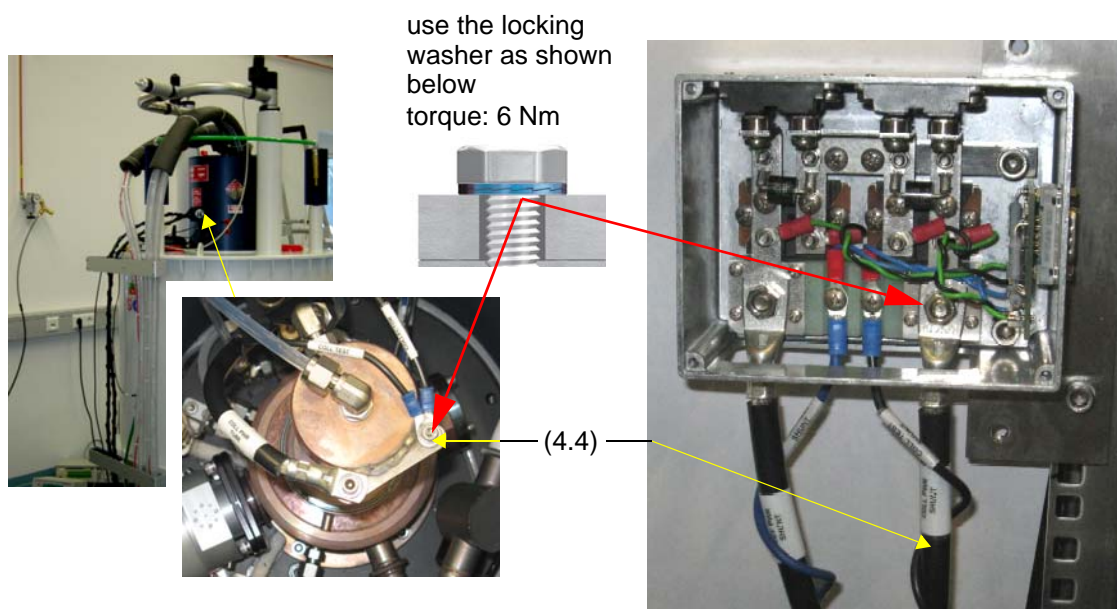
Strain relief is shown in [Figure 7.45](#)

Figure 7.38 Connection 4.2



Strain relief is shown in [Figure 7.45](#)

Figure 7.39 Connection 4.3



Strain relief is shown in [Figure 7.45](#)

Figure 7.40 Connection 4.4

GROUND PROTECTION

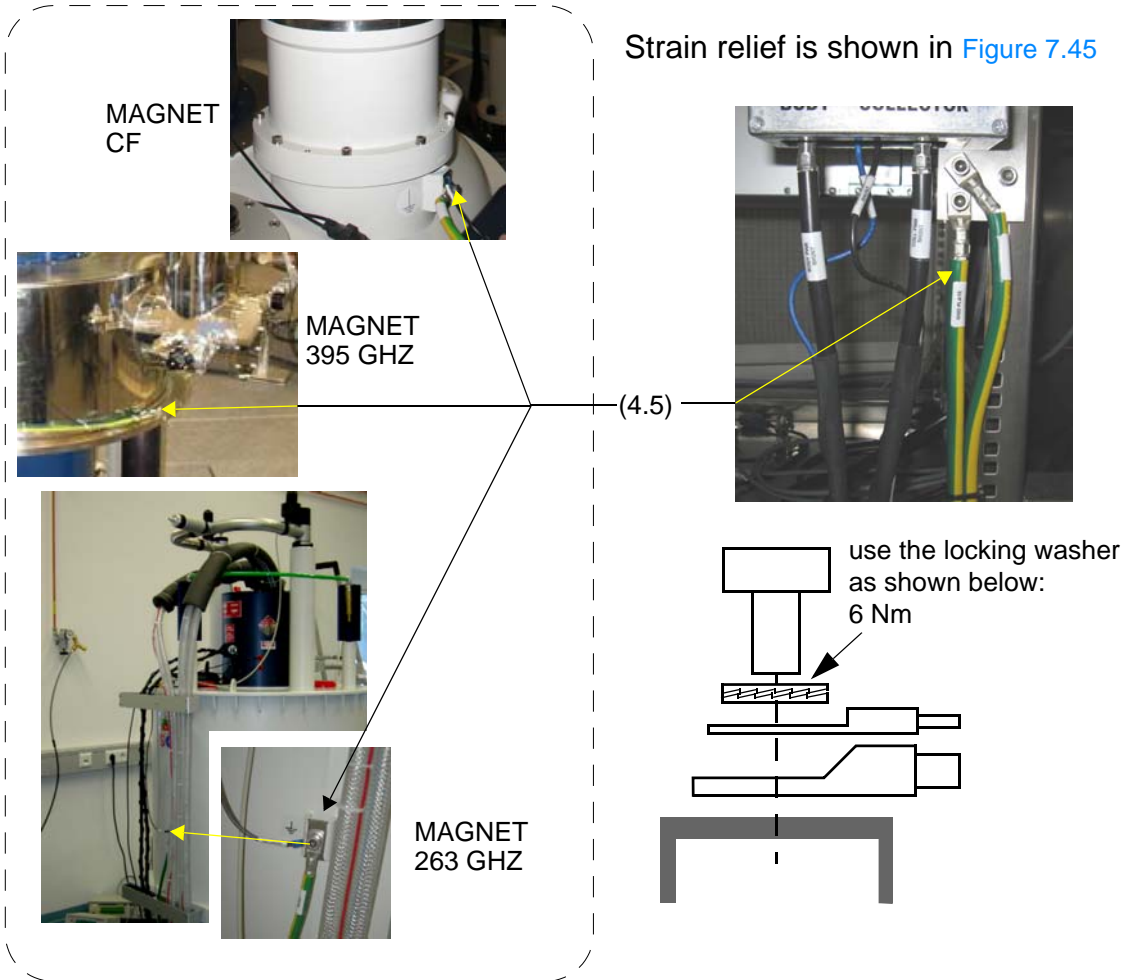


Figure 7.41 Connection 4.5

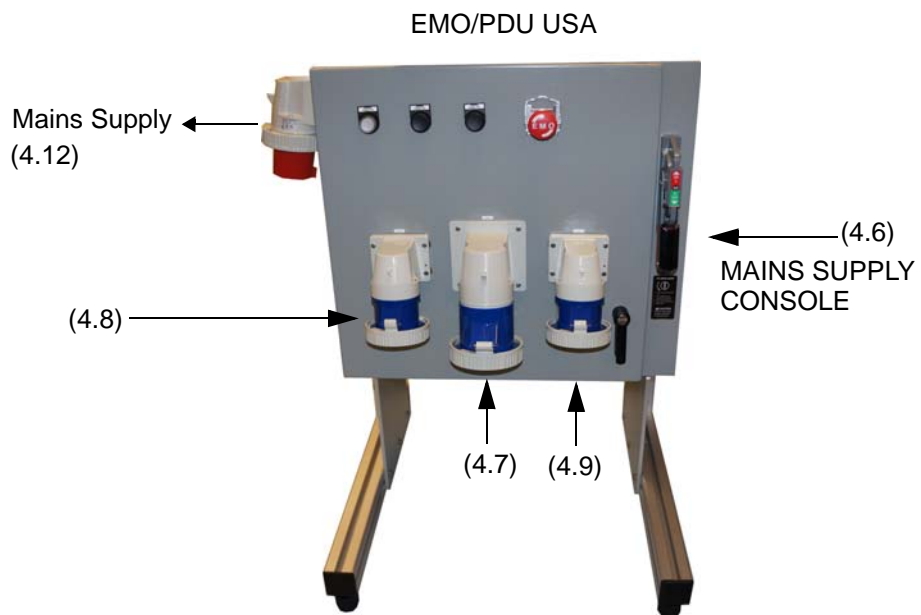
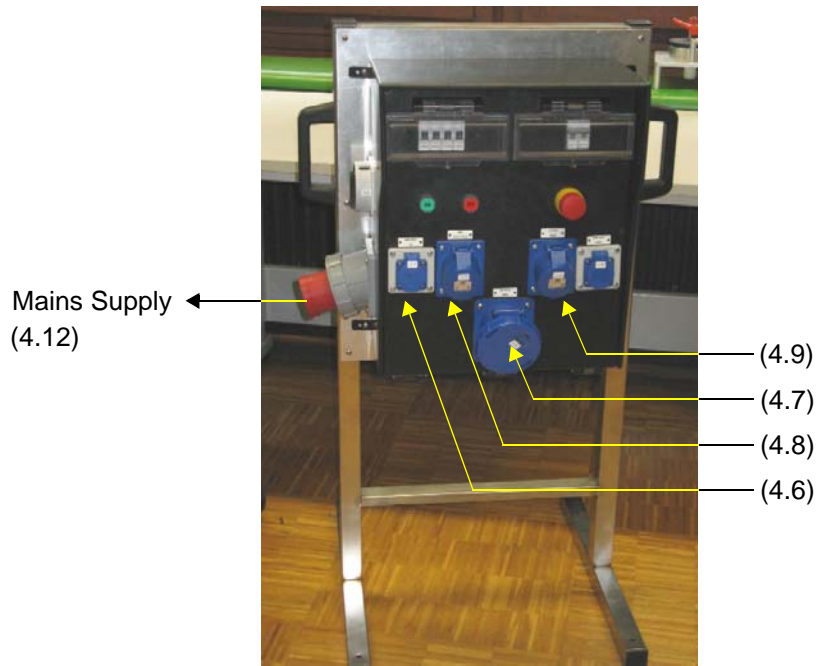


Figure 7.42 Connection 4.6 - 4.9 / 4.12

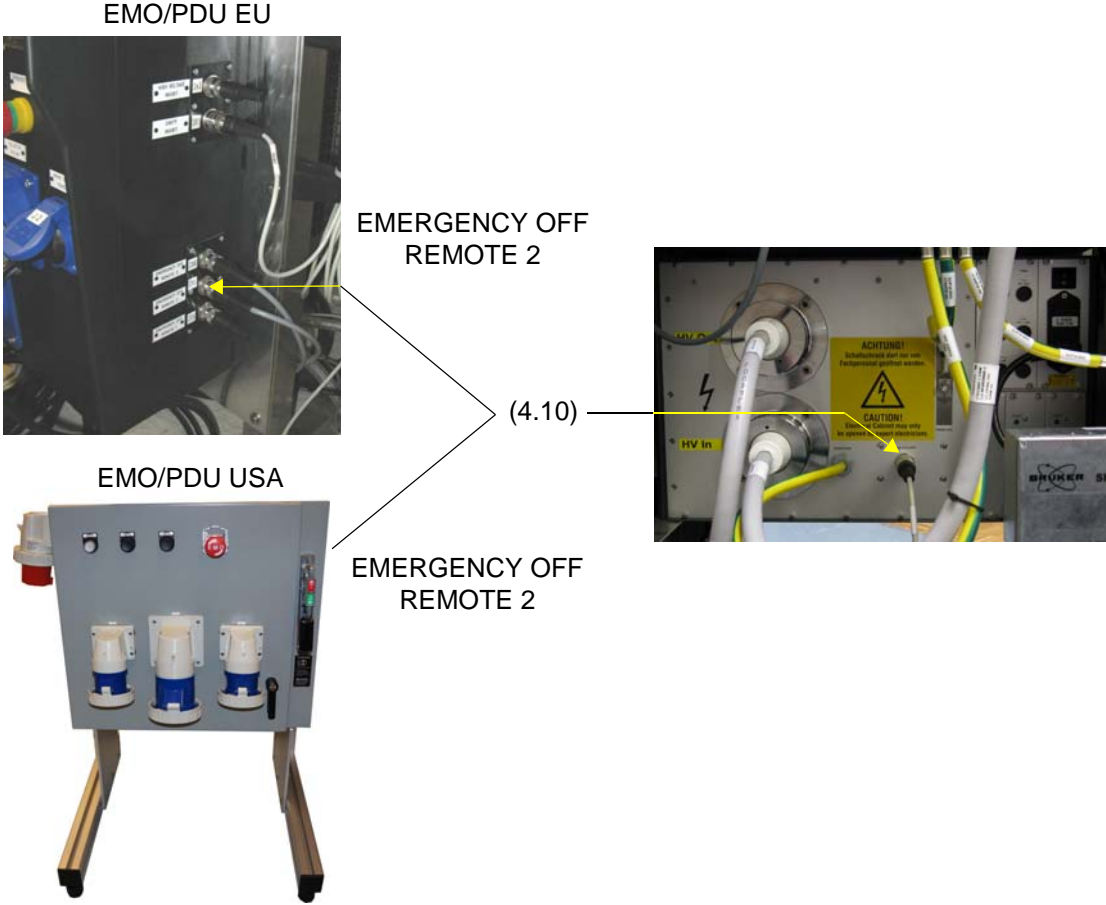


Figure 7.43 Connection 4.10

The Emergency OFF Button has to be clearly visible and easily accessible

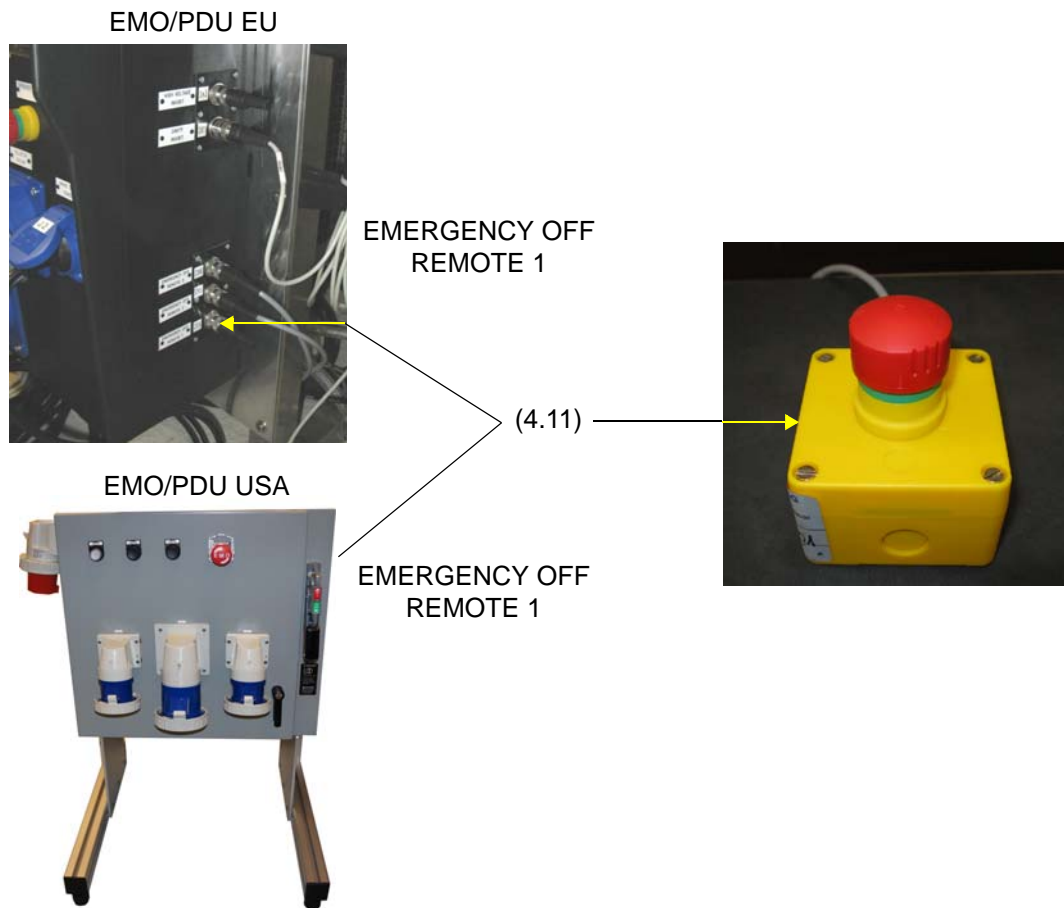
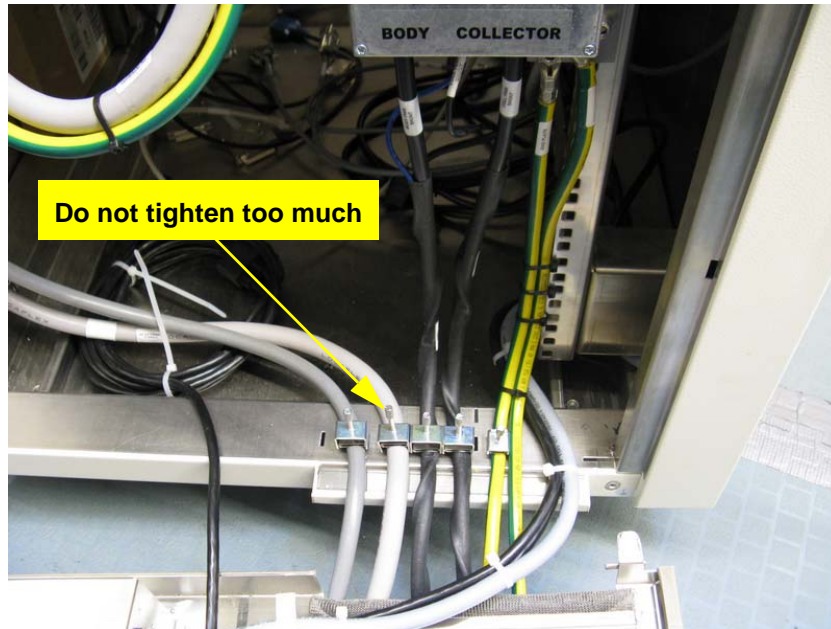


Figure 7.44 Connection 4.11

CONSOLE TYPE A



CONSOLE TYPE B



Figure 7.45 Strain relief at console entry

7.3 Configuration

7.3.1 Introduction

This chapter describes the configuration steps which are required during the installation process. The setup procedure of the operating system and the DNP Control Software is not included in this chapter. Only the system- and tube specific configuration steps are part of these explanations.

The configuration settings of the sensors: gun, cavity and collector flow are defined in the DNP System documentation, please refer to these manuals to get more detailed information about the sensor parameters.

General

NOTICE

The dnp_user must have full access to the DNP Control Software directory (and all sub-directories).

7.3.2 User management

	Password
PXI PC	
BIOS	brukerch
Windows XP	
dnp_user	password
Administrator	*****
DNP Control Software	
User	none
Service	*****
Developer	*****

Table 7.7 Passwords/Users

7.3.3 DNP Control Software

The DNP Control Software is configured by several .ini-files located in: ..\ConfigFiles.



WARNING

Modifications of these files have to be done carefully. Before modifying an ini-file, it is recommended to backup the original version.

An ini-file is a simple text file containing sections and parameters. Parameters that belong together are grouped in sections. Not all ini-files need to be modified during the installation process of a DNP Control System. The affected files are described below:

Section	Parameter	Unit	Description
Unsuitable settings may lead to unexpected high voltage- or filament current values!			
RANGES	HV_MAX	[V]	Upper limit of the high voltage supply voltage (gyrotron gun and cathode).
	FILAMENT_CURR_MAX	[mA]	Upper limit of the gun heater current

Table 7.8 HVConfigFile.ini

Section	Parameter	Unit	Value	Version
SYSTEM_PARAMETERS	MAINS_FREQUENCY	Hz	50	Power Supply System 50 Hz
		Hz	60	Power Supply System 60 Hz
CATHODE_CURRENT	SCALE_FACTOR	[-]	1	All versions
BODY_CURRENT	SCALE_FACTOR	[-]	0.5889	All versions
COLL_CURRENT	SCALE_FACTOR	[-]	58.88	FAST PROTECTION UNIT Z113289 ECL: 00 - 03
		[-]	30.0	FAST PROTECTION UNIT Z113289 ECL: 04 and higher
CAV_FLOW	SCALE_FACTOR	[-]	3.7854	All versions
COLL_FLOW	SCALE_FACTOR	[-]	3.7854	All versions
VACION_CURR	SCALE_FACTOR	[-]	1	All versions
VACION_RESTART_CURR	SCALE_FACTOR	[-]	1	All versions
VACION_VOLT	SCALE_FACTOR	[-]	1000	All versions
GUN_FLOW	SCALE_FACTOR	[-]	100	All versions
QUENCH1	SCALE_FACTOR	[-]	0.0909	All versions
QUENCH2	SCALE_FACTOR	[-]	0.0909	All versions
HE_LEVEL	SCALE_FACTOR	[-]	1	All versions

Table 7.9 SystemConfigFile.ini (General)

Section	Parameter	Unit	Value	Version
RF_POWER	SCALE_FACTOR	[-]	1	All versions
MAGNET_FIELD	SCALE_FACTOR	[-]	769.23	All versions
CAVITY_INTLOCK_T	SCALE_FACTOR	[-]	57.142	All versions
PROBEHEAD_INTLOCK_TEMP	SCALE_FACTOR	[-]	57.142	All versions

Table 7.9 SystemConfigFile.ini (General)

Section	Parameter	Unit	Description
<p>This type of parameter consists of three range sets and one default value:</p> <p>RANGE_L/H_ACTUAL: Active range limits RANGE_L/H_STANDARD: Range limits for access level 'SERVICE' RANGE_L/H_EXT: Extended limits for access level 'DEVELOPER'</p> <p>The values of these parameters are not defined in this manual, further information is available in the DNP Control System Manual (Limits & Operating Parameters).</p>			
	SET_CATHODE_VOLTAGE	[V]	Settling Gyrotron cathode voltage
	SET_FILAMENT_CURRENT	[mA]	Settling Gyrotron gun heater current
	SET_CAVITY_TEMPERATURE	[°C]	Target value cavity liquid temperature
	SET_CAV_TECO_P	[-]	Cavity temperature regulator: proportional constant
	SET_CAV_TECO_I	[1/s]	Cavity temperature regulator: integral constant
	SET_CAV_TECO_CHILLER_TEMP	[°C]	Settling temperature cavity heater/chiller
	SET_COLLECTOR_TEMPERATURE	[°C]	Target value collector liquid temperature
	SET_COLL_TECO_P	[-]	Collector temperature regulator: proportional constant
	SET_COLL_TECO_I	[1/s]	Collector temperature regulator: integral constant
	SET_COLL_TECO_CHILLER_TEMP	[°C]	Settling temperature collector chiller

Table 7.10 SystemConfigFile.ini (SET PARAMETERS)

Section	Parameter	Unit	Description
<p>Similar to the range parameters this type consists of three limit sets:</p> <p>LIMIT_L/H_ACTUAL: Active limits LIMIT_L/H_STANDARD: Limit range for access level 'SERVICE' LIMIT_L/H_EXT: Limit range for access level 'DEVELOPER'</p> <p>The values of these parameters are not defined in this manual, further information is available in the DNP Control System Manual (Limits & Operating Parameters).</p>			
	READ_CATHODE_VOLTAGE	[V]	Gyrotron cathode voltage, read back value from high voltage supply
	READ_FILAMENT_CURRENT	[mA]	Gyrotron gun heater current, read back value from high voltage supply
	READ_CAVITY_TEMPERATURE	[°C]	Cavity liquid temperature measured by pt1000
	READ_CAV_TECO_CHILLER_TEMP	[°C]	Cavity liquid temperature measured by heater/chiller itself.
	READ_COLLECTOR_TEMPERATURE	[°C]	Collector liquid temperature measured by pt1000
	READ_COLL_TECO_CHILLER_TEMP	[°C]	Collector liquid temperature measured by chiller itself.
	CATHODE_CURRENT	[mA]	Collector cathode current, read back value from high voltage supply
	BODY_CURRENT	[mA]	Body current, measured by FPU
	COLL_CURRENT	[mA]	Collector current, measured by FPU
	CAV_FLOW	[lpm]	Cavity liquid flow rate
	COLL_FLOW	[lpm]	Collector liquid flow rate
	VACION_CURR	[mA]	Vacion pump current, limits after high voltage has switched on.
	VACION_RESTART_CURR	[mA]	Vacion pump current, start condition to set high voltage > 0V.
	VACION_VOLT	[V]	Vacion pump voltage
	GUN_FLOW	[lpm]	Gyrotron gun cooling flow
	QUENCH1	[V]	Magnet quench detection output voltage 1
	QUENCH2	[V]	Magnet quench detection output voltage 2
	HE_LEVEL	[%]	Magnet helium level
	RF_POWER	[V]	Microwave power, measured by diode detector
	MAGNET_FIELD	[V]	Magnet stray field sensor
	CAVITY_INTLOCK_T	[°C]	Cavity interlock temperature
	PROBEHEAD_INTLOCK_TEMP_MPWRON	[°C]	Probe head interlock temperature (Microwave power = ON)
	PROBEHEAD_INTLOCK_TEMP_MPWROFF	[°C]	Probe head interlock temperature (Microwave power = OFF)

Table 7.11 SystemConfigFile.ini (LIMIT PARAMETERS)

Section	Parameter	Unit	Default	Description
Cavity Heater Chiller				
DEVICE_0	COM	[-]	4	Com port number
	DEVICE_ADDRESS	[-]	50	Modbus address
	DEVICE_TYPE	[-]	1	0: OptiTemp (all types) 1: Haskris (all types)
	CONFIG_FILE	[-]	Heater chiller configuration file Default: HaskrisCavConfigFile.ini Note: Currently, OptiTemp devices have to be configured manually, therefore no configuration files are available.	
Collector Chiller				
DEVICE_1	COM	[-]	4	Com port number
	DEVICE_ADDRESS	[-]	50	Modbus address
	DEVICE_TYPE	[-]	1	0: OptiTemp (all types) 1: Haskris (all types)
	CONFIG_FILE	[-]	Heater chiller configuration file Default: HaskrisCollConfigFile.ini Note: Currently, OptiTemp devices have to be configured manually, therefore no configuration files are available.	

Table 7.12 ChillerConfigFile.ini

7.4 Installation Checklist

This checklist is intended to support DNP service and installation engineers at the system installation. Only the most important steps are included. In general, all instructions in this manual must be strictly observed.

After completion put this installation checklist into the ring binder which is part of the instrument and stays on site.

ID	Description	Check
1	Double check the connections according to 9.3 "Cable Checks"	p
2	"Interlock Checks" 9.4 have been performed successfully	p
3	Double check the EMO/OFF buttons and the FPU over temperature interlock according to "Emergency OFF / Power Distribution Unit" 9.5 and "Crowbar Over-Temperature Protection" 9.6	p
4	On site risk assessment performed - especially put emphasize on potential hazards related to the wiring	p
5	Suitable cable protection is installed	p
6	Backup the PXI computer Bruker directory	p
7	Hand-over the User Manual to the customer	p
8	Customer training completed (in particular safety topics, owners obligations, and maintenance).	p

Table 7.13 Installation Checklist

Date:

Signature:



8 Operation

8.1 Introduction

This chapter will be part of the next version of this manual

9 Maintenance

9.1 Scheduled Maintenance

Some of the maintenance procedures do not require special skills and can be performed by the operator. Their description is available in the DNP CTRL SYS CONSOLE USER MANUAL.

The procedures below require special knowledge and must be performed by authorized Bruker personnel only.

Unit	Procedure	Interval [year]	Notes
DNP PXI WIRED (Z113544)	Air filter inspection	1	If the filter is not clean it is necessary to call the operators attention to this issue.
DNP CONTROL UNIT (Z113292)	Cleaning	1	Open the device and remove dust (use compressed air if available).
HIGH VOLTAGE SUPPLY	Cleaning	1	Open the device and remove dust according to the manufacturers user manual (use compressed air if available).
	Front panel lamp exchanging	2	See "High Voltage Supply" 9.2
DNP FAST PROTECTION UNIT (Z113289)	Cleaning	1	Open the device and remove dust (use compressed air if available).
	MAINTENANCE	10	For safety reasons the unit must be inspected and maintained in the factory.
Water hoses	Visual inspection	1	They have to be tight (no water on the floor or somewhere else).
Cables		1	Visual inspection of the external cables (especially high voltage and ground wires) See "Cable Checks" 9.3
The interlock checks have to be executed annually 9.4 .			

Table 9.1 Maintenance

9.2 High Voltage Supply

As a precaution the front panel bulbs of the high voltage supply must be exchanged according to the description in DNP Control System Maintenance Procedure.

9.3 Cable Checks

The most important cables must be checked periodically. All connections as listed below have to be inspected visually for damages or bad contacts (e.g. dissolved screws). Verify that the end connectors are tight and properly secured with the locking screw.

If any damage is visible, exchange the cable and modify the cable route to prevent more damage.

Part Name	PartNo	ID	Notes
Internal Cables			
CABLE DNP HV INTERNAL	Z113899	1.10	
CABLE DNP FPU PE	Z115801	2.5	
CABLE DNP GND PLATE	Z114496	2.6	
-	-	2.10	
External Cables			
CABLE DNP PROTECT GND	Z113893	4.1	
CABLE DNP HV EXTERNAL	Z113898	4.2	
CABLE DNP BODY PWR/TEST	Z113885	4.3	
CABLE DNP COLL PWR/TEST	Z113886	4.4	
CABLE DNP MAGNET PE	Z113892	4.5	
CABLE HIGH VOLTAGE VACION PUMP	-	3.2	

Table 9.2 Important cables

9.4 Interlock Checks

For safety reasons the most important interlock circuits are checked annually. The following test connectors are needed to perform these tests:

Part Name	PartNo	Notes
DNP STEST CAV FLOW F 2.0LPM (TYPE A)	Z129652	
DNP STEST CAV FLOW P 3.5LPM (TYPE A)	Z129653	
DNP STEST COLL FLOW F 8.6LPM (TYPE A)	Z129654	
DNP STEST COLL FLOW P 11.6LPM (TYPE A)	Z129655	

Table 9.3 Test connectors

Part Name	PartNo	Notes
DNP STEST GUN FLOW F 150LPM (TYPE A)	Z129650	
DNP STEST GUN FLOW P 300LPM (TYPE A)	Z129651	
DNP STEST PT1000 -63.3°C 4P (TYPE A)	Z129657	
DNP STEST PT1000 0°C 9P (TYPE A)	Z129660	
DNP STEST PT1000 54.2°C 4P (TYPE A)	Z129656	
DNP STEST PT1000 54.2°C 9P (TYPE A)	Z129658	

Table 9.3 Test connectors

Most of the interlock checks are provided by the DNP GYROTRON CONTROL SOFTWARE. After the login as service engineer the self tests are available by selecting the operation mode SELFTEST as shown below:

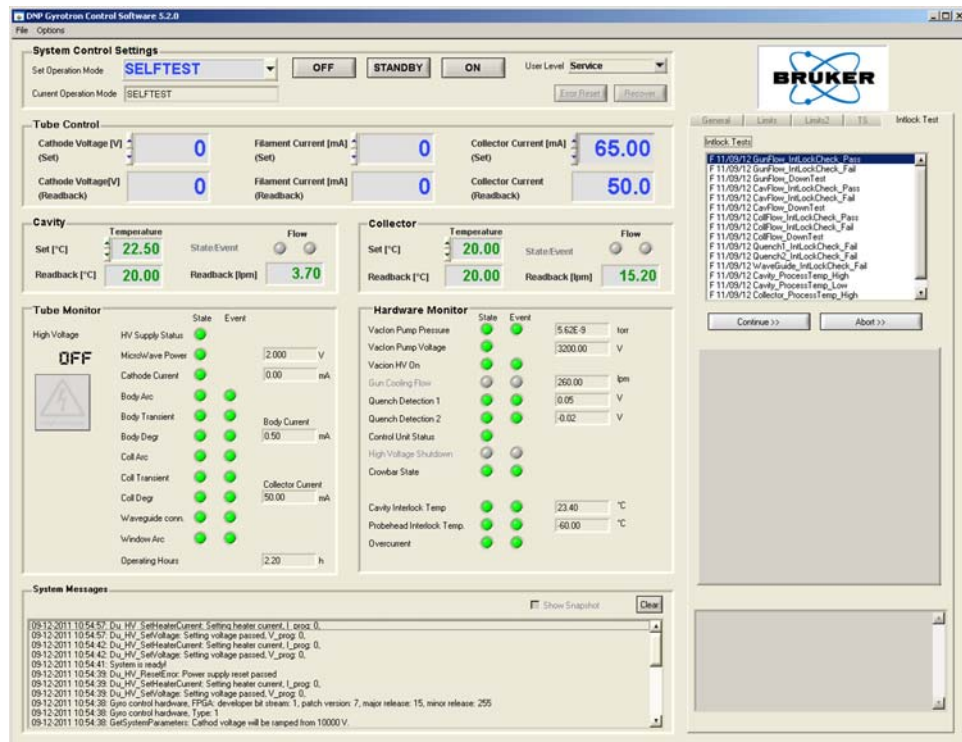


Figure 9.1

All the tests which are listed above must be performed successfully. The result is indicated by the first letter in the list (P: passed / F: failed) followed by the date of expiry.

9.5 Emergency OFF / Power Distribution Unit

The purpose of this procedure is to check der Emergency OFF / Power Distribution Unit with its according EMERGENCY Off (EMO) buttons. It is necessary to test all EMO buttons. The procedure below needs to be repeated for each button.

1. Shutdown the PXI computer
2. Verify that the collector chiller is powered
3. Press the EMO button
4. Verify that the collector chiller ist NOT powered
5. Twist the EMO button to release
6. Press the POWER ON on the EMO/PDU enclosure
7. Verify that the collector chiller is powered
8. Repeat this procedure for all EMO button which are installed
9. After testing all EMO buttons, press the DCS cabinet power button
10. Verify that all chillers, the high voltage supply and the Control Unit are powered

9.6 Crowbar Over-Temperature Protection

The Crowbar of the Fast Protection Unit includes a bimetallic over-temperature switch which separates the whole system from the mains supply in the case of excessive temperature increase.

1. Shutdown the PXI computer
2. Unplug the connector as shown below for a short time

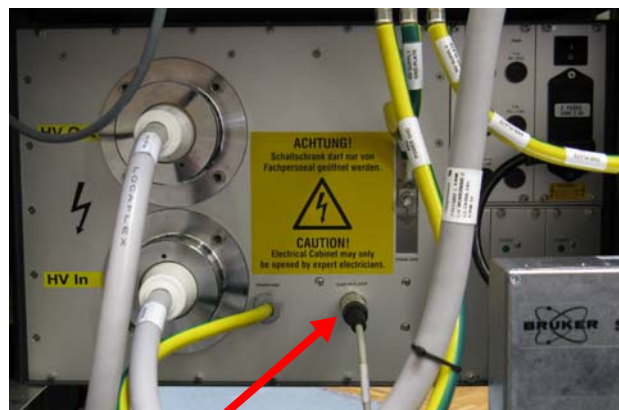


Figure 9.2

3. Verify that the PXI computer is not powered anymore.
4. Press the POWER ON button on the EMO/PDU enclosure
5. Press the DCS cabinet power button
6. Verify that the PXI computer is powered.

9.7 Maintenance Checklist

All maintenance tests according to the DNP Control System Console „Service Manual“ Version 002 have been performed successfully. As a consequence the instrument is safe to operate for another year.

ID	Description	Check
1	Procedures according to "Maintenance" Table 9.1	p
2	Cable checks described in "Cable Checks" 9.3 successfully performed.	p
3	Interlock check ("Interlock Checks" 9.4) passed.	p
4	Successfully executed EMO/OFF button and the FPU over temperature interlock tests according to "Emergency OFF / Power Distribution Unit" 9.5 and "Crowbar Over-Temperature Protection" 9.6	p

Table 9.4

After completion this maintenance checklist is put into the ring binder which is part of instrument and stays on site.

Date:

Signature:



10 Troubleshooting

10.1 Introduction

This chapter will be part of the next version of this manual

11 Dismantling and Disposal

Following the end of its useful life, the device must be dismantled and disposed of in accordance with the environmental regulations.

11.1 Safety

Electrical System



WARNING

Electrical hazard from electrical shock!

A life threatening shock may result when the housing is open during operation.

- ▶ Disconnect the device from the electrical power supply before opening the device.
- ▶ Be sure that the power supply cannot be reconnected without notice.

Improper Dismantling



WARNING

Danger of injury due to improper dismantling!

Stored residual energy, angular components, points and edges on and in the device or on the tools needed can cause injuries.

- ▶ Ensure sufficient space before starting work.
- ▶ Handle exposed, sharp-edged components with care.
- ▶ Dismantle the components properly.
- ▶ Secure components so that they cannot fall down or topple over.
- ▶ Consult the manufacturer if in doubt.

11.2 Dismantling

Before starting dismantling:

- Shut down the device and secure to prevent restarting.

- Physically disconnect the power supply from the device; wait 10 minutes minimum before going ahead.

Clean assemblies and parts properly and dismantle in compliance with applicable local occupational safety and environmental protection regulations.

11.3 Disposal Instructions

If no return or disposal agreement has been made, send the dismantled components for recycling.

- Scrap metals.
- Send plastic elements for recycling.
- Sort and dispose of other components in accordance with their material composition.


NOTICE

Danger to the environment from incorrect handling of pollutants!

Incorrect handling of pollutants, particularly incorrect waste disposal, may cause serious damage to the environment.

- ▶ Always observe the instructions below regarding handling and disposal of pollutants.
- ▶ Take the appropriate actions immediately if pollutants escape accidentally into the environment. If in doubt, inform the responsible municipal authorities about the damage and ask about the appropriate actions to be taken.



 **Bruker Corporation**

info@bruker.com
www.bruker.com

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