

## Service Manual

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# Freedom EVO<sup>®</sup> Freedom EVO Clinical<sup>®</sup>



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# Table of Contents

<b>1</b>	<b>About This Manual</b>	
1.1	Reference Documents .....	1-2
1.2	Trademarks .....	1-3
1.3	Abbreviations .....	1-3
<b>2</b>	<b>Safety</b>	
2.1	User Qualification .....	2-1
2.2	Notices and Symbols .....	2-2
2.2.1	Warning Notices Used in This Manual .....	2-2
2.2.2	Warning Notices Attached to the Product or Its Surroundings .....	2-4
2.3	Product Safety .....	2-8
2.3.1	Instrument-Related Hazards and Safety Measures .....	2-8
2.3.2	Other Hazards and Safety Measures .....	2-9
2.3.3	Safety Elements .....	2-10
2.4	Decontamination .....	2-13
2.5	General Safety Rules .....	2-14
<b>3</b>	<b>Technical Data</b>	
3.1	Working Area Dimensions .....	3-1
3.1.1	Ranges in X and Y-Direction .....	3-1
3.1.2	Ranges in Z-Direction .....	3-2
3.1.3	Rotating Ranges of the RoMa .....	3-3
3.2	Computer Requirements .....	3-4
3.3	Location of PCBs .....	3-5
3.3.1	Freedom EVO Base Unit .....	3-5
3.3.2	Optional Equipment .....	3-7
3.3.3	Options .....	3-7
3.4	Configuration Data .....	3-8
3.4.1	Arm Configurations Freedom EVO .....	3-8
3.4.2	Optional Equipment Freedom EVO .....	3-10
3.5	Compatibility of Options .....	3-11
3.5.1	Available Options .....	3-11
3.5.2	Available OEM Options .....	3-12
3.5.3	Compatibility Overview .....	3-13
3.5.4	Firmware Compatibility (Minimum Requirements) .....	3-15

<b>4</b>	<b>Installation</b>	
4.1	Site and System Preparation . . . . .	4-1
4.1.1	Site Requirements . . . . .	4-1
4.2	Unpacking . . . . .	4-3
4.3	Transport . . . . .	4-3
4.4	Installing and Connecting . . . . .	4-5
4.4.1	Freedom EVO Instrument . . . . .	4-5
4.4.2	Modules and Options . . . . .	4-6
4.5	Checking the CAN Bus Resistance . . . . .	4-7
4.6	Installing Options . . . . .	4-9
4.6.1	Modifications on Safety Panels . . . . .	4-9
4.6.2	Mains Outlets for Options . . . . .	4-10
4.6.3	Te-Link . . . . .	4-11
4.6.4	Reader . . . . .	4-17
4.6.5	Centrifuge . . . . .	4-18
4.7	Site Acceptance . . . . .	4-22
<b>5</b>	<b>Upgrade Procedures</b>	
5.1	Modifying the Arm Configuration . . . . .	5-1
5.1.1	Adding a LiHa . . . . .	5-1
5.1.2	Adding a RoMa . . . . .	5-4
5.1.3	Adding a P&P . . . . .	5-5
5.1.4	Inserting an Additional X-carriage . . . . .	5-7
5.2	Adding a PosID 2 . . . . .	5-8
5.3	Adding a Reader . . . . .	5-9
5.3.1	Introduction . . . . .	5-9
5.3.2	Installation of the Distance Brackets . . . . .	5-11
5.3.3	Installation in Cabinet (Left Side) . . . . .	5-12
5.3.4	Installation in Cabinet (Right Side) . . . . .	5-15
5.3.5	Installation on Worktable Extension . . . . .	5-17
5.3.6	Electrical Connection . . . . .	5-24
5.3.7	Setup and Tests . . . . .	5-25
5.4	Lower DiTi Eject Option . . . . .	5-25
5.5	I/O Option . . . . .	5-25
<b>6</b>	<b>Maintenance</b>	
6.1	Tools and Consumables . . . . .	6-1
6.1.1	Tools . . . . .	6-1
6.1.2	Cleaning Agents . . . . .	6-1
6.1.3	Lubricants . . . . .	6-2
6.2	Maintenance Schedule . . . . .	6-2
6.2.1	Maintenance Table: Basic Tasks to Be Performed . . . . .	6-3
6.2.2	Maintenance Table: Half-Yearly Maintenance . . . . .	6-3
6.2.3	Maintenance Table: Yearly Maintenance . . . . .	6-3
6.2.4	Maintenance Table: Special Intervals . . . . .	6-4
6.3	Maintenance Tasks . . . . .	6-5
6.3.1	Cleaning the System . . . . .	6-5
6.3.2	Cleaning Parts of the Arms . . . . .	6-5
6.3.3	Centrifuge . . . . .	6-6

<b>7</b>	<b>Troubleshooting</b>	
7.1	Troubleshooting Table . . . . .	7-1
7.2	Troubleshooting Instructions . . . . .	7-10
7.2.1	Status LEDs on PCBs . . . . .	7-10
7.2.2	Power LEDs on Optibo DCU . . . . .	7-11

<b>8</b>	<b>Repair</b>	
8.1	General Notes on Repair . . . . .	8-1
8.1.1	Electrical Safety . . . . .	8-1
8.1.2	Marking Connectors . . . . .	8-1
8.2	Safety Panels / Covers . . . . .	8-2
8.2.1	Access to Components . . . . .	8-2
8.2.2	Gas Spring . . . . .	8-3
8.2.3	Door Locks . . . . .	8-4
8.3	Worktable . . . . .	8-5
8.3.1	Spare Parts Worktable . . . . .	8-5
8.4	System Electronics . . . . .	8-6
8.4.1	Spare Parts Electronics . . . . .	8-6
8.4.2	Te-CU Board . . . . .	8-7
8.4.3	Optibo DCU . . . . .	8-7
8.4.4	DCU 2 Board . . . . .	8-8
8.4.5	Gate Board . . . . .	8-9
8.4.6	SMIO/SAFY Board . . . . .	8-10
8.4.7	ON/OFF/Pause/Resume Switch . . . . .	8-10
8.4.8	Status Lamp . . . . .	8-12
8.5	Power Supply Module . . . . .	8-13
8.5.1	Spare Parts Power Supply Module . . . . .	8-14
8.5.2	Replacing Power Supply Module . . . . .	8-15
8.6	X-Drive Assembly and X-Carriage . . . . .	8-17
8.6.1	Spare Parts X-Drive Assembly . . . . .	8-17
8.6.2	X-Drive Assembly . . . . .	8-17
8.6.3	X-Carriage . . . . .	8-19
8.7	Liquid Handling Arm (LiHa) . . . . .	8-22
8.7.1	Overview . . . . .	8-22
8.7.2	Spare Parts LiHa . . . . .	8-23
8.7.3	Complete LiHa Arm . . . . .	8-23
8.7.4	Tip Adapter . . . . .	8-27
8.7.5	Electronic Boards and Cables . . . . .	8-29
8.7.6	Y-Belt . . . . .	8-38
8.8	Y-Motors . . . . .	8-41
8.8.1	Z-Motors . . . . .	8-42
8.8.2	Square Shaft/Pinion Gear . . . . .	8-44
8.8.3	Lower DiTi Eject Option . . . . .	8-47
8.9	Robotic Manipulator Arm (RoMa Standard, Long) . . . . .	8-53
8.9.1	Overview . . . . .	8-53
8.9.2	Spare Parts RoMa . . . . .	8-55
8.9.3	Basic Considerations . . . . .	8-57
8.9.4	Complete RoMa Arm . . . . .	8-57
8.9.5	Mechanical Adjustment After Reinstallation . . . . .	8-60
8.9.6	Gripper Fingers . . . . .	8-63
8.9.7	Gripper Module Head . . . . .	8-64
8.9.8	R-motor . . . . .	8-67
8.9.9	Y-flex cable . . . . .	8-68
8.9.10	Gripper/Rotator Flex Cables . . . . .	8-69
8.9.11	Y/R- and Z/G-DC Servo (II) Boards . . . . .	8-70
8.9.12	RoMa 2 Backplane . . . . .	8-72
8.9.13	Y-Belt . . . . .	8-73
8.9.14	Y-motor . . . . .	8-75
8.9.15	Z-motor . . . . .	8-76

8.9.16	Z-Brake .....	8-77
8.9.17	RoMa Freedom Backplane .....	8-79
8.9.18	Device CU .....	8-81
8.9.19	X-DC Servo Power Board .....	8-82
8.9.20	Checking RoMa Operating Readiness .....	8-84
8.10	Pick and Place Arm (P&P) .....	8-85
8.10.1	General Information .....	8-85
8.10.2	Spare Parts P&P .....	8-85
8.10.3	Complete P&P Arm .....	8-85
8.10.4	Electronic Boards .....	8-87
8.10.5	Belts .....	8-90
8.10.6	Motors .....	8-94
8.10.7	Gripper Head and Fingers .....	8-97
8.10.8	Solenoid Z-Brake .....	8-100
8.11	X-Flex Cables .....	8-102
8.11.1	Installing X-Flex Cables .....	8-102
8.11.2	X-Flex Cable Bend Drawings .....	8-104
8.12	PosID 2 .....	8-105
8.12.1	Spare Parts PosID 2 .....	8-105
8.12.2	Complete PosID 2 Assembly .....	8-106
8.12.3	X-Drive Assembly .....	8-109
8.12.4	Electronic Boards .....	8-113
8.12.5	Scanner Assembly .....	8-117
8.12.6	Y-Drive Assembly .....	8-120
8.12.7	No Tube Sensor .....	8-123
8.13	Te-Link .....	8-125
8.13.1	Spare Parts .....	8-125
8.13.2	Complete Te-Link .....	8-125
8.13.3	Making the Parts Accessible .....	8-125
8.13.4	Toothed Belt .....	8-127
8.13.5	Motor Assembly .....	8-129
8.13.6	DC Servo II Board .....	8-131
8.13.7	Device CU Board .....	8-132
8.13.8	Te-Stack Backplane .....	8-133
8.14	Centrifuge .....	8-134
8.14.1	Spare Parts .....	8-134
8.14.2	Removal of the Centrifuge .....	8-134
8.14.3	Removal of Upper Front Panel .....	8-134
8.14.4	Temperature Sensors .....	8-135
8.14.5	Fuses .....	8-138
8.14.6	Imbalance Switch Adjustment .....	8-140
8.15	Liquid System .....	8-141
8.15.1	Overview .....	8-141
8.15.2	Tubing System .....	8-142
8.15.3	Low Volume Option .....	8-144
8.15.4	Monitored Pump Option/Fast Wash Option .....	8-147
8.15.5	Diluters .....	8-154
8.16	Settings .....	8-160
8.16.1	Address Settings Overview .....	8-160
8.16.2	Volume of the Acoustic Alarm Device .....	8-162




<b>9</b>	<b>Shutdown, Storage and Shipping</b>	
9.1	Shutdown .....	9-1
9.2	Storage .....	9-1
9.2.1	Packaging .....	9-2
9.3	Shipping .....	9-9
<b>10</b>	<b>Spare Parts and Accessories</b>	
10.1	Base Unit .....	10-1
10.2	Safety Panels .....	10-2
10.3	System Electronics .....	10-2
10.4	Liquid Handling Arm (LiHa) .....	10-3
10.5	Robotic Manipulator Arm (RoMa) .....	10-4
10.6	Pick and Place (P&P) .....	10-6
10.7	PosID .....	10-7
10.8	Te-Link .....	10-8
10.9	Liquid System .....	10-8
10.9.1	Standard Tubing .....	10-8
10.9.2	High Resistant Tubing Type A .....	10-9
10.9.3	High Resistant Tubing Type B .....	10-9
10.9.4	Low Volume Option .....	10-10
10.9.5	Monitored Pump Option/Fast Wash Option .....	10-10
10.9.6	Diluters .....	10-11
10.10	Centrifuge .....	10-12
10.11	Reader .....	10-13
10.12	Accessories and Options .....	10-14
10.13	Tools .....	10-14



<b>11</b>	<b>Diagrams</b>	
11.1	Overview . . . . .	11-1
11.2	Diagram Pages . . . . .	11-2
11.2.1	Communication Overview . . . . .	11-3
11.2.2	Arm Configurations . . . . .	11-4
11.2.3	Wiring Diagram Freedom EVO . . . . .	11-5
11.2.4	Wiring Diagram Diluters . . . . .	11-6
11.2.5	Wiring Diagram LiHa 2-Channel . . . . .	11-7
11.2.6	Wiring Diagram LiHa 4-Channel . . . . .	11-8
11.2.7	Wiring Diagram LiHa 8-Channel . . . . .	11-9
11.2.8	Wiring Diagram MPO . . . . .	11-10
11.2.9	Wiring Diagram RoMa (DC Servo) . . . . .	11-11
11.2.10	Wiring Diagram RoMa (DC Servo II) . . . . .	11-12
11.2.11	Wiring Diagram P&P . . . . .	11-13
11.2.12	Wiring Diagram PosID 2 . . . . .	11-14
11.2.13	Wiring Diagram Access Functions . . . . .	11-15
11.2.14	Wiring Diagram Te-Link . . . . .	11-16
11.2.15	CU PosID 2 (PCB) . . . . .	11-17
11.2.16	P&P Backplane (PCB) . . . . .	11-18
11.2.17	Gate Board (PCB) . . . . .	11-19
11.2.18	SMIO/SAFY Board (PCB) . . . . .	11-20
11.2.19	RoMa Freedom Backplane (PCB) . . . . .	11-21
11.2.20	RoMa 2 Backplane (PCB) . . . . .	11-22
11.2.21	DC Servo [II], [Power] (PCB) . . . . .	11-23
11.2.22	Te-CU (PCB) . . . . .	11-24
11.2.23	Optibo DCU (PCB) . . . . .	11-25
11.2.24	LiHa 1536 Backplane (PCB) . . . . .	11-26
11.2.25	ILID-Freedom Protected (PCB) . . . . .	11-27
11.2.26	VCC Dilback (PCB) . . . . .	11-28
11.2.27	MPO Board (PCB) . . . . .	11-29
11.2.28	Te-Stack Backplane (PCB) . . . . .	11-30
<b>12</b>	<b>Index</b>	



# 1 About This Manual

<b>Purpose of This Chapter</b>	This chapter points out the purpose of the manual, specifies the product the manual deals with and who the manual is intended for. Furthermore, it explains the symbols, conventions and abbreviations used and offers other general information.
<b>Purpose of This Manual</b>	This Service Manual describes the installation and the setup of the Freedom EVO. Furthermore, it offers help for troubleshooting and provides all necessary information on maintenance and repair.
<b>Target Group</b>	This manual is intended for qualified field service engineers only. These personnel have received appropriate service training and are authorized to carry out the maintenance and service work described in this Service Manual.
<b>Scope</b>	<p>This manual is applicable for the</p> <ul style="list-style-type: none"> <li>◆ Freedom EVO 100; Part No. 641241; from serial No. 0201.</li> <li>◆ Freedom EVO 150; Part No. 641441; from serial No. 0201.</li> <li>◆ Freedom EVO 200; Part No. 641541; from serial No. 0201.</li> <li>◆ Freedom EVO Clinical 100; Part No. 641242; from serial No. 0201.</li> <li>◆ Freedom EVO Clinical 150; Part No. 641442; from serial No. 0201.</li> <li>◆ Freedom EVO Clinical 200; Part No. 641542; from serial No. 0201.</li> </ul>
<b>Symbols and Conventions</b>	<ul style="list-style-type: none"> <li>◆ Cross-references appear as follows: e.g. “Refer to section 1.1.1,  1-1” <ul style="list-style-type: none"> <li>– 1.1.1 refers to the corresponding section number</li> <li>– The symbol  denotes “page number”</li> <li>– 1-1 refers to the page number, whereas the first number stands for the chapter number (chapter 1 - page 1)</li> </ul> </li> </ul> <p><b>Note:</b> The symbols pertaining to safety (WARNINGS and ATTENTIONS) are explained in Chapter 2 “Safety”,  2-1.</p>
<b>For Your Safety</b>	<b>Before performing any work on or with the Freedom EVO, first read the Service Manual carefully, in particular chapter 2 “Safety”.</b>

## 1.1 Reference Documents

This section provides a list of documents which are needed or may be useful in connection with the Freedom EVO.

They either concern the instrument or options of the Freedom EVO.

### What Does the Doc. ID Tell You?

The Doc. IDs listed below are root numbers. Therefore, they do not contain information about the language, document version or the medium (data storage medium, hardcopy, downloadable file, etc.) the document is published with. Check the scope of the corresponding document to make sure that you are in possession of the correct version.

**Note:** *The Doc. ID does not represent ordering information. For orders refer to the number on the binder, CD casing, etc.*

### Instrument Documents

- ◆ Freedom EVO Operating Manual (Doc. ID 392 886)
- ◆ Freedom EVO Clinical Operating Manual (Doc. ID 393 062)
- ◆ Freedom EVO Maintenance and Service Logbook (Doc. ID 392 815)

### Application Software

- ◆ Gemini Software Manual (Doc. ID 391 201)
- ◆ FACTS Software Manual (Doc. ID 391 252)
- ◆ Logic Application Software Manual (Doc. ID 391 117)

### Setup & Service Software

- ◆ Instrument Software Manual (Doc. ID 392 888)

### Freedom EVO Options

According to used options.

### Centrifuge (Option)

- ◆ Rotanta 46 RSC ROBOTIC Operating Instruction (Hettich, AB090GB)
- ◆ Rotanta 46 RSC ROBOTIC Repair instructions (Hettich, AR090GB)

### Reader (Option)

- ◆ Safire<sup>2</sup> Operating Manual (I 112 942)
- ◆ Safire<sup>2</sup> Technical Manual (T 112 942)
- ◆ GENios Pro Operating Manual (I 112 935)
- ◆ GENios Pro Technical Manual (T 112 935)
- ◆ Ultra Operating Manual (I 112 910)
- ◆ Ultra Technical Manual (T 112 910)

### Supplementary Information

- ◆ Order Configuration/Packing List for Freedom EVO (Doc. ID 392 885)
- ◆ Order Configuration/Packing List for Freedom EVO Clinical (Doc. ID 393 070)
- ◆ Order Configuration/Packing List for EVO Upgrades (Doc. ID 393 178)

### Forms

- ◆ Instrument Decontamination Form (Doc. ID 390 901)
- ◆ Installation Qualification (Doc ID 392 816)
- ◆ Operation Qualification (Doc ID 392 817)
- ◆ Freedom EVO Preventive Maintenance Checklist (Doc ID 392 819)
- ◆ Freedom EVO Service Checklist (Doc ID 392 820)

## 1.2 Trademarks

The following product names and any registered and unregistered trademarks mentioned in this manual are used for identification purposes only and remain the exclusive property of their respective owners:

- ◆ Freedom EVOware<sup>®</sup>, Freedom EVO<sup>®</sup> and Genesis Freedom<sup>®</sup> are registered trademarks of Tecan Group Ltd in major countries .
- ◆ Teflon<sup>®</sup> is a registered trademarks of E.I. du Pont de Nemours and Company.
- ◆ Tygon<sup>®</sup> is a registered trademarks of Norton Performance Plastics Corporation (a Saint-Gobain Company).

## 1.3 Abbreviations

The following abbreviations are used in this manual:

<b>CAN</b>	Controller Area Network
<b>DCU</b>	Device Control Unit
<b>DMSO</b>	Dimethyl Sulfoxide
<b>FaWa</b>	Fast Wash Pump
<b>FEP</b>	Fluorinated Ethylene Propylene
<b>FSE</b>	Field Service Engineer
<b>FWO</b>	Fast Wash Option
<b>ILID</b>	Integrated Liquid Detection
<b>LH</b>	Liquid Handling
<b>LICOS</b>	Liquid Container Supervisor
<b>LiHa</b>	Liquid Handling arm
<b>MP</b>	Microplate
<b>MPO</b>	Monitored Pump Option
<b>NPS</b>	Nanopipetting System
<b>PCB</b>	Printed Circuit Board
<b>PosID</b>	Positive Identification Option (barcode reader)
<b>PP</b>	Polypropylene
<b>PVDF</b>	Polyvinylidene Fluoride
<b>RoMa</b>	Robotic Manipulator arm
<b>Te-PS</b>	Tecan Positioning System



## 2 Safety

### **Purpose of This Chapter**

This chapter contains specific rules of behavior and warnings from hazards related to installation, setup, troubleshooting, maintenance and repair of the Freedom EVO.

### **Significance of These Safety Instructions**

The safety of users and personnel can only be ensured if these safety instructions and the safety-related warnings in the individual chapters are strictly observed and followed.

Therefore, the Service Manual must always be available to all persons performing the tasks described herein.

In addition to the safety instructions given in this Service Manual, the safety instructions pointed out in the Operating Manual of the Freedom EVO apply as well.

### 2.1 User Qualification

#### **FSE Authorization**

The field service engineers (FSE) are specially trained personnel. Exclusively FSEs are entitled to perform the maintenance and service work described in this Service Manual.

The manufacturer Tecan authorizes the FSEs if they fulfill the following particular qualifications:

- ◆ They must have received appropriate service and operator training from Tecan.
- ◆ They must be familiar with the good laboratory practice guidelines.
- ◆ They must have read and understood the instructions in this Service Manual.

## 2.2 Notices and Symbols

### 2.2.1 Warning Notices Used in This Manual

The symbols used for safety-related notices have the following significance:

WARNING notices appear as follows:

**WARNING  
Symbols**



**WARNING**

Generally, the triangular warning symbol indicates the possibility of personal injury or even loss of life if the instructions are not followed.

Whenever possible, the symbol indicates the hazard a person is exposed to more specifically. The symbols used in this Service Manual have the following significance:



**WARNING**

Toxic substances



**WARNING**

Biological hazard



**WARNING**

Radioactive radiation



**WARNING**

Caustic substances



**WARNING**

Fire hazard



**WARNING**

Electrical danger





**WARNING**  
Laser hazard



**WARNING**  
Pinch point, mechanical hazards

**ATTENTION Symbols**



ATTENTION notes appear as follows:

**ATTENTION**

With the general “Read This!” symbol, ATTENTIONs indicate the possibility of equipment damage, malfunctions or incorrect process results, if instructions are not followed.

Other symbols indicate the significance of the ATTENTION more specifically:



**ATTENTION**

Damage to electronics by electrostatic discharge.  
Always follow ESD safety practices.



**ATTENTION**

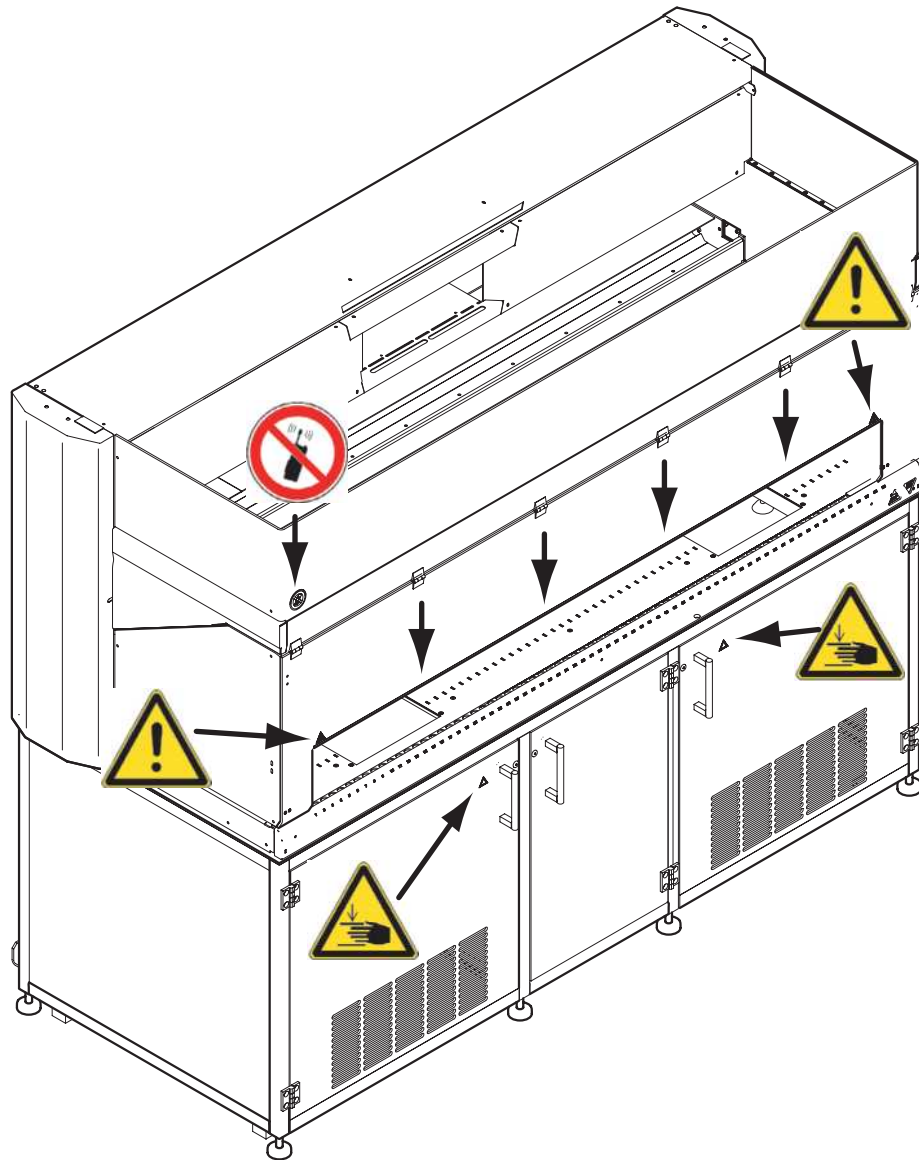
Disturbance of functions by electromagnetic RF waves.  
Do not use a cellular phone.

### 2.2.2 Warning Notices Attached to the Product or Its Surroundings

Where are  
Safety Notices  
Attached?

#### Freedom EVO Instrument




The figure shows the safety notices that are attached to the Freedom EVO instrument. It also shows their locations:



**Fig. 2-1** Safety notices attached to the product

The following table explains the significance of the notices:

Tab. 2-1 Significance of the safety notices

Symbol	Significance	Location
	Warning of hazards if you reach beyond the yellow line (see short arrows)	See Fig. 2-1, 2-4
	Warning of hazards if you reach into the cabinet if, for instance, a reader or centrifuge is installed.	See Fig. 2-1, 2-4
	Do not use a cellular phone	See Fig. 2-1, 2-4

PosID

Safety Notices on the PosID

The figure shows the safety notices that are attached to the PosID:

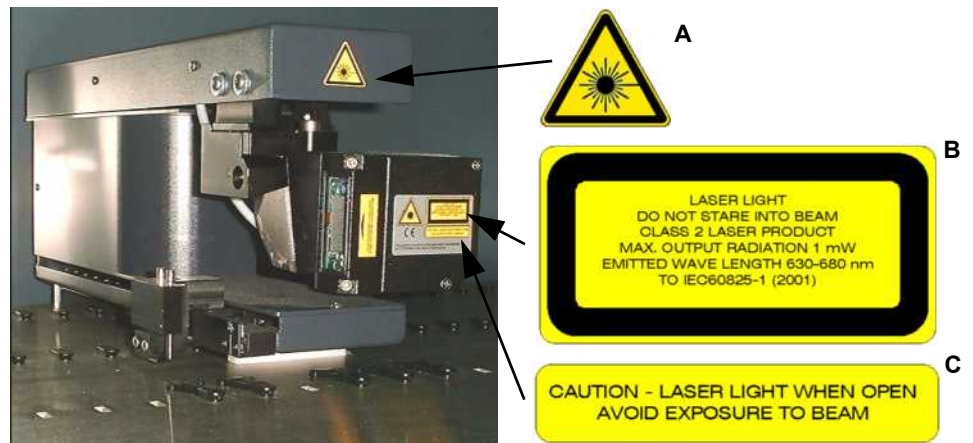


Fig. 2-2 Laser labelling on PosID

Tab. 2-2 Significance of the safety notices on the PosID

Label	Significance	Location
A	<b>Warning label:</b> Laser hazard symbol	See Fig. 2-2, 2-5
B	<b>Explanatory label:</b> Identifies a CLASS 2 LASER PRODUCT <sup>a)</sup> that contains an embedded visible low power laser barcode scanner. Warns against direct viewing into laser beam or its reflections.	See Fig. 2-2, 2-5
C	<b>Label for panels:</b> Warns against removing or displacing of protective housing/panels, which permits human access to the laser light.	See Fig. 2-2, 2-5

a) According to IEC60825-1

### Sensor Plate

#### Safety Notices on the Sensor Plate

The figure shows the safety notices that are attached to the sensor plate:

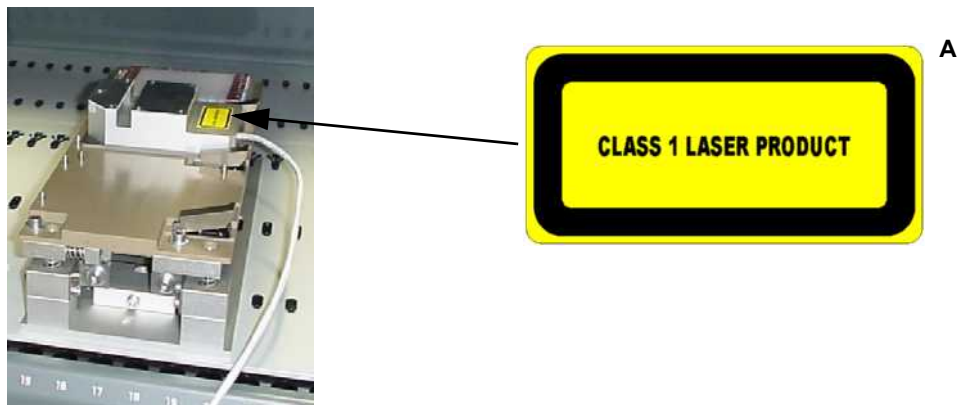


Fig. 2-3 Laser labelling on sensor plate

Tab. 2-3 Significance of the safety notices on the sensor plate

Label	Significance	Location
A	Explanatory label: Identifies a CLASS 1 LASER PRODUCT <sup>a)</sup>	See Fig. 2-3, 2-6

a) According to IEC60825-1

### Symbol BC Scanner

#### Safety Notices on the Symbol BC Scanner

The figure shows the safety notices that are attached to the symbol BC scanner:

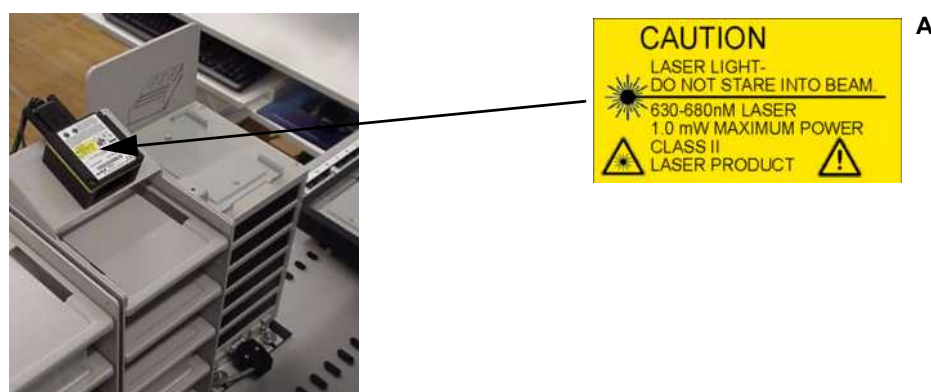


Fig. 2-4 Laser labelling on the symbol BC scanner

**Tab. 2-4** Significance of the safety notices on the symbol BC scanner

Label	Significance	Location
A	Explanatory label: Identifies a CLASS 2 LASER PRODUCT <sup>a)</sup> that contains an embedded visible low power laser barcode scanner. Warns against direct viewing into laser beam or its reflections.	See <a href="#">Fig. 2-4</a> , <a href="#">Fig. 2-6</a>

a) According to IEC60825-1

Damaged or fallen off symbols (notices or stickers) must be replaced immediately.

## 2.3 Product Safety

### Principle

The Freedom EVO is designed and built in accordance with the present state-of-the-art technology and the recognized technical safety regulations.

Nevertheless, risks to users, property, and the environment can arise when the instrument is used carelessly or improperly.

Appropriate warnings in the Operating Manual of the Freedom EVO and in this Service Manual serve to make the user alert to these residual dangers.

### 2.3.1 Instrument-Related Hazards and Safety Measures

Pay attention to the following safety notices:



#### WARNING

Potentially lethal voltage inside the instrument.

- ◆ Equipment is to be connected to a grounded power source using an approved power cord with grounding conductor.
- ◆ Whenever possible, disconnect the instrument from the mains before carrying out maintenance or repair work.
- ◆ If work must be carried out with the instrument running, all covers and other parts protecting from electricity must remain in place.

Though the safety concept assumes that the safety panel is always closed during normal operation, it is necessary to have access to the elements in the working area behind the safety panel for setup, maintenance and troubleshooting purposes.



#### WARNING

Pointed tips and other sharp-edged elements, which might cause injuries when you reach into the working area with the safety panel open.

- ◆ Always be aware of the mechanical hazards.
- ◆ Wear laboratory apparel, rubber gloves, safety goggles, etc. as appropriate.



#### WARNING

Freely accessible parts, which can move automatically.

Injuries (piercing and crushing) are possible when you reach into the working area of the arms or optional equipment during setup and adjustment procedures, or when tests are run.

- ◆ Do not reach into the working area when parts of the instrument are moving.
- ◆ Make sure that no other person activates the drives when the safety covers are not in place.



**ATTENTION**

- ◆ Unsafe operating condition and wrong measuring results in the process, if the system is leaking.
- ◆ If liquid is dripping from the tips or other parts of the liquid system, the Freedom EVO must not be operated any more.

Operation may only be resumed if the necessary maintenance or repair work has been performed and the proper condition of the system has been verified.



**ATTENTION**

Electromagnetic RF waves from a cellular phone may affect the function of the liquid detection.

Faulty detection of the liquid surface may be the result, which causes the system to produce incorrect measurements.

Keep a distance of at least 2 m from the instrument when using a cellular phone.



**ATTENTION**

Damage to the electronic boards due to electrostatic discharge (ESD).

Always wear a wrist strap when handling the boards.

**2.3.2 Other Hazards and Safety Measures**

Pay attention to the following safety notices:



**WARNING**

Chemical, biological and radioactive hazards can be associated with the substances used or the samples processed with the Freedom EVO.

The same applies to waste disposal.

- ◆ Always be aware of possible hazards associated with these substances.
- ◆ Use appropriate protective clothing, safety goggles and gloves.



**WARNING**

Caustic substances can cause burns and eye injury.

- ◆ Avoid exposure to caustic substances.

Always be aware of possible hazards associated with these substances.

### 2.3.3 Safety Elements

#### Safety Panels

The space around the worktable is protected with safety panels. Whereas the front safety panel can be opened, the other safety panels are permanently installed on the Freedom EVO.

#### Door Locks

During operation the front safety panel is locked by means of two door locks. The safety concept of the Freedom EVO assumes that the front safety panel is always closed when the instrument is running.

#### Modifications on the Safety Panels

Some options for the Freedom EVO require modifications on the safety panels. These modifications must be performed by an authorized Tecan FSE (field service engineer) when the option is installed.



#### WARNING

If the options which require modifications on the Freedom EVO are installed improperly, the safety concept may be impaired.

Always make sure that the options are installed in compliance with the instructions given by the manufacturer.

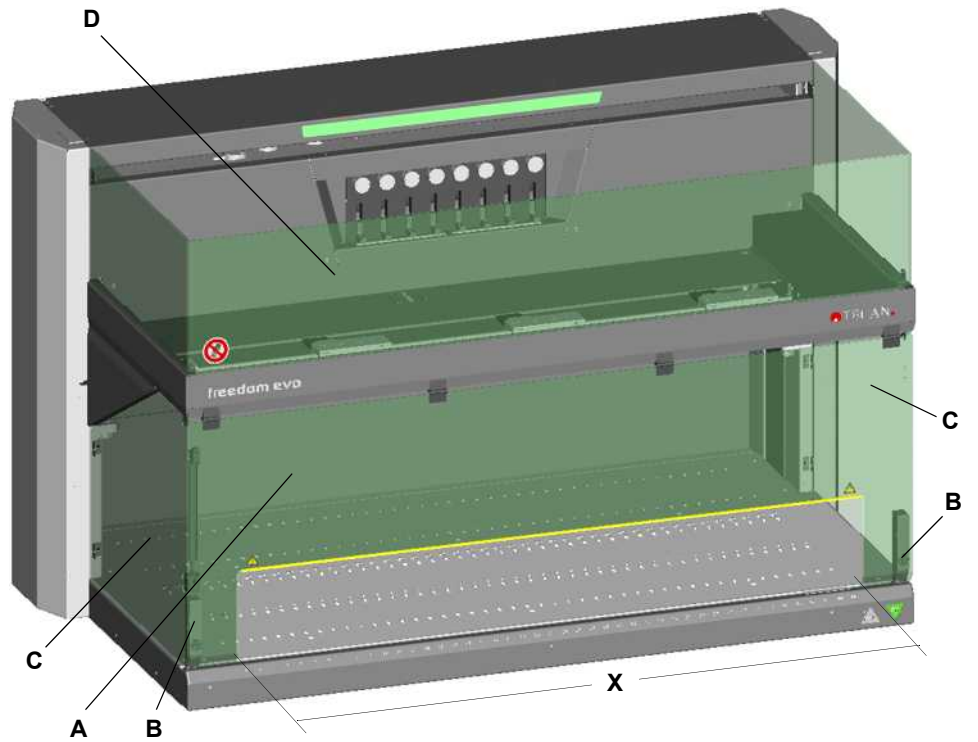
When installing options, strictly follow the instructions given in the manuals of the options and in this Service Manual.

#### Which are Safety Elements?

#### Freedom EVO with Standard Front Safety Panel

The figure shows the elements of the Freedom EVO, which have a protective function or have in any other way to do with safety:



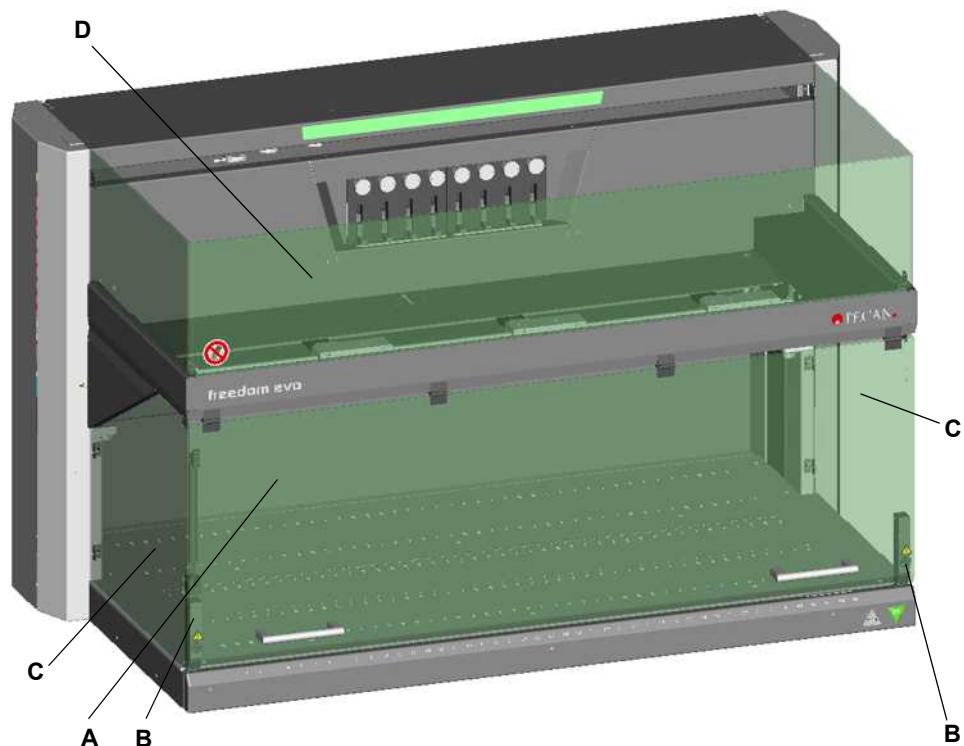


**Fig. 2-5** Safety elements

- A** Standard front safety panel
- B** Door lock
- C** Side safety panel

- D** Top safety panel
- X** Cutout for continuous loading

**Freedom EVO with Closed Front Safety Panel (Option)**



**Fig. 2-6** Safety elements/closed front safety panel (option)

- |                                    |                            |
|------------------------------------|----------------------------|
| <b>A</b> Closed front safety panel | <b>C</b> Side safety panel |
| <b>B</b> Door lock                 | <b>D</b> Top safety panel  |

**Removal of  
Safety  
Elements**

The protective and safety devices installed on the Freedom EVO must be neither removed nor disabled during operation.  
If such elements were removed, e.g. for maintenance work, operation may only be resumed when all protective and safety devices have been completely installed and checked.

## 2.4 Decontamination

### When to Decontaminate

Apart from regular decontamination, the user must thoroughly decontaminate the instrument according to standard laboratory regulations in the following cases:

- ◆ Before any maintenance or service work is performed on the instrument
- ◆ In case of accidents (e.g. crash, spilt substances, etc.)
- ◆ Before a Tecan field service engineer (FSE) performs any in-site work on the instrument
- ◆ Before the instrument or parts of it are returned to Tecan (e.g. for repair)
- ◆ Prior to storage of the instrument
- ◆ Prior to disposal of the instrument or parts of it
- ◆ Generally before the instrument or parts of it leave the user's site

### Decontamination Method

The decontamination method must be adapted to the respective application and the substances associated with it. The user takes the full responsibility for the appropriate decontamination of the entire equipment.



#### WARNING

Biological or chemical hazard and/or radioactive radiation.

Contamination hazard due to parts of the instrument which are not completely decontaminated.

Mind that not only the parts having direct contact with chemicals or biological material must be treated, but also the tubing system as well as the whole upstream equipment.

### Decontamination Form

Before a Tecan FSE carries out any work on the instrument, or before the instrument is returned to Tecan, the owner of the instrument must confirm in writing that the decontamination has been performed properly and in accordance with good laboratory practice guidelines. For this, the owner must enclose a declaration (Use the Instrument Decontamination Form or in case of repairs, properly fill out the Repair Order). The corresponding forms are filed in the Maintenance and Service Logbook or can be provided by Tecan.

**Note:** Tecan reserves the right to refuse any instrument or a part of it, or will charge an extra fee, if the Instrument Decontamination Form or the Repair Order is not filled out and duly signed.

## 2.5 General Safety Rules

<b>Legal Regulations</b>	Legal regulations, such as local, state and federal laws which prescribe the use or application as well as the handling of dangerous materials in connection with the Freedom EVO must be strictly followed.
<b>Duty of Maintenance and Care</b>	The user is responsible for ensuring that the Freedom EVO is operated in proper condition only, and that maintenance, service, and repair jobs are performed with care and on schedule, and by authorized personnel only.
<b>Spare Parts to Be Used</b>	Use only genuine consumables and genuine spare parts for maintenance and repair to assure good system performance and reliability.
<b>Modifications</b>	Modifications to the Freedom EVO are only permitted after prior consultation with and with the written approval of the manufacturer. Modifications and upgrades shall only be carried out by an authorized field service engineer. The manufacturer will decline any claim resulting from unauthorized modifications.

### 3 Technical Data

**Purpose of This Chapter**

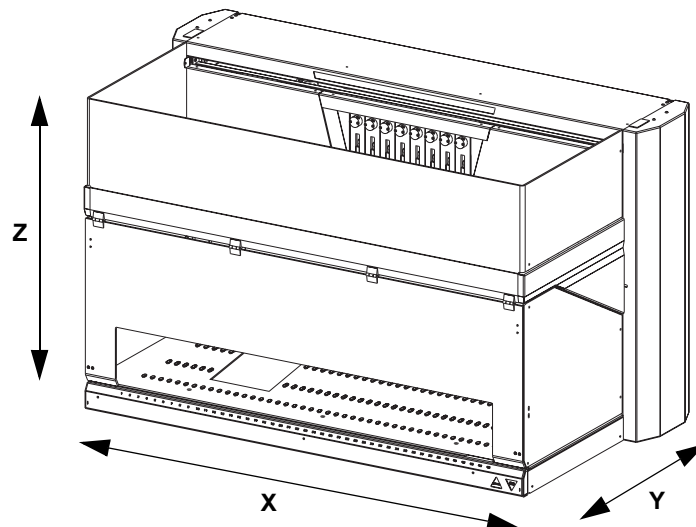
This chapter contains supplementary technical data, which is of interest for the FSE with respect to installation, setup, upgrading and repair of the Freedom EVO.

*Note: For common technical data, such as power rating, dimensions, etc., refer to the “Freedom EVO Operating Manual”.*

#### 3.1 Working Area Dimensions

**Working Area Dimensions**

The figure shows the Freedom EVO’s main axes and their designations:



**Fig. 3-1** Main axes of the Freedom EVO

##### 3.1.1 Ranges in X and Y-Direction

**Tab. 3-1** X/Y-ranges

Freedom EVO	100	150	200
<b>Accessible X-range (X-travel)</b>	757 mm (29.8 in.)	1132 mm (44.6 in.)	1732 mm (68.2 in.)
<b>Accessible Y-range (Y-travel)</b>			
- 2-tip LiHa, 4-tip LiHa	409 mm (16.1 in.)	409 mm (16.1 in.)	409 mm (16.1 in.)
- 8-tip LiHa	373 mm (14.7 in.)	373 mm (14.7 in.)	373 mm (14.7 in.)
<b>Grid positions on worktable</b>	30	45	69

**Worktable  
Cutouts**

Optional, the Freedom EVO (not applicable for Freedom EVO Clinical) can be equipped with special worktables:

Worktable cutout for centrifuge : 200 x 260 mm (X x Y)

Worktable cutout for reader : 252 x 150 mm (X x Y)

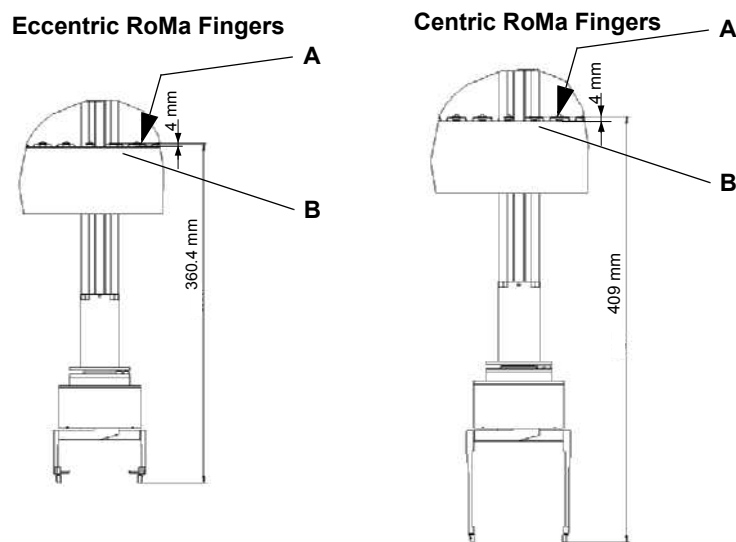
**3.1.2 Ranges in Z-Direction**

The following table shows the Z-ranges of the different arms (not applicable for Freedom EVO Clinical):

**Tab. 3-2** Z-ranges

Arm	Z-range
P&P	385 mm
RoMa Standard	259 mm
RoMa Long	610mm

**Z-Range Below  
Worktable**



**Fig. 3-2** Space below worktable

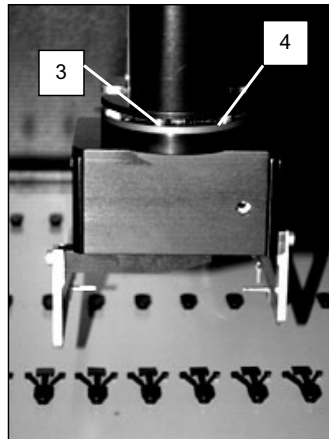
**A** Positioning pin

**B** Worktable

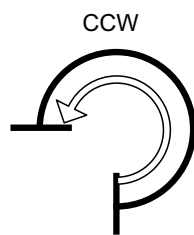
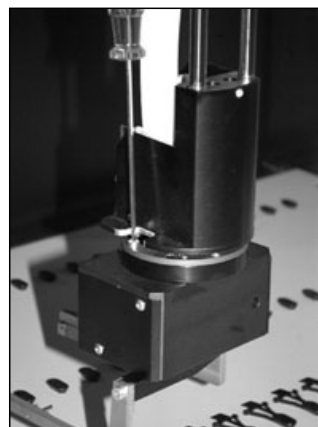
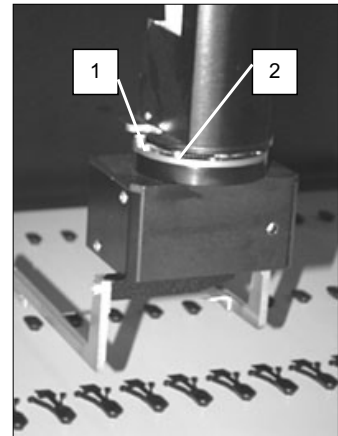
**3.1.3 Rotating Ranges of the RoMa**

**Orientation  
RoMa Long and  
RoMa Standard**

Screw position for CCW

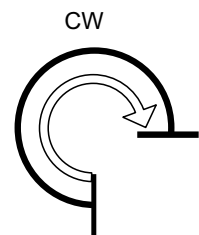


Screw position for CW



left

Front



right

**Fig. 3-3** RoMa default direction of rotation

**CW** Clockwise

**CCW** Counter-clockwise

## 3.2 Computer Requirements

**Computer  
Hardware**

- ◆ Two RS232 ports

Also refer to your “Instrument Software Manual” and to the “Application Software Manual” for details on minimum computer requirements.

**Software**

The table lists the software versions used with the Freedom EVO:

**Tab. 3-3** *Software requirements*

<b>Purpose</b>	<b>Software</b>	<b>Version</b>
Setup & Service	Instrument Software	V 4.6 or later version
Application Software	Gemini	V 4.2 or later version
	FACTS	V 5.0 or later version
	EVOware	V 1.0 or later version
	Logic <sup>a)</sup>	V2.6 or later version

a) *Freedom EVO Clinical*

It is strongly recommended that you use the latest software versions. Please contact the Tecan Customer Service for more information.



### 3.3 Location of PCBs

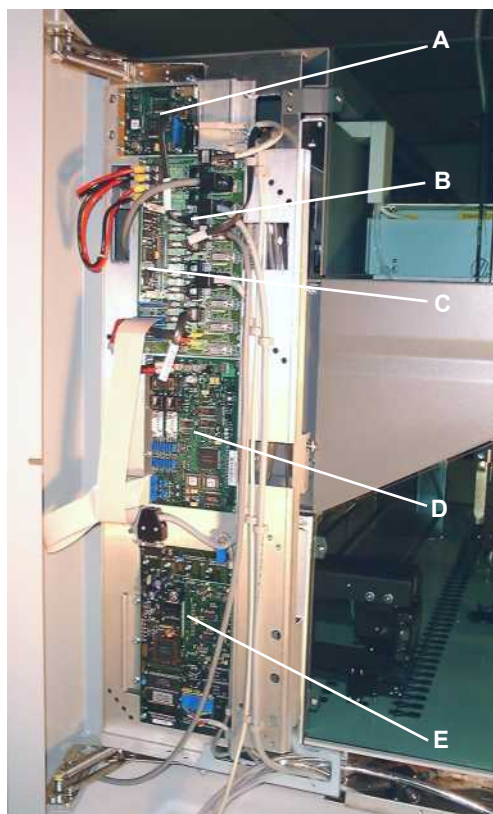
#### 3.3.1 Freedom EVO Base Unit

The following printed circuit boards are installed in the base unit of the Freedom EVO:

- ♦ Power supply module
- ♦ Te-CU board (Tecan control unit)
- ♦ Optibo DCU board (option board with device control unit)
- ♦ DCU 2 board (device control unit second generation)
- ♦ Gate board (P&P control)
- ♦ CU PosID 2 board (control unit PosID 2)
- ♦ VCC Dilback (diluter backplane)
- ♦ SMIO board (monitored input/output board)
- ♦ MPO board (monitored pump option control)

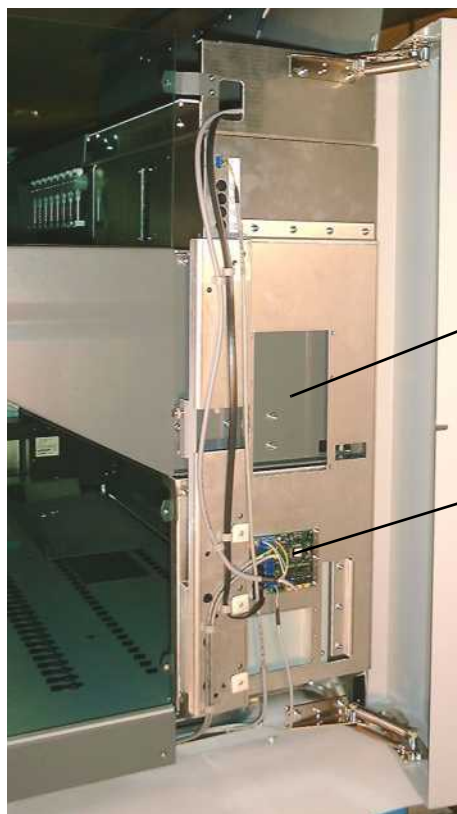
#### Where Are the PCBs Located?

The following figures show where the PCBs in the base unit are located.



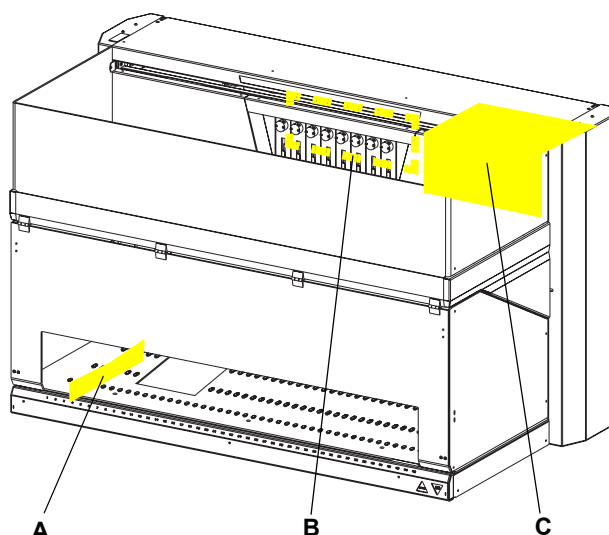
- A** *Te-CU*
- B** *Optibo DCU*
- C** *DCU 2*
- D** *Gate board*
- E** *CU PosID 2*

**Fig. 3-4** PCBs behind left access door



- A** Space reserved for additional PCB
- B** SMIO/SAFY board

**Fig. 3-5** PCBs behind right access door



**Fig. 3-6** PCBs in other locations

- A** MPO board (below worktable)
- B** VCC Dilback (behind diluters)
- C** Power supply module

### 3.3.2 Optional Equipment

#### Other Equipment with PCBs

#### LiHa

The LiHa is equipped with the following printed circuit boards:

- ◆ LiHa 1536 backplane
- ◆ DC servo II board (DC motor control second generation)
- ◆ DC servo II power board (DC motor control second generation with high power output)
- ◆ ILID Freedom protected board (liquid detection)

#### RoMa

The RoMa is equipped with the following printed circuit boards:

- ◆ RoMa Freedom backplane
- ◆ DCU board (device control unit)
- ◆ RoMa 2 backplane
- ◆ Gripper board
- ◆ DC servo (II)<sup>1)</sup> board (DC motor control)
- ◆ DC servo (II)<sup>1)</sup> power board (DC motor control with high power output)

#### P&P Arm

The P&P arm is equipped with the following printed circuit boards:

- ◆ P&P backplane
- ◆ DC servo (I) board (DC motor control)
- ◆ DC servo (I) power board (DC motor control with high power output)

#### PosID 2

The PosID 2 is equipped with the following printed circuit boards:

- ◆ Pos ADA board (PosID adapter board)
- ◆ Y/B board (PosID backplane/I/O interface)
- ◆ DC servo board (DC motor control)
- ◆ DSP board (barcode signal processor)

### 3.3.3 Options

#### Te-PS

The Te-PS (positioning system) is equipped with the following printed circuit boards:

- ◆ 1536 Sensor plate board

#### Te-Link

The Te-Link is equipped with the following printed circuit boards:

- ◆ Te-Stack backplane
- ◆ DCU board (device control unit)
- ◆ DC servo II board (DC motor control)

<sup>1)</sup> from instrument serial No. 0284: DC servo II (power)

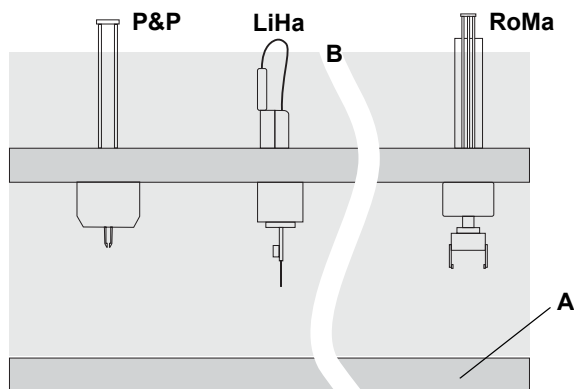
### 3.4 Configuration Data

#### 3.4.1 Arm Configurations Freedom EVO

**Explanations**

This section gives information on possible arm configurations for the Freedom EVO.

The following figure explains the symbols used in the arm configuration pictures:



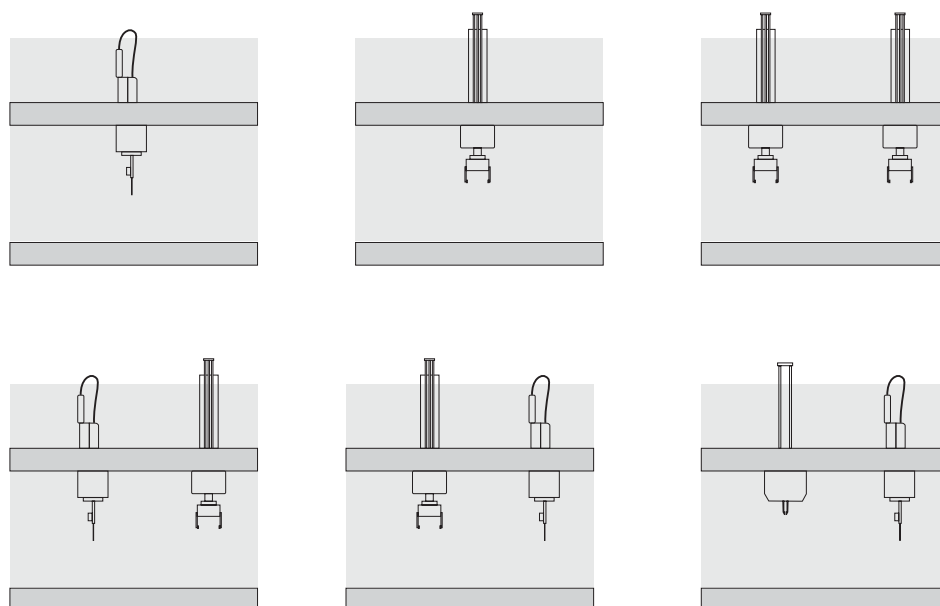
**Fig. 3-7** Symbols used to show the arm configurations

- |   |   |
|---|---|
| <b>A</b> Freedom EVO base unit  | <b>LiHa</b> Liquid handling arm<br>(with 2, 4 or 8 tips)            |
| <b>B</b> Breaking line: Indicates that both 150 and 200 instruments are concerned | <b>RoMa</b> Robotic manipulator arm<br>(RoMa standard or RoMa long) |
| <b>P&amp;P</b> Pick & place arm   |   |

#### Freedom EVO 100

**Possible Arm Configurations**

The Freedom EVO 100 can be equipped with up to 2 arms. The figure shows all possible arm configurations:

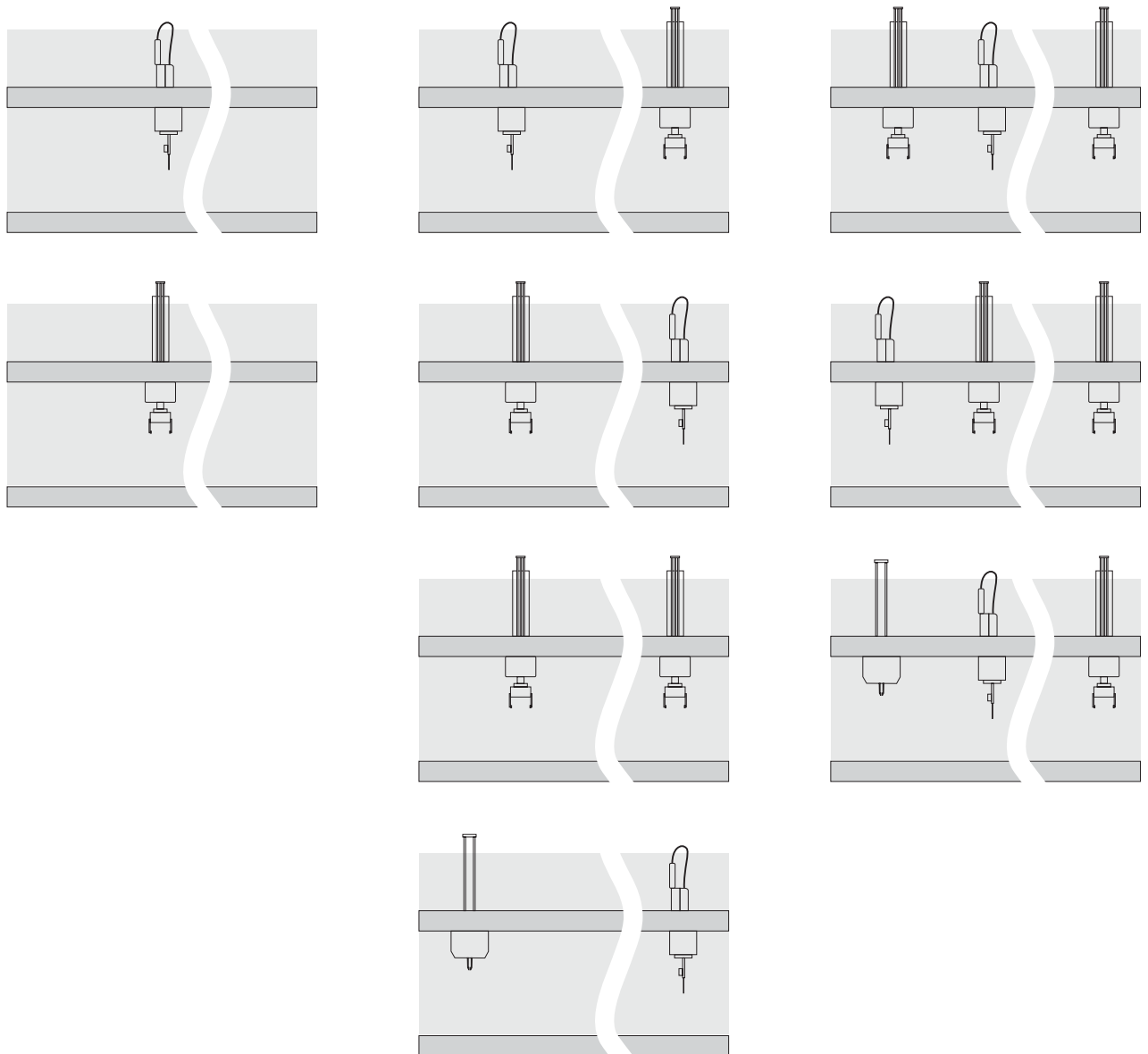


**Fig. 3-8** Possible arm configurations with the Freedom EVO 100

**Freedom EVO 150 and 200**

**Possible Arm Configurations**

The Freedom EVO 150 and 200 can be equipped with up to 3 arms. The figure shows all possible arm configurations:



**Fig. 3-9** Possible arm configurations with the Freedom EVO 150 and 200

**General Notes**

**Note:** Pay attention to the following:

- Configurations other than shown in the above pictures are either not standard or not possible.
- If there is a RoMa installed on the left side, its working range is mirrored as compared to a RoMa on the right side. However, this combination can be changed by a Tecan authorized field service engineer.

### 3.4.1.1 Arm Configuration Freedom EVO Clinical

The Freedom EVO Clinical is equipped with one LiHa.

### 3.4.2 Optional Equipment Freedom EVO

The following optional equipment is available:

**Tab. 3-4** *Optional equipment*

Designation	Abbreviation
Liquid handling arm with 2 channels	LiHa/2
Liquid handling arm with 4 channels	LiHa/4
Liquid handling arm with 8 channels	LiHa/8
Robotic manipulator arm (standard Z-axis)	RoMa standard
Robotic manipulator arm (long Z-axis)	RoMa long
Pick and place arm	P&P
Positive identification option	PosID 2
Low volume option	LV
Nanopipetting system (up to 8 active tips)	NPS
Tecan Positioning System	Te-PS
Monitored pump option	MPO
Fast wash pump in MPO option	FaWa
Lower disposable tip eject option	
Standard tips	
Low volume tips	
Disposable tips	DiTi
Te-Link	

**Note:** *The equipment mentioned here is described in this Service Manual.*

### 3.4.2.1 Equipment Freedom EVO Clinical

The following equipment is available:

**Tab. 3-5** *Optional equipment*

Designation	Abbreviation
Liquid handling arm with 4 channels	LiHa/4
Liquid handling arm with 8 channels	LiHa/8
Positive identification option	PosID 2
Monitored pump option	MPO
Fast wash pump in MPO option	FaWa
Lower disposable tip eject option	
Standard tips	
Disposable tips	DiTi

**Note:** *The equipment mentioned here is described in this Service Manual.*

## 3.5 Compatibility of Options

### 3.5.1 Available Options

The following options for the Freedom EVO are available (not applicable for Freedom EVO Clinical):

**Tab. 3-6** *Options*

Designation	Abbreviation
Tecan multichannel pipetting option	Te-MO 3/3-96
Tecan multichannel pipetting option	Te-MO 3/3-384
Tecan multichannel pipetting option	Te-MO 3/5-96
Tecan multichannel pipetting option	Te-MO 3/5-384
Wash and refill center <sup>a)</sup>	WRC
Tecan DiTi and plate stacker for Te-MO <sup>*/b)</sup> _*c)	Te-Stack
Tecan DiTi and plate stacker for Genesis (4 stacker, 2 transfer stations)	Te-Stack
Tecan vacuum separation module	Te-VacS
Te-Vacs for ProTeam digest workstation	
Modified Columbus dispenser for ProTeam	

**Tab. 3-6** Options

Designation	Abbreviation
Tecan magnetic separation module	Te-MagS
Tecan shaker	Te-Shake
Monitored Incubator Option (4 or 6 slots with/without shaking)	MIO
Liconic Carousel/Carousel HS with or without barcode scanner	
GenePaint	Te-Flow
Water bath for Te-Flow	
Symbol BC scanner	
I/O Option (input/output and RS 485 interface board)	
Tecan washers (various types)	
Tecan readers (various types)	
Tecan laser scanner	LS

a) part of the Te-MO \*/\*-\*\* option

b) \*/\* refers to both 3/3 and 3/5 (number of slides/positions per slide) versions of Te-MO

c) \*\* refers to both 96 and 384 channel versions of Te-MO

**Note:** Refer to the separate documentation of these options.

### 3.5.2 Available OEM Options

The following options from “original equipment manufacturers” are available (not applicable for Freedom EVO Clinical):

**Tab. 3-7** OEM options

Designation	Manufacturer
Hettich centrifuge	Andreas Hettich GmbH
Mettler balance	Mettler Toledo
H+P Variomag magnetic stirrer	H+P Labortechnik AG

**Note:** For detailed information refer to the documentation of the respective manufacturer.



### 3.5.3 Compatibility Overview

#### Compatible Options

##### Which Options Are Fully Compatible?

The following options are fully hardware compatible with the Freedom EVO (not all options applicable for Freedom EVO Clinical):

- ◆ High resistance tubing set
- ◆ Longer RoMa finger
- ◆ Te-MagS
- ◆ All Readers
- ◆ All washers
- ◆ MPO Version 4 (also for Freedom EVO Clinical)
- ◆ FWO (also for Freedom EVO Clinical)
- ◆ Low volume option Freedom
- ◆ I/O option
- ◆ Te-PS option
- ◆ Te-Link option

#### Options Compatible with Limitations

##### Which Options Are Compatible with Limitations

The options listed below are compatible with the following limitations (not applicable for Freedom EVO Clinical):

- ◆ Carousel limited compatibility
  - Compatibility with the following modules is limited:
    - Freedom EVO: Modifications on the side safety panel necessary
    - Hotels: Not compatible if hotels are placed in the loading area of the carousel
- ◆ Centrifuge limited compatibility
  - Compatibility with the following modules is limited:
    - PosID 2: Shortened X-range if hatch of centrifuge is opened
    - P&P: Cannot load the centrifuge
    - RoMa: Centrifuge can only be loaded by a RoMa long equipped with centric grippers
- ◆ Hotel limited compatibility
  - Depending on the placement of the hotels, compatibility with the following modules is limited:
    - PosID 2: Shortened X-range if the hotels are placed on the back of the worktable
    - Reader: Not compatible if the loading drawer of the reader blocks loading of the hotel
- ◆ Incubator limited compatibility
  - Compatibility with the following modules is limited:
    - Incubators: Number of incubators limited, depending on the power supply of the instrument
    - PosID 2: Shortened X-range if the incubators are placed on the back of the worktable

- Reader: Not compatible if the loading drawer of the reader blocks loading of the incubator
- ◆ Lower DiTi eject option limited compatibility
  - Compatibility with the following modules is limited:
    - Te-MO \*/\*-\*: X-range of LiHa shortened as it cannot move past the option
- ◆ PosID 2 limited compatibility
  - Compatibility with the following modules is limited:
    - Incubators: Shortened X-range if the incubators are placed on the back of the worktable
    - Hotels: Shortened X-range if the hotels are placed on the back of the worktable
    - Te-MO \*/\*-\*: Shortened X-range
    - Centrifuge: Shortened X-range if the hatch of the centrifuge is opened
    - Te-Shake: Shortened X-range if the te-Shake is placed in the back of the worktable
- ◆ P&P limited compatibility
  - Compatibility with the following modules is limited:
    - Centrifuge: P&P cannot load the centrifuge
- ◆ Reader limited compatibility
  - The reader must be accessible with RoMa, therefore limited compatibility exists with:
    - Incubators: Incompatible if placed in the loading area of the reader
    - Hotels: Incompatible if placed in the loading area of the reader
- ◆ RoMa limited compatibility
  - Compatibility with the following modules is limited:
    - Centrifuge: Centrifuge is only accessible with a RoMa Long with centric grippers
    - Te-VacS: RoMa is not compatible with MPO-VacS board V1.0
- ◆ Te-MO \*/\*-\* limited compatibility
  - Compatibility with the following modules is limited:
    - Lower DiTi Eject Option: X-range of LiHa shortened as it cannot move past the option
    - Te-Flow: Depending on space on worktable
    - PosID 2: Shortened X-range of PosID
- ◆ Te-MO 3/5-\* limited compatibility
  - Compatibility with the following modules is limited:
    - Closed front safety panel: Not compatible as option protrudes from the worktable
- ◆ Te-Shake limited compatibility
  - Compatibility with the following modules is limited:
    - PosID 2: Shortened X-range if the Te-Shake is place on the back of the worktable

- ◆ Te-VacS limited compatibility
  - Compatibility with the following modules is limited:
    - Front safety panel: Not compatible with closed front safety panel, if equipped with plate waste slide and bag holder
    - Te-Stack: Not compatible with MPO-VacS board V1.0
    - RoMa: Not compatible with MPO-VacS board V1.0
    - LiHa: Not compatible with MPO-VacS board V1.0
    - Te-Link: Not compatible with MPO-VacS board V1.0

### 3.5.4 Firmware Compatibility (Minimum Requirements)

#### Firmware Versions

The table lists the compatible firmware versions of the system modules and options:

**Note:** The table lists **only the minimum requirements**. For more detailed information on current firmware versions refer to the “**Instrument Software Manual**”.

**Tab. 3-8** Firmware versions

Module/Option	Firmware name/Version
Te-CU	TECU-V 1.0 <sup>a)</sup> TECU-V 1.10 or later version
DC servo II	DCS2-V1.0 or later version
LiHa DCU	LIHACU-V1.2 or later version
XP SMART	XP2000-V1.01 or later version
RoMa DCU	ROMACU-V1.13 <sup>b)</sup> / V2.00 <sup>c)</sup> or later version
PosID	POSID2-V2.51 or later version
MPO	MPO-V2.00 or later version
P&P (Gate board)	PNPCU-V1.08 or later version
SAFY (SMIO/SAFY board)	SAFY-V1.10 or later version
Te-PS (Sensor plate)	SPL-V1.00 or later version
Te-Link	SHUTTLE-V1.00 or later version

a) Does not support the I/O option

b) to instrument serial No. 0283



c) from instrument serial No. 0284



## 4 Installation

**Purpose of This Chapter** This chapter describes how the Freedom EVO is prepared and put into place at the customer's site and how all necessary connections are made to prepare the instrument for use.



### 4.1 Site and System Preparation

- Site Requirements**
- 1 Check the customer's site for the general site requirements. Refer to section [4.1.1 "Site Requirements"](#),  4-1.
  - 2 If you want to install a centrifuge, it needs to be screwed down to the floor: Check the consistency of the floor. Refer to section [4.6.5 "Centrifuge"](#),  4-18 for detailed information on the screw size, etc. Is it possible to drill holes in the floor?
  - 3 Describe any modifications needed.

**Date of Delivery** Determine the date of delivery.

#### 4.1.1 Site Requirements

**Delivery Route** Take the following points into consideration with regard to transport of the instrument within the customer's site:

Loading platform	Is there a loading platform or similar device? Is it suitable for unloading the instrument from a truck?
Load capacity of elevator	At least 400 kg / 882 lbs
Minimum size of elevator	According to instrument size. Refer to section <a href="#">9.2.1 "Packaging"</a> ,  9-2.
Doors and entryway openings	Wider than 940 mm / 37 in.
Passageway corners	Are the passageways wide enough to transport the instrument around corners? Length of instrument: Refer to section <a href="#">9.2.1 "Packaging"</a> ,  9-2.

### Space

**Is There  
Enough Space  
of all  
Components?**

Check the size of the room where the instrument will be installed:

- ◆ Enough space to place instrument, cabinet and extensions?
- ◆ Enough space to open doors of instrument and cabinet?
- ◆ Enough walking space around the instrument?
- ◆ Space for placing system liquid / waste containers?
- ◆ Space for the control computer?

Minimum space between instrument and wall:

- ◆ 10 cm / 4 in.


**Note:** *Though the instrument works perfectly at this minimum distance to the wall, be aware of the fact that it is an advantage if the rear of the instrument is accessible, e.g. for maintenance and service work.*


### Supply

**Which  
Components  
Take Wall  
Outlets?**

Check the availability of wall outlets:

- ◆ Instrument
- ◆ Computer
- ◆ Centrifuge
- ◆ Reader
- ◆ Other modules

**Note:** *Pay attention to the additional requirements for instruments connected with Te-Link, especially if liquid level detection is used. Refer to section 4.6.3 “Te-Link”,  4-11.*

**Note:** *Low-power options can be directly connected to the switched mains outlet of the Freedom EVO. Refer to section 4.6 “Installing Options”,  4-9.*

Check if the power supply requirements (see Freedom EVO Operating Manual) are fulfilled.

## 4.2 Unpacking

### How to Unpack the Instrument

Check before you completely unpack the Freedom EVO:

- Is the packaging damaged in any way?
- Are there any damages visible on the instrument?
- Is the material complete according to the “Order Configuration/Packing List” for the Freedom EVO?

**Note:** *The Freedom EVO is a precision instrument with sensitive parts. Only lift it up by holding it by the main structure, using the special transport devices.*



### WARNING

Transporting or moving the Freedom EVO wrongly may result in serious instrument damage or even injuries to personnel (e.g. if a cover breaks off).

Never lift the instrument holding it by the arms, the arm guide or any part of the covers.

**Note:** *Tecan recommends you to keep the original packaging for future transport or storage of the Freedom EVO.*

*The packaging has been carefully designed to prevent damage to the instrument or its parts.*

For detailed information on packing/unpacking refer to section [9.2.1 “Packaging”](#), [9-2](#).

## 4.3 Transport

Transport the instrument on the wooden pallet to the place of installation, using a suitable stacker truck or the like.





## 4.4 Installing and Connecting

### 4.4.1 Freedom EVO Instrument

#### Putting Instrument into Place

##### Cross References

List of cross references to information provided in other sections:

Action	Reference
Set screw anchors	See section 4.6.5, <a href="#">4-18</a>
Unpack instrument	See section 4.2, <a href="#">4-3</a>
Use of transport handles	See section 4.3, <a href="#">4-3</a>

##### Unpacking and Positioning

To unpack and put the instrument into place, proceed as follows:

- 1 If the cabinet needs to be screwed down to the floor (if a centrifuge is used, this is always the case): Use the drilling template and set the required screw anchors.  
Refer to cross references above.
- 2 If applicable: Place cabinet in its proper position.
- 3 If applicable: Screw cabinet down to the floor.
- 4 Unpack the instrument.  
Refer to cross references above.  
*Leave transport locks and moorings in place.*
- 5 Place the instrument onto the workbench or the cabinet using the special transport handles.  
Refer to cross references above.
- 6 Remove transport locks and moorings.  
*Do not forget the cardboard strips in the X-bay (X-drive mooring).*
- 7 Level the instrument, as required.

#### Checks

##### Movement Check

To check the mechanics, manually move the axes of all modules and options.

**Note:** *The P&P arm and the RoMa are equipped with Z-brakes. Therefore, these axes cannot be checked when the instrument is switched off.*

##### Checking Screw Terminals

Check the screw terminals of the power supply as follows:

- 1 Open the left access door.

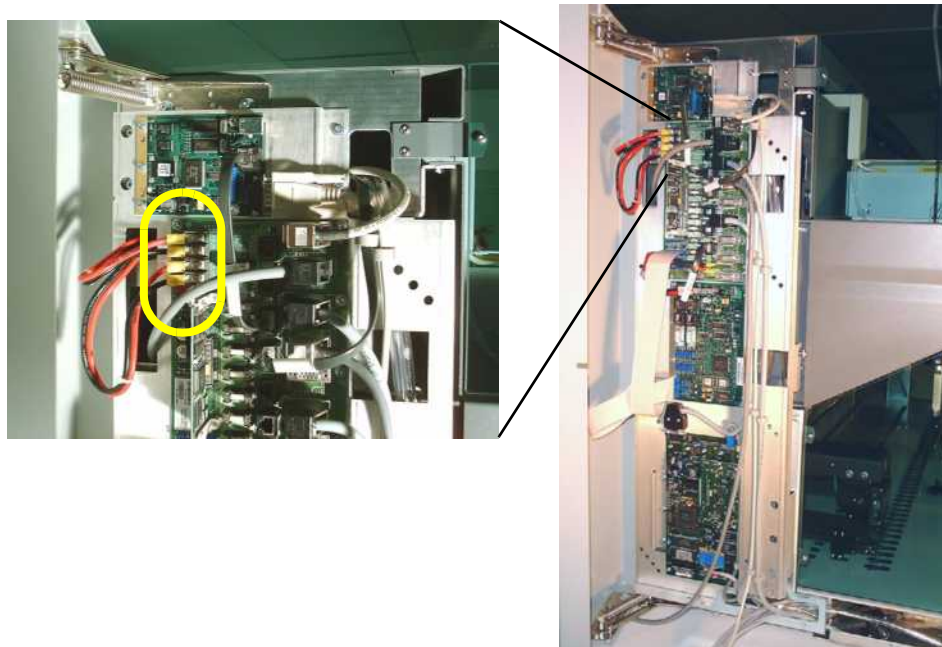


Fig. 4-2 Screw terminals

- 2 Tighten the four screw terminals on the Optibo DCU.

### Liquid System

To check the liquid system connections, proceed as follows:

- 1 Tighten the tubing connections to the diluters.  
*To have better access to the tubing connections, remove the valves with syringes from the diluter, if necessary.*
- 2 Open the top cover.
- 3 Tighten the tubing connections on distributors.
- 4 Instal the tips.
- 5 Place the wash station on the worktable.

### 4.4.2 Modules and Options

- 1 Make sure that all modules are compatible.  
See section 3.5 “Compatibility of Options”, 3-11.
- 2 Assure proper address settings.  
See section 8.16.1 “Address Settings Overview”, 8-160.
- 3 Connect all options and modules according to manufacturers instructions. Refer to
  - section 4.6.4 “Reader”, 4-17.
  - section 4.6.5 “Centrifuge”, 4-18.
  - section 4.6 “Installing Options”, 4-9.
  - separate Service Manual of corresponding option.

### Checking Liquid System Connections

### Connecting Modules and Options

## 4.5 Checking the CAN Bus Resistance

### CAN Bus Strings

To control the different modules and options of the Freedom EVO there are CAN bus strings on two different levels:

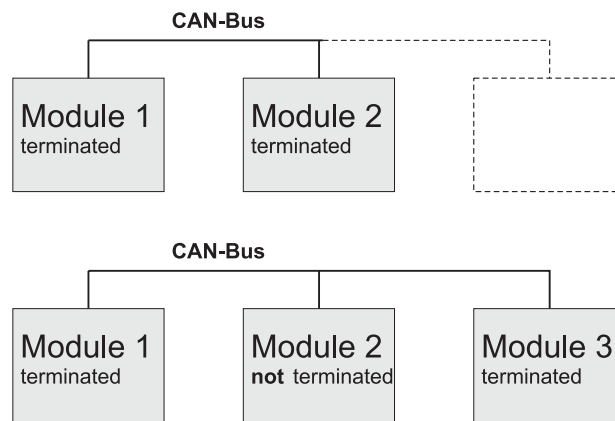
- ♦ High CAN (or Option CAN [communication with modules and options])
- ♦ Low CAN (or Local CAN [communication within modules and options, e.g. liquid handling system, PosID, etc.]

### CAN Bus Termination

The CAN bus termination must be adapted to the individual configuration of the instrument. For this reason, most PCBs have either jumpers or switches to connect the termination resistors, where appropriate.

In every case two participants of a CAN bus string must be terminated.

The example below shows how the implementation of an additional module (e.g. Module 3) may affect the CAN bus termination. Which modules exactly must be terminated depends on the position of the module.

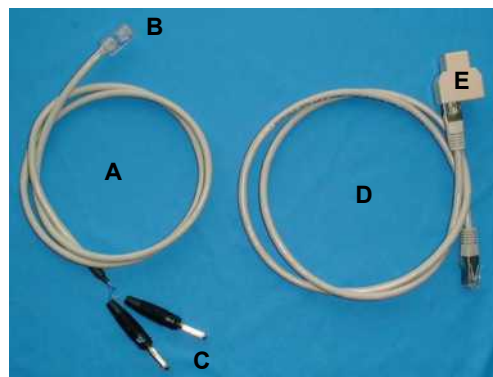


**Fig. 4-3** Example: CAN bus termination

The prioritization is illustrated in the communication overview (refer to the diagram in section 11.2.1, 11-3).

### Measuring Cable

To check the termination, use the special cable to measure the resistance of the CAN bus string.



**Fig. 4-4** Cable set to measure termination resistance

Measuring cable (A) with RJ45 connector (B) to PCB and plugs (C) to connect a multimeter. Adapter cable (D) with distributor (T-piece, E), used if all RJ45 connectors on the PCB are occupied. In this case, unplug one option. Connect the adapter cable between the PCB and the measuring cable and connect the option to the T-piece.

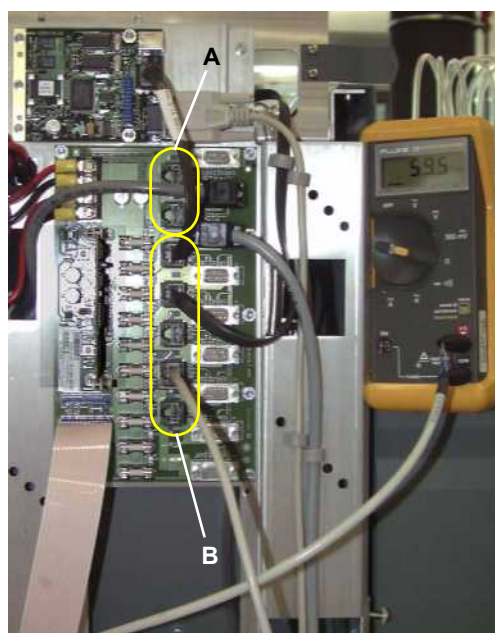
### Checking the Settings

#### How to Check the Termination

Check the jumper or switch settings for the CAN bus termination as follows:

- 1 Open the left access door.

**Note:** Make sure that instrument is switched off whilst measuring the CAN bus resistance.



- 2 Connect the multimeter to the RJ45 connector of the corresponding PCB (in most cases the Optibo DCU).
- 3 Measure the CAN bus resistance.

**A** Low CAN (or Local CAN)  
**B** High CAN (or Option CAN)

**Fig. 4-5** Multimeter connected to Optibo DCU

- 4 Set the jumpers or switches on the corresponding PCB according to the following table:

**Tab. 4-1** Jumper/switch settings for correct CAN bus termination resistance

CAN Bus	Checkpoints	Resistance	Means
Option CAN	RJ45 on Optibo DCU, gate board <sup>a)</sup> , SMIO/SAFY board	50-65 Ω ~ 40 Ω ~ 120 Ω	Correct number of jumpers 1 jumper redundant 1 jumper missing
Local CAN	RJ45 on Optibo DCU, gate board <sup>a)</sup> / corresponding test points on PCBs	50-65 Ω ~ 40 Ω ~ 120 Ω	Correct number of jumpers 1 jumper redundant 1 jumper missing

a) Checkpoints on gate board: See 11.2.17 "Gate Board (PCB)", 11-19.

## 4.6 Installing Options

### How to install the Option

For information on how to install the option, refer to the Service Manual of the respective option.

### 4.6.1 Modifications on Safety Panels

#### Modifications on the Safety Panels

Some options for the Freedom EVO require modifications on the safety panels. These modifications must be performed by an authorized Tecan FSE (field service engineer) when the option is installed.



#### WARNING

If the options which require modifications on the Freedom EVO are installed improperly, the safety concept may be impaired.

Always make sure that the options are installed in compliance with the instructions given by the manufacturer.

#### Cutout Dimensions

The cutout dimensions cannot be specified exactly here, because some of the options (e.g. Te-Link) can be installed in different positions.

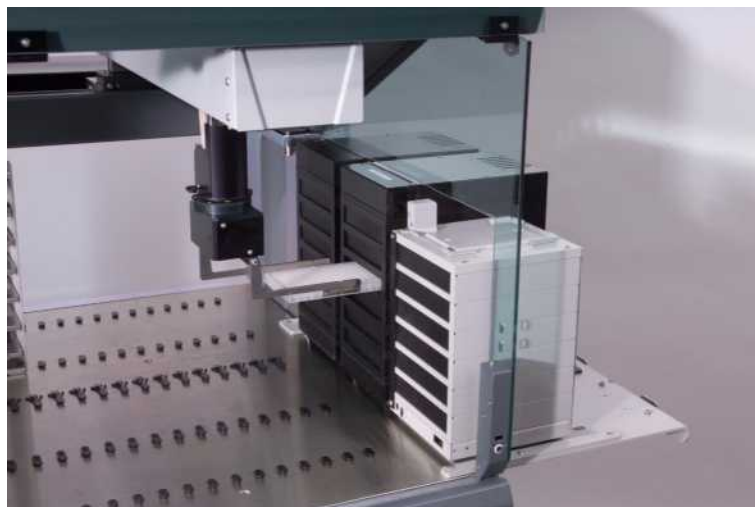
Therefore, the following general rule applies:

**Cut the safety panel in such a way that the gap between the panel and the option does not exceed 8 mm.**

Have the cutout done by a professional plastics workshop or use a suitable tool, such as a jig saw to cut the panels.

#### Example

The following figure shows an example of a modification on the right side safety panel:



**Fig. 4-6** Example of a safety panel cutout

### 4.6.2 Mains Outlets for Options

The instrument is equipped with switched mains outlets, which are located behind the diluter cover. The outlets are intended for options with low power consumption, such as washers and readers. They are only powered when the instrument is switched on.

The max current of all outlets together must not exceed 2 amps.

#### ATTENTION

The mains outlets are internally fused with 2 A fuses. Do not connect options with high power consumption.

To make the mains outlets accessible for connecting options, proceed as follows:



#### Connecting Options to Mains Outlet

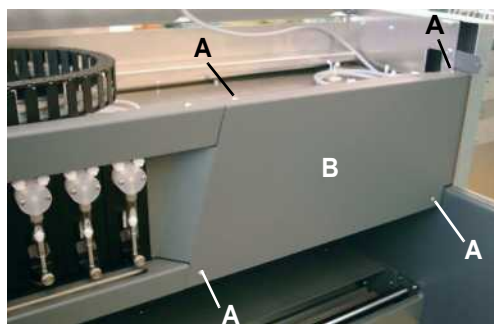


Fig. 4-7 Diluter cover

- 1 Open the top cover.
- 2 Remove the four screws (A).
- 3 Remove the right diluter cover (B).

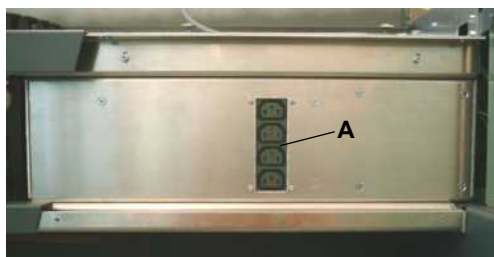


Fig. 4-8 Mains outlets

- 4 Connect the options to the mains outlets (A).

*Note:*  
The space behind the diluter cover is restricted. Therefore, angle type mains plugs must be used, otherwise, the diluter cover cannot be installed any more.

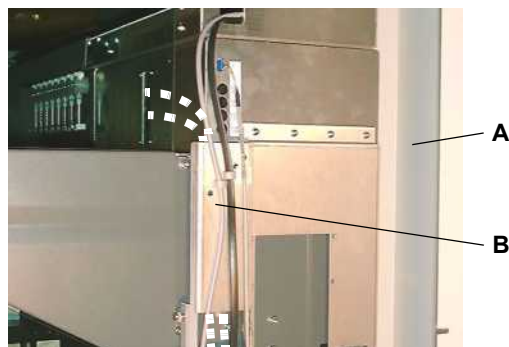


Fig. 4-9 Cable routing

- 5 Open the right access door (A).
- 6 Guide the mains cables to the right (see dashed lines in the figure).
- 7 Route the cables behind the carrier plate (B) down to the options.
- 8 Remount the diluter cover.
- 9 Close covers and doors.

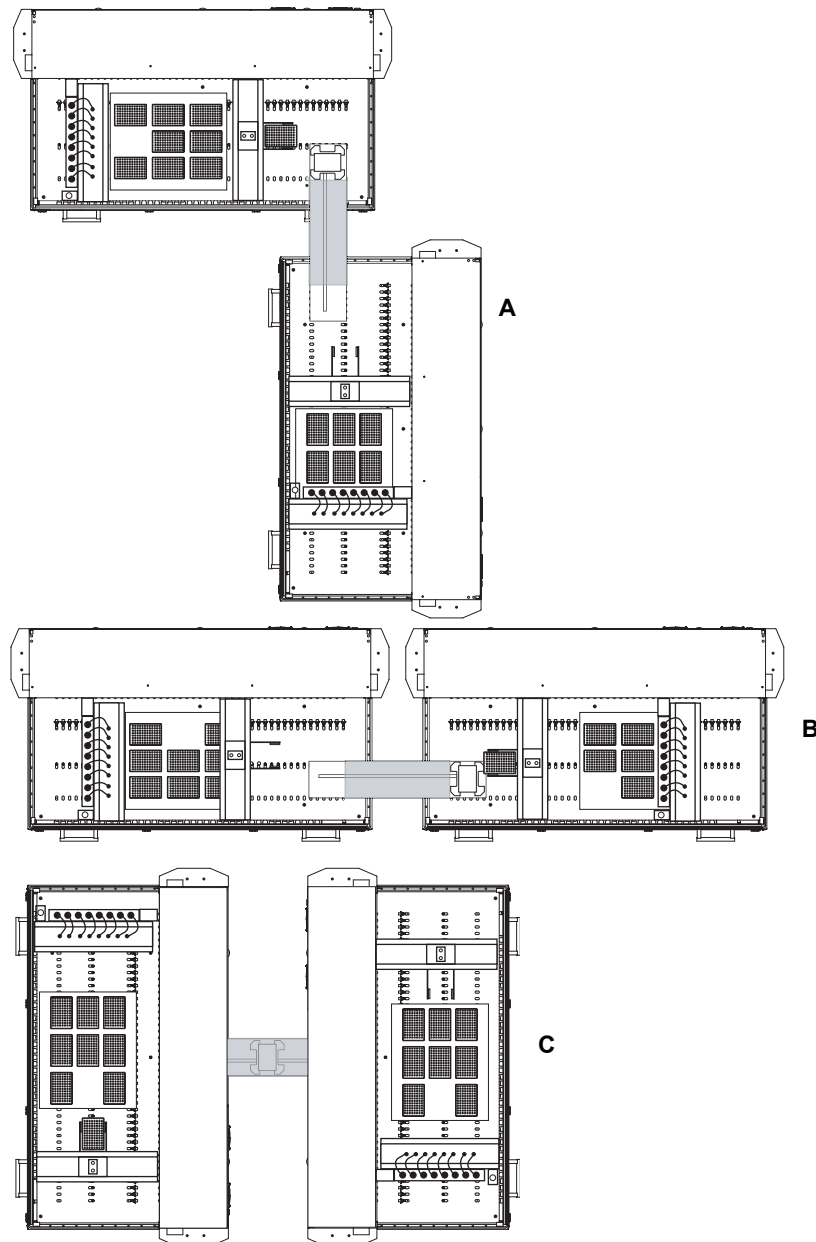
**4.6.3 Te-Link**

**Te-Link Arrangements**

**How Can the Te-Link be Used?**

The Te-Link can be positioned in different ways on the worktables of the instruments to be connected.

The figure shows a few examples on how the Te-Link can be applied:



**Fig. 4-10** Different arrangements of instruments connected with Te-Link

- A** Angled arrangement
- B** Linear arrangement

- C** Back-to-back arrangement

### Liquid Level Detection

If you intend to carry out liquid level detection (LLD) on the Te-Link, the following considerations are important:



#### ATTENTION

Faulty liquid level detection, if instruments are connected to different power supply lines or if liquid level detection is carried out on an instrument, which is improperly connected to the Te-Link.

Pay attention to the following:

- ◆ All instruments that are connected with the Te-Link must be connected to the same wall outlet group to prevent ground loops, i.e. to avoid a difference of ground potential.
- ◆ The carrier plate must be installed to the carrier.

#### Restrictions

LLD must only be carried out on the instrument the Te-Link is connected with (master instrument).

#### Orientation on the Worktable

As shown in Fig. 4-10, 4-11, the orientation of Te-Link in relation to the worktable of the instrument can vary.

#### How Is the Te-Link Positioned?

The adapter plate allows you to place the Te-Link on the positioning pins of the instruments in different positions, parallel to the X or the Y-axis.

Depending on the orientation of the Te-Link, some of the positioning pins must be removed from the worktable.

The adapter plate can be rotated, if necessary (in case you want to instal the Te-Link very near the instrument border).

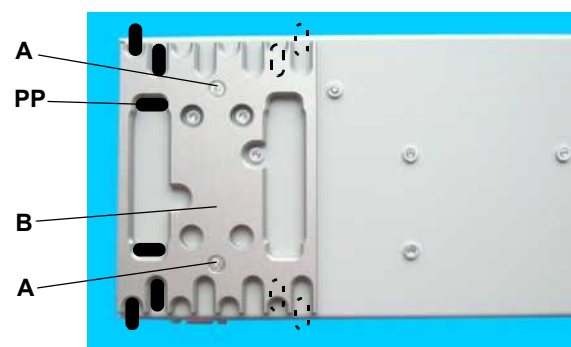


Fig. 4-11 Te-Link bottom view: Adapter plate

**Note:** The dashed lines denote the possible presence of positioning pins (PP) when the adapter plate (B) is rotated by 180 degrees.

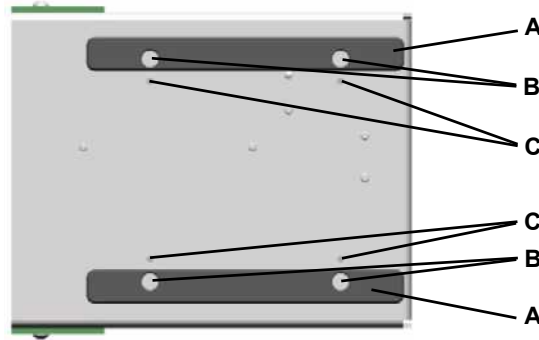
#### How to Rotate the Adapter Plate

To rotate the adapter plate, remove the two flat head screws (A) and fix the plate in rotated position.



**Positioning on the Other Side**

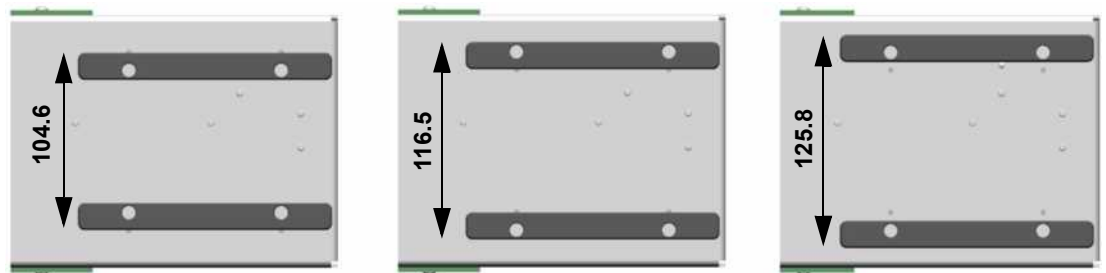
On the opposite side of the Te-Link, there are two feet, which can be fixed in different positions.



**Fig. 4-12** Te-Link bottom view: Feet

**How to Change the Feet Position**

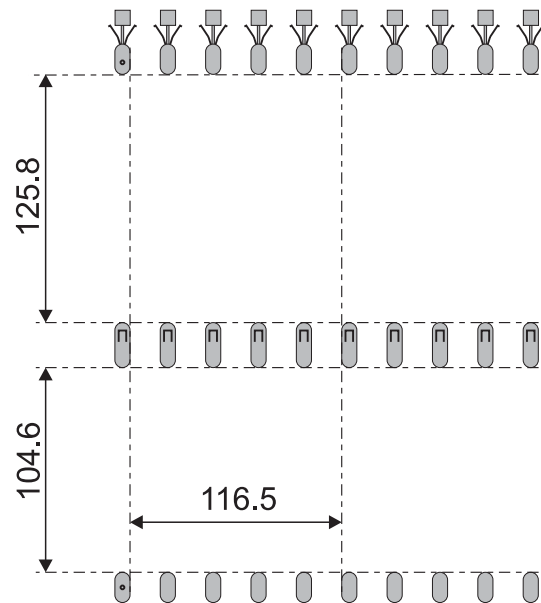
To change the position of the feet (A), remove the four flat head screws (B) and fix the feet in the appropriate position, i.e. feet in rotated position, alternative fixing holes (C), as explained in the figures below.



**Fig. 4-13** Different feet positions (dimensions in mm)

**How the Feet Match the Worktable Grid**

Mount the feet in one of the following positions to match the grid of the worktable (compare the distances of the feet with the distances of the positioning pins).

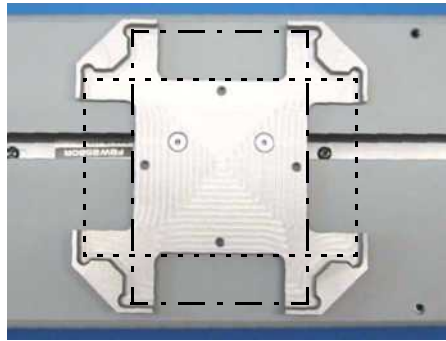


**Fig. 4-14** Worktable grid (dimensions in mm)

### Orientation of the MP on the Carrier

#### How Can the Microplates Be Put on the Carrier?

The microplates can be put on the carrier oriented parallel to the axis of the Te-Link or transversely to the axis.

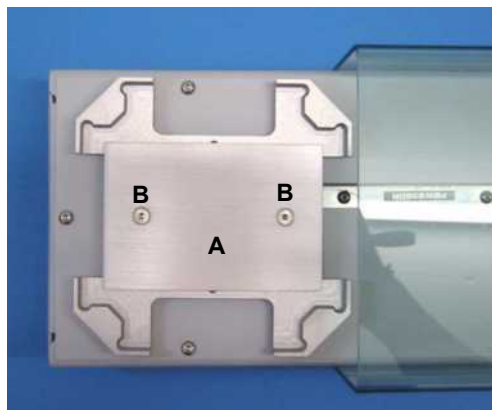


**Note:** The dashed line and the dash-dotted line show the two different orientations of the microplate on the carrier.

Fig. 4-15 Carrier

#### What is the Carrier Plate Used For?

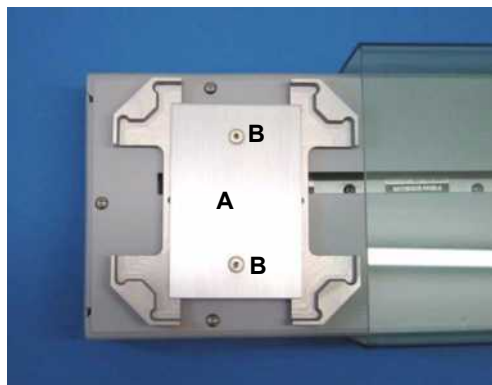
If liquid level detection on the Te-Link is used, an additional plate must be mounted on the carrier according to the microplate orientation.



The figure shows the carrier with the carrier plate (A) mounted parallel to the Te-Link axis. To change the orientation of the carrier plate:

- 1 Remove the two flat head screws (B)
- 2 Fix the plate with changed orientation.

Fig. 4-16 Carrier plate parallel



The figure shows the carrier with the carrier plate mounted transversely to the Te-Link axis.

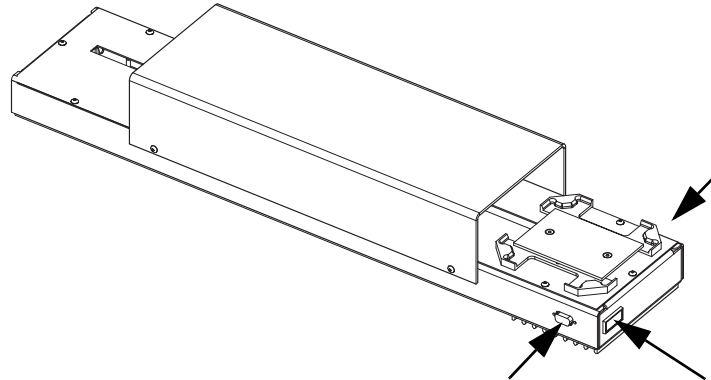
**Note:** If no liquid level detection is made on the Te-Link, the carrier plate can be removed completely from the carrier.

Fig. 4-17 Carrier plate 90°

**Changing Place of Connector**

**Why to Change Place of Connector?**

Depending on the Te-Link orientation on the worktable, the D-sub connector for the CAN bus cable can be moved to a different location. The figure shows the three possible locations where the corresponding holes for the connector are prepared (see arrows):



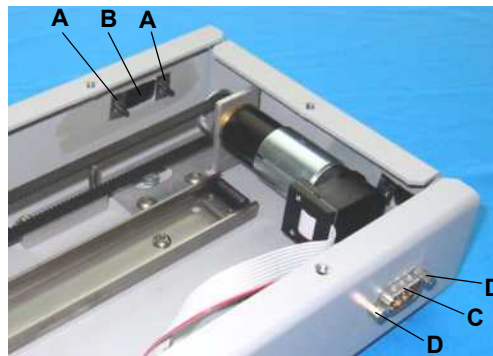
**Fig. 4-18** Possible places for CAN bus connector

**Note:** If no connector is installed, a dummy socket covers the hole.

**How to Change Place of the Connector**

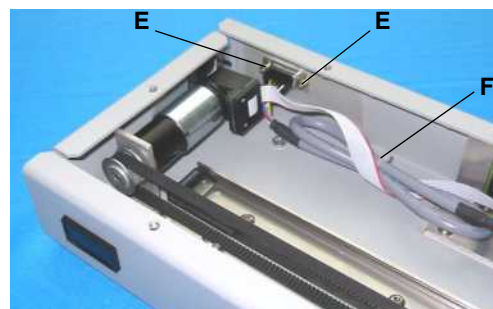
To change place of the D-sub connector, proceed as follows:

- 1 Open the housing of the Te-Link. Refer to cross references above.



**Fig. 4-19** Dummy socket

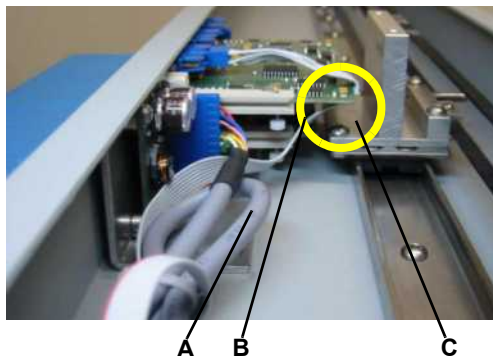
- 2 Remove the spring clips (A) of the dummy socket (B) in the position you want to place the D-sub connector (C).
- 3 Remove the dummy socket.



**Fig. 4-20** D-sub connector

- 4 Remove the two screws (D) and nuts (E) of the D-sub connector.
- 5 Remove the D-sub connector
- 6 Cut the cable tie (F), if necessary (cable length).
- 7 Remount the D-sub connector in the corresponding place.
- 8 Remount the dummy socket where the D-sub connector was before.

- 9 Arrange all cables properly.  
Pay attention to the following:



**Fig. 4-21** Possible collision point of cables and slide

- ♦ Make sure that the CAN bus cable (A) and the flat cable (B) or the motor are not caught by the slide (C) when the axis moves.
- ♦ Fix all cables properly.

- 10 Instal all removed parts.

### Installing the Te-Link

#### Cross References

List of cross references to information provided in other sections:

Action	Reference
Carry out adaptations	See section <a href="#">4.6.3</a> , <a href="#">4-11</a>
Modify safety panel	See section <a href="#">4.6</a> , <a href="#">4-9</a>
Connect Te-Link	See section <a href="#">11.2.14</a> , <a href="#">11-16</a> and section <a href="#">11.2.23</a> , <a href="#">11-25</a>

#### Installing

To instal the Te-Link, proceed as follows:

- 1 Carry out the necessary adaptations to the Te-Link.  
Refer to cross references above.
- 2 Carry out the necessary modifications on the safety panel.  
Refer to cross references above.
- 3 Place the Te-Link in the appropriate position on the worktable.
- 4 Open the front access panel.
- 5 Route the CAN bus cable through the tubing channel.
- 6 Open the left access door.
- 7 Connect the Te-Link CAN bus cable to the Optibo DCU (OCAN J12).  
Refer to cross references above.

#### Connecting the Te-Link to the Instrument

#### Tests and Settings

To ensure operating readiness, perform the following setups and tests:  
Refer to the “Instrument Software Manual”.


- ♦ Autorange
- ♦ Range Move Test

- ◆ Random Move Test

#### 4.6.4 Reader

##### Cross References

List of cross references to information provided in other sections:

Action	Reference
Adding a reader	See section 5.3,  5-9

##### Reader Types

The following readers can be used with a Freedom EVO instrument

- ◆ Safire<sup>2</sup>
- ◆ GENios Pro
- ◆ Ultra

##### Installation Locations

The reader can be installed in the following locations:

- ◆ Cabinet beneath the instrument, left or right compartment
- ◆ Worktable extension

##### Installation Details

The installation procedure depends on whether the reader is delivered together with a new instrument or whether it is added at a later time. If it is added later, the instrument must be upgraded before the reader can be installed.

For detailed information about the reader installation (and a possible instrument upgrade) refer to chapter “Upgrade Procedures”. See cross-references above.

## 4.6.5 Centrifuge

### Cross References

List of cross references to information provided in other sections:

Action	Reference
Connect centrifuge	See section <a href="#">11.2.3</a> , <a href="#">11-5</a>
Imbalance test	See section <a href="#">6.3.3.1</a> , <a href="#">6-6</a>
Speed calibration	See section <a href="#">6.3.3.2</a> , <a href="#">6-7</a>
Temperature calibration	See section <a href="#">6.3.3.3</a> , <a href="#">6-9</a>
Hatch check	See section <a href="#">6.3.3.4</a> , <a href="#">6-11</a>

### Preparation

Prepare the centrifuge according to the manufacturer's instructions.

### Material Needed

To fix the centrifuge on the floor, the following material is needed:

- ◆ Drilling template (supplied with the cabinet of Freedom EVO)
- ◆ Screws (not supplied)
  - Diameter: M8 or  $\frac{5}{16}$  in.
  - Length: At least 30 mm
- ◆ Screw anchors (not supplied)
  - As suitable for the chosen screws
- ◆ Washers (not supplied)
  - Diameter: As suitable for the chosen screws

### Installing Centrifuge Brace

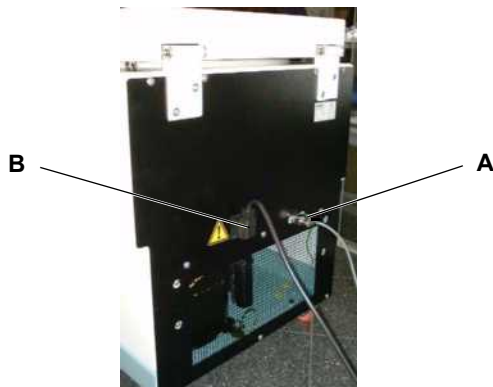
To instal the centrifuge brace on the floor, proceed as follows:

- 1 Spread the drilling template out on the floor and position it according to customer specifications.  
*Make sure that the minimum free space between the instrument and the wall is observed.*
- 2 Fix drilling template in place using masking tape.
- 3 Drill the holes in the floor according to the drilling template.
- 4 Remove the drilling template.
- 5 Set the screw anchors.
- 6 Place the centrifuge brace on the floor and apply the screws loosely (brace must still be movable).

### Installing Centrifuge

To instal the centrifuge, proceed as follows:

- 1 Set up the centrifuge in front of the instrument.



- 2** Connect the communication cable to the centrifuge.  
Refer to cross references above.
- 3** Connect the power cable to the centrifuge.

**A** *Communication cable (RS 232)*  
**B** *Power cable (mains)*



- 4** Place the cables in the cable holders as shown in the figure.



- 5** Switch the centrifuge on.
- 6** Turn the lock in CCW direction to the open position.
- 7** Open the centrifuge lid.
- 8** Switch centrifuge off and disconnect the power cable.



- 9** Unscrew the plastic cover.
- 10** Remove the three threaded rods blocking the motor.
- 11** Keep the 3 threaded rods for future use.



- 12** Install the plastic cover, fix it with the four screws.
- 13** Pull the seal on the whole diameter over the basin rim.



- 14** Install the rotor and the hangers.  
*Motor shaft cone and rotor bore must be clean and dry.*  
*The two slots on the rotor bottom side engage in the pin at the rotor shaft.*
- 15** Align the mark on the face of the motor shaft with the one on the rotor bush and lower rotor onto motor shaft.



- 16** Tighten rotor with the special square spanner.
- 17** Check rotor for proper fit.



- 18** Apply a thin film of Hettich grease No. 4051 (see spare parts) to hanger bearing surfaces.
- 19** Install hangers.





**WARNING**

The great centrifugal forces result in substantial balance error, if not all hangers are installed.

Do not switch on the centrifuge before all four hangers are installed.



**20** Put the four hangers in place. If the hangers are numbered, install them in the corresponding position.

**21** Connect centrifuge and switch power on.

**22** Close the lid.

**23** Turn the lock in CW direction to the closed position.

*LOCK2 appears on the centrifuge display.*

**24** Place the centrifuge on the brace.

**25** Firmly fix the centrifuge (brace) in place.

**Tests and Settings**

To ensure operating readiness, perform the following tests:  
Refer to cross references above.

- ◆ Imbalance test
- ◆ Speed calibration
- ◆ Temperature calibration
- ◆ Hatch check

## **4.7 Site Acceptance**

### **Completion**

- 1 Fill out the form "Installation Qualification" and "Operation Qualification".
- 2 Have it signed by the customer.

## 5 Upgrade Procedures

### Purpose of This Chapter

This chapter offers an overview of upgrade possibilities with the Freedom EVO and instructs how to implement specific upgrades.

### How to Order Material for Upgrades

Refer to chapter 10 “Spare Parts and Accessories”, ¶ 10-1 and to the document “Order Configuration / Packing List for EVO Upgrades (see 1.1 “Reference Documents”, ¶ 1-2).

## 5.1 Modifying the Arm Configuration

Refer to section 3.4.1 “Arm Configurations Freedom EVO”, ¶ 3-8 for information about the possible arm configurations.

### 5.1.1 Adding a LiHa

#### LiHa Configurations

Since there is a variety of LiHa configurations with respect to

- ◆ the number of tips
- ◆ the tip type
- ◆ the tubing type (standard or high resistant)
- ◆ FWO/MPO option yes/no
- ◆ low volume option yes/no
- ◆ lower DiTi eject option yes/no

the LiHa upgrade procedure slightly differs from type to type. The following instructions take only the main considerations into account. For details refer to the information about the corresponding option or component in this Service Manual.

**Note:** Consult the Order Configuration/Packing List for arm upgrades.

#### Cross References

List of cross references to information provided in other sections:

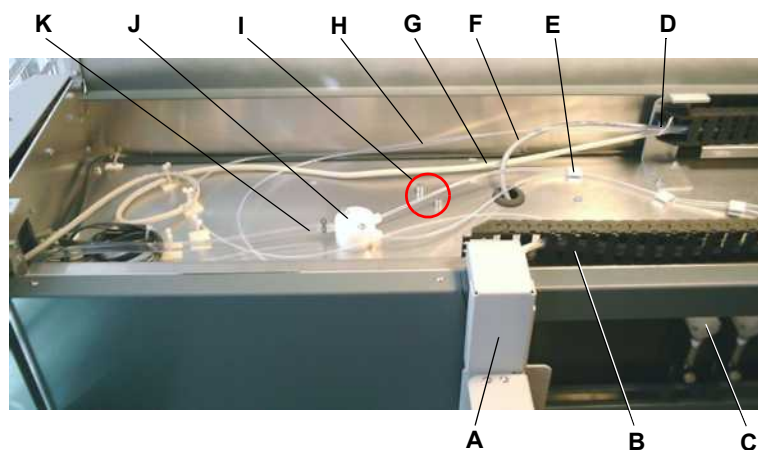
Action	Reference
Insert X-carriage	See section 5.1.4, ¶ 5-7
Install lower DiTi eject option	See section 8.8.3, ¶ 8-47
Install LiHa arm	See section 8.7.3, ¶ 8-23
Adjust X-drive assembly	See section 8.6.2, ¶ 8-17
Install FWO/MPO	See section 8.15.4, ¶ 8-147
Install LiHa cable	See section 11.2.3, ¶ 11-5
Install low volume cable	See section 11.2.4, ¶ 11-6
Check address switch	See section 8.16.1, ¶ 8-160/11.2.23, ¶ 11-25

Action	Reference
Check configuration switch	See section <a href="#">11.2.23</a> , <a href="#">11-25</a>
Install diluters	See section <a href="#">8.15.5</a> , <a href="#">8-154</a>
Install tubing	See section <a href="#">8.15</a> , <a href="#">8-141</a>
Check CAN bus resistance	See section <a href="#">4.5</a> , <a href="#">4-7</a>

### Adding a LiHa

To add a **LiHa** arm, proceed as follows:

- 1 Insert the new X-carriage.  
Refer to cross references above.
- 2 Provisionally mount the X-drive assembly.  
Do not tighten the screws yet.
- 3 Open the top cover.
- 4 If applicable: Install the lower DiTi eject option.  
Refer to cross references above.
- 5 Instal the complete LiHa arm.  
Refer to cross references above.
- 6 Adjust the X-drive assembly.  
Refer to cross references above.
- 7 If applicable: Install FWO/MPO.  
Refer to cross references above.



**Fig. 5-1** LiHa tubing and cables (example with 2-tip LiHa)

- |                                  |   |
|----------------------------------|---|
| <b>A</b> LiHa cable guide        | <b>G</b> LiHa connection cable                            |
| <b>B</b> Cable holder chain      | <b>H</b> Interconnecting tubing                           |
| <b>C</b> Diluter                 | <b>I</b> Mounting position of 2 <sup>nd</sup> distributor |
| <b>D</b> Cable tie               | <b>J</b> Distributor                                      |
| <b>E</b> Tubing holder           | <b>K</b> Aspirating tubing                                |
| <b>F</b> Low volume option cable |   |

- 8 Install the LiHa connection cable.  
Refer to cross references above.
  - Guide the cable through the cable holder chain.

- 9** If applicable: Install the low volume option cable.  
Refer to cross references above.
  - Guide the cable through the cable holder chain.
- 10** Install the LiHa device CU
  - Plug the DCU 2 in on the Optibo DCU
  - Check the address switch SW2 on Optibo DCU for correct address setting.  
Refer to cross references above.
  - Check the configuration switch SW3 (2,4 or 8 channels) for correct setting.  
Refer to cross references above.
- 11** Install the diluters.  
Refer to cross references above.
- 12** Install the tubing.  
Refer to cross references above.
  - Guide the pipetting tubing through the cable holder chain.
- 13** Check the CAN bus resistance of the local CAN bus.  
Refer to cross references above.
- 14** Perform the following setup and test procedures for the LiHa arm.  
Refer to the “Instrument Software Manual”.
  - Check firmware version
  - Enter serial number
  - Set X-drive properties
  - All setups for the existing arms
  - All tests for arms
- 15** Print system information and file it in the “Freedom EVO Maintenance and Service Logbook”.
- 16** Inform the local Tecan representative about the current instrument configuration.

## 5.1.2 Adding a RoMa

### Cross References

List of cross references to information provided in other sections:

Action	Reference
Remove X-bay cover	See section <a href="#">8.2.1</a> , <a href="#">8-2</a>
Insert X-carriage	See section <a href="#">5.1.4</a> , <a href="#">5-7</a>
install RoMa arm	See section <a href="#">8.9.4</a> , <a href="#">8-57</a>
install X-flex cable	See section <a href="#">8.11.1</a> , <a href="#">8-102</a>
Adjust X-drive assembly	See section <a href="#">8.6.2</a> , <a href="#">8-17</a>
Check CAN bus resistance	See section <a href="#">4.5</a> , <a href="#">4-7</a>

### Adding a RoMa

To add a RoMa arm, proceed as follows:

- 1 Remove the X-bay covers.  
Refer to cross references above.
- 2 Insert the new X-carriage.  
Refer to cross references above.
- 3 Provisionally mount the X-drive assembly.  
Do not tighten the screws yet.
- 4 Instal the complete RoMa arm.  
Refer to cross references above.
- 5 Make sure that the X-flex cable is installed properly.  
Refer to cross references above.
- 6 Adjust the X-drive assembly.  
Refer to cross references above.
- 7 Check the CAN bus resistance of the local CAN bus.  
Refer to cross references above.
- 8 Perform the following setup and test procedures for the RoMa arm.  
Refer to the “Instrument Software Manual”.
  - Check firmware version
  - Enter serial number
  - Set X-drive properties
  - All setups for the existing arms
  - All tests for arms
- 9 Print system information and file it in the “Freedom EVO Maintenance and Service Logbook”.
- 10 Inform the local Tecan representative about the current instrument configuration.

**5.1.3 Adding a P&P**

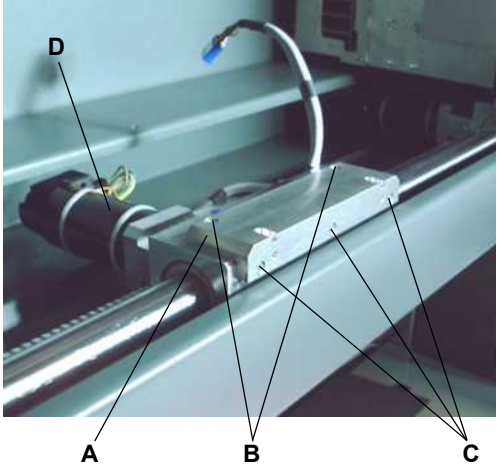
**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Install gate board	See section 3.3.1, 3-5
Connect gate board	See section 11.2.3, 11-5
Check address switch	See section 8.16.1, 8-160/11.2.17, 11-19
Remove X-bay cover	See section 8.2.1, 8-2
Insert X-carriage	See section 5.1.4, 5-7
install P&P arm	See section 8.10.3, 8-85
install X-flex cable	See section 8.11.1, 8-102
Adjust X-drive assembly	See section 8.6.2, 8-17
Check CAN bus resistance	See section 4.5, 4-7

**Adding a P&P**

To add a P&P arm, proceed as follows:

- 1 Open the left access door.
  - 2 Install the gate board:
    - Mount the gate board in the base unit. Refer to cross references above.
    - Connect the board to the Optibo DCU. Refer to cross references above.
    - Check the address switch SW2 for correct address setting. Refer to cross references above.
  - 3 Remove the X-bay covers. Refer to cross references above.
  - 4 Insert the new X-carriage. Refer to cross references above.
- 
- 5 Mount the adapter plate (A) with the two upper screws (B) and the three front screws (C).
  - 6 Provisionally mount the X-drive assembly (D). Do not tighten the screws yet.

**Fig. 5-2** X-carriage

- 7** Instal the complete P&P arm.  
Refer to cross references above.
- 8** Make sure that the X-flex cable is installed properly.  
Refer to cross references above.
- 9** Adjust the X-drive assembly.  
Refer to cross references above.
- 10** Check the CAN bus resistance of the option and local CAN bus.  
Refer to cross references above.
- 11** Perform the following setup and test procedures for the P&P arm.  
Refer to the "Instrument Software Manual".
  - Check firmware version
  - Enter serial number
  - Set X-drive properties
  - All setups for the existing arms
  - All tests for arms
- 12** Print system information and file it in the "Freedom EVO Maintenance and Service Logbook".
- 13** Inform the local Tecan representative about the current instrument configuration.



**5.1.4 Inserting an Additional X-carriage**

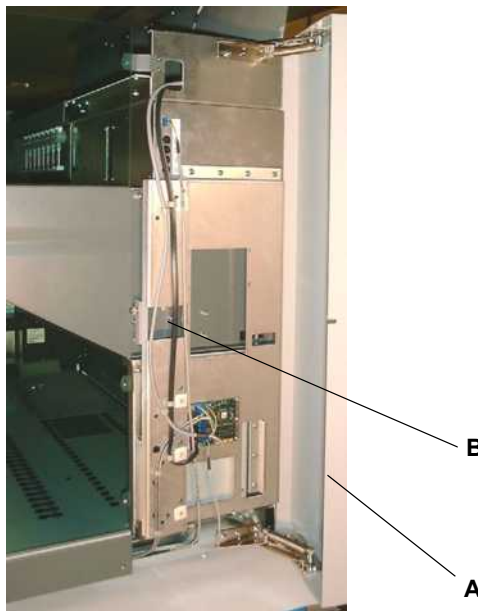
Depending on the arm configuration, the new X-carriage must be inserted on the left or the right side.

**How to Insert a New X-carriage**

To insert a new X-carriage, proceed as follows:

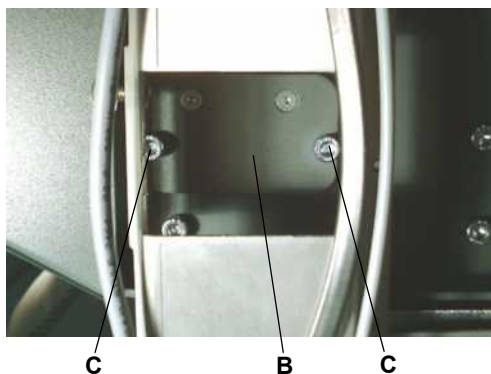
***Note:** The description given here shows the procedure to insert an X-carriage on the right side. If you need to insert an X-carriage on the left side, proceed in the same way on the other side.*

- 1 Open the right access door (A).  
*The X-shaft cover (B) is now accessible.*



**Fig. 5-3** X-shaft cover location

- 2 Put the cables aside in such a way that the recess for the X-shaft cover is not obstructed.



**Fig. 5-4** X-shaft cover

- 3 Remove the two screws (C).

- 4 Remove the X-shaft cover (B).




Fig. 5-5 X-carriage

- 5 Insert the new slide as shown in the figure.
- 6 Remount the X-shaft cover.

## 5.2 Adding a PosID 2

### Cross References

List of cross references to information provided in other sections:

Action	Reference
install PosID	See section <a href="#">8.12.2</a> ,  <a href="#">8-106</a>

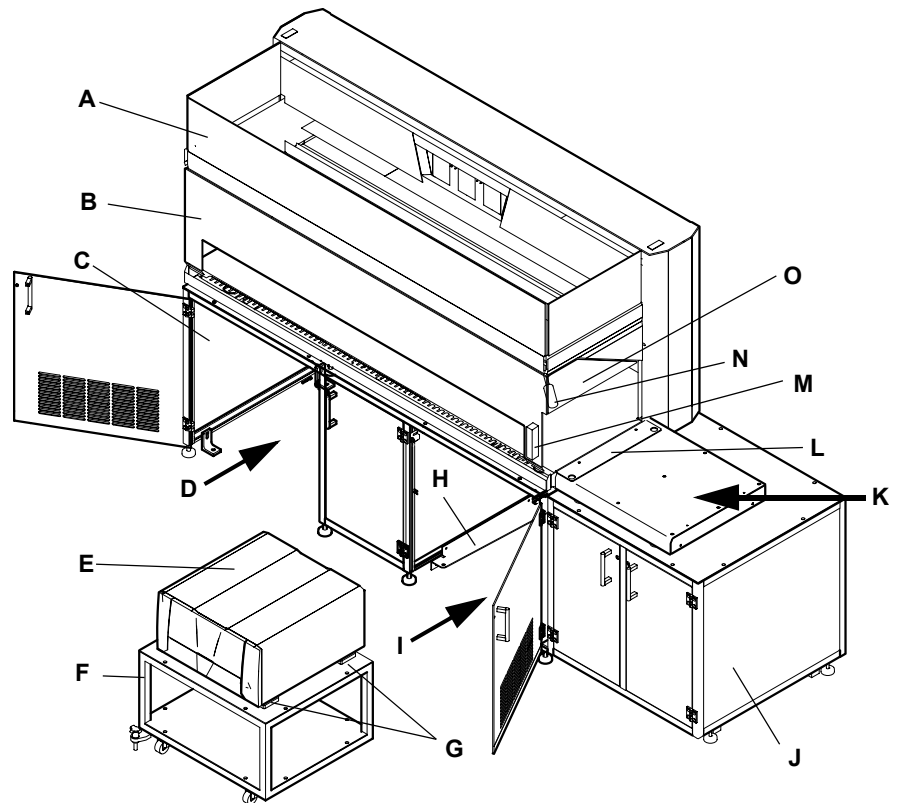
- 1 Perform the following setup and test procedures for the PosID 2. Refer to the “Instrument Software Manual”.
  - Check firmware version
  - Enter serial number
  - All setups
  - All tests
- 2 Print system information and file it in the “Freedom EVO Maintenance and Service Logbook”.
- 3 Inform the local Tecan representative about the current instrument configuration.

### 5.3 Adding a Reader

**Purpose** This section describes how a Safire<sup>2</sup>, a GENios Pro or an Ultra reader is installed on a Freedom EVO instrument.

#### 5.3.1 Introduction

**Overview**



**Fig. 5-6** Installation of a reader

- |  |                                  |
|--|----------------------------------|
| <b>A</b> Instrument                    | <b>I</b> Right compartment       |
| <b>B</b> Front safety panel            | <b>J</b> External cabinet        |
| <b>C</b> Cabinet                       | <b>K</b> Worktable extension     |
| <b>D</b> Left compartment              | <b>L</b> Adapter plate           |
| <b>E</b> Reader (Safire <sup>2</sup> ) | <b>M</b> Door lock               |
| <b>F</b> Trolley                       | <b>N</b> Gas spring              |
| <b>G</b> Adapter plates                | <b>O</b> Right side safety panel |
| <b>H</b> Guiding bracket               |                                  |

**Possible Installation Locations**

The reader (E) can be installed in the following locations:

- ♦ On a trolley (F) in the left compartment of the cabinet (D)
- ♦ On a trolley (F) in the right compartment of the cabinet (I)
- ♦ On the right side of the instrument, on the worktable extension (K).

**What's Needed  
for the  
Installation?**

The following table lists the parts required for the installation. The parts you need depend on the following:

- ♦ The installation location (cabinet or worktable extension).
- ♦ The reader type. The various readers require different adapter plates and/or different side safety panels.
- ♦ If the reader is to be installed on the worktable extension of an already existing instrument, some parts must be replaced or installed in a different position (see below).

**Tab. 5-1** *Parts used for installation*

Item in figure	Designation	Used for installation of reader in / on...	Comment
B	Special safety panel	Worktable extension	Has a cutout on right side
E	Reader	Cabinet / worktable extension	Safire <sup>2</sup> , GENios Pro or Ultra
F	Trolley	Cabinet	
G	Adapter plates	Cabinet	To be installed on trolley: • 2 plates for Safire <sup>2</sup> • 1 plate for GENios Pro • 1 plate for Ultra
H	Guiding bracket	Cabinet	For fixing the trolley
n.v <sup>a)</sup>	Distance brackets on rear side	Cabinet	To guarantee minimum distance between cabinet and wall behind
K	Worktable extension	Worktable extension	Right side of instrument
L	Adapter plate	Worktable extension	Plate depends on reader
M	Door lock	Worktable extension	Must be moved to rightmost grid position
N	Short gas spring	Worktable extension	Only with Freedom EVO 200
O	Special side panel on right side	Worktable extension	Depends on reader model
n.v <sup>a)</sup>	Special mounting brackets	Worktable extension	For fixing the gas spring and the side panel

a) *Items marked n.v. are not visible in the figure*

**Before You Start**

Ensure that you have the reader's documentation handy in which you can find detailed information on how to install and set up the reader.



**WARNING**

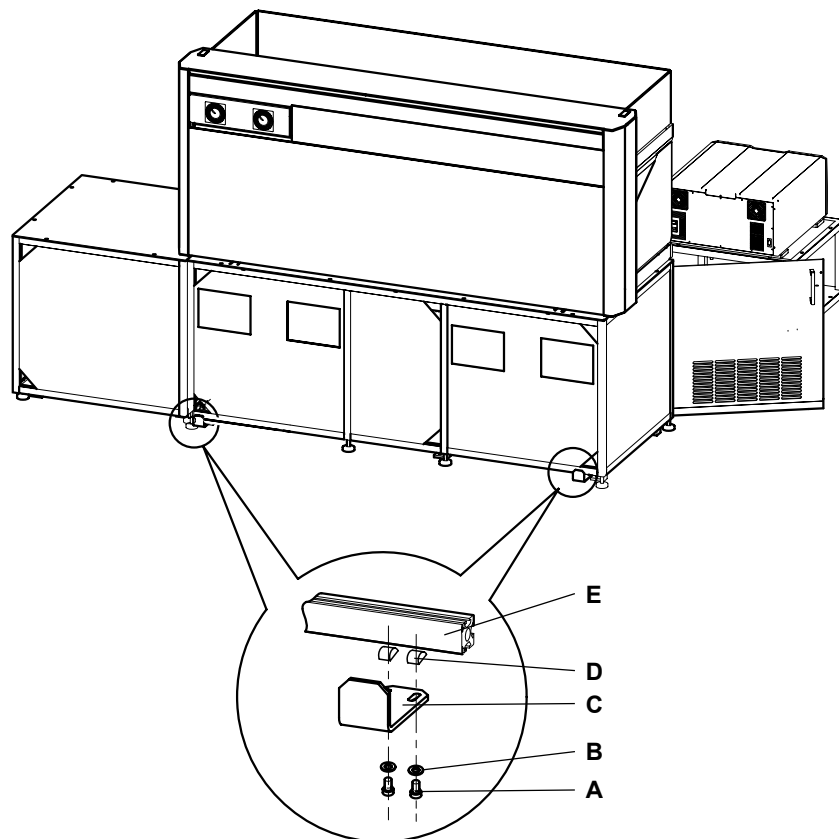
Keep in mind that the reader is heavy (about 40 kg).

- ◆ Be careful when you lift the reader so as not to damage your back.
- ◆ If necessary ask another person for help when you have to lift the device.

**5.3.2 Installation of the Distance Brackets**

**Purpose**

These brackets guarantee a minimum distance of about 67 to 80 mm between the cabinet/instrument and a wall behind the instrument. If the reader is to be installed in the cabinet and the instrument is to be placed close to a wall, the brackets should be installed in order to avoid damage to the connectors and cables that connect the reader to the mains power supply and the computer.



**Fig. 5-7** Distance brackets

- |                           |                           |
|---------------------------|---------------------------|
| <b>A</b> Fixing screws    | <b>D</b> T-nuts           |
| <b>B</b> Washers          | <b>E</b> Aluminum profile |
| <b>C</b> Distance bracket |                           |

**Note:** The brackets have slotted mounting holes, which allows you to adjust the distance.

**Procedure**

To install the distance brackets:

- 1 At each end of the cabinet, insert two T-nuts into the bottom groove of the aluminum profile.
- 2 Use a 90° offset Allen key to screw the brackets to the profiles as shown in the figure above. Do not tighten the screws yet.
- 3 Adjust the positions of the brackets and their distance from the wall and tighten the fixing screws.

**5.3.3 Installation in Cabinet (Left Side)**

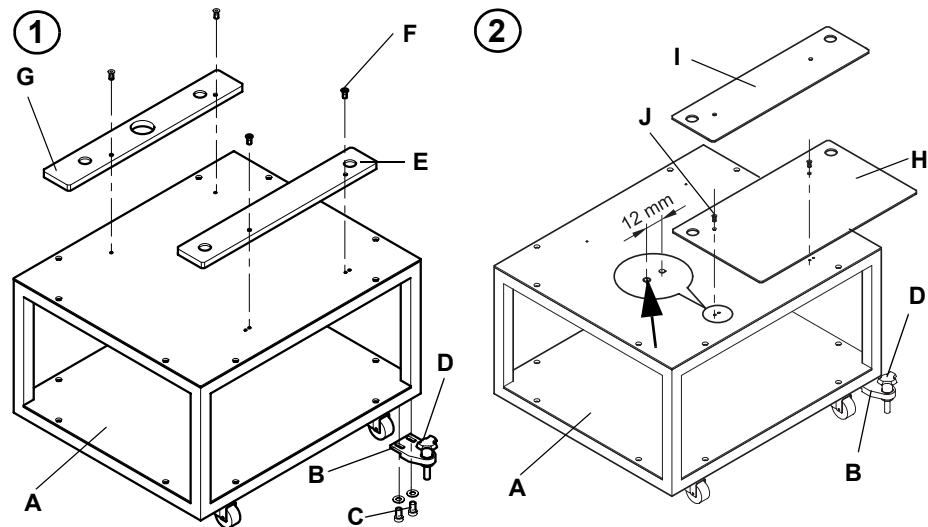
**Cross References**

List of cross-references to information provided in other sections.

Information	References
Connection of the reader	See section 5.3.6, <a href="#">5-24</a>
Setups and tests	See section 5.3.7, <a href="#">5-25</a>

To install the reader in the left compartment of the cabinet proceed as described below.

**Prepare Trolley**



**Fig. 5-8** Preparing the trolley

- |  |   |
|--|---|
| 1 Trolley equipped for Safire <sup>2</sup> | E Front adapter plate for Safire <sup>2</sup> |
| 2 Trolley for GENios Pro or Ultra          | F Fixing screws                               |
| A Trolley                                  | G Rear adapter plate for Safire <sup>2</sup>  |
| B Flange                                   | H Adapter plate for GENios Pro                |
| C Fixing screws for flange                 | I Adapter plate for Ultra                     |
| D Retaining pin                            | J Fixing screws                               |

The preparation of the trolley is very similar for the Safire<sup>2</sup>, GENios Pro and Ultra reader.

**Note:** The three models require different adapter plates which must be mounted to the trolley.

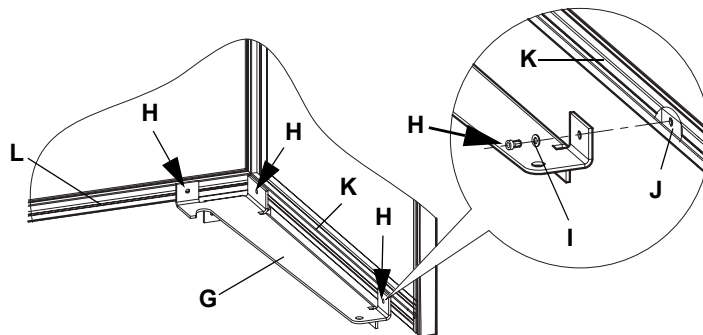
- Two adapter plates are needed for Safire<sup>2</sup> reader (left picture)
- One adapter plate is needed for the GENios Pro and the Ultra reader (right picture). Note that the plate for GENios Pro is larger than that for Ultra.

To prepare the trolley:

- 1 Screw the flange (D) near the right bottom corner to the frame of the trolley..
- 2 Screw the adapter plate(s) to the top of the trolley:
  - Safire<sup>2</sup>: Make sure you mount the adapter plate with the center hole (G) in the rear position.
  - GENios Pro/Ultra: Note that there are two positions (4 mounting holes) in which the adapter plate can be mounted. Make sure you mount the adapter plate in the left position as shown in the previous figure (black arrow).

**Mount Bracket**

- 3 In the left compartment of the cabinet, insert two T-nuts (J) in the groove of the lower right aluminum profile (K) and one T-nut in the lower rear aluminum profile (L).

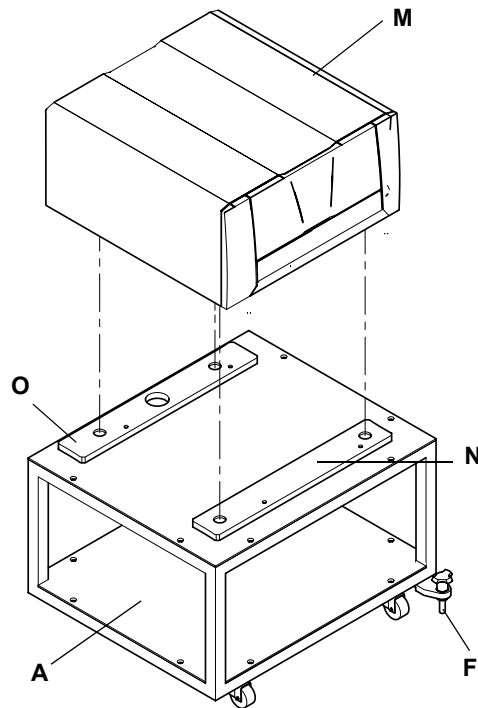


**Fig. 5-9** Mount bracket to frame in left cabinet

- |                        |                                 |
|------------------------|---------------------------------|
| <b>G</b> Bracket       | <b>J</b> T-nut                  |
| <b>H</b> Fixing screws | <b>K</b> Right aluminum profile |
| <b>I</b> Washer        | <b>L</b> Rear aluminum profile  |

- 4 Screw the guiding bracket (F) to the T-nuts as shown in the above figure.

**Place Reader  
on Trolley**



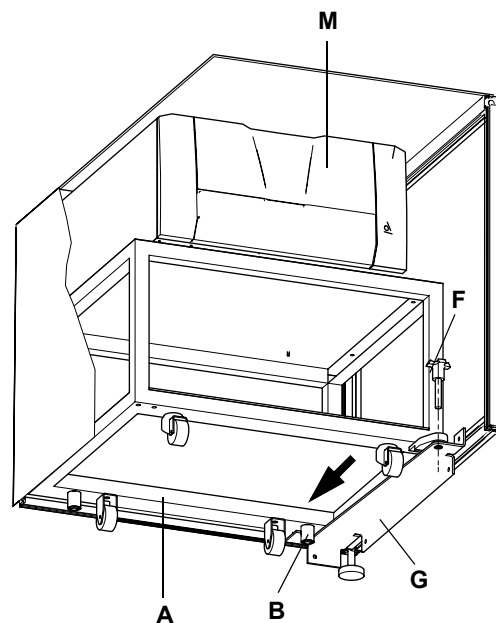
- A** Trolley
- F** Retaining pin
- M** Safire<sup>2</sup> reader
- N** Front adapter plate
- O** Rear adapter plate (Safire<sup>2</sup> only)

**Note:** The figure shows a Safire<sup>2</sup> reader. The procedure is the same for the GENios Pro reader.

- 5 Place the reader on the trolley as shown in the figure:
  - The front of the reader must be on the side of the retaining pin (F).
  - Make sure the reader's feet are correctly seated in the corresponding holes in the adapter plate(s).

**Fig. 5-10** Place reader on trolley

**Install Trolley &  
Reader in Left  
Compartment**



- 6 Push the trolley with the reader along the bracket (G) into the compartment (black arrow in figure). The pin (B) at the bottom of the trolley must engage with the rear cutout of the bracket.
- 7 Secure the trolley with the retaining pin (F).

**Fig. 5-11** Install trolley in left compartment (bottom view)

**Connection,  
Setup and Test**

See cross-references at the beginning of this section.



**5.3.4 Installation in Cabinet (Right Side)**

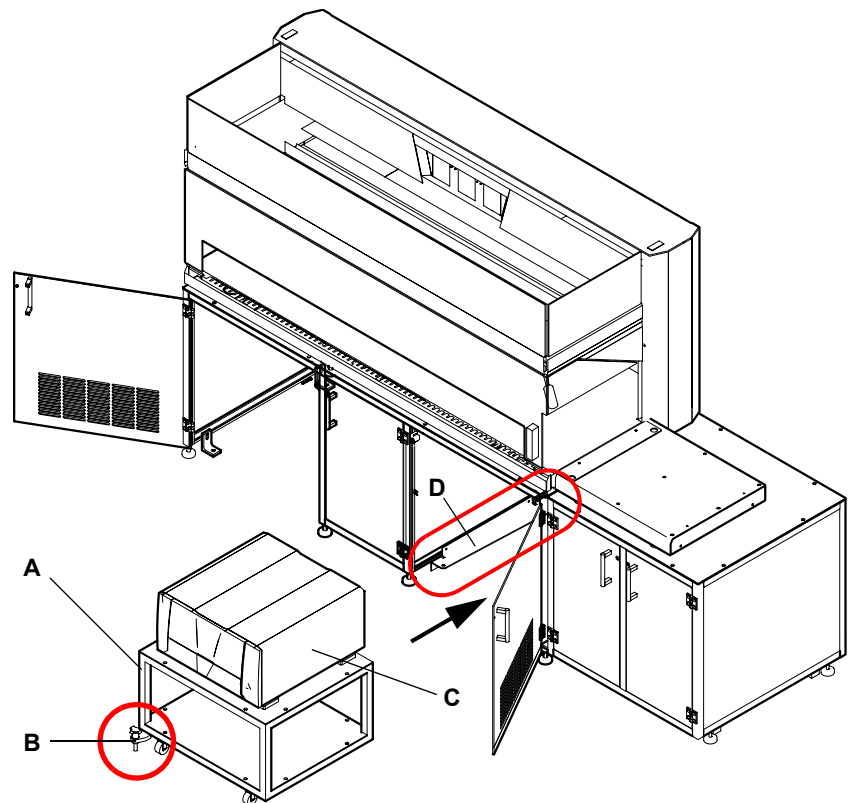
**Cross  
References**

List of cross-references to information provided in other sections:

Subject	Reference
Installation in left compartment	See section 5.3.3, 5-12
Connection of the reader	See section 5.3.6, 5-24
Setups and tests	See section 5.3.7, 5-25

**Procedure**

The installation of the reader in the right compartment of the cabinet is practically the same as that for the left compartment.

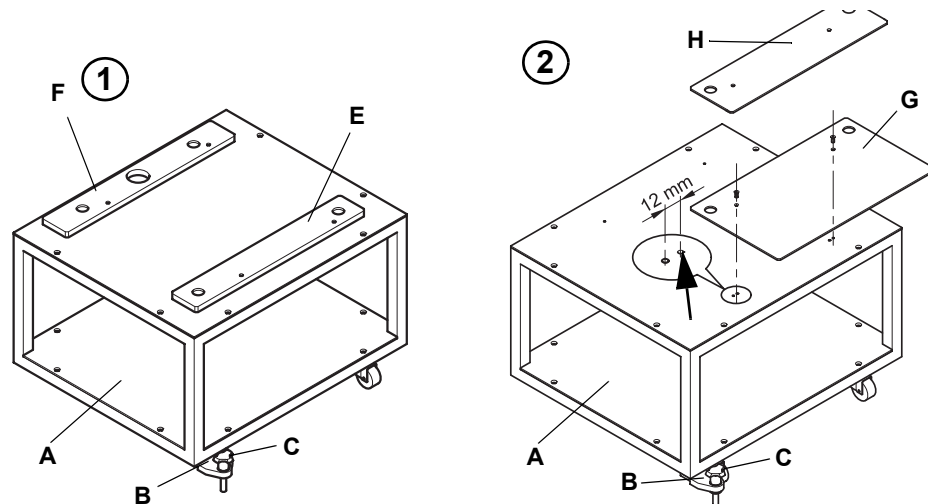


**Fig. 5-12** Installation of reader in right compartment of cabinet

- |          |                           |          |                               |
|----------|---------------------------|----------|-------------------------------|
| <b>A</b> | Trolley                   | <b>C</b> | Reader (Safire <sup>2</sup> ) |
| <b>B</b> | Flange with retaining pin | <b>D</b> | Guiding bracket               |

**Procedure**

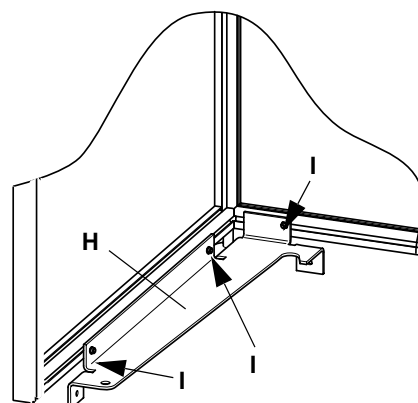
To install the reader in the right compartment:



**Fig. 5-13** Preparing the trolley

- |          |  |          |   |
|----------|--|----------|---|
| <b>1</b> | Trolley equipped for Safire <sup>2</sup> | <b>E</b> | Front adapter plate for Safire <sup>2</sup> |
| <b>2</b> | Trolley for GENios Pro / Ultra           | <b>F</b> | Rear adapter plate for Safire <sup>2</sup>  |
| <b>A</b> | Trolley                                  | <b>G</b> | Adapter plate for GENios Pro                |
| <b>B</b> | Flange                                   | <b>H</b> | Adapter plate for Ultra                     |
| <b>C</b> | Retaining pin                            |          |   |

- 1 Screw the flange (B) near the left bottom corner to the frame of the trolley..
- 2 Screw the adapter plate(s) to the top of the trolley:
  - Safire<sup>2</sup>: Make sure you mount the adapter plate with the center hole (G) in the rear position.
  - GENios Pro / Ultra: Note that there are two positions (4 mounting holes) in which the adapter plate can be mounted. Make sure you mount the adapter plate in the right position as shown in the figure (black arrow).
- 3 Place the reader on the trolley (see [Fig. 5-12](#), [Fig. 5-15](#)).



**Fig. 5-14** Mounting the guiding bracket

- |          |                 |
|----------|-----------------|
| <b>H</b> | Guiding bracket |
| <b>I</b> | Fixing screws   |
| <b>J</b> | Cutout          |
- 4 To mount the guiding bracket insert three T-nuts in the grooves of the lower aluminum profiles:
    - Two T-nuts into the left profile.
    - One T-nut into the rear profile.

- 5 Fix the guiding bracket to the profiles as shown in the figure.

- 6 Push the trolley with the reader along the bracket (D) into the cabinet compartment. Make sure the rear pin at the bottom of the trolley engages properly with the cutout (F) at the rear of the bracket.
- 7 Fix the trolley with the retaining pin.

**Connection,  
Setup and Test**

See cross-references at the beginning of this section.

**5.3.5 Installation on Worktable Extension**

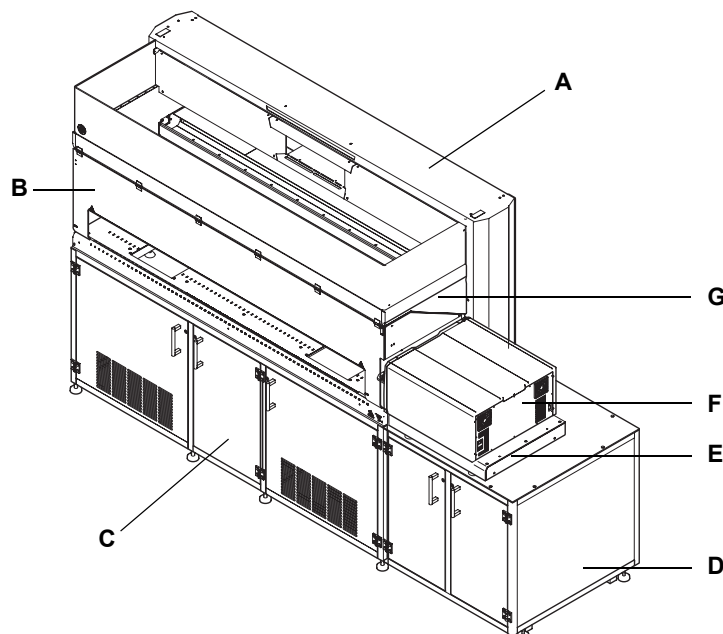
**Cross  
References**

List of cross-references to information provided in other sections:

Subject	Reference
Connection of the reader	See section 5.3.6, 5-24
Setups and tests	See section 5.3.7, 5-25
Parts for reader installation	See section 10.11, 10-13
Document “Order Configuration / Packing List for EVO Upgrades”	See section 1.1, 1-2

**Overview**

**Example  
with Safire<sup>2</sup>**



**Fig. 5-15** Installation of reader on worktable extension

- A** Instrument
- B** Front safety panel
- C** Cabinet
- D** External cabinet
- E** Worktable extension
- F** Reader
- G** Left side safety panel

### Prerequisites

The reader can only be installed on the worktable extension on the right side, if the instrument is equipped as follows:

- ◆ The front safety panel must have a cutout on the right side.
- ◆ A special side safety panel must be installed that allows the RoMa to access the reader.
- ◆ If the instrument is a Freedom EVO 200, a special (short) gas spring must be used on the right side.
- ◆ The right door lock must be installed in the rightmost grid position.

**Note:** The necessary parts can be ordered at Tecan. For further information see:

- Chapter “Spare Parts and Accessories”
- Document “Order Configuration / Packing List for EVO Upgrades”
- Refer to “Cross-References” at the beginning of this section.

### How to Proceed

Depending on the customer’s order configuration, there are two possible cases:

- ◆ If the instrument was ordered with a reader for installation on the worktable extension, the instrument was already equipped accordingly at Tecan. In this case, you can directly begin the with the installation according to section “Installing the Worktable Extension and the Reader”, ¶ 5-21.
- ◆ If the reader is to be added at a later time, the parts listed under “Prerequisites” (see above) must first be ordered at Tecan and installed according to the following section “Upgrading an Instrument”, ¶ 5-18.

### Upgrading an Instrument

#### Purpose

To prepare an instrument for installation of the reader on the worktable extension.

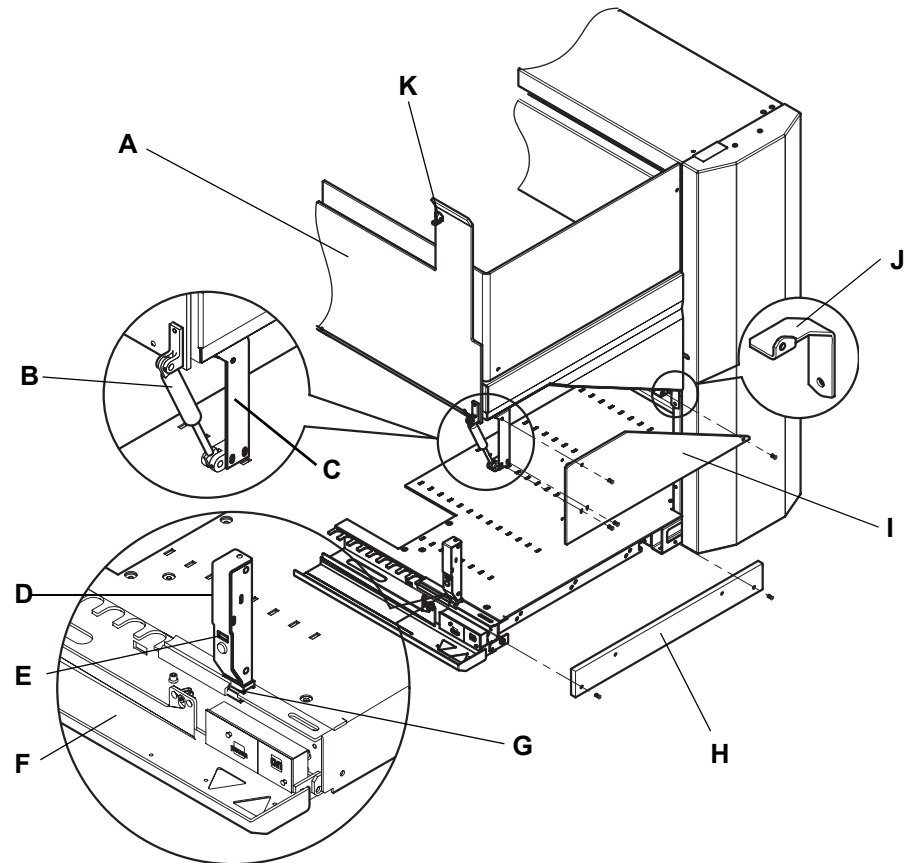
#### Procedure

To upgrade the instrument (also see also Fig. 5-16, ¶ 5-19.):

- 1 Open the front access panel (F).
- 2 Remove the original parts listed in the following table and replace or reinstall them according to the table.

**Tab. 5-2** Upgrading an instrument for installation of reader on worktable extension

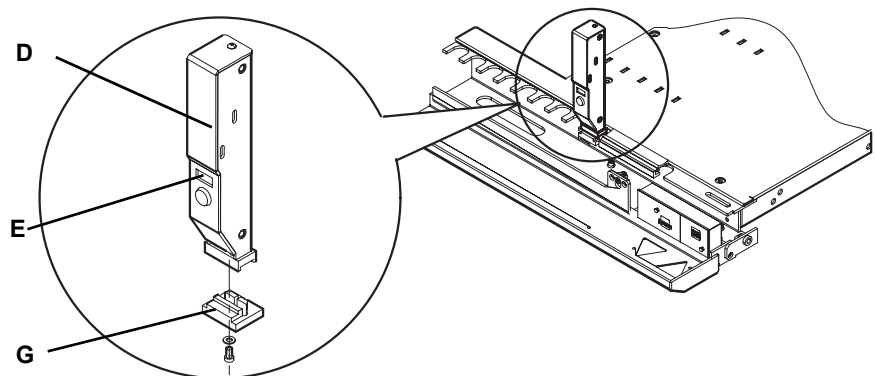
Remove original part...	Replace with...	Item
Front safety panel	Special front safety panel with cutout on right side	<b>A</b>
Gas spring right	Short gas spring (only Freedom EVO 200)	<b>B</b>
Front bracket	Special front bracket	<b>C</b>
Right door lock and clamp	Move door lock to rightmost grid position • Freedom EVO 100: Position 30 • Freedom EVO 150: Position 45 • Freedom EVO 200: Position 69	<b>D, G</b>
Right side cover	Intermediate plate (needed for fixing the worktable extension)	<b>H</b>
Right side safety panel	Small panel (allows RoMa to access reader). <b>Important:</b> Different panels for GENios Pro and Safire2 / Ultra !	<b>I</b>
Rear bracket	Special rear bracket (for fixing the side safety panel)	<b>J</b>



**Fig. 5-16** Upgrading an existing instrument

- |  |                                  |
|--|----------------------------------|
| <b>A</b> Front safety panel            | <b>G</b> Door lock clamp         |
| <b>B</b> Gas spring (only Freedom 200) | <b>H</b> Intermediate plate      |
| <b>C</b> Front bracket                 | <b>I</b> Right side safety panel |
| <b>D</b> Right door lock               | <b>J</b> Rear bracket            |
| <b>E</b> Slot in door lock             | <b>K</b> Door lock catch         |
| <b>F</b> Front access panel (open)     |                                  |

**Reinstall Door  
Lock in New  
Position**



**Fig. 5-17** Reinstalling the door lock

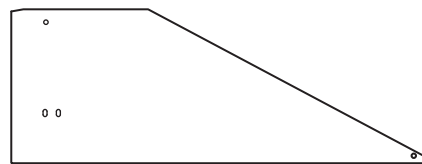
- 3 To move the door lock (D) from its original position to the rightmost grid position, proceed as follows (see previous figure):
  - Remove the door lock from its original position. Please note:
    - With new instruments (delivered as of January 2005), the door lock (D) is fixed to the original position with a simple screw. In this case, the upgrade kit contains a clamp (G) with which you can mount it in the new position.
    - If you are upgrading an earlier version of the instrument, the door lock is fixed to the original position with a clamp. In this case you can use this clamp for the reinstallation.
  - Reinstall the door lock in the rightmost grid position as shown in the figure:
    - Freedom EVO 100: Grid position 30
    - Freedom EVO 150: Grid position 45
    - Freedom EVO 200: Grid position 69

**Gas Spring  
(only Freedom  
EVO 200)**

- 4 No special adjustments required.

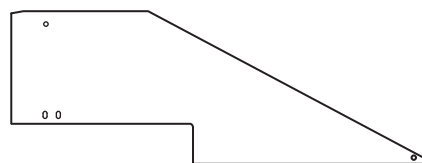
**Side Safety  
Panel**

- 5 Please note that the side safety panel depends on the reader type. Make sure that you install the correct panel.



Side safety panel for

- ◆ Safire<sup>2</sup>
- ◆ Ultra



Side safety panel for GENios Pro

**Fig. 5-18** Side safety panels

**Alignment of  
Front Safety  
Panel**

- 6 Pay attention to the following:
  - Ensure that the front safety panel is correctly aligned with the outer edge of the **left side safety panel** of the instrument (also see [Fig. 5-15](#), [Fig. 5-17](#)).
  - Mechanically check whether the door lock catches (K) fit correctly in the slots (E) of the door locks. Adjust the position of the door locks as necessary.
  - At the end of the installation you should perform the door lock test with the aid of the “Instrument Software”. See [5.3.7 “Setup and Tests”](#), [Fig. 5-25](#).

**Installing the Worktable Extension and the Reader**

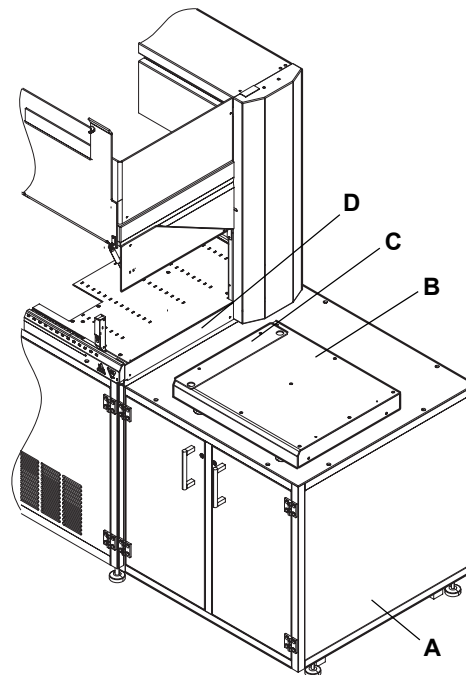
**Before You Start**

**Note:**

- *Make sure that the instrument is equipped for installation of the reader on the worktable extension.*
- *If necessary carry out the modifications according to paragraph “Upgrading an Instrument”, 5-18.*

**Procedure**

To install the reader on the worktable extension:

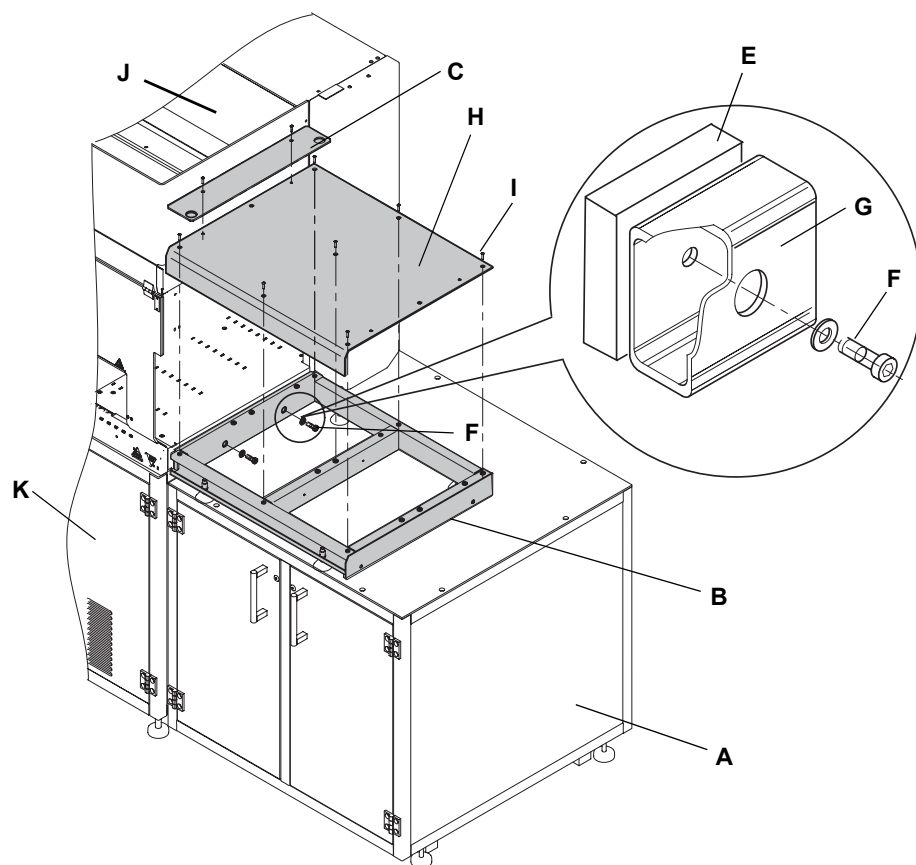


- A** External cabinet
- B** Worktable extension
- C** Adapter plate
- D** Right side cover

- 1** If not done yet, remove the right side cover (D) and replace it with the intermediate plate (E, see Fig. 5-20, 5-22).

**Fig. 5-19**

- 2** Place the worktable extension (B) on the external cabinet (A) (or on a suitable table).
- 3** If necessary, adjust the feet of the worktable extension until its surface is the same height as that of the instrument’s worktable. Make sure it is well aligned with the worktable. If necessary, use a spirit level.
- 4** Unscrew the cover of the worktable extension (H, see Fig. 5-20, 5-22).

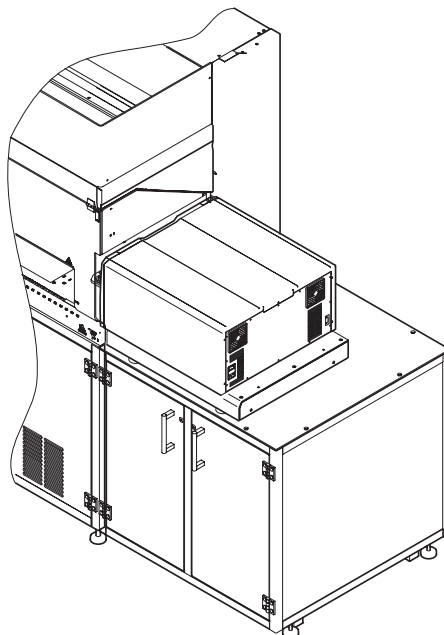


**Fig. 5-20** Installing the worktable extension

<b>A</b>	External cabinet	<b>G</b>	Profile
<b>B</b>	Worktable extension (chassis)	<b>H</b>	Cover of worktable extension
<b>C</b>	Adapter plate	<b>I</b>	Fixing screws for cover
<b>E</b>	Intermediate plate	<b>J</b>	Instrument
<b>F</b>	Fixing screws for worktable extension	<b>K</b>	Cabinet (beneath instrument)

- 5 Use the screws (F) together with their washers to fix the worktable extension (B) to the intermediate plate (E) on the right side of the instrument worktable. *It is a bit difficult to pass the screws (F) with the washers into the holes of the profile (G) without losing them in the profile. If possible use a magnetic Allen key to hold the screw.*
- 6 Reinstall the cover (H) and fix the adapter plate (C) to the worktable extension. Make sure that you use the correct adapter plate. *Remember that the various reader models require different adapter plates.*





- 7 Place the reader on the worktable extension when finished.

**Fig. 5-21** Reader on cabinet

**Connection,  
Setup and Test**

See cross-references at the beginning of this section.

### 5.3.6 Electrical Connection

**Cross  
References**

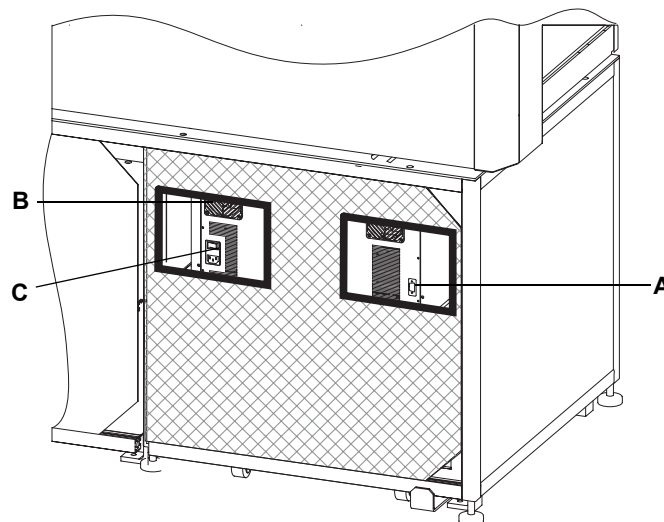
List of cross-references to information provided in other sections:

Subject	Reference
Setup and tests	See section <a href="#">5.3.7</a> , <a href="#">5-25</a>

**Connectors and  
Power Switch**

The elements for switching the reader on and off and for connecting it to the mains and the computer are arranged at the back.

- If the reader is installed on the worktable extension (see [Fig. 5-21](#), [5-23](#)) the power switch and the connectors are easily accessible.
- If the reader is installed in the left or right compartment of the cabinet, they are accessible through the openings in the grid at the rear side of the cabinet (see following figure).
- The power cord and the RS-232 communications cable for the connection to the computer are included in the delivery of the reader.



**Fig. 5-22** Electrical connection of the Safire<sup>2</sup> reader

- A** RS-232 connector
- B** Power on/off switch
- C** Socket for power cord

**Connection**

To connect the reader:

- 1 Connect the power cord to the reader and to a mains outlet.
- 2 Connect communications cable to the reader and to a RS-232 port of the computer.

**Setup and Test**

See cross-references at the beginning of this section.

### 5.3.7 Setup and Tests

**Software  
Installation,  
Configuration**

Refer to the reader's Technical Manual for detailed information about:

- ◆ The installation of the reader software.
- ◆ Setup of the communication between the reader and the computer:
- ◆ Further configuration.

**Door Lock Test**

If it was necessary to replace the front safety panel, it is strongly recommended that you perform the door lock test. Refer to the Instrument Software Manual, "Access Status Options" for details.

**Set up RoMa  
for Access to  
Reader**

The access of the RoMa to the reader must be set up the application software (e.g. EVOware).

## 5.4 Lower DiTi Eject Option

To upgrade the instrument with the lower DiTi eject option, refer to [8.8.3 "Lower DiTi Eject Option"](#), [8-47](#).

## 5.5 I/O Option

To upgrade the instrument with the I/O option, refer to the separate Operating Manual of the I/O option.



## 6 Maintenance

### Purpose of This Chapter

This chapter gives instructions on all extended maintenance work to be performed in order to keep the Freedom EVO in a perfect working condition or to restore it to a state in which it maintains the specified performance.

### 6.1 Tools and Consumables

#### 6.1.1 Tools

To perform the tests, the following tools or additional material is needed:

- ◆ Precision balance (for gravimetric test)

*Note: To perform the tests, the Setup & Service software is used.*

#### 6.1.2 Cleaning Agents

According to the degree of contamination, the following cleaning agents are suitable for cleaning the parts of the Freedom EVO:

#### Suitable Cleaning Agents

- ◆ Water
  - Distilled or de-ionized water.
- ◆ Alcohol
  - 70% ethanol
  - 70% 2-Propanol (isopropanol).
- ◆ Bleach
  - Bleach solution (up to 6% NaOCl)
- ◆ Detergents
  - Mild detergent
  - Special detergents like Roboscrub® (order from Tecan US) or
  - CLEAN-SYSTEM
    - Daily System Clear: To clean the system daily
    - Setup Clean: To clean contaminated systems
    - Protolyse: To clean the system from proteins
    - Carrystop: Against carryover



#### ATTENTION

Strong detergents may dissolve carrier and worktable surface coatings. Use only cleaning agents that are recommended by Tecan.

- ◆ Tissues
  - Use lint-free tissues only.

### 6.1.3 Lubricants

The following table lists the suitable lubricants used for the Freedom EVO:

**Tab. 6-1** Lubricants

Lubricant	Point of lubrication
Hettich grease No. 4051	Centrifuge hangers
Klübersynth UH1 14-151	LiHa Z-axis (Z-racks)
Klüberplex BEM 34-123	X-axis (X-rail), P&P (Y-casing cover)

## 6.2 Maintenance Schedule

### Maintenance Record

**Note:** In order to be able to track all maintenance performed on the Freedom EVO over the whole lifetime, the periodic maintenance must be recorded as follows:

- Fill in the necessary data in the form “Preventive Maintenance Checklist”.
- File the form in the logbook of the Freedom EVO.

### Maintenance Tables

The maintenance tables are divided according to the frequency the corresponding maintenance task must be periodically performed. For example, there are tables for:

- ♦ Daily maintenance
- ♦ Weekly maintenance
- ♦ Half-yearly maintenance

### Example and Explanations

Example for a maintenance table, followed by explanations:

**Tab. 6-2** Example (e.g. daily maintenance)

Instrument/Component	Maintenance Task	Reference
Part A	Clean thoroughly	Water with weak detergent
Part B	Check adjustment of component C	Refer to section <a href="#">X.X.X</a> , <a href="#">Y-Z</a>

- ♦ Instrument/Component
  - Specifies the instrument or one of its individual components on which a maintenance task must be performed.
- ♦ Maintenance Task
  - States briefly what maintenance must be performed on the instrument/ component mentioned before.
- ♦ Reference
  - Gives additional information, e.g. on means, tools, etc. that are necessary to perform the maintenance task mentioned before.
  - Contains references to the sections in this manual or to other documents where the corresponding instructions can be found.

**Note:** For maintenance tasks on the options refer to the Service Manual of the respective option.

### 6.2.1 Maintenance Table: Basic Tasks to Be Performed

**Every Time  
when  
Maintenance  
Work is  
Performed**

*Tab. 6-3 Basic maintenance*

Instrument/Component	Maintenance Task	Reference
Complete Freedom EVO	Decontaminate system	Consult the Freedom EVO Operating Manual

### 6.2.2 Maintenance Table: Half-Yearly Maintenance

**Every Half Year**

*Tab. 6-4 Half-yearly maintenance*

Instrument/Component	Maintenance Task	Reference
Complete Freedom EVO	Clean system	See section 6.3.1, 6-5
	Print out system information	Refer to “Instrument Software Manual”
Frontal arm guide	Clean	See section 6.3.2, 6-5
DiTi cone and tubing extension	Replace <sup>a)</sup>	See section 6.3.1, 6-5
RoMa; Z-rod	Clean	See section 6.3.2, 6-5
PnP, Y and Z-belts	Visually inspect belts for wear. Replace faulty belts.	See section 8.10.5, 8-90

a) every 6 months or after 250000 Z-moves

### 6.2.3 Maintenance Table: Yearly Maintenance

**Every Year**

*Tab. 6-5 Yearly maintenance*

Instrument/Component	Maintenance Task	Reference
Liquid system, diluters	Replace syringe <sup>a)</sup>	See section 8.15.5 “Diluters”, 8-154
Liquid system, diluters	Replace 3-way valve <sup>a)</sup>	See section 8.15.5 “Diluters”, 8-154
LiHa	Replace tips	Consult the Freedom EVO Operating Manual
LiHa; liquid detection	Replace ILID cables	See section 8.7.5 “Electronic Boards and Cables”, 8-29

**Tab. 6-5** Yearly maintenance

Liquid system	Replace aspirating tubing	See section 8.15.2 "Tubing System", 8-142
Liquid system	Replace interconnecting tubing	See section 8.15.2 "Tubing System", 8-142
Liquid system	Replace pipetting tubing	See section 8.7.3 "Complete LiHa Arm", 8-23
Liquid system	Replace waste tubing	See section 8.15.2 "Tubing System", 8-142
LiHa; Z-rod	Clean and apply very thin layer of grease	See section 6.1.3 "Lubricants", 6-2
X-rail	Clean and apply thin layer of grease	See section 6.1.3 "Lubricants", 6-2
Centrifuge	Perform the imbalance test	See section 6.3.3.1 "Imbalance Test", 6-6
Centrifuge	Carry out the speed calibration	See section 6.3.3.2 "Speed Calibration", 6-7
Centrifuge	Carry out the temperature calibration	See section 6.3.3.3 "Temperature Calibration", 6-9
Complete Freedom EVO	Perform tests according to form "Operation Qualification"	Refer to the "Freedom EVO Maintenance and Service Log-book"

a) every year or after 1 million moves

### 6.2.4 Maintenance Table: Special Intervals

**Every Three Years**

Perform the following maintenance jobs every three years or after service:

**Tab. 6-6** Maintenance; special intervals

Instrument/Component	Maintenance Task	Reference
Centrifuge Rotana 46 / Rubber-metal bearings	Check for cracks; replace, if necessary	Consult separate documentation of centrifuge



## 6.3 Maintenance Tasks

### 6.3.1 Cleaning the System

**How to Clean**


Pay attention to the following table:

Instrument Part	Cleaning Agent
Liquid system, waste system	Water, alcohol, mild detergent
Worktable	Alcohol, mild detergent, bleach
Casing	Alcohol
Metal parts	Alcohol
Carriers	Alcohol, mild detergent, bleach
Racks	Alcohol, mild detergent, bleach
Tips	Alcohol, bleach solution (up to 6% NaOCl)
Disposable tip cones	Alcohol
PosID scanner head laser beam output window	Alcohol

### 6.3.2 Cleaning Parts of the Arms

**How to Clean**

Pay attention to the following table:

Instrument Part	Cleaning Agent
Frontal arm guide, arm guide roller of LiHa and RoMa Standard, Long, P&P	Lint-free cloth (do not use any agent)
Z-drive rod RoMa Standard, Long	Lint-free cloth (do not use any agent)
Square shaft LiHa	Lint-free cloth (do not use any agent)
Y-square bar LiHa	Lint-free cloth (do not use any agent). Remove side covers of LiHa as described in <a href="#">8.7.3 "Complete LiHa Arm"</a> ,  8-23.

### 6.3.3 Centrifuge

#### 6.3.3.1 Imbalance Test

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Pull centrifuge out	See section 8.14.2,  8-134
Adjust imbalance switch	See section 8.14.6,  8-140

Carry out this test using controls and display of the centrifuge. Proceed as follows:

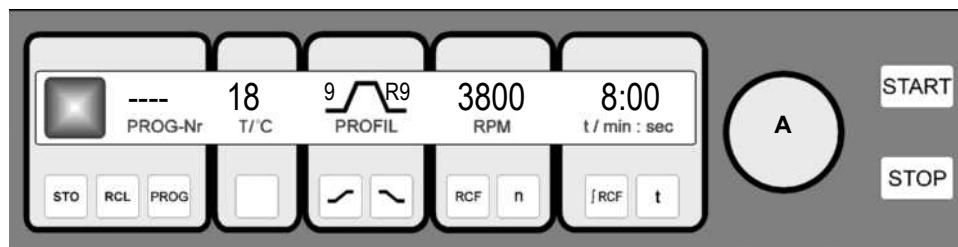
- 1 Pull centrifuge out from under the instrument.  
Refer to cross references above.



**Fig. 6-1** Centrifuge key switch

- 2 Turn key to mid-position.  
*No "LOCK" message on the display.*

- 3 Setup the centrifuge as follows:
  - Press corresponding button.
  - Turn adjusting knob (A):



**Fig. 6-2** Imbalance test, setup

- 4 Open lid, put a deep-well MP with a total weight of 30 g in bucket #1. Close lid.
- 5 Press **START**. Observe Speed (RPM) display. As soon as 2000 is exceeded, press **STOP**.  
*There should be no **IMBALANCE** message.*  
*If there is an **IMBALANCE** message, adjust the imbalance switch.*  
*Refer to cross references above.*

- 6 Repeat step 4 with deep-well MP in bucket #2.
- 7 Repeat step 4 with deep-well MP in bucket #3.
- 8 Repeat step 4 with deep-well MP in bucket #4.
- 9 Carry out steps 4 to 8 using a deep-well MP with a total weight of 45 g.  
**IMBALANCE** must be displayed.  
*If no **IMBALANCE** message appears, adjust the imbalance switch. Refer to cross references above.*

**6.3.3.2 Speed Calibration**

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Perform temperature calibration	See section 6.3.3.3, 6-9

**Required tools**

To measure the centrifuge speed you need the following tool:

- ♦ Stroboscope (e.g. MOVISTROB MS-2000 N/D-WP from GEHAG Elektronik AG, Switzerland)

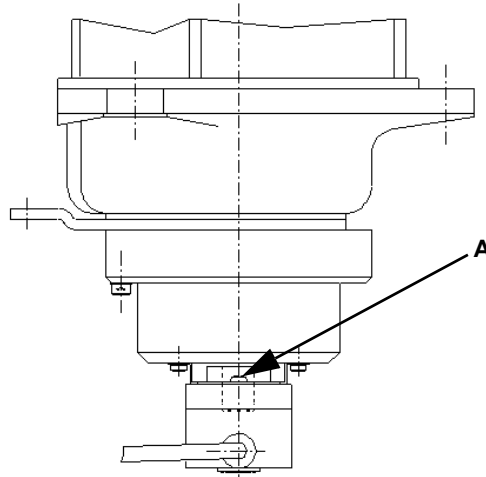
**Measuring Procedure**

To measure the centrifuge speed, proceed as follows:

- 1 Set centrifuge speed to 3500 RPM.
- 2 Start centrifuge.
- 3 Set the strobe's flash rate to the centrifuge speed (3500 RPM).
- 4 From behind the instrument, point the stroboscope through the wire screen at the collet chuck (the only rotating part visible).



**Fig. 6-3** Stroboscope



*In the strobe light, the collet chuck (A) seems to slowly rotate.*

- 5** Adjust the flash rate in such a way that the collet chuck seems to stand still.

**Fig. 6-4** Collet chuck

- 6** Compare the centrifuge RPM with the flash rate. The permissible deviation is  $\pm 3\%$ .

*Example:*

*Set centrifuge RPM = 3500. Measured RPM (= flash rate) must be between 3395 and 3605.*

- 7** If the measured centrifuge RPM is not within the  $\pm 3\%$  tolerance, replace the tacho and check RPM.  
For information on how to replace the parts, refer to the separate documentation of the centrifuge.
- 8** If still not within tolerance, replace the control panel c/w display, the keyboard and the EPROM and check RPM.  
For information on how to replace the parts, refer to the separate documentation of the centrifuge.
  - If OK, perform the temperature calibration procedure.  
Refer to cross references above.
- 9** If still not within tolerance, replace encoder and check RPM.  
For information on how to replace the parts, refer to the separate documentation of the centrifuge.
- 10** If still not within tolerance, replace the frequency converter and check RPM.  
For information on how to replace the parts, refer to the separate documentation of the centrifuge.
- 11** If still not within tolerance, replace the centrifuge or contact the Tecan Customer Service.

6.3.3.3 Temperature Calibration

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Pull centrifuge out	See section 8.14.2, 8-134
Replace temperature sensor	See section 8.14.4, 8-135

**Required tools**

To measure the centrifuge speed you need the following tool:

- ◆ Precision Thermometer (calibrated)

**OFFSET Adjustment**

An OFFSET adjustment is performed to adjust the temperature sensors, the supply board electronics and the control panel electronics to one another. If one of the temperature sensors, the supply board, or the control panel has been replaced, an adjustment must be performed in any event.

The OFFSET adjustment for the following temperature sensors is carried out in the control panel:

- ◆ B1 = Temperature sensor in lid gasket
- ◆ B2 = Temperature sensor in centrifuge chamber
- ◆ B3 = Temperature jumper on condenser

For the OFFSET adjustment, the temperature must, at each temperature sensor, be ascertained with a temperature measuring instrument. If the temperature of the centrifuge is identical to the room temperature, the temperature at the wall of the centrifuge chamber can be measured for B2. The temperature values indicated in the display must now be corrected to agree with the individual measured values given by the temperature measuring instrument.

Each correction must be confirmed with the **START** key.

**Preparation**

Prepare the centrifuge as follows:

- 1 Requirements:
  - Rotor has stopped.
  - Lid is unlocked.
  - Mains switch is OFF.
- 2 Pull centrifuge out from under the instrument.
- 3 Remove control panel.
- 4 Move jumper on coding strip of supply board from the B0-B1 factory setting to the B0 OFFSET position as shown in the figure:

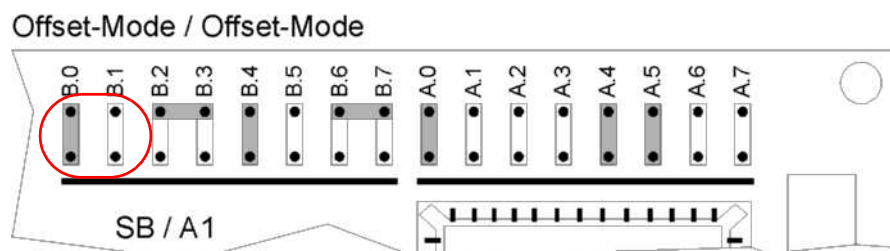


Fig. 6-5 Jumper setting for offset mode




## OFFSET Value

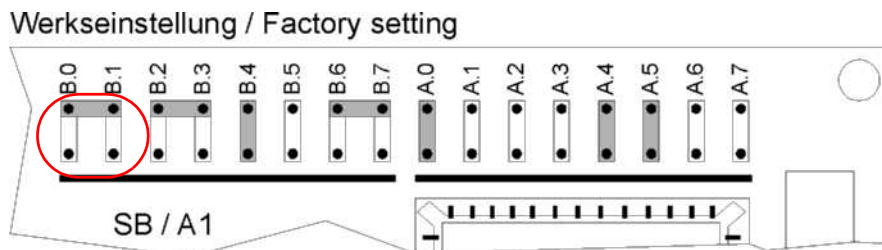
The OFFSET value is the difference between the actual temperature and the sensor temperature.

Example:    Actual temperature    - sensor temperature    = OFFSET value  
                 25.5 °C                    - 27.0 °C                    = -1.5 °C

## OFFSET Adjustment

Procedure for performing an OFFSET adjustment:

- 1 Switch mains switch ON.  
*Display: \* OFFSET - MODE \**
- 2 When the  symbol is flashing:
  - Open the lid.
- 3 Press the  key.  
*Two temperature readings, and the particular allocation of the temperature sensor (B1 - B3), appear in the display.*
  - Left reading
    - Sensor value (e.g. T1 = 27.0°C)
  - Right reading
    - Actual temperature (e.g. 25.5°C)
- 4 Adjust the actual temperature (right reading) with the adjusting knob to make it agree with the temperature measured with the thermometer.
- 5 Press the **START** key.  
*Confirmation of temperature settings. If the temperature settings are not confirmed by pressing the **START** key, the old settings will be maintained.*  
*Display: \*\*\* OK \*\*\**
- 6 Press the  key.  
*Display changes to temperature setting for the next temperature sensor.*
- 7 Repeat steps 3 and 6 until all the temperature sensors B1 - B3 (T1 - T3) have been aligned.
- 8 Switch mains switch OFF.
- 9 Move jumper on coding strip of supply board from the B0 OFFSET position to the B.0-B.1 factory setting as shown in the figure:



**Fig. 6-6** Jumper position for factory setting

**Note:** If the adjustment of the offset is not possible, replace the corresponding temperature sensor.  
Refer to cross references above.

**6.3.3.4 Hatch Check**

**Manual Mode**

This check is performed in manual mode. It serves to watch the opening and closing of the centrifuge's loading hatch.

To change to manual mode and perform the check, proceed as follows:



- 10** Turn key counterclockwise to “Lock 1” position.
- 11** Press the **RCL** key on the control panel to open the hatch.
- 12** Press the **STO** key on the control panel to close the hatch.

**Fig. 6-7** Centrifuge key switch





# 7 Troubleshooting

**Purpose of This Chapter**

This chapter helps to resume operation of the Freedom EVO after a problem has occurred which cannot be eliminated by the operator. The troubleshooting tables list possible occurrences, their probable cause and suggest how to remedy the problem.

**Errors to Be Corrected by the FSE**

The troubleshooting table below gives supplementary information to the troubleshooting table in the “Freedom EVO Operating Manual”. It only lists malfunctions and errors of the Freedom EVO which cannot be eliminated by the operator him/herself.

**Note:** Also refer to the troubleshooting table in the “Freedom EVO Operating Manual”.

The corrective measures listed in the column “Corrective measures” enable the FSE to eliminate the problems or errors.

## 7.1 Troubleshooting Table

**Troubleshooting by the FSE**

The following table lists problems and errors and instructs how to eliminate them.

Tab. 7-1 Troubleshooting table

Problem / error	Possible cause	Corrective measures
<b>Instrument level</b>		
Initialization error	Obstacles present in the range of the axes	Remove obstacles
	No communication Hardware defective	Reboot system Check for error messages Check PCBs and replace, if necessary
Front safety panel is not unlocked	Mechanical failure of the door locks	Check door locks and replace, if necessary
Front safety panel is not locked	Mechanical failure of the door locks	Check door locks and replace, if necessary
Positioning error	X, Y or Z-drive mechanics blocked	Check drives and replace defective components
PCBs: Green status LED flashes quickly (See <a href="#">7.2.1 “Status LEDs on PCBs”</a> , 7-10)	No valid firmware installed Download in progress	Download valid firmware version Wait until download is finished

**Tab. 7-1** Troubleshooting table (cont.)

Problem / error	Possible cause	Corrective measures
PCBs: Green status LED flashes 4 times short and once long (See <a href="#">7.2.1 "Status LEDs on PCBs"</a> , ¶ 7-10)	CAN bus error; e.g. termination incorrect, PCB defective, etc.	Check CAN bus termination Replace PCB, if necessary
PCBs: Gate board: Both status LEDs are lit; red status LED flickers	Incorrect firmware on device Gate board or flash EPROM defective	Download valid firmware version Replace gate board or flash EPROM, if necessary
PCBs: Status LEDs remain dark	Power supply to PCB interrupted Hardware defective	Check power supply lines Replace PCB
PCBs: Status LEDs are continuously lit	Hardware defective	Replace PCB
<b>LiHa and liquid handling system</b>		
No response from LiHa	Fuse blown	Check fuses on the OPTIBO DCU and replace, if necessary (see <a href="#">7.2.2 "Power LEDs on Optibo DCU"</a> , ¶ 7-11)
	Device CU board defective	Replace device CU board
	Poor connection to LiHa	Check cable connection between the OPTIBO DCU and the LiHa 1536 backplane; replace defective components
DiTi ejection erroneous	Tip adapter not clean	Clean tip adapter with air
	Tip adapter defective	Replace tip adapter
Lower DiTi eject option: DiTi ejection erroneous	Poor mechanical adjustment of lower DiTi eject option	Perform lower DiTi eject test (refer to the Instrument Software Manual); readjust according to <a href="#">8.8.3 "Lower DiTi Eject Option"</a> , ¶ 8-47
	Solenoid defective	Replace solenoid
	Poor connection of lower DiTi eject option	Check cable connection between the lower DiTi eject option and the LiHa 1536 backplane; replace defective components
LiHa X-axis accuracy/ alignment bad	Improper setup/teaching	Check reference positions and scaling factor
	Improper adjustment of X-drive	Readjust according to <a href="#">8.6.2 "X-Drive Assembly"</a> , ¶ 8-17
LiHa X-axis hardware failure	Poor connection of X-motor	Check cable connection between X-drive assembly and the LiHa 1536 backplane; replace defective components


**Tab. 7-1** Troubleshooting table (cont.)

Problem / error	Possible cause	Corrective measures
	DC servo power board defective	Replace DC servo power board
	Motor defective	Replace motor
	X-belt worn	Replace X-belt or X-drive assembly
	X-drive incorrectly adjusted	Check the distance between the X-rack and the X-drive assembly according to <a href="#">8.6.2 “X-Drive Assembly”</a> , <a href="#">8-17</a>
LiHa Y-axis accuracy/alignment bad	Improper setup/teaching	Check reference positions and scaling factor
LiHa Y-axis hardware failure	Belt drive problem	Check the tension of the Y-belt Check the set screws of the drive pulleys on the motor shaft; replace belt, if necessary
	Ball bearing defective	Check ball bearings and replace, if necessary
	Poor connection of Y-motors	Check cable connection between the Y-motors and the LiHa 1536 backplane; replace defective components
	DC servo board defective	Swap DC servo boards of the same type to find a faulty one
	Motor defective	Replace motor
LiHa Z-axis accuracy/alignment bad	Improper setup/teaching	Check Z-axis setup; absolute Z; adjust Z-axis offset or tip type length; check tip configuration
LiHa Z-axis hardware failure	Z-drive couplings loose	Check the set screws of the drive pulleys on the motor shaft
	Z-drive couplings defective	Replace Z-drive couplings
	Poor connection of Z-motors	Check cable connection between the Z-motors and the LiHa 1536 backplane; replace defective components
	DC servo board defective	Swap DC servo boards of the same type to find a faulty one
	Motor defective	Replace motor
Liquid detection: Tip does not detect liquid	DiTi cone loose	Tighten DiTi cone
	O-rings worn	Replace O-rings
	LiHa, X-, Y-, and Z-setup incorrect	Perform setup (refer to Instrument Software Manual)

**Tab. 7-1** Troubleshooting table (cont.)

Problem / error	Possible cause	Corrective measures
	Tip adapter defective	Replace tip adapter
	ILID cable defective	Replace ILID cable
	ILID integrated circuit defective	Replace ILID integrated circuit
	ILID Freedom protected board defective	Replace ILID Freedom protected board
	Poor connection between PCBs	Check cable connection between the ILID Freedom protected board and the LiHa 1536 backplane; replace defective components
	Electromagnetic “noise” from power supply, UPS, or other sources	Eliminate the source of the radiation
Precision (gravimetric) test failed	Dirty tips, kinked tubing, loose connections	Check the complete liquid handling system
	Air bubbles in tubing	Check the complete liquid handling system
Air bubbles in tubing	Diluter (bypass valve) leaking	Replace valve
Drop forming at tip after aspirating	DiTi cone loose	Tighten DiTi cone
One diluter failing	Electronics error; status LED not blinking (see <a href="#">7.2.1 “Status LEDs on PCBs”</a> , ¶ 7-10).	Check connections to VCC DILBACK board; replace diluter
	Address setting incorrect	Check address setting and correct, if necessary
	Tubing kinked, valve blocked	Check tubing and valve; replace, if necessary
	Syringe or valve leaking	Replace valve/syringe
	Syringe plunger does not move or valve does not close/open	Replace valve/diluter
Diluters failing	Fuse blown	Check fuses on the OPTIBO DCU and replace, if necessary (see <a href="#">7.2.2 “Power LEDs on Optibo DCU”</a> , ¶ 7-11)
	Poor connection to diluters	Check cable connection between the OPTIBO DCU and the VCC DILBACK board and replace defective components
<b>RoMa</b>		

**Tab. 7-1** Troubleshooting table (cont.)

<b>Problem / error</b>	<b>Possible cause</b>	<b>Corrective measures</b>
No response from RoMa	Fuse blown	Check fuses on the OPTIBO DCU and replace, if necessary (see 7.2.2 “Power LEDs on Optibo DCU”,  7-11)
	Device CU board defective	Replace device CU board
	Address setting incorrect	Check address setting and correct, if necessary
	Poor connection to RoMa	Check cable connection between the OPTIBO DCU and the RoMa Freedom backplane; replace defective components
Rotator accuracy/alignment bad	Improper setup	Check rotator setup/teaching
Rotator hardware failure	Poor connection of R-motor	Check cable connection between the R-motor and the gripper board; replace defective components
	Poor connection between PCBs	Check cable connection between the gripper board and the RoMa2 backplane; replace defective components
		Check cable connection between the RoMa2 backplane and the RoMa Freedom backplane; replace defective components
	Y/R-DC servo board defective	Replace Y/R-DC servo board
	Motor defective	Replace motor
	Address setting incorrect	Check address setting and correct, if necessary
	R-motor defective	Replace R-motor
Gripper accuracy/alignment bad	Improper setup	Check gripper setup/teaching
Gripper hardware failure	Poor connection of gripper motor	Check cable connection between the gripper motor and the gripper board; replace defective components
	Poor connection between PCBs	Check cable connection between the gripper board and the RoMa2 backplane; replace defective components

**Tab. 7-1** Troubleshooting table (cont.)

Problem / error	Possible cause	Corrective measures
		Check cable connection between the RoMa2 backplane and the RoMa Freedom backplane; replace defective components
	Z/G DC servo board defective	Replace Z/G-DC servo board
RoMa Y-axis accuracy/alignment bad	Improper setup/teaching	Check reference positions, scaling factor, teaching, Y-alignment
RoMa Y-axis hardware failure	Belt drive problem	Check the tension of the Y-belt Check the set screws of the drive pulleys on the motor shaft; replace belt, if necessary
	Poor connection of Y-motor	Check cable connection between the Y-motor and the RoMa2 backplane; replace defective components
	Poor connection between PCBs	Check cable connection between the RoMa2 backplane and the RoMa Freedom backplane; replace defective components
	Y/R-DC servo board defective	Replace Y/R-DC servo board
	Motor defective	Replace motor
RoMa Z-axis accuracy/alignment bad	Improper setup/teaching	Check setup for the Z-axis, teaching
RoMa Z-axis hardware failure	Poor connection of Z-motor	Check cable connection between the Z-motor and the RoMa2 backplane; replace defective components
	Poor connection between PCBs	Check cable connection between the RoMa2 backplane and the RoMa Freedom backplane; replace defective components
	Z/G-DC servo board defective	Replace Z/G-DC servo board
	Motor defective	Replace motor
RoMa Z-brake failure	Poor adjustment of brake shoe	Readjust according to section <a href="#">8.9.16 "Z-Brake"</a> , <a href="#">8-77</a>
	Poor connection or Z-brake	Check cable connection between the Z-brake and the RoMa2 backplane; replace defective components
	Poor connection between PCBs	Check cable connection between the RoMa2 backplane and the RoMa Freedom backplane; replace defective components

**Tab. 7-1** Troubleshooting table (cont.)

<b>Problem / error</b>	<b>Possible cause</b>	<b>Corrective measures</b>
	Z/G-DC servo board defective	Replace Z/G-DC servo board
	Z-brake defective	Replace Z-brake
RoMa X-axis accuracy/ alignment bad	Improper setup/teaching	Check reference positions and scaling factor
RoMa X-axis hardware failure	Poor connection of X-motor	Check cable connection between X-drive assembly and the RoMa Freedom backplane; replace defective components
	DC servo power board defective	Replace DC servo power board
	Motor defective	Replace motor
	X-belt worn	Replace X-belt or X-drive assembly
<b>P&amp;P</b>		
No response from P&P	Fuse blown	Check fuses on the OPTIBO DCU and replace, if necessary (see 7.2.2 "Power LEDs on Optibo DCU", 7-11)
	Poor connection between PCBs	Check cable connection between the P&P backplane and the gate board; replace defective components
P&P X-axis accuracy/ alignment bad	Improper setup/teaching	Check reference positions and scaling factor
P&P X-axis hardware failure	Poor connection of X-motor	Check cable connection between X-drive assembly and the P&P backplane; replace defective components
	DC servo power board defective	Replace DC servo power board
	Motor defective	Replace motor
Excessive play in rotator or gripper	Screws at motor shaft or couplings loose	Tighten screws
	Screws at Z-axis to gripper head adapter loose	Tighten screws
Gripper head crashes onto worktable	Set screw fixing coupling to shaft loose	Tighten set screw
Recurring error message "tube not fetched"	Gripper fingers bent/defective	Replace fingers / teach tube diameter
	Mechanical play in gripper head	Replace gripper head
<b>PosID</b>		

**Tab. 7-1** Troubleshooting table (cont.)

Problem / error	Possible cause	Corrective measures
No response from PosID	Fuse blown	Check fuses on the OPTIBO DCU and replace, if necessary (see 7.2.2 “Power LEDs on Optibo DCU”, 7-11)
	Poor connection between PCBs	Check cable connection between the Pos ADA board and the CU PosID board; replace defective components
		Check cable connection between the CU PosID board and the OPTIBO DCU board; replace defective components
PosID X-axis hardware failure	Belt drive problem	Check the tension of the X-belt; replace, if necessary
	Poor connection of X-motor	Check cable connection between the X-motor and the Pos ADA board; replace defective components
	DC servo board defective	Replace DC servo board
	Motor defective	Replace motor
PosID Y-axis hardware failure	Gap between worktable and release finger incorrectly adjusted	Adjust gap to 0.2 mm (distance between worktable surface and release finger)
	Gap between PosID service rack and gripper pin incorrectly adjusted	Adjust gap to 0.5 mm (distance between PosID service rack and gripper pin)
	Belt drive problem	Check the tension of the Y-belt; replace, if necessary
	Poor connection of Y-motor	Check cable connection between the Y-motor and the Y/B board; replace defective components
	Poor connection between PCBs	Check cable connection between the Y/B board and the Pos ADA board; replace defective components
		DC servo board defective
	Motor defective	Replace motor
Tube sensor failure	Poor connection of “No tube sensor”	Check cable connection between the “No tube sensor” and the Y/B board; replace defective components



**Tab. 7-1** Troubleshooting table (cont.)

<b>Problem / error</b>	<b>Possible cause</b>	<b>Corrective measures</b>
	Poor connection between PCBs	Check cable connection between the Y/B board and the Pos ADA board; replace defective components
	“No tube sensor” defective	Replace “No tube sensor”
Barcode reading error	Lock pin on the worktable defective or missing	Check lock pins and replace, if necessary
	Poor mechanical adjustment of barcode reader	Perform setup of PosID (refer to the Instrument Software Manual)
	Poor connection of barcode reader	Check cable connection between the barcode reader and the Y/B board; replace defective components
	Poor connection between PCBs	Check cable connection between the DSP board and the Y/B board; replace defective components
		Check cable connection between the Y/B board and the Pos ADA board; replace defective components
	Barcode reader defective	Replace barcode reader
B-axis hardware failure	Poor connection of B-motor	Check cable connection between the B-motor and the Y/B board; replace defective components
	Poor connection between PCBs	Check cable connection between the Y/B board and the Pos ADA board; replace defective components
	DC servo board defective	Swap DC servo boards of the same type to find a faulty one
	B-motor defective	Replace B-motor
<b>FaWa Option</b>		
FaWa pump test failed	Clogged tips	Declog tips, clean liquid system
	Kinked tubing	Check tubing and rearrange, if necessary
	Pressure relief valve defective	Check pressure relief valve and replace, if necessary
	Diluter valve defective	Check diluter valve and replace, if necessary
	FaWa pump defective	Replace FaWa pump

## 7.2 Troubleshooting Instructions

### 7.2.1 Status LEDs on PCBs

#### PCB With Red and Green LED

The red and the green status LED on the PCBs with two LEDs indicate the following states:

Tab. 7-2

Green LED	Red LED	Status	Error correction
Flashing slowly (2/sec)	Remains dark	Normal operation, no error	-
Remains dark	Remains dark	No power supply	Check power supply
Remains dark or continuously lit	Remains dark or continuously lit	Fatal hardware error	Replace defective PCB
Flashing slowly (2/sec)	Continuously lit	Flash EPROM not accessible	Replace PCB
Flashing slowly (2/sec)	Flashing slowly (2/sec)	"Power fail" circuit failure	Check power supply/connections
Alternated fast flashing (4/sec)	Alternated fast flashing (4/sec)	Boot mode	Requires firmware download






This applies to the following PCBs:

- ◆ Gate board
- ◆ CU PosID board

#### PCB With One Green LED

The green status LED on the PCBs with one single LED indicates the following states:

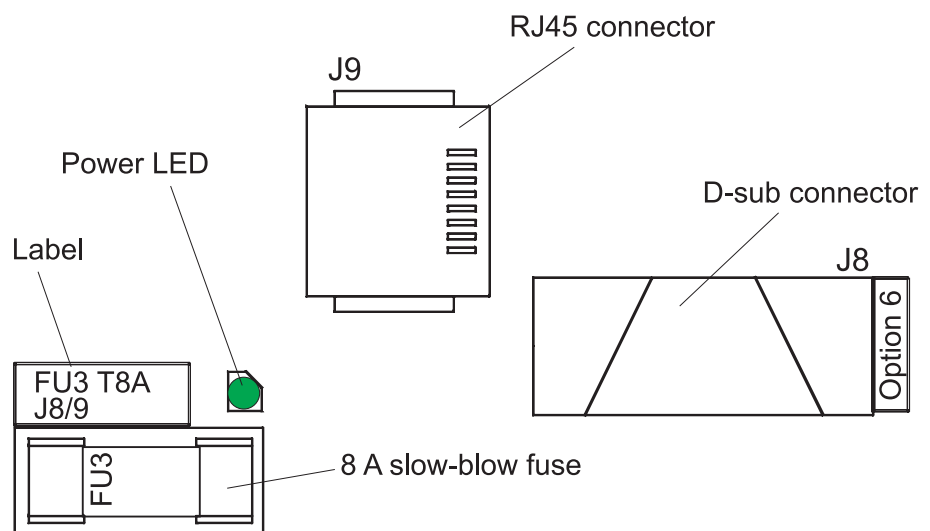
Tab. 7-3 Status LED

Symbol	Mode	Status	Error correction
	Flashing 1/sec	Normal operation, no error	-
	Flashing 5/sec	No valid firmware loaded	Download valid firmware version
	Flashing 4 times short/once long	CAN bus error	Check CAN bus termination
	Dark	No power supply or hardware defective	Check power supply Replace defective PCB
	Continuously lit	Hardware defective	Replace defective PCB

### 7.2.2 Power LEDs on Optibo DCU

The power LEDs on the Optibo DCU indicate if the respective CAN bus connector group is fed with energy. If the LED does not light, check the corresponding fuse on the board.

The figure shows a group of CAN bus supply elements and connectors. Several of such CAN bus connector groups can be found on the Optibo DCU:



**Fig. 7-1** Example of a group of elements on the Optibo DCU

**Note:** The label indicates the connectors the fuse and power LED refers to.

- Always use the correct fuse type for replacement.

Fuse rating on the Optibo DCU: 8 A slow-blow type.



#### ATTENTION

Damage to the equipment possible, if fuses with low breaking capacity are used. Use the original ceramic type fuses only.



# 8 Repair

**Purpose of This Chapter**

This chapter instructs how to carry out adjustment and repair work to restore the Freedom EVO to its original condition after a failure has occurred or if the specified performance is not met anymore.

## 8.1 General Notes on Repair

*Note: Please read these instructions before carrying out any repair job.*

### 8.1.1 Electrical Safety

**Switch Instrument Off!**

Unless the instructions explicitly state that the instrument must be running, switch the instrument off and unplug the power cord before performing any maintenance or repair job.

**Setups and Tests**

When setups and tests need to be performed by means of a software tool, the running state of the instrument is not explicitly mentioned in the repair instructions. In this case, however, make sure that all safety-relevant elements, such as covers and safety panels, etc. are in place before you start the test.

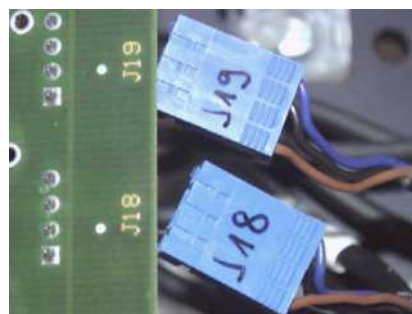


**WARNING**

Potentially lethal voltage inside the instrument.

- ◆ Equipment is to be connected to a grounded power source using an approved power cord with grounding conductor.
- ◆ Whenever possible, disconnect the instrument from the mains before carrying out maintenance or repair work.
- ◆ If work must be carried out with the instrument running, all covers and other parts protecting from electricity must remain in place.

### 8.1.2 Marking Connectors



When disconnecting cables, always mark designation (Jxx) on connector housing, e.g. with a felt-tip pen, as shown in the figure.

**Note:** If there are no markings on the connectors, and if you are unsure about the proper connections, refer to the diagrams.

**Fig. 8-1** Marked connectors

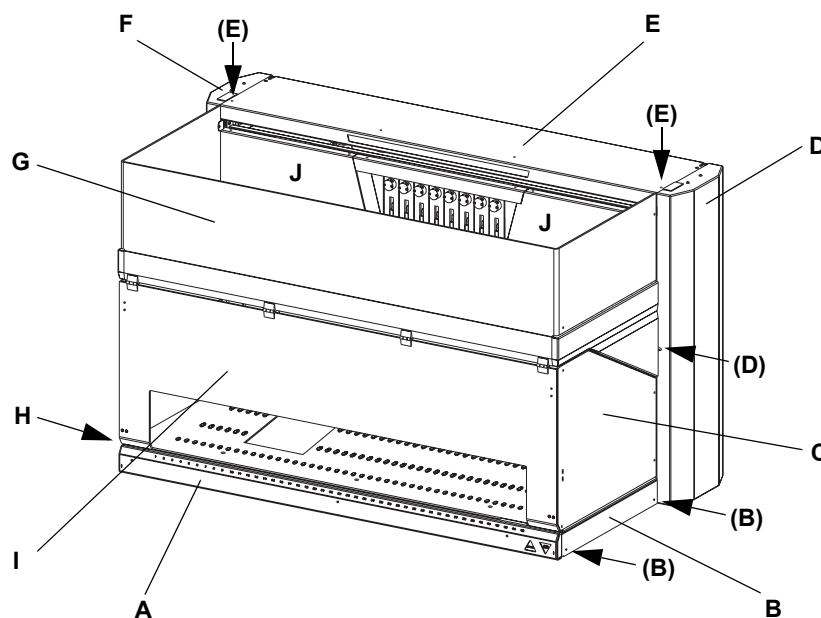
## 8.2 Safety Panels / Covers

### 8.2.1 Access to Components

#### Which Panels / Covers can Be Opened?

In order to make the inner components of the Freedom EVO accessible for repair jobs, panels and covers can either be opened like doors or must be removed for this purpose.

The figure shows the most important panels and covers and their designations:

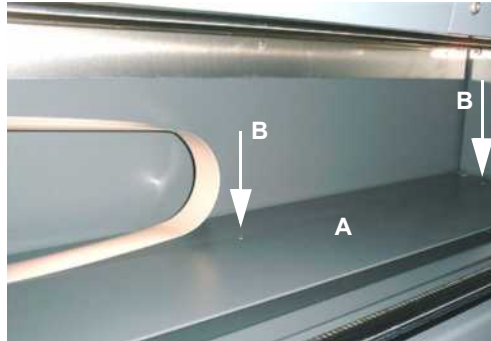


**Fig. 8-2** Panels and covers

<b>A</b> Front access panel (openable)	<b>F</b> Left access door (openable)
<b>B</b> Right worktable cover	<b>G</b> Top safety panel
<b>C</b> Side safety panel	<b>H</b> Left worktable cover
<b>D</b> Right access door (openable)	<b>I</b> Front safety panel (openable)
<b>E</b> Top cover (openable)	<b>J</b> Diluter cover

**Note:** Pay attention to the following:

- The letters in brackets refer to the screws to be loosened/removed for the respective panel/cover.
- The parts which are not marked with “openable” must be removed completely to gain access to the components located behind them.
- Not visible on the picture: X-bay cover (cover above the X-motor, see [Fig. 8-3](#), [Fig. 8-3](#)).



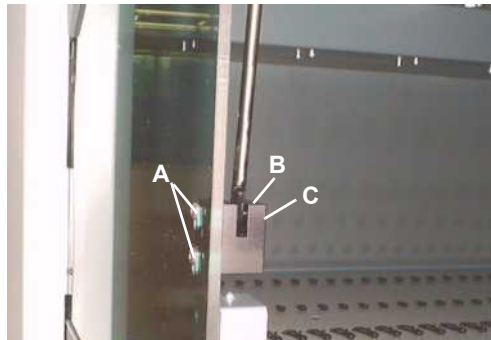
**A** X-bay cover  
**B** Fixing screw of X-bay cover

**Fig. 8-3** X-bay cover

### 8.2.2 Gas Spring

#### Replacing the Gas Spring

To replace the gas spring, proceed as follows:



**Fig. 8-4** Gas spring lower fixing

- 1 Open the front safety panel.
- 2 Fix the front safety panel in such a way that it cannot fall down.
- 3 Release the tension of the gas spring by loosening the screws (A).
- 4 Remove the screws.
- 5 Loosen the set screw (B).
- 6 Remove the axle (C).



**Fig. 8-5** Gas spring fixing flap side

- 7 Loosen the set screw (D)
- 8 Remove the axle (E).
- 9 Remove the gas spring.

#### Installing

**10** Instal the gas spring in reverse order as described for removal. Pay attention to the following:

- Before tightening the screws (A in [Fig. 8-4](#), [Fig. 8-3](#)), pretension the gas spring by compressing it by approx. 2 mm (0.08 in.).

### 8.2.3 Door Locks

#### Replacing Door Lock

To replace the door locks, proceed as follows:

**Note:** The figure shows a door lock on the right side only. Proceed in the same way for a left door lock.

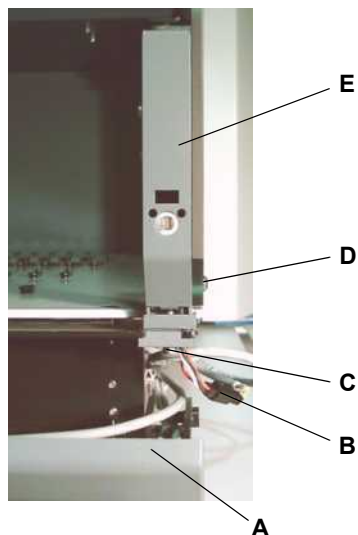


Fig. 8-6 Door lock

- 1 Open the front safety panel.
- 2 Open the front access panel (A).
- 3 Remove the right worktable cover.
- 4 Loosen the socket head screw (C).
- 5 Remove the screw (D).
- 6 Unplug the connector (B).
- 7 Remove the complete door lock (E).

8 Instal door lock in reverse order as described for removal.

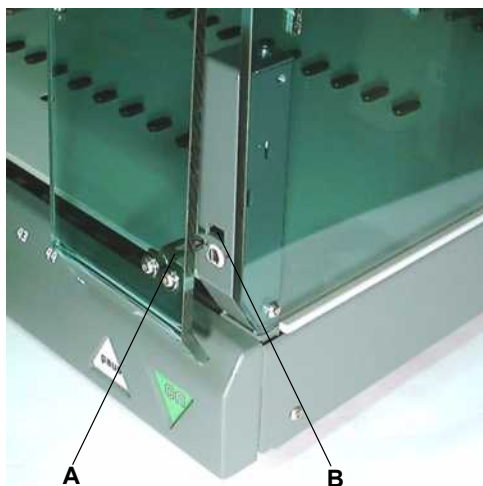


Fig. 8-7 Door lock/catch

- 9 Before tightening all screws of the door lock, check the mechanical alignment of the catch (A) on the front safety panel and the keyhole (B) in the door lock.
- 10 Correct the position of the door lock, if necessary.
- 11 Tighten all screws.

#### Tests and Settings


- 12 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Device test
    - Test door locks



## 8.3 Worktable

### 8.3.1 Spare Parts Worktable

**Which Spare  
Parts are  
Available?**

Refer to 10.1 “Base Unit”,  10-1 to identify the available spare parts and their part numbers.

**Required  
Special Tool**

- ◆ Reference tip for LiHa

**When to  
Remove the  
Worktable?**

Removal of the worktable will be necessary

- ◆ if a new or different type of worktable needs to be installed.
- ◆ if you need to gain access to the PosID 2.

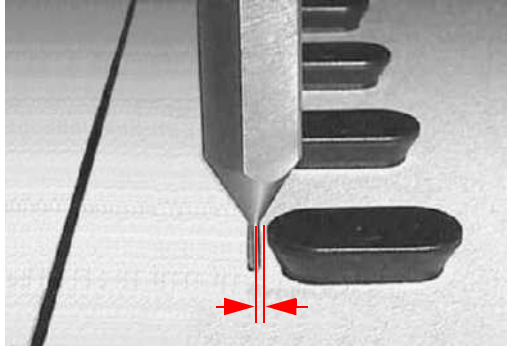
#### Removal

**Removing the  
Worktable**

- 1 Clear the worktable completely.
- 2 Open the front access panel.
- 3 Remove all screw caps using a watchmaker’s screwdriver.
- 4 Remove all fixing screws from the worktable.
- 5 Carefully lift the worktable and remove it from the instrument.

**Installing the  
Worktable**

- 1 Carefully put the worktable into place.
- 2 Insert the four flat head screws in the rear part of the worktable but do not tighten them yet.
- 3 Insert but only *slightly* tighten the other fixing screws.
- 4 Manually align the worktable, then tighten the front left screw.  
*This screw will act as a pivot point during the following alignment.*
- 5 Install the reference tip onto the LiHa:
  - 4-Tip LiHa: mount reference tip on position 1 (first tip counted from the rear).
  - 8-Tip LiHa: mount reference tip on position 1 (first tip counted from the rear).
- 6 Manually position the reference tip at the edge of the foremost positioning pin in grid position 1 (leftmost grid position).
- 7 Check the gap between pin and reference tip.



**Fig. 8-8** Gap between reference tip/pin

- 8 Manually move the LiHa to the rightmost grid position and check the gap between pin and reference tip.  
*The gap must be the same on either side of the worktable.*
- 9 Align the worktable as necessary.
- 10 If the position is correct, tighten the fixing screws and insert the screw caps.

- 11 Reinstall all previously removed parts.
- 12 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Verify reference positions
  - Tip alignment verification
  - Individual Z verification
  - RoMa reference plate test
  - PosID tests

## 8.4 System Electronics




### ATTENTION

Damage to electronics due to electrostatic discharge (ESD).

- ◆ Observe precautions for handling ESD-sensitive devices.
- ◆ Always wear a wrist strap.

### 8.4.1 Spare Parts Electronics

#### Which Spare Parts are Available?

Refer to [10.3 "System Electronics"](#),  [10-2](#) to identify the available spare parts and their part numbers.

### 8.4.2 Te-CU Board

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Cable connections	See section <a href="#">11.2.3</a> , <a href="#">11-5</a>

**Location**

The Te-CU board is located behind the left access door.

To replace the board, proceed as follows:

**Removing**

- 1 Make sure that the instrument is switched off and the mains power connection is disconnected.
- 2 Disconnect all cables from the Te-CU board.
- 3 Remove the Te-CU board fixing screws.

**Installing**

**Note:** *Spare Te-CU boards may be delivered with an older firmware version. In this case, upgrading of the firmware is necessary.*

- 4 Install the PCB in reverse order as described for removal.  
*For correct cable connection refer to cross references above.*

**Tests and Settings**

- 5 To ensure operating readiness, perform the following setups and tests: Refer to the "Instrument Software Manual".
  - Instrument basic setup
  - PosID tests
  - EEPROM backup

### 8.4.3 Optibo DCU

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Check settings / fuses	See section <a href="#">11.2.1</a> , <a href="#">11-3</a> and section <a href="#">11.2.23</a> , <a href="#">11-25</a>
Cable connections	See section <a href="#">11.2.3</a> , <a href="#">11-5</a>
Check CAN bus resistance	See section <a href="#">4.5</a> , <a href="#">4-7</a>

**Location**

The Optibo DCU is located behind the left access door.

To replace the board, proceed as follows:

**Removing**

- 1 Make sure that the instrument is switched off and the mains power connection is disconnected.
- 2 Disconnect all cables from the Optibo DCU.  
*Do not forget to disconnect the Diluter cable on the rear side of the PCB.*

- 3 Unplug the DCU 2 board.
- 4 Remove Optibo DCU fixing screws.

**Installing**

- 1 Check if the switch SW1 (CAN bus termination) on the Optibo DCU is set correctly according to the configuration of the instrument.  
Refer to cross references above.
- 2 Check if the address switch SW2 (DCU 2 address) is set correctly.  
Refer to cross references above.
- 3 Check if the switch SW3 (LiHa configuration) is set correctly
- 4 Install the PCB in reverse order as described for removal.  
*For correct cable connection refer to cross references above.*

**Tests and Settings**

- 5 To ensure operating readiness, perform the following tests:
  - CAN bus resistance.  
Refer to cross references above.

**Fuses**

**Note:** *Fuses are located on the Optibo DCU.*

- *See cross references above for correct allocation.*
- *Always use the correct fuse type for replacement.*

Fuse rating on the Optibo DCU: 8 A slow-blow type.



**ATTENTION**

Damage to the equipment possible, if fuses with low breaking capacity are used.  
Use the original ceramic type fuses only.

**8.4.4 DCU 2 Board**

**Location**

The DCU 2 board is located on the Optibo DCU.  
To replace it, unplug the DCU 2 board from the Optibo DCU.

**Tests and Settings**

To ensure operating readiness, perform the following setups and tests:  
Refer to the "Instrument Software Manual".

- ◆ Instrument basic setup
- ◆ Verify reference positions
- ◆ Tip alignment verification
- ◆ Individual Z verification
- ◆ (Lower) DiTi eject test
- ◆ Liquid detection test
- ◆ EEPROM backup

### 8.4.5 Gate Board

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Check settings	See section 11.2.1, <a href="#">11-3</a> and section 11.2.17, <a href="#">11-19</a>
Cable connections	See section 11.2.3, <a href="#">11-5</a>
Check CAN bus resistance	See section 4.5, <a href="#">4-7</a>

**Location**

The gate board is located behind the left access door.

To replace the board, proceed as follows:

**Removing**

- 1 Make sure that the instrument is switched off and the mains power connection is disconnected.
- 2 Disconnect all cables from the gate board.
- 3 Remove gate board fixing screws.

**Installing**

- 1 Check if the switch S2 (CAN termination) on the gate board is set correctly according to the configuration of the instrument.  
Refer to cross references above.
- 2 Check if the address switch SW2 is set correctly.  
Refer to cross references above.
- 3 Install the PCB in reverse order as described for removal.  
*For correct cable connection refer to cross references above.*

**Tests and  
Settings**

- 4 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - CAN bus resistance.  
Refer to cross references above.
  - Instrument basic setup
  - Verify reference positions
  - Range move test
  - Random move test

### 8.4.6 SMIO/SAFY Board

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Check settings	See section <a href="#">11.2.1</a> , <a href="#">11-3</a> and section <a href="#">11.2.18</a> , <a href="#">11-20</a>
Cable connections	See section <a href="#">11.2.13</a> , <a href="#">11-15</a>
Check CAN bus resistance	See section <a href="#">4.5</a> , <a href="#">4-7</a>

**Location**

The SMIO/SAFY board is located behind the right access door.

To replace the board, proceed as follows:

**Removing**

- 1 Make sure that the instrument is switched off and the mains power connection is disconnected.
- 2 Disconnect all cables from the SMIO/SAFY board.
- 3 Remove SMIO/SAFY board fixing screws.

**Installing**

- 1 Check if the jumper J9 (CAN termination) on the SMIO/SAFY board is set correctly according to the configuration of the instrument. Refer to cross references above.
- 2 Check if the address switch SW1 is set correctly. Refer to cross references above.
- 3 Install the PCB in reverse order as described for removal.  
*For correct cable connection refer to cross references above.*

**Tests and  
Settings**

- 4 To ensure operating readiness, perform the following tests: Refer to the "Instrument Software Manual".
  - CAN bus resistance. Refer to cross references above.
  - Instrument basic setup
  - Device test
    - Test door locks
    - Test alarm device
    - Test pause/resume button

### 8.4.7 ON/OFF/Pause/Resume Switch

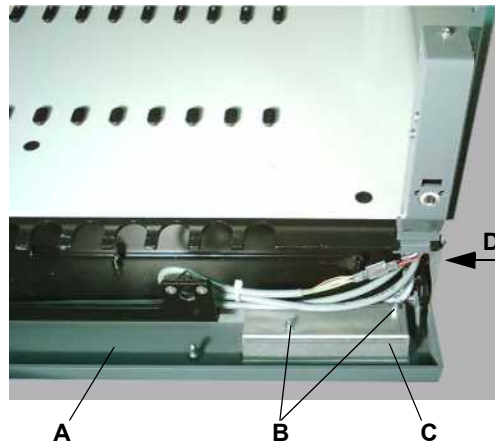
**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Cable connections	See section <a href="#">11.2.3</a> , <a href="#">11-5</a>

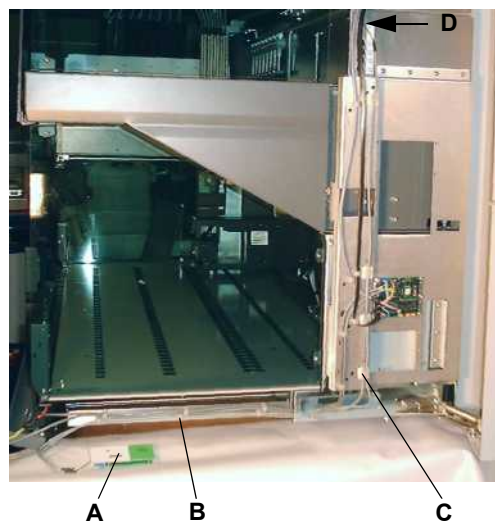
To replace the ON/OFF/Pause/Resume switch, proceed as follows:

**Removing**



**Fig. 8-9** Casing of switch

- 1 Open front access panel (A).
- 2 Remove the right worktable cover (D).
- 3 Unscrew the two lock nuts (B).
- 4 Remove the casing (C) of the ON/OFF/Pause/Resume switch.



**Fig. 8-10** Connection cable

- 5 Remove the switch (A) and lay it aside.
- 6 Open the cable holder clips (B).
- 7 Cut the cable ties (C).
- 8 Unplug the connector (D) from the power supply module.

**Installing**

- 1 Install the ON/OFF/Pause/Resume switch in reverse order as described for removal. For correct wiring, refer to cross references above.



**Tests and Settings**

- 2 To ensure operating readiness, perform the following tests: Refer to the "Instrument Software Manual".
  - Device test
    - Test pause/resume button

### 8.4.8 Status Lamp

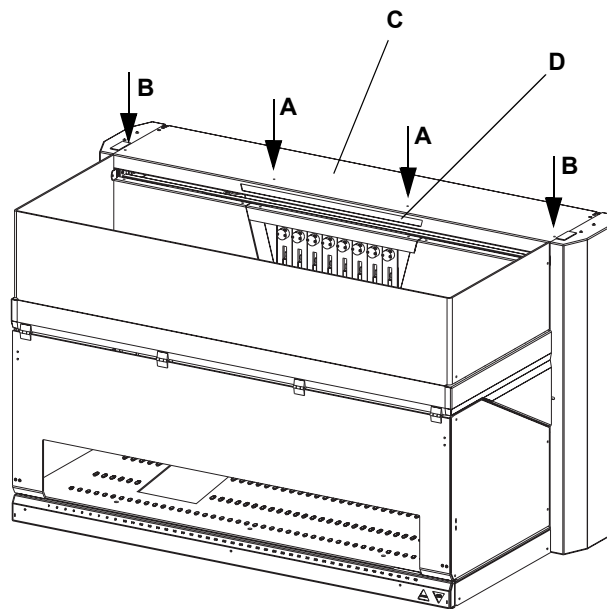
**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Cable connections	See section <a href="#">11.2.13</a> ,  11-15
Set volume of acoustic alarm device	See section <a href="#">8.16.2</a> ,  8-162

To replace the status lamp, proceed as follows:

**Removing**



**Fig. 8-11** Removal of status lamp

- 1 Remove the two screws (B) of the top cover.
- 2 Open the top cover (C).
- 3 Remove the two fixing screws (A) of the status lamp while holding it.

**ATTENTION**

Damage to the status lamp. Make sure that the status lamp (D) does not fall down.

- ◆ Hold it while removing the screws.



- 4 Remove the status lamp.





- 5 Unplug the connector (A) to the status lamp PCB.
- 6 Remove the status lamp.

**Fig. 8-12** Status lamp assembly

**Installing**

- 1 Install the status lamp in reverse order as described for removal. For correct wiring, refer to cross references above.

**Tests and Settings**

- 2 To ensure operating readiness, perform the following tests and settings: Refer to the "Instrument Software Manual".
  - Device test
    - Test alarm device
  - Set the volume (loudness) of the acoustic alarm device (buzzer). Refer to cross references above.

## 8.5 Power Supply Module

**Note:** Additional information on the power supply module:

- For supply ratings refer to the Freedom EVO Operating Manual.
- Check power rating printed on the type plate of the instrument for correct identification.

## Fuses on the Power Supply Module


### Location of Fuses

The fuses of the power supply module are accessible behind the right access door as shown in the figure:



Fig. 8-13 Fuses of power supply module

Fuses and connectors:

- J3** Connection to ON/OFF/Pause/Resume switch
- FU1/2** Line L and N to mains outlets for options (refer to 4.6.2,  4-10)
- FU3/4** Supply line for Freedom EVO

Fuse ratings:

- FU1** 2 AT (slow-blow type)
- FU2** 2 AT (slow-blow type)
- FU3** 10 AT (slow-blow type)
- FU4** 10 AT (slow-blow type)

To check or replace fuses, open the screw caps.

**Note:** Always use the correct fuse type for replacement.




### ATTENTION

Damage to the equipment possible, if fuses with low breaking capacity are used. Use the original ceramic type fuses only.

## 8.5.1 Spare Parts Power Supply Module

### Which Spare Parts are Available?



Refer to 10.3 "System Electronics",  10-2 to identify the available spare parts and their part numbers.

### WARNING


Potentially lethal voltage.  
The power supply module as a whole is a spare part.

- ◆ For safety reasons no replacement of individual components is allowed.
- ◆ Do not attempt to perform repairs within the module.
- ◆ Faulty wiring will seriously endanger user and instrument.

### 8.5.2 Replacing Power Supply Module

**Cross  
References**

List of cross references to information provided in other sections:

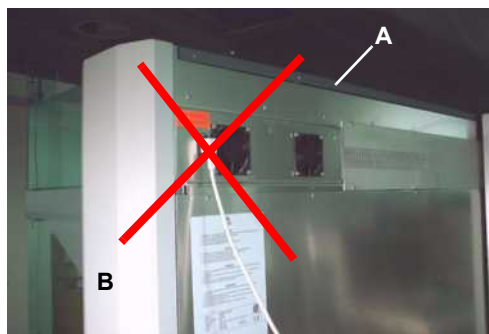
Action	Reference
Cable connections	See section 11.2.3,  11-5




**WARNING**

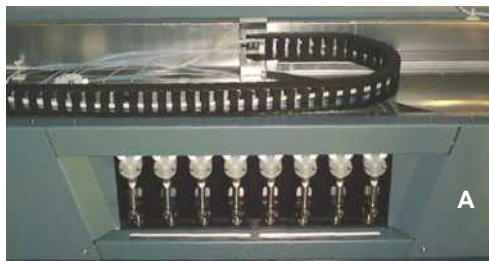
Potentially lethal voltage.  
Switch the instrument off and disconnect the mains cable before performing any work on the power supply module.

**Removing**



**Fig. 8-14** Mains cable

- 1 Make sure that the instrument is not connected to the mains.
- 2 Open top cover (A).
- 3 Open the right access door (B).
- 4 Remove the four screws (F in [Fig. 8-16](#),  8-16) and the right access door.



**Fig. 8-15** Parts to be removed

- 5 Remove the right diluter cover (A).
- 6 Remove the five top fixing screws of the power supply module.
- 7 Remove the six bottom fixing screws of the power supply module.

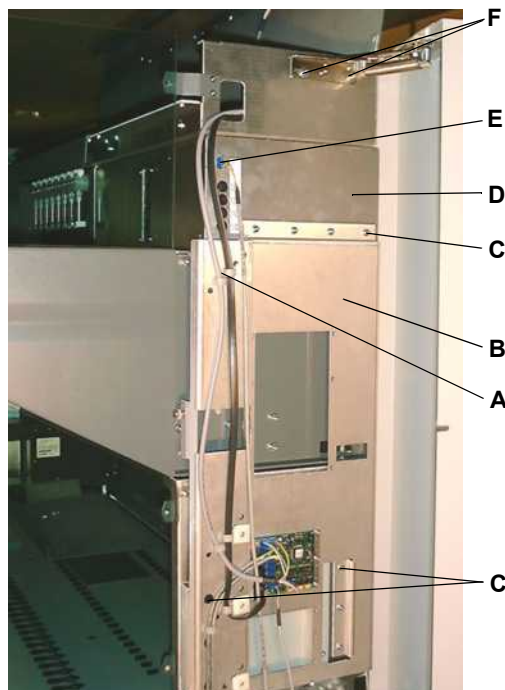


Fig. 8-16 Carrier plate

- 8 Remove all cables from the cable holder clips (A) and put them aside.
- 9 Remove the ten screws (C) of the carrier plate (B).
- 10 Lower the carrier plate in such a way that the power supply module (D) is accessible.
- 11 Unplug the connector (E) from the power supply module.

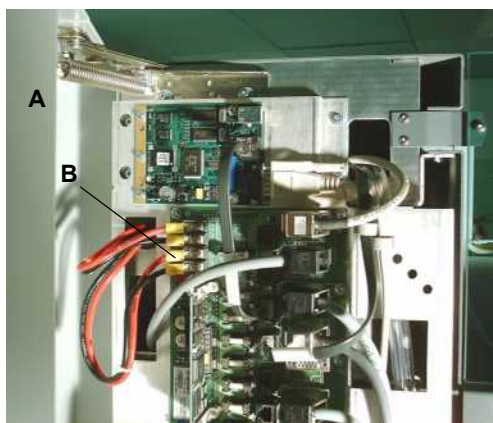


Fig. 8-17 DC power connections

- 12 Open the left access door (A).
- 13 Disconnect the red and black power cables (B) from the Optibo DCU.
- 14 Remove the power supply module on the right side of the instrument.

### Installing

- 1 Install the power supply module in reverse order as described for removal.

**Note:** In doing so, observe the directions given hereafter:

- To facilitate the insertion of the power cables into the cable channel fix the cables together with an adhesive tape.
- For correct cable connections, refer to cross references above.

### Tests and Settings

- 2 To ensure operating readiness, perform the following tests: Refer to the "Instrument Software Manual".
  - Liquid detection test

## 8.6 X-Drive Assembly and X-Carriage

### 8.6.1 Spare Parts X-Drive Assembly

**Which Spare Parts are Available?**

Refer to

- ♦ 10.4 "Liquid Handling Arm (LiHa)", 10-3
- ♦ 10.5 "Robotic Manipulator Arm (RoMa)", 10-4
- ♦ 10.6 "Pick and Place (P&P)", 10-6

to identify the available spare parts and their part numbers.

### 8.6.2 X-Drive Assembly

**Cross References**

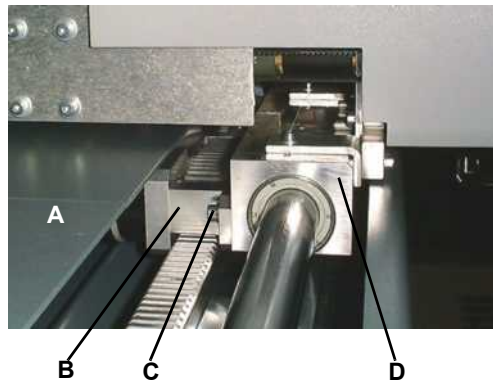
List of cross references to information provided in other sections:

Action	Reference
Connect X-motor cable	See section 8.7.3, 8-23

**Note:** Do not mix up the X-drive assemblies of the LiHa and the RoMa or the P&P arm.

To replace the X-drive assembly, proceed as follows:

**Removing**



- 1 Remove the X-bay cover (A).
- 2 Disconnect the X-motor cable.
- 3 Remove the 2 fixing screws (C).
- 4 Remove X-drive assembly (B) from the X-carriage (D).

**Fig. 8-18** X-drive assembly/X-carriage

**Installing**

Pay attention to the following:



**ATTENTION**

Malfunction of the arm device (LiHa or RoMa) possible if the DC servo boards of the arm are not compatible with the X-motor used in the X-drive assembly.

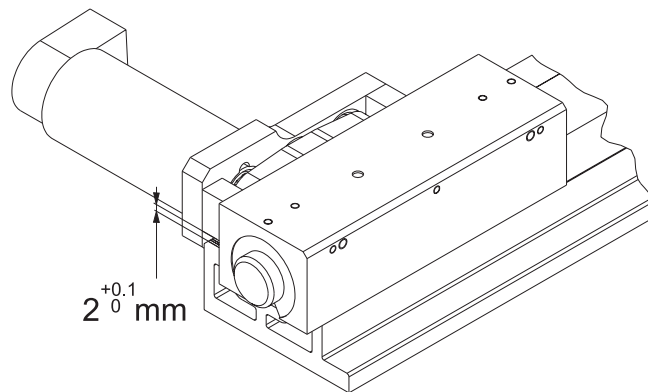
- ♦ Make sure that the X-motor with the correct number of increments is combined with the DC servo boards used.
- ♦ Also make sure that the correct firmware version is used.

The following table shows the correct combinations (**OK** = correct, **x** = not recommended).

**Tab. 8-1** Supported combinations X-motor / DC servo boards and firmware versions

Arm Device	X-Motor with 500 increments	X-Motor with 1000 increments	RoMa Device CU FW 1.13	RoMa Device CU FW 2.0 or later
LiHa with DC Servo II	x	OK		
RoMa with DC servo I	OK	x	OK	x
RoMa with DC servo II	x	OK	x	OK
RoMa with Device CU FW 1.13	OK	x		
RoMa with Device CU FW 2.0	x	OK		

- 1 Install the X-drive assembly, but do not tighten the 2 fixing screws yet.
- 2 Make sure that the arm, e.g. LiHa is mounted properly.
- 3 Adjust the distance between the X-rack and the X-drive assembly as shown in the figure (use a feeler gauge to measure the distance).



**Fig. 8-19** X-drive adjustment

- 4 Connect the X-motor cable.  
Refer to cross references above.
- 5 Remount the X-bay cover.
- 6 To ensure operating readiness, perform the following tests and settings for the corresponding arm:  
Refer to the “Instrument Software Manual”.
  - LiHa arm
    - Perform the setup procedure
    - Verify reference positions
    - Range move test
    - Random move test
    - (Lower) DiTi eject test
    - Liquid detection test

**Tests and Settings**

- RoMa arm
  - Perform the setup procedure
  - Verify reference positions
  - Range move test
  - Random move test
  - RoMa reference plate test
- P&P arm
  - Perform the setup procedure
  - Verify reference positions
  - Range move test
  - Random move test

### 8.6.3 X-Carriage

#### Cross References

List of cross references to information provided in other sections:

Action	Reference
Remove/install LiHa arm	See section 8.7.3, <a href="#">8-23</a>
Remove/install RoMa arm	See section 8.9.4, <a href="#">8-57</a>
Remove/install P&P arm	See section 8.10.3, <a href="#">8-85</a>
Remove/install X-drive assembly	See section 8.6.2, <a href="#">8-17</a>

To replace the X-carriage , proceed as follows:

**Note:** *The description given here shows the procedure to replace an X-carriage on the right side. If you need to replace an X-carriage on the left side, proceed in the same way on the other side.*

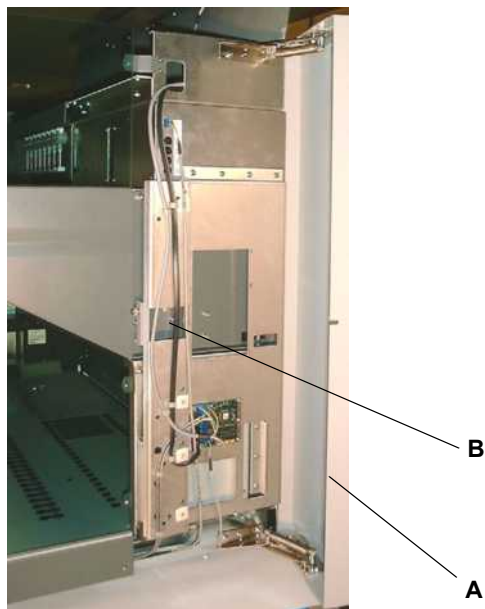
#### Removing

- 1 Remove the corresponding arm from the X-carriage.  
Refer to cross references above.
- 2 Remove the X-drive assembly.  
Refer to cross references above.
- 3 Clean the X-shaft and check it for damages.

**Note:**

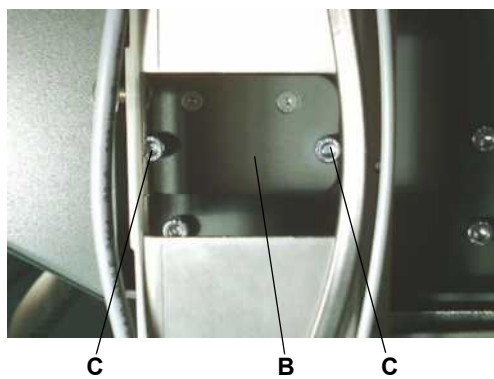
*If the X-shaft is severely damaged, replacing the X-carriages is not recommendable. In this case the instrument must be sent to the manufacturer for overhauling.*

- 4 Open the right access door (A).  
*The X-shaft cover (B) is now accessible.*



**Fig. 8-20** X-shaft cover location

- 5** Put the cables aside in such a way that the recess for the X-shaft cover is not obstructed.



**Fig. 8-21** X-shaft cover

- 6** Remove the two screws (C).
- 7** Remove the X-shaft cover (B).





- 8** Pull the X-carriage away from the X-shaft as shown in the figure.

*Fig. 8-22 X-carriage*

**Installing**

- 1** Install the X-carriage in reverse order as described for removal.

**Tests and Settings**

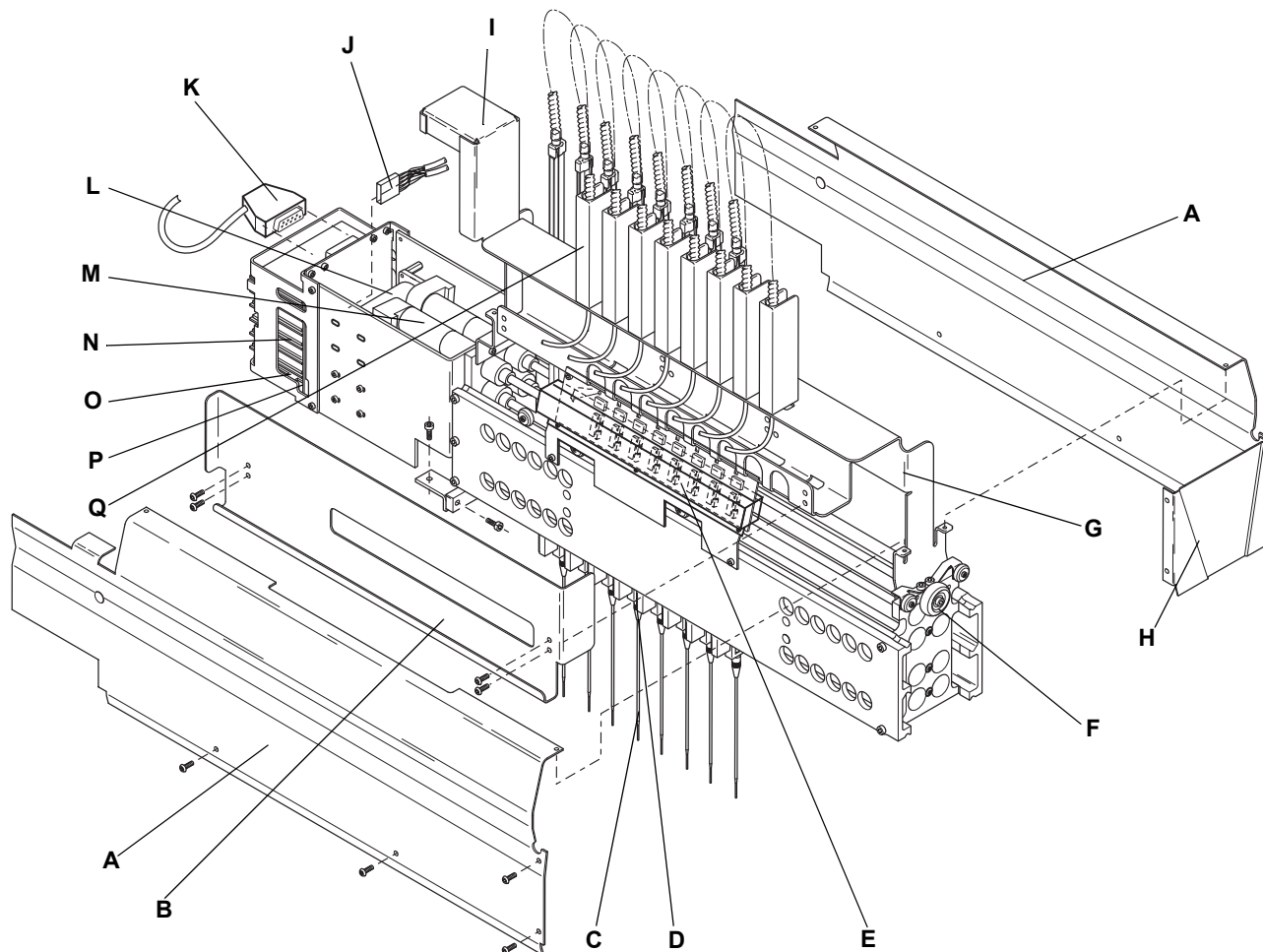
- 2** To ensure operating readiness, perform the following tests and settings: Refer to the "Instrument Software Manual".
  - Perform the setup procedure for the corresponding arm.

## 8.7 Liquid Handling Arm (LiHa)

### 8.7.1 Overview

#### LiHa Parts

The figure shows the main parts of the LiHa:



**Fig. 8-23** LiHa parts

- |          |                        |          |  |
|----------|------------------------|----------|--|
| <b>A</b> | Side cover             | <b>J</b> | X-motor cable                                |
| <b>B</b> | Tubing shelf cover     | <b>K</b> | LiHa cable                                   |
| <b>C</b> | Standard tip           | <b>L</b> | Y-motor (Y-spreading motor is located below) |
| <b>D</b> | Tip nut                | <b>M</b> | Z-motor                                      |
| <b>E</b> | ILID Freedom protected | <b>N</b> | DC servo                                     |
| <b>F</b> | Arm guide roller       | <b>O</b> | DC servo power                               |
| <b>G</b> | Tubing shelf           | <b>P</b> | LiHa backplane                               |
| <b>H</b> | Front cover            | <b>Q</b> | Support tubing guide block                   |
| <b>I</b> | Cable/tubing holder    |          |  |

### 8.7.2 Spare Parts LiHa

**Which Spare Parts are Available?**

Refer to 10.4 “Liquid Handling Arm (LiHa)”, 10-3 to identify the available spare parts and their part numbers.

### 8.7.3 Complete LiHa Arm

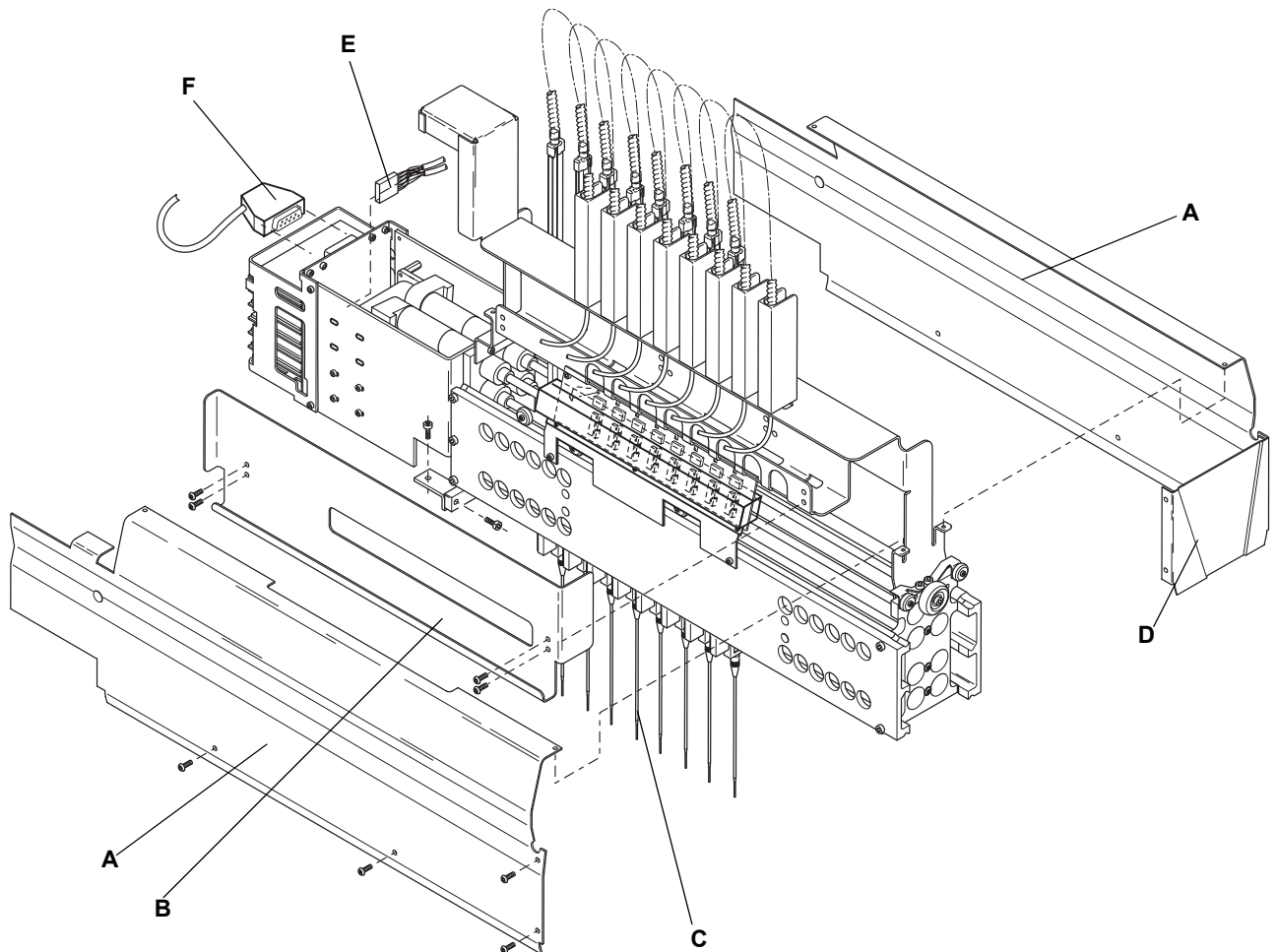
**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Remove diluter cover	See section 8.2.1, 8-2
CAN bus resistance test	See section 4.5, 4-7
Correct X-drive motor	See section 8.6.2, 8-17

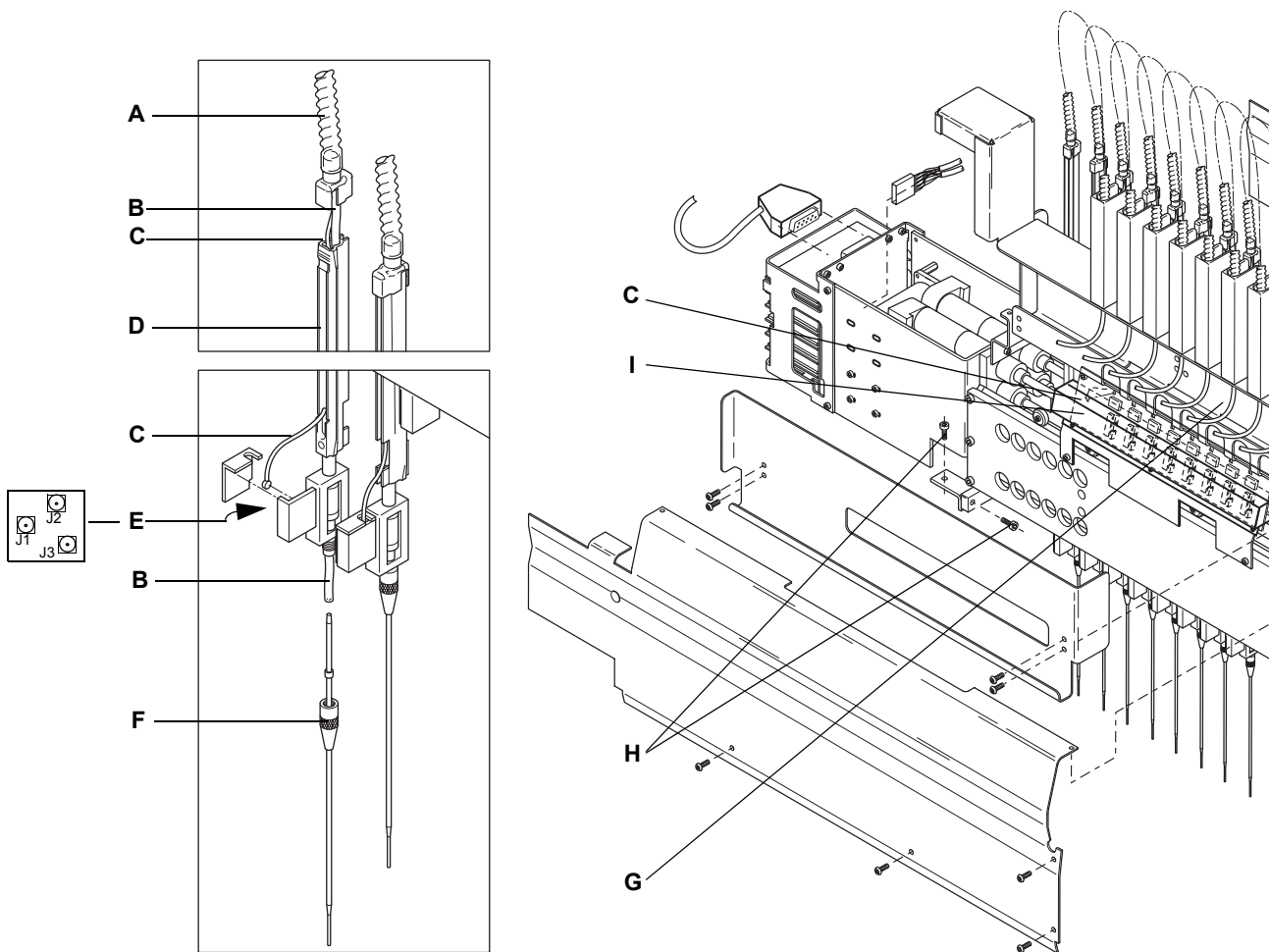
**Removing**

To remove the LiHa arm, proceed as follows:



**Fig. 8-24** LiHa removal

- 1 Remove all tips (C).
- 2 Remove the front cover (D).
- 3 Remove the side covers (A).
- 4 Remove the tubing shelf cover (B).
- 5 Unplug the D-sub connector of the LiHa cable (F) from the LiHa backplane.
- 6 Unplug the connector of the X-motor cable (E) from the LiHa backplane.



**Fig. 8-25** Removal of ILID cables and tubing from Z-rod

- |                           |   |
|---------------------------|---|
| <b>A</b> Support tubing   | <b>G</b> Tubing shelf   |
| <b>B</b> Pipetting tubing | <b>H</b> Fixing screws  |
| <b>C</b> ILID cable       | <b>I</b> ILID Freedom protected board                             |
| <b>D</b> Z-rod            | <b>J1</b> ILID; tip adapter to ILID Freedom protected board (TIP) |
| <b>E</b> TIP-ADAPT board  | <b>J2</b> NPS; to ILID Freedom protected board (PIEZO)            |
| <b>F</b> Tip nut          | <b>J3</b> NPS; to tip   |

- 7 Disconnect the ILID cables (C) from the TIP-ADAPT board (E).
- 8 Disconnect the ILID cables from the ILID Freedom protected board (I).

- 9 Remove the support tubing (A) with ILID cables (C) and pipetting tubing (B) from the Z-rods (D).
- 10 Open the top cover.
- 11 Remove the tubing shelf (G) and place it with the complete tubing in the open gap on top of the instrument.
- 12 Remove the diluter cover on one side.  
Refer to cross references above.
- 13 Slide the LiHa to the position with the diluter cover removed.
- 14 If the lower DiTi option is installed: Remove the bearing block near the fixing screw (H).
- 15 Remove the four fixing screws (H).
- 16 Shift the LiHa arm aside from the X-carriage.
- 17 Carefully lift the LiHa out of the instrument.

**Installing**

To install the LiHa arm, proceed as follows:



**ATTENTION**

Malfunction possible if the DC-servo boards of LiHa are not compatible with the X-drive motor.

- ♦ Make sure you use the correct combination DC-servo boards / X-drive motor.
- ♦ Refer to section “X-Drive Assembly” for detailed information (see cross references above).

- 1 Clean the contact surface of the guide rail as well as the guide rollers and the support roller with a lint-free tissue and some ethyl alcohol.
- 2 Install the LiHa in reverse order as described for removal. Pay attention to the following:
  - Before reinstalling the support tubing on the Z-rod
    - first lead the ILID cables through the Z-rods
    - then lead the aspiration tubing through the Z-rods
  - Reconnect the X-motor cable correctly to the LiHa 1536 backplane.



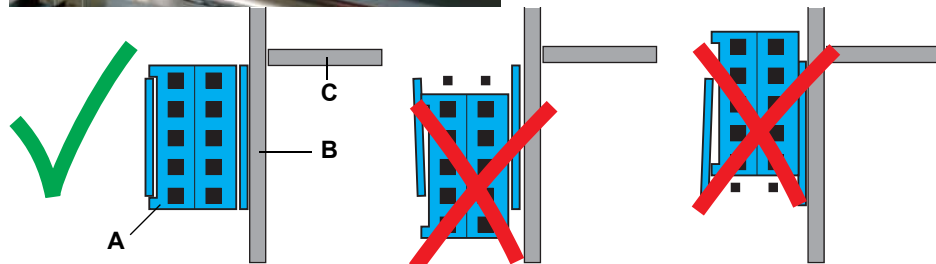
**ATTENTION**

Damage to the electronics if the connector of the X-motor is not plugged in properly.

- ♦ Use a dentist’s mirror and a flashlight to inspect the connector. Make sure that the connector of the X-motor is not plugged in wrongly (staggered).
- ♦ Make sure that the connector is plugged in completely, i.e. to the stop.
- ♦ Also make sure that the upper edge of the X-motor connector is aligned with the lower edge of the DC-servo (II) power board as shown in the figure.

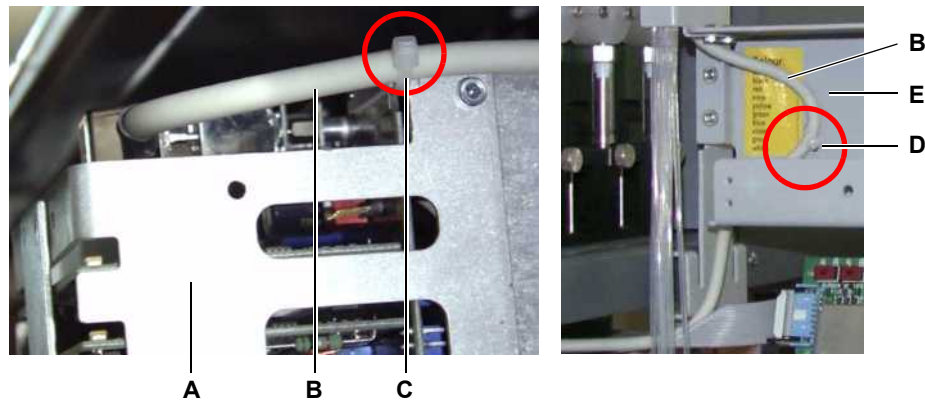


- A** X-motor connector
- B** LiHa backplane
- C** DC-servo (II) power board



**Fig. 8-26** Connection of the X-motor cable

- 3** When you reconnect the LiHa cable to the LiHa backplane, make sure you lay and fix the LiHa cable (B) properly as shown in the following figures.
- Fix the cable with a cable tie (C) to the backplane support (A).
  - Also fix it to the inside of the right side cover (E) . Make sure that the buckle of the cable tie (D) is on the inside of the cover as shown in the figure.



**Fig. 8-27** Fixing the LiHa cable

- A** Backplane support
- B** LiHa cable
- C** Cable tie (on backplane support)
- D** Cable tie (on right side cover)
- F** Right side cover (view from left side)

- 4** To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
- CAN bus resistance test.  
Refer to cross references above.
  - Verify reference positions
  - Range move test

- Random move test
- Tip alignment verification
- Individual Z verification
- (Lower) DiTi eject test
- Liquid detection test
- FaWa pump test
- Gravimetric (precision) test

### 8.7.4 Tip Adapter

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Connect the ILID cable	See section <a href="#">11.2.7</a> , <a href="#">11-9</a>

**Replacing**

To replace the tip adapter, proceed as follows:

- 1 Remove the DiTi adapter or the fixed tip (see “Freedom EVO Operating Manual”).
- 2 Remove the cover of the TIP-ADAPT board.
- 3 Disconnect the ILID cable from the TIP-ADAPT board.



**Fig. 8-28** Tip adapter/Z-rod

- 4 Remove the set screw (M 1.5) fixing the tip adapter to the Z-rod.
- 5 Hold the Z-rod with one hand and, with the other hand, carefully pull the tip adapter out of the Z-rod.

**Installing**

- 6 Insert the tip adapter into the Z-rod until the shoulder of the tip adapter shaft (below the alignment hole) is flush with the base of the Z-rod.
- 7 Align the positioning hole in the tip adapter shaft with the thread in the Z-Rod and fix the tip adapter in the Z-rod with the set screw.



**Fig. 8-29** Set screw/TIP-ADAPT board

- 8** Connect the ILID cable to J1 of the TIP-ADAPT board.  
Refer to cross references above.
- 9** Reinstall the cover of the TIP-ADAPT board.
- 10** Install the DiTi adapter or the fixed tip.

- J1** *ILID; tip adapter to ILID Freedom protected board*
- J2** *NPS; to ILID Freedom protected board*
- J3** *NPS; to tip*

**Tests and Settings**

- 11** To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Tip alignment verification
  - Individual Z verification
  - (Lower) DiTi eject test
  - Liquid detection test



### 8.7.5 Electronic Boards and Cables

#### DC Servo II Boards, DC Servo II Power Board

#### Cross References

List of cross references to information provided in other sections:

Action	Reference
Remove LiHa	See section 8.7.3, 8-23
CAN bus resistance test	See section 4.5, 4-7

#### Removing

To remove the DC servo boards, proceed as follows:

- 1 Remove rear panel.  
Or If the rear of the instrument is not accessible: Remove the LiHa from the instrument.  
Refer to cross references above.

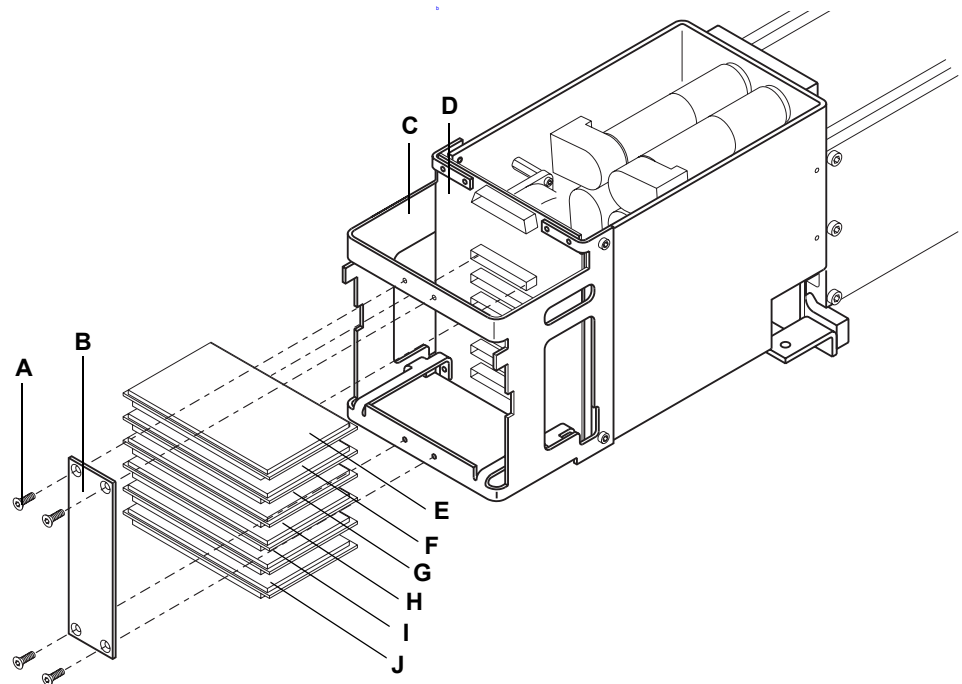


Fig. 8-30 LiHa DC servo Boards

- |   |   |
|---|---|
| <b>A</b> Screw                          | <b>F</b> DC servo II (on PCB: DCSERVO4)       |
| <b>B</b> Board housing cover            | <b>G</b> DC servo II (on PCB: DCSERVO3)       |
| <b>C</b> Board housing                  | <b>H</b> DC servo II (on PCB: DCSERVO2)       |
| <b>D</b> LiHa 1536 backplane            | <b>I</b> DC servo II (on PCB: DCSERVO1)       |
| <b>E</b> DC servo II (on PCB: DCSERVO5) | <b>J</b> DC servo II power (on PCB: DCSERVO6) |

- 2 Remove the four screws (A) and the board housing cover (B) from the board housing (C) at the back of the LiHa.
- 3 Remove the corresponding DC servo board.

**Note:** The DC servo and the DC servo II, as well as the DC servo power and the DC servo II power boards are not identical and, therefore, not interchangeable. Do not mix up the boards.

### Installing

To instal the DC servo boards, proceed as follows:

- 1 Install the DC servo boards in reverse order as described for removal.
  - Pay attention to the address setting of the corresponding DC servo board according to the following table:

**Tab. 8-2** DC servo board address/motor connections

Board/ Position <sup>a)</sup>	PCB Connector	Address Setting	Motors			Motor Connector
			8-tip LiHa	4-tip LiHa	2-tip LiHa	
DC servo II Position 1	DCSERV5	#4	Y1 Y2 (Y-spreading)	Y1 Y2 (Y-spreading)	Y1 Y2 (Y-spreading)	J4 J5
DC servo II Position 2	DCSERV4	#3	Z3 Z6	Z3 Z2	Z1 Z2	J6 J7
DC servo II Position 3	DCSERV3	#2	Z7 Z2	n.a.	n.a.	J8 J9
DC servo II Position 4	DCSERV2	#1	Z1 Z8	n.a.	n.a.	J10 J11
DC servo II Position 5	DCSERV1	#0	Z5 Z4	Z1 Z4	n.a.	J12 J13
DC servo II power Position 6	DCSERV6	#5	X1 Lower DiTi eject (option)	X1 Lower DiTi eject (option)	X1 Lower DiTi eject (option)	J16 J3

a) Counted from top to bottom

- 2 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - Instrument basic setup
  - Random move test
  - (Lower) DiTi eject test
  - Liquid detection test

### LiHa 1536 Backplane

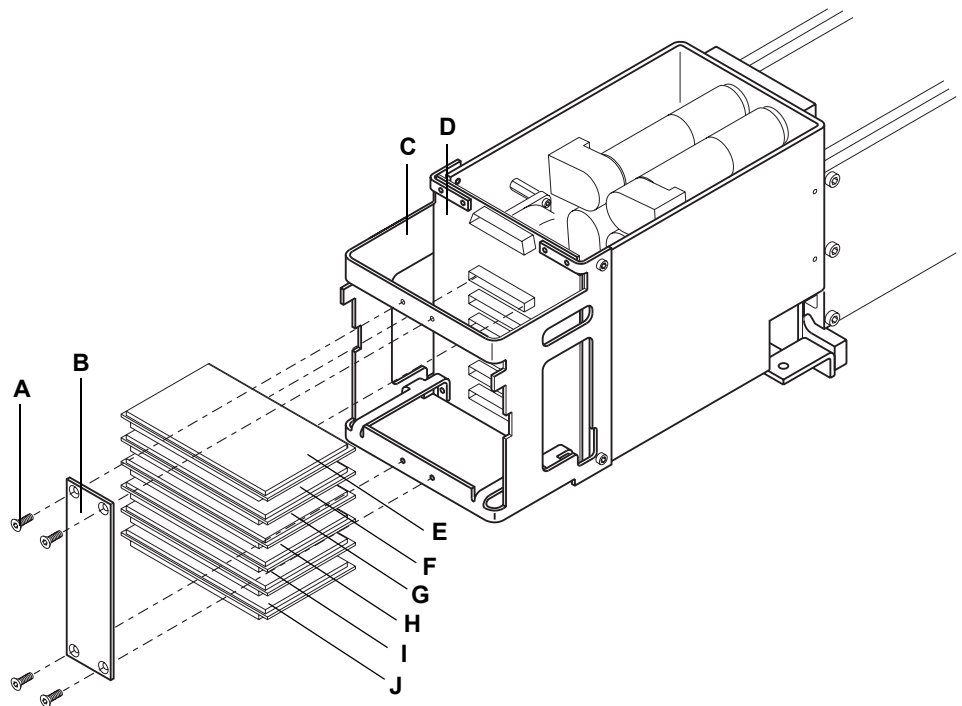
#### Cross References

List of cross references to information provided in other sections:

Action	Reference
Remove LiHa	See section 8.7.3, 8-23
Address settings	See section “DC Servo II Boards, DC Servo II Power Board”, 8-29
Cable connections	See section 11.2.6, 11-8 and section 11.2.7, 11-9
CAN bus resistance test	See section 4.5, 4-7

#### Removing

- Remove rear panel.  
*Or* If the rear of the instrument is not accessible: Remove the LiHa from the instrument.  
Refer to cross references above.



**Fig. 8-31** LiHa 1536 backplane

- Remove the four screws (A) and the board housing cover (B) from the board housing (C) at the back of the LiHa.
- Unplug the DC servo boards (E–J).
- Disconnect the ILID flat cable from the LiHa 1536 backplane (D).
- Disconnect all Y-motor and Z-motor cables.
- Remove the six screws and the LiHa 1536 backplane.

### Installing

- 1 Install in reverse order as described for removal. Pay attention to the following:
  - Address setting of the DC servo boards.  
Refer to cross references above.
  - Cable connections.  
Refer to cross references above.
- 2 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - CAN bus resistance test.  
Refer to cross references above.
  - (Lower) DiTi eject test
  - Liquid detection test

### ILID Freedom Protected Board

### Cross References

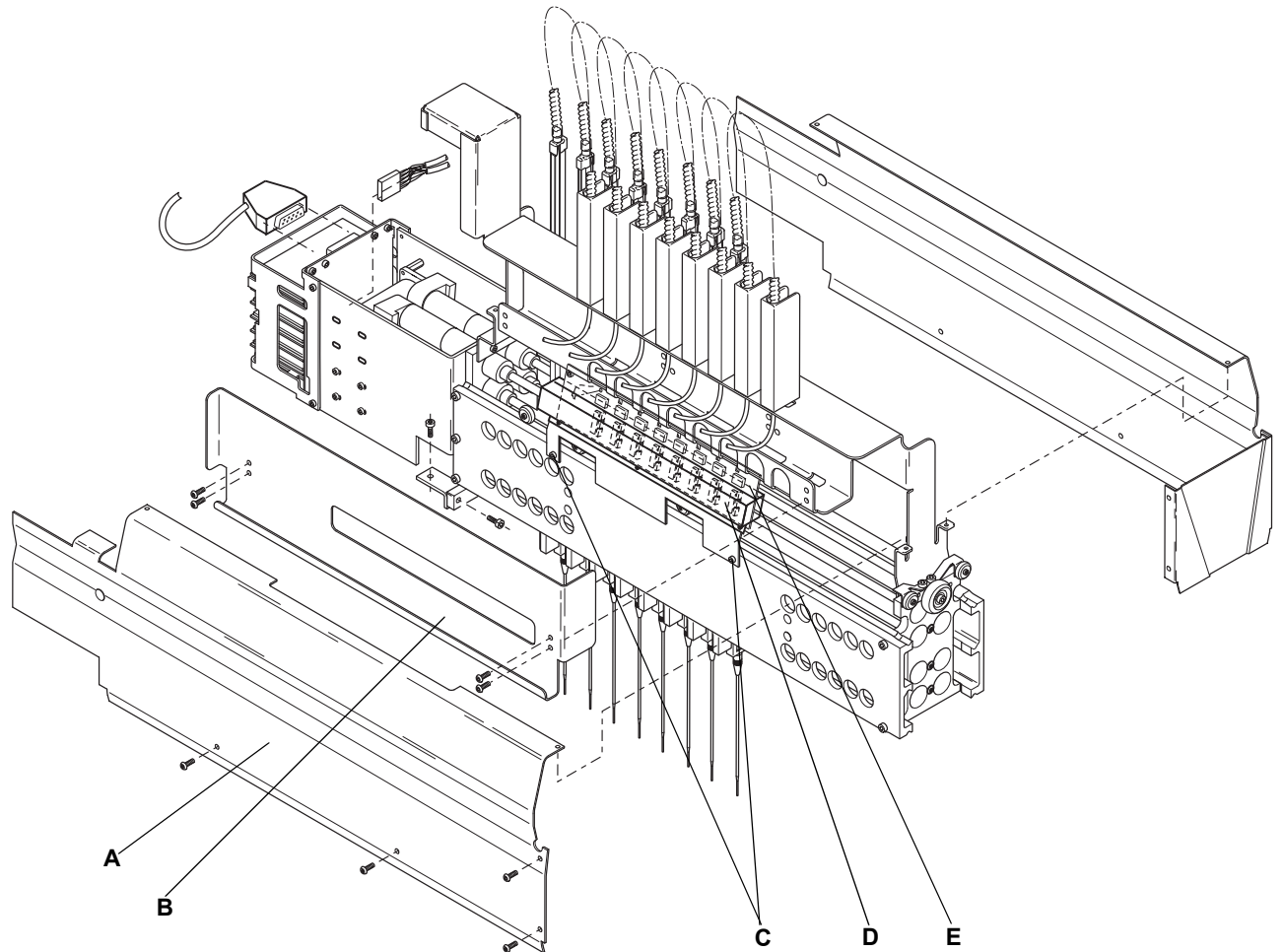
List of cross references to information provided in other sections:

Action	Reference
Settings on PCB	See section <a href="#">11.2.25</a> , <a href="#">11-27</a>

### Removing

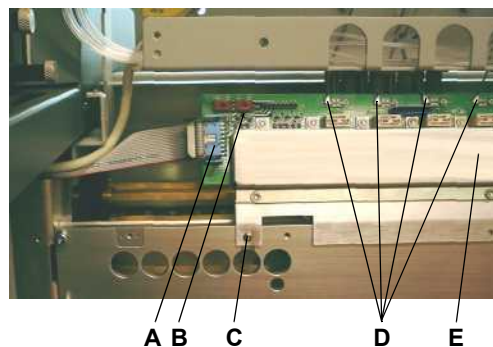
To remove the ILID Freedom protected board or to make the board accessible in order to replace related parts, proceed as follows:

- 1 Remove the tubing shelf cover (B).
- 2 Remove the left side cover (A).



**Fig. 8-32** LiHa parts

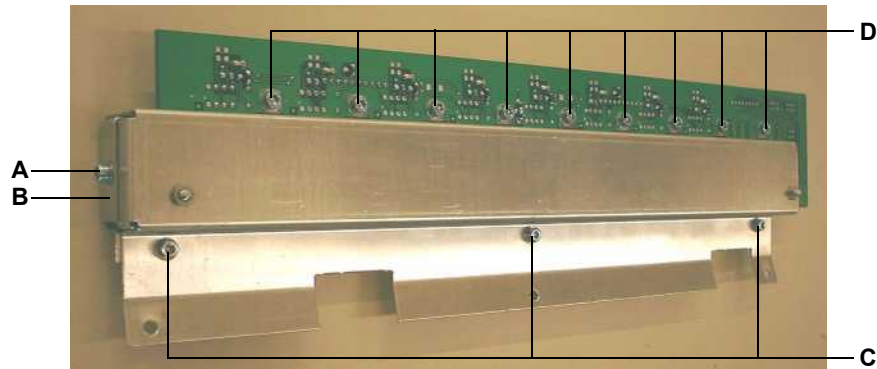
- |  |                                       |
|--|---------------------------------------|
| <b>A</b> Left side cover               | <b>D</b> Protective shield            |
| <b>B</b> Tubing shelf cover            | <b>E</b> ILID Freedom protected board |
| <b>C</b> ILID electronics fixing screw |                                       |



**Fig. 8-33** LiHa with ILID electronics

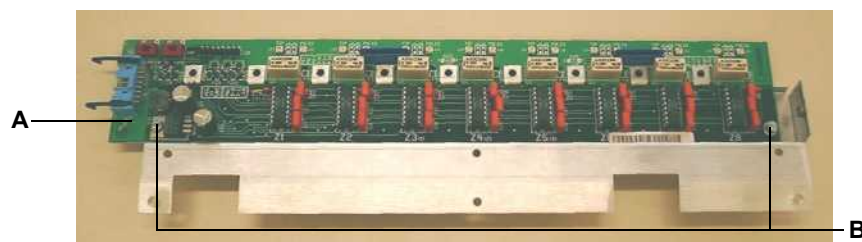
- 3** Disconnect the ILID board flat cable (A) from the ILID Freedom protected board (B).
- 4** Disconnect all ILID cables (D).
- 5** Remove the two screws (C) and the complete ILID electronics (protective shields (E) and ILID Freedom protected board).

6 Lay the ILID electronics on the table as shown in the figure:



**Fig. 8-34** ILID electronics

- 7 Remove the screw (A) and the washer.
- 8 Remove the three screws (C) and the washers.
- 9 Remove the eight screws (D) and the washers.
- 10 Remove the protective shield.
- 11 Turn the ILID electronics over as shown in the figure:



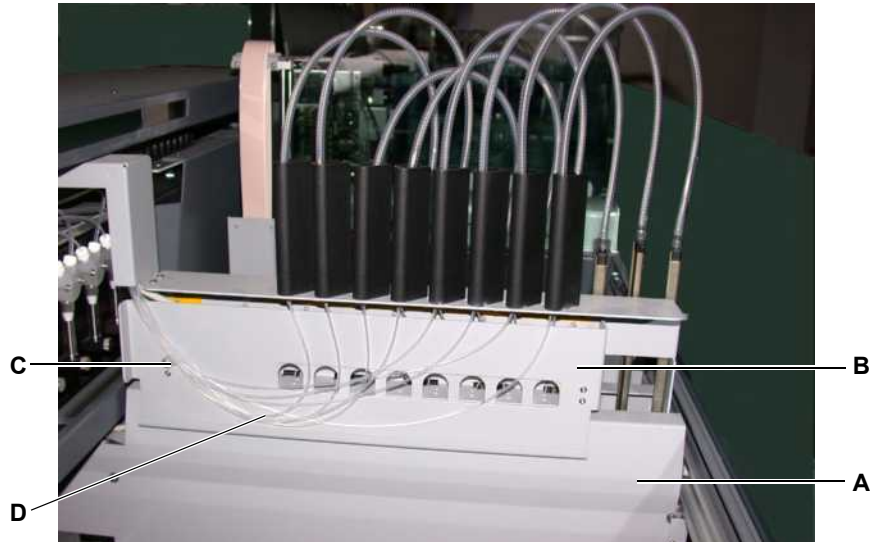
**Fig. 8-35** ILID Freedom protected board

- 12 Remove the two screws (B).
- 13 Remove the ILID Freedom protected board (A).

## Installation

To install the ILID Freedom protected board, proceed as follows:

- 1 Install the ILID Freedom protected board in reverse order as described for removal. Pay attention to the following:
  - The ILID Freedom protected board must be configured according to the LiHa number of tips. Set the two switches on the board accordingly. Refer to cross references above.
  - Check if Y-slide of the LiHa collides with the protective shields. Make sure that the moving Y-slide does not touch the protective shield.



**Fig. 8-36** Arrangement of the tubings and the tubing shelf cover

- |          |                    |          |         |
|----------|--------------------|----------|---------|
| <b>A</b> | Left side cover    | <b>C</b> | Clamp   |
| <b>B</b> | Tubing shelf cover | <b>D</b> | Tubings |

- 2 Reinstall the left side cover and the tubing shelf cover according to the above figure. Pay attention to the following:
  - Make sure that the tubings (D), leading from the diluters to the tips, and the tubing shelf cover (B) are arranged correctly as shown in the figure. Note that the tubings must be arranged outside the tubing shelf cover.
  - The tubings must be fixed to the cover with a clamp (C).
  
- 3 To ensure operating readiness, perform the following tests: Refer to the “Instrument Software Manual”.
  - Liquid detection test
  - If NPS option is installed: NPS quick test

**Tests and Settings**

## ILID Chip

### Cross References

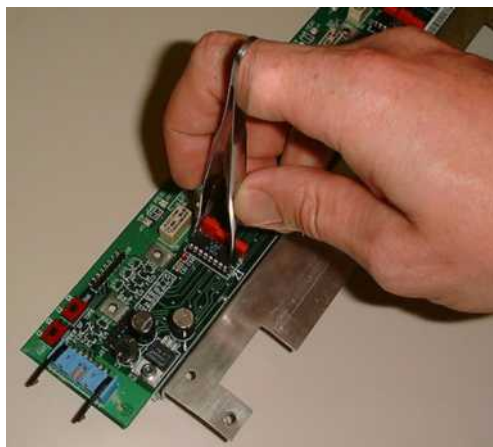
List of cross references to information provided in other sections:

Action	Reference
Make board accessible	See section <a href="#">“ILID Freedom Protected Board”</a>

### Replacing

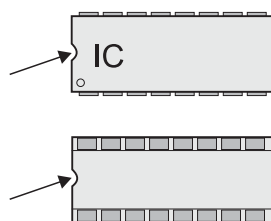
The replace the integrated circuit (ILID chip) on the ILID Freedom protected board, proceed as follows:

- 1 Make the ILID Freedom protected board accessible.  
Refer to cross references above.



- 2 Use the special tool to remove the integrated circuit (ILID chip) from the board as shown in the figure.

**Fig. 8-37** Integrated circuit (ILID chip)



**Fig. 8-38** IC and socket

- 3 Place the integrated circuit (ILID chip) onto the socket. Pay attention to the following:
  - Make sure that the notches (see arrows) in the integrated circuit (ILID chip) and in the socket correspond.
  - Make sure that the pins of the integrated circuit (ILID chip) are not offset from the socket connectors.

### Tests and Settings

- 4 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - Liquid detection test
  - If NPS option is installed: NPS quick test



### ILID Board Flat Cable

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Make board accessible	See section <a href="#">“ILID Freedom Protected Board”</a>

**Replacing**

To replace the ILID board flat cables, proceed as follows.

- 1 Make the ILID Freedom protected board accessible. Refer to cross references above.
- 2 Disconnect the flat cable from the ILID Freedom protected board.
- 3 Disconnect the flat cable from the LiHa 1536 backplane.
- 4 Install the ILID board flat cables in reverse order as described for removal.

**Tests and  
Settings**

- 5 To ensure operating readiness, perform the following tests: Refer to the “Instrument Software Manual”.
  - Liquid detection test
  - If NPS option is installed: NPS quick test

### ILID Cable

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Make board accessible	See section <a href="#">“ILID Freedom Protected Board”</a>
Disconnect ILID cable	See section <a href="#">8.7.3</a> , <a href="#">8-23</a>

**Replacing**

To replace the ILID cables, proceed as follows.

- 1 Make the ILID Freedom protected board accessible. Refer to cross references above.
- 2 Disconnect the ILID cable from the TIP-ADAPT board as described in the instructions for LiHa arm removal. Refer to cross references above.
- 3 Disconnect the ILID cable from the ILID Freedom protected board.
- 4 Remove the support tubing from the Z-rod.
- 5 Remove the ILID cable and the pipetting tubing from the Z-rod and the support tubing.
- 6 Install the ILID cable in reverse order as described for removal. Pay attention to the following:
  - Before reinstalling the support tubing on the Z-rod
    - first lead the ILID cables through the Z-rods
    - then lead the pipetting tubing through the Z-rods

**Tests and Settings**

- 7 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Liquid detection test

**8.7.6 Y-Belt**

**Cross References**

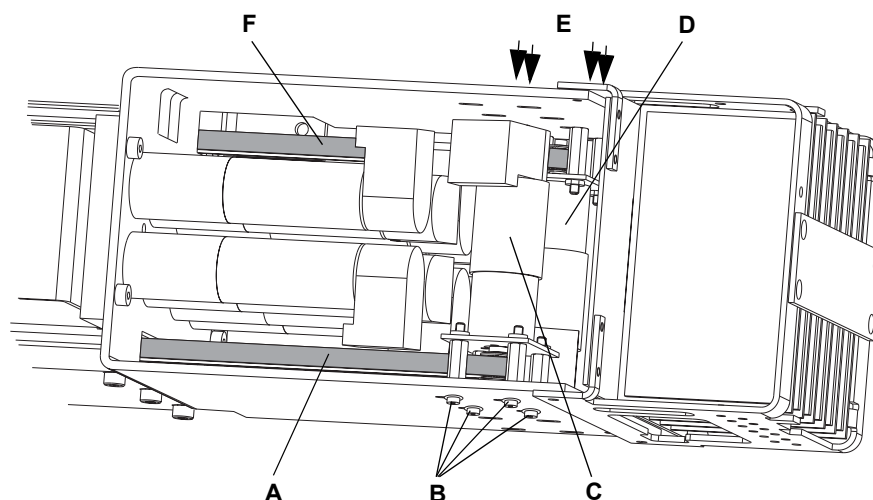
List of cross references to information provided in other sections:

Action	Reference
Remove LiHa	See section <a href="#">8.7.3</a> , <a href="#">8-23</a>

**Removing**

To remove the Y-belt or the Y-spreading belt, proceed as follows:

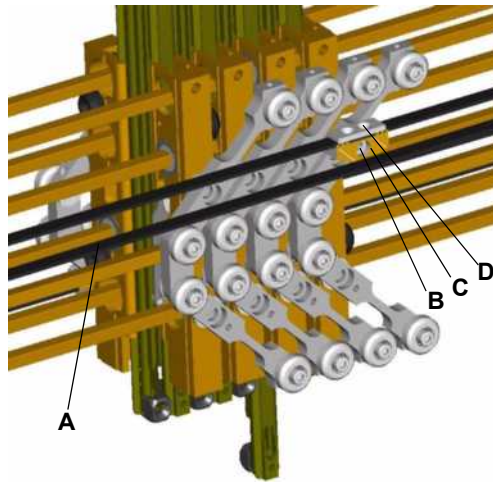
- 1 Remove the LiHa from the instrument.  
Refer to cross references above.



**Fig. 8-39** LiHa motors/Y-belts

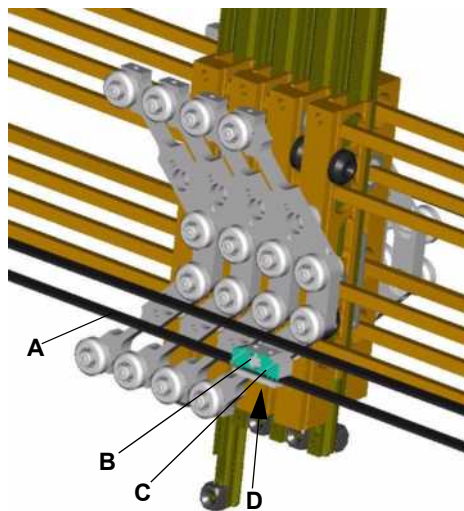
- |                               |   |
|-------------------------------|---|
| <b>A</b> Y-belt               | <b>D</b> Y-spreading motor              |
| <b>B</b> Y-motor fixing screw | <b>E</b> Y-spreading motor fixing screw |
| <b>C</b> Y-motor              | <b>F</b> Y-spreading belt               |

- 2 Remove the fixing screws of the Y-motor or the Y-spreading motor (B or E), respectively, to release the tension of the Y-belt (A or F).
- 3 Disengage the belt from the Y-motor or the Y-spreading motor (C or D), respectively.



**Fig. 8-40** Y-slide/Y-belt lock

- 4** Remove the Y-belt (A) as follows:
- Remove the screw (B) and the Y-belt lock (C) from the Y-slide.
  - Remove the two belt lock screws (D) and open the belt lock.
  - Remove the Y-belt from the LiHa arm.



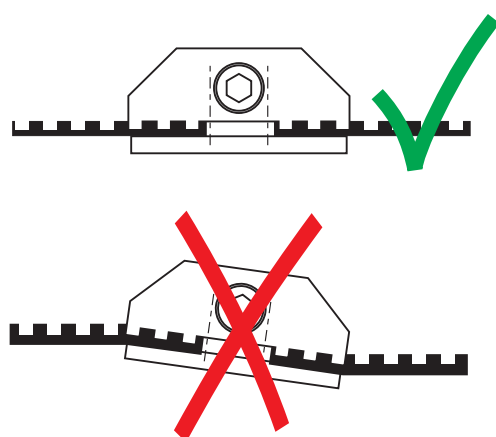
**Fig. 8-41** Y-slide/Y-spreading belt lock

- Or Remove the Y-spreading belt (A) as follows:
- Remove the screw (B) and the Y-spreading belt lock (C) from the Y-slide.
  - Remove the two belt lock screws (D) and open the belt lock.
  - Remove the Y-spreading belt from the LiHa arm.

**Installing**

To instal the Y-belt or the Y-spreading belt, proceed as follows:

- 1** Check the Y-belt length:  
*The length of the Y-belt must amount to **1260 mm / 49.6 in.***  
*The length of the Y-spreading belt must amount to **1260 mm / 49.6 in.***
- 2** Check and clean idler roller in the front part of the LiHa arm.
- 3** Instal the Y-belt and fix it in the belt lock.
- 4** Engage the Y-belt in the pulley of the Y-motor.



- 5 Fix the belt lock to the Y-slide.  
*Make sure that the belt lock is in a straight line with the belt as shown in the figure.*
- 6 Instal the Y-motors, but do not tighten the fixing screws yet.
- 7 Adjust the tension of the Y-belt as described below.
- 8 Instal all removed parts in reverse order as described for removal.

Fig. 8-42 Proper fixing of Y-belt lock

### How to Adjust the Tension

To adjust the tension of the Y-belt, proceed as follows:

- 1 Shift the Y-slide (A, not spread) to the middle position as shown in the figure:

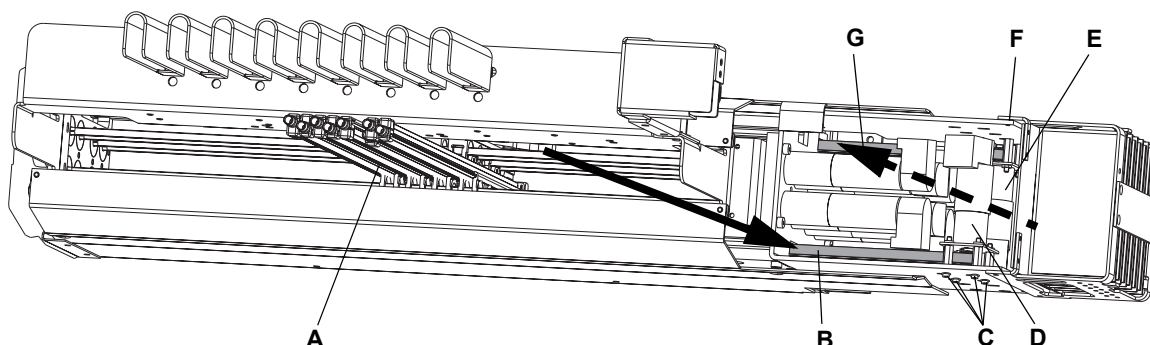


Fig. 8-43 Adjusting LiHa Y-belt tension

- 2 At the position indicated with the arrows (dashed arrow: from below), use a spring balance to measure the force that is needed to push the Y-belt (B or G) towards the other belt strand until it touches the other belt strand.  
*The force must amount to 2.3–2.5 N when the upper strand of the Y-belt just touches the lower strand.*
- 3 To adjust the tension of the Y-belt, change the position of the Y-motor (D or E).
- 4 Tighten the motor fixing screws (C or F).

### Tests and Settings

- 5 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - Verify reference position
  - Range move test
  - Random move test
  - Tip alignment verification
  - Individual Z verification
  - (Lower) DiTi eject test
  - Liquid detection test

## 8.8 Y-Motors

### Cross References

List of cross references to information provided in other sections:

Action	Reference
Remove LiHa	See section 8.7.3, 8-23
Cable connections	See section 11.2.6, 11-8 and section 11.2.7, 11-9
Adjust tension of Y-belt	See section 8.7.6, 8-38

### Removing

To remove the Y-motor or the Y-spreading motor, proceed as follows:

- 1 Remove the LiHa from the instrument.  
Refer to cross references above.

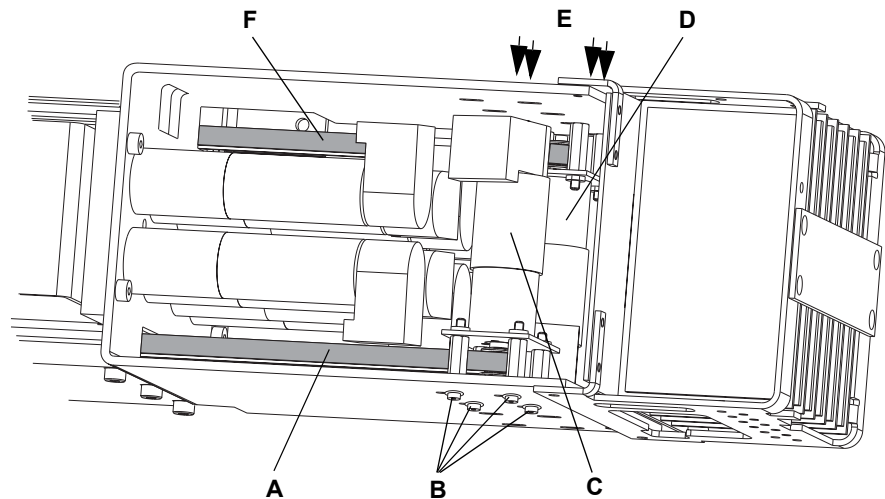


Fig. 8-44 LiHa motors/Y-motors

- |   |                      |   |                                |
|---|----------------------|---|--------------------------------|
| A | Y-belt               | D | Y-spreading motor              |
| B | Y-motor fixing screw | E | Y-spreading motor fixing screw |
| C | Y-motor              | F | Y-spreading belt               |

- 2 Remove the fixing screws of the Y-motor or the Y-spreading motor (B or E), respectively, to release the tension of the Y-belt (A or F).
- 3 Disengage the belt from the Y-motor or the Y-spreading motor (C or D), respectively.
- 4 Disconnect the Y-motor from the LiHa 1536 backplane.
- 5 Remove the Y-motor.
- 6 Loosen the set screw and remove the pulley from the motor.

### Installing

To instal the Y-motor or the Y-spreading motor, proceed as follows:

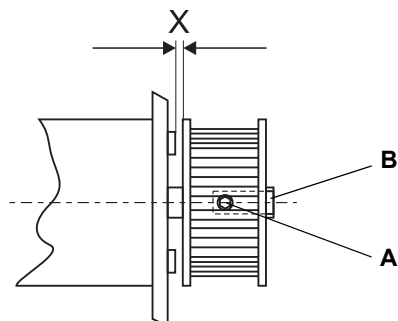


Fig. 8-45 Proper fixing of motor pulley

- 1 Mount the pulley on the motor shaft.  
Pay attention to the following:  
*The distance "x" must amount to 0.5 mm.*  
*Make sure that the set screw (A) of the pulley rests on the flat part (B) of the motor shaft.*

**Tests and Settings**

- 2 Install the Y-motor in reverse order as described for removal.  
*For cable connections, refer to cross references above.*
- 3 Adjust the tension of the Y-belt.  
Refer to cross references above.
- 4 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Verify reference position
  - Range move test
  - Random move test
  - Tip alignment verification
  - Individual Z verification
  - (Lower) DiTi eject test
  - Liquid detection test

**8.8.1 Z-Motors**

**Cross References**

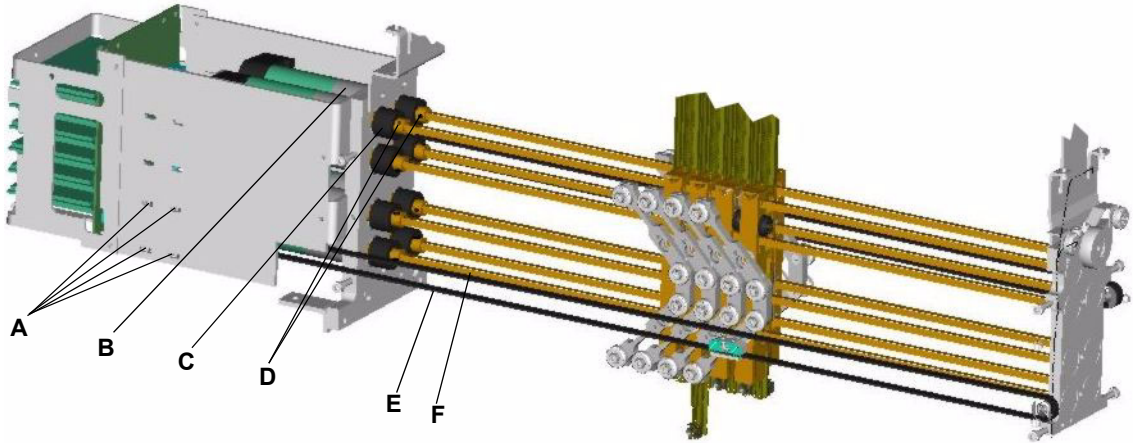
List of cross references to information provided in other sections:

Action	Reference
Remove LiHa	See section <a href="#">8.7.3</a> , <a href="#">8-23</a>
Cable connections	See section <a href="#">11.2.6</a> , <a href="#">11-8</a> and section <a href="#">11.2.7</a> , <a href="#">11-9</a>
Adjust tension of Y-belt	See section <a href="#">8.7.6</a> , <a href="#">8-38</a>

**Removing**

To remove the Z-motor, proceed as follows:

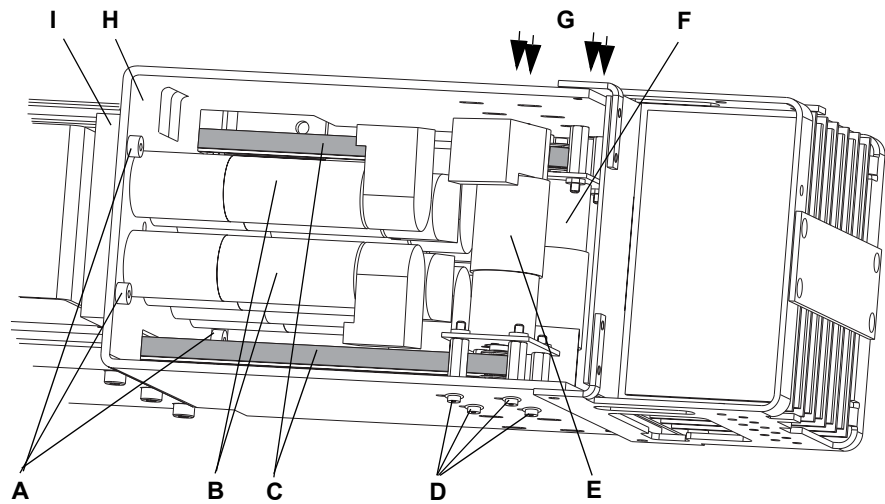
- 1 Remove the LiHa from the instrument.  
Refer to cross references above.



**Fig. 8-46** LiHa phantom view

- |   |                       |
|---|-----------------------|
| <b>A</b> Y-spreading motor fixing screw | <b>D</b> Set screw    |
| <b>B</b> Z-motor                        | <b>E</b> Y-belt       |
| <b>C</b> Coupling                       | <b>F</b> Square shaft |

- 2 Remove the set screws (D) of all couplings (C).
- 3 Remove the fixing screws (A) of the Y-motor and the Y-spreading motor to release the tension of the Y-belts (E).



**Fig. 8-47** LiHa motors/Z-motor

- |                               |   |
|-------------------------------|---|
| <b>A</b> Socket head screw    | <b>F</b> Y-spreading motor              |
| <b>B</b> Z-motor              | <b>G</b> Y-spreading motor fixing screw |
| <b>C</b> Y-belt               | <b>H</b> Z-motor assembly               |
| <b>D</b> Y-motor fixing screw | <b>I</b> Arm plate                      |
| <b>E</b> Y-motor              |   |

- 4 Disengage the belts (C) from the Y-motors (E, F).
- 5 Remove the four socket head screws (A).
- 6 Carefully separate the arm plate (I) from the Z-motor assembly (H).

*Do not pull the square shafts out of the Y-slide. Hold the square shafts back while removing the Z-motor assembly.*

- 7 Loosen the socket head screw of the coupling.
- 8 Remove the coupling from the Z-motor.
- 9 Remove the three Z-motor fixing screws and the Z-motor.
- 10 Disconnect the Z-motor from the LiHa 1536 backplane.
- 11 Remove the Z-motor.

**Installing**

To instal the Z-motor, proceed as follows:

- 1 Install the Z-motor in reverse order as described for removal.  
*For cable connections, refer to cross references above.*
- 2 Adjust the tension of the Y-belt.  
Refer to cross references above.



**Tests and Settings**

- 3 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - Verify reference position
  - Range move test
  - Random move test
  - Tip alignment verification
  - Individual Z verification
  - (Lower) DiTi eject test
  - Liquid detection test

**8.8.2 Square Shaft/Pinion Gear**

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Remove LiHa	See section <a href="#">8.7.3</a> ,  <a href="#">8-23</a>
Remove tip adapter	See section <a href="#">8.7.4</a> ,  <a href="#">8-27</a>



**ATTENTION**

Damage to the new pinion gear Z-axis.  
If the pinion gear Z-axis is worn the square shaft is usually in bad condition, too.  
When paired with a used square shaft the pinion gear Z-axis may wear off quickly.

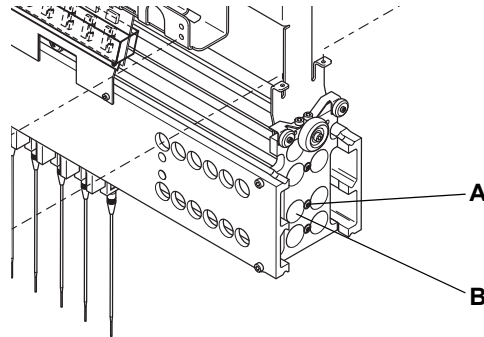
- ♦ Always replace both parts at the same time.

**Removing**

To remove the square shaft and the pinion gear Z-axis, proceed as follows:

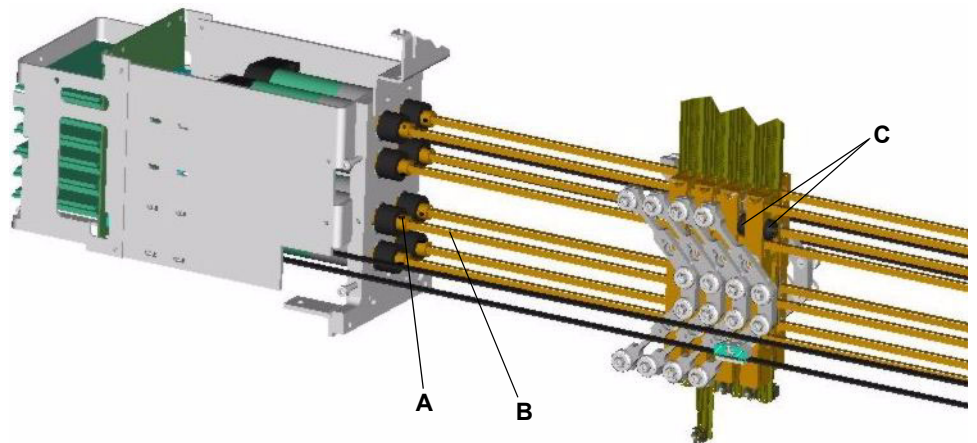
- 1 Remove the LiHa from the instrument.  
Refer to cross references above.





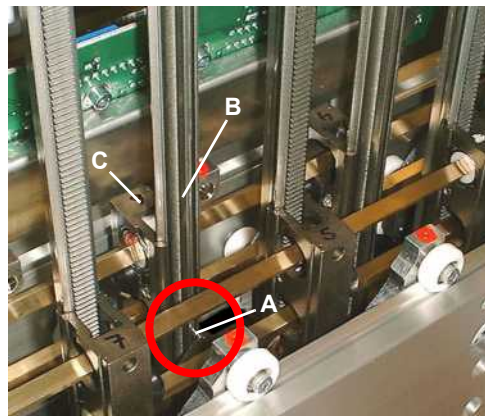
- 2 Remove the screw (A) of the corresponding front bushing.  
*The instructions given here refer to one specific square shaft/pinion gear Z-axis. To replace others, remove the corresponding parts.*
- 3 Remove the bushing (B).

**Fig. 8-48** Front bushings



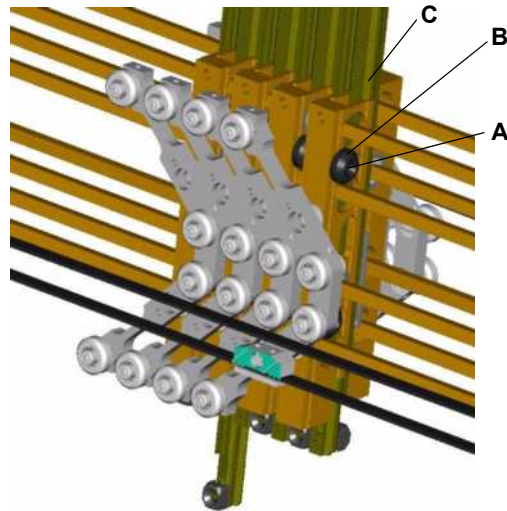
**Fig. 8-49** Phantom view: Removal of square shaft

- 4 Loosen the set screw (A).
- 5 Remove the square shaft (B).
- 6 Spread the Z-rods to make the screws of the retainers (C) accessible.



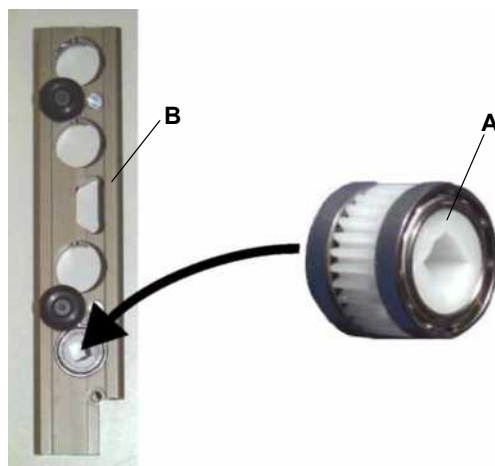
- 7 If necessary, carefully disengage the pin (A) of the spreading links from the slot (B) in the Z-rod, using a screwdriver.  
*The corresponding Z-guide (C) can be moved more freely to ease access to the screw of the retainer.*

**Fig. 8-50** Pin of spreading links



**Fig. 8-51** Retainer and Z-rod

- 8 Remove the screw (A).
- 9 Remove the retainer (B).
- 10 Remove the tip adapter from the Z-rod.  
Refer to cross references above.
- 11 Pull the Z-rod (C) out of the Z-guide until the gear is not engaged any more.



**Fig. 8-52** Pinion gear Z-axis

- 12 Extract the pinion gear Z-axis (A) together with the ball bearings from the Z-rod guide (B).

### Installing

To install the pinion gear Z-axis, proceed as follows:

- 1 Install the square shaft and the pinion gear Z-axis in reverse order as described for removal.  
Pay attention to the following:
  - Do not lubricate the parts
  - Do not apply force when pushing in the Z-rod; turn the pinion gear Z-axis in such a way that it engages properly in the Z-rod.
  - If removed: Make sure that the pin of the spreading links is engaged properly in the slot of the Z-rod.

### Tests and Settings


- 2 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - Verify reference position
  - Range move test
  - Random move test

- Tip alignment verification
- Individual Z verification
- (Lower) DiTi eject test
- Liquid detection test

### 8.8.3 Lower DiTi Eject Option

#### Spare Parts



**Which Spare Parts are Available?**

Refer to [10.4 “Liquid Handling Arm \(LiHa\)”](#),  [10-3](#) to identify the available spare parts and their part numbers.

#### Removing/Installing the Option

**Cross References**

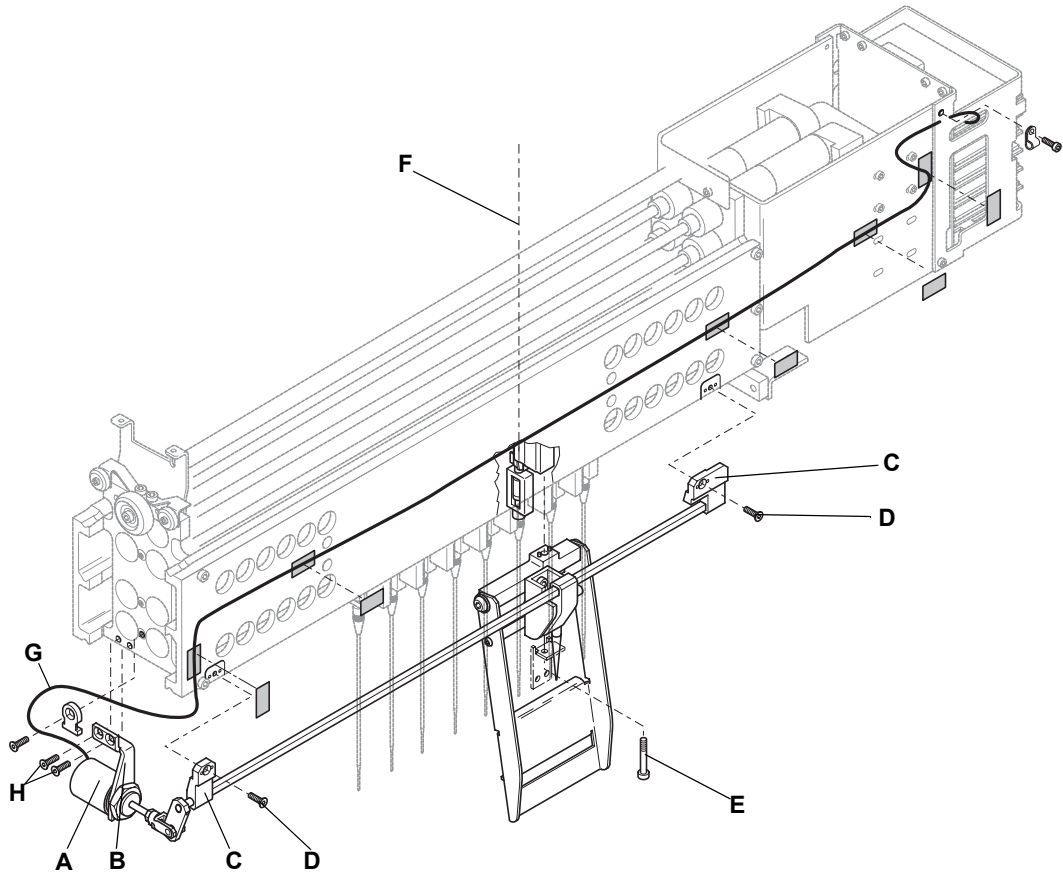
List of cross references to information provided in other sections:

Action	Reference
Cable connections	See section <a href="#">11.2.7</a> ,  <a href="#">11-9</a>
Rocker adjustment procedure	See section <a href="#">“Rocker Adjustment Procedure”</a> ,  <a href="#">8-51</a>

**Removing**

To remove the lower DiTi eject option, proceed as follows:

- 1 Remove the front cover and the right side cover of the LiHa.



**Fig. 8-53** Lower DiTi eject option assembly

<b>A</b>	Solenoid	<b>E</b>	Fixing screw rocker assembly
<b>B</b>	Solenoid holder	<b>F</b>	Z-rod No.3
<b>C</b>	Bearing block	<b>G</b>	Solenoid cable
<b>D</b>	Fixing screw bearing block	<b>H</b>	Fixing screw solenoid holder

- 2 Disconnect the solenoid cable (G) from the LiHa 1536 backplane.
- 3 Free the cable from cable holders and velcro tape.
- 4 Unscrew the fixing screw (E) from the housing of the Z-rod No. 3 (F).
- 5 Unscrew the fixing screws (D) of the bearing blocks (C).
- 6 Unscrew the fixing screws (H) of the solenoid holder (B).
- 7 Remove the complete lower DiTi eject option assembly.

## Installing

To install the lower DiTi eject option, proceed as follows:

- 1 Install the lower DiTi eject option in reverse order as described for removal. Pay attention to the following:
  - Make sure that the fixing screws of the solenoid holder (H) are tightened firmly.
  - Connect the solenoid cable correctly to the LiHa 1536 backplane as shown in the following figure. Also refer to cross references above.

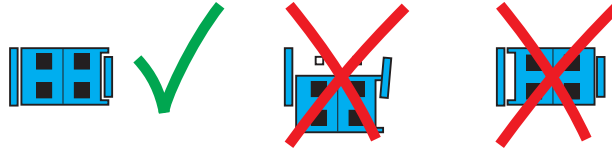


Fig. 8-54 Correct connection of solenoid cable to LiHa backplane

**Tests and Settings**

- 2 Perform the rocker adjustment procedure. Refer to cross references above.
- 3 To ensure operating readiness, perform the following settings and tests: Refer to the "Instrument Software Manual".
  - Calibrate lower DiTi eject
  - Lower DiTi Eject test

**Solenoid**

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Cable connections	See section 11.2.7, 11-9
Rocker adjustment procedure	See section "Rocker Adjustment Procedure", 8-51

**Replacing**

To replace the solenoid, proceed as follows:

- 1 Remove the front cover and the right side cover of the LiHa.

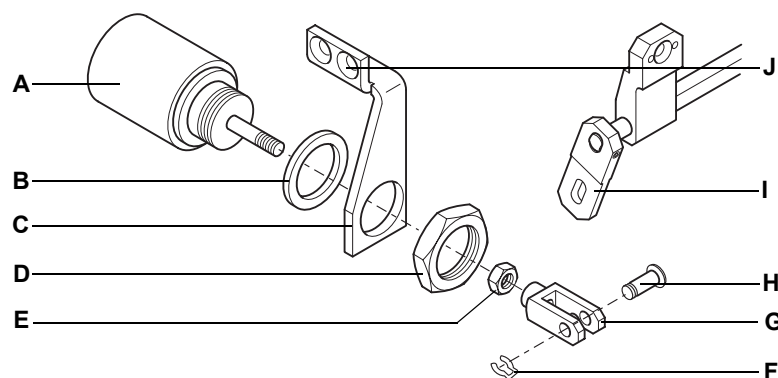


Fig. 8-55 Solenoid

- |                       |                |
|-----------------------|----------------|
| A Solenoid            | F Circlip      |
| B Washer              | G Fork head    |
| C Solenoid holder     | H Pin          |
| D Solenoid fixing nut | I Lever        |
| E Armature fixing nut | J Fixing screw |

- 2 Disconnect the solenoid cable from the LiHa 1536 backplane.

- 3 Free the cable from cable holders and velcro tape.
- 4 Remove the circlip (F).
- 5 Pull out the pin (H).
- 6 Remove the cable clamp securing the solenoid cable to the front face of the LiHa.
- 7 Remove the two fixing screws (J) of the solenoid holder (C).
- 8 Remove the fork head (G) and the armature fixing nut (E).
- 9 Unscrew the solenoid fixing nut (D).
- 10 Remove the solenoid (A) and the washer (B) from the solenoid holder.

**Installing**

- 11 Instal the solenoid in reverse order as described for removal. Pay attention to the following:
  - Sparingly apply grease to the pin (H).
  - Make sure that the solenoid holder screws are tightened firmly.
  - Check if the solenoid assembly can move freely. The lever (I) must have sufficient play in the fork head.
  - Connect the solenoid cable correctly to the LiHa 1536 backplane. Refer to cross references above.
- 12 Perform the rocker adjustment procedure. Refer to cross references above.

**Tests and Settings**

- 13 To ensure operating readiness, perform the following settings and tests: Refer to the “Instrument Software Manual”.
  - Calibrate lower DiTi eject
  - Lower DiTi Eject test

**When to Perform the Adjustment?**

**Rocker Adjustment Procedure**

Always perform the rocker adjustment procedure

- ♦ after installation the complete lower DiTi eject option,
- ♦ replacement of the solenoid,
- ♦ whenever the rocker touches the Z-rods on the LiHa,
- ♦ if DiTis are not ejected correctly.

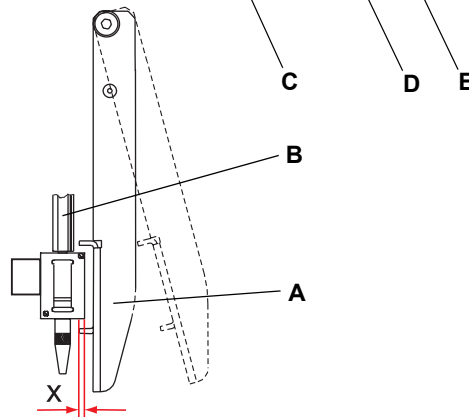
To adjust the rocker, proceed as follows:



- 1 Manually pull the solenoid armature back as shown in the figure to check the distance between the rocker assembly (A) and the Z-rods (B):

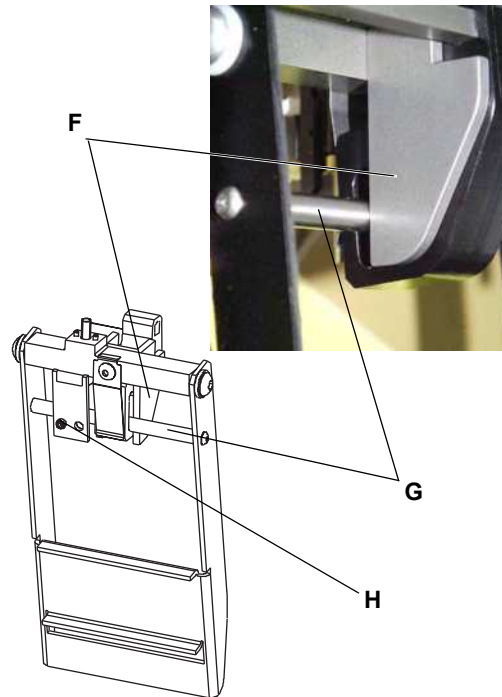
*In the eject position, the overlap distance (x) between the rocker nose and the tip adapter must be between 2 and 3 mm.*

*The rocker assembly must never touch the Z-rods.*



- A Rocker assembly
- B Z-rod
- C Solenoid
- D Armature
- E Armature fixing nut

**Fig. 8-56** Rocker adjustment



**Fig. 8-57** Adjustment screw

- F** Moving lever guide
- G** Rocker shaft
- H** Set screw

- 2** If necessary, adjust the overlap distance by means of the set screw (H) on the rocker stop:
  - Turn the set screw clockwise to decrease the overlap.
  - Turn the set screw counter-clockwise to increase the overlap.
- 3** Loosen the armature fixing nut (E, see Fig. 8-56 “Rocker adjustment”, 8-51).
- 4** Reduce the clearance between rocker shaft (G) and moving lever guide (F) to an absolute minimum (until almost touching):
  - Turn the solenoid armature (D, see Fig. 8-56 “Rocker adjustment”, 8-51) clockwise to reduce the clearance until the rocker moves away from the moving lever guide.
  - Then turn 1/2 turn counter-clockwise.
- 5** Tighten the armature fixing nut.
- 6** To ensure operating readiness, perform the following settings and tests: Refer to the “Instrument Software Manual”.
  - Calibrate lower DiTi eject
  - Lower DiTi Eject test



## 8.9 Robotic Manipulator Arm (RoMa Standard, Long)

### Special Tools

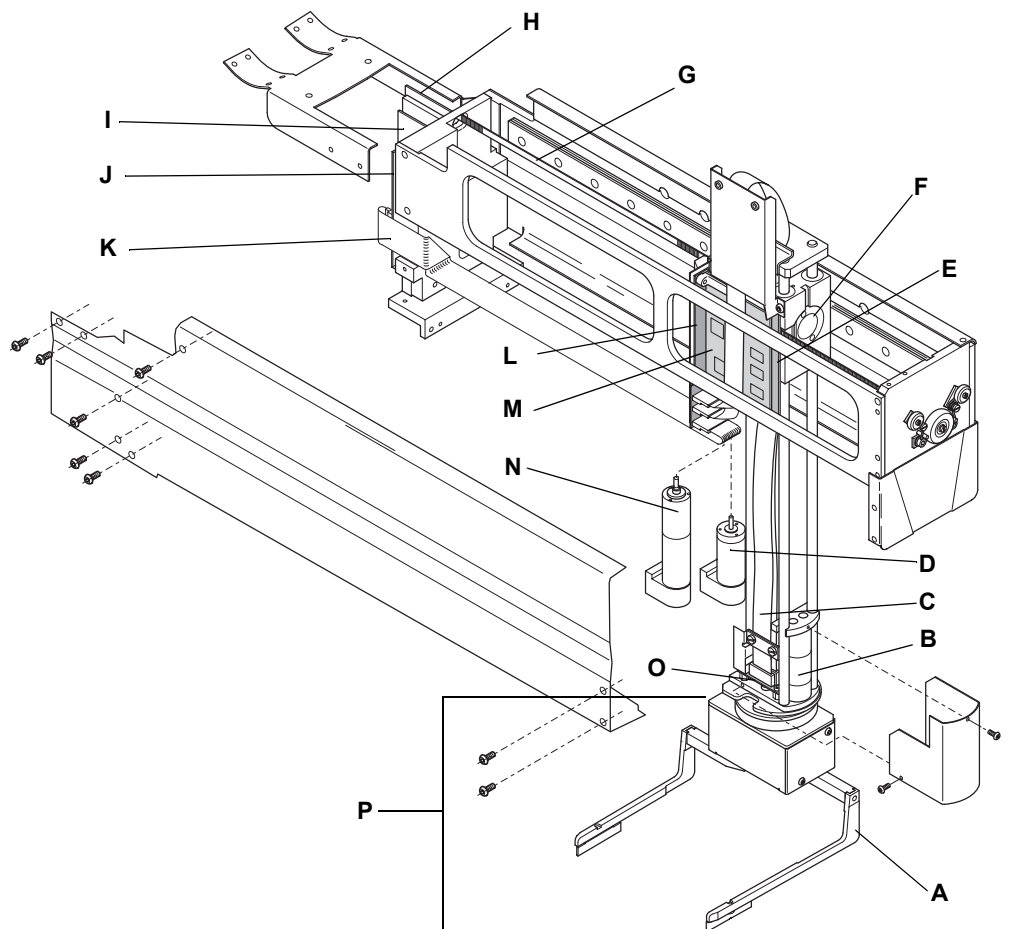
The following special tools are necessary:

- ♦ Mounting bracket
- ♦ Reference tip

### 8.9.1 Overview

#### RoMa Standard Parts

The figure shows the main parts of the RoMa standard:

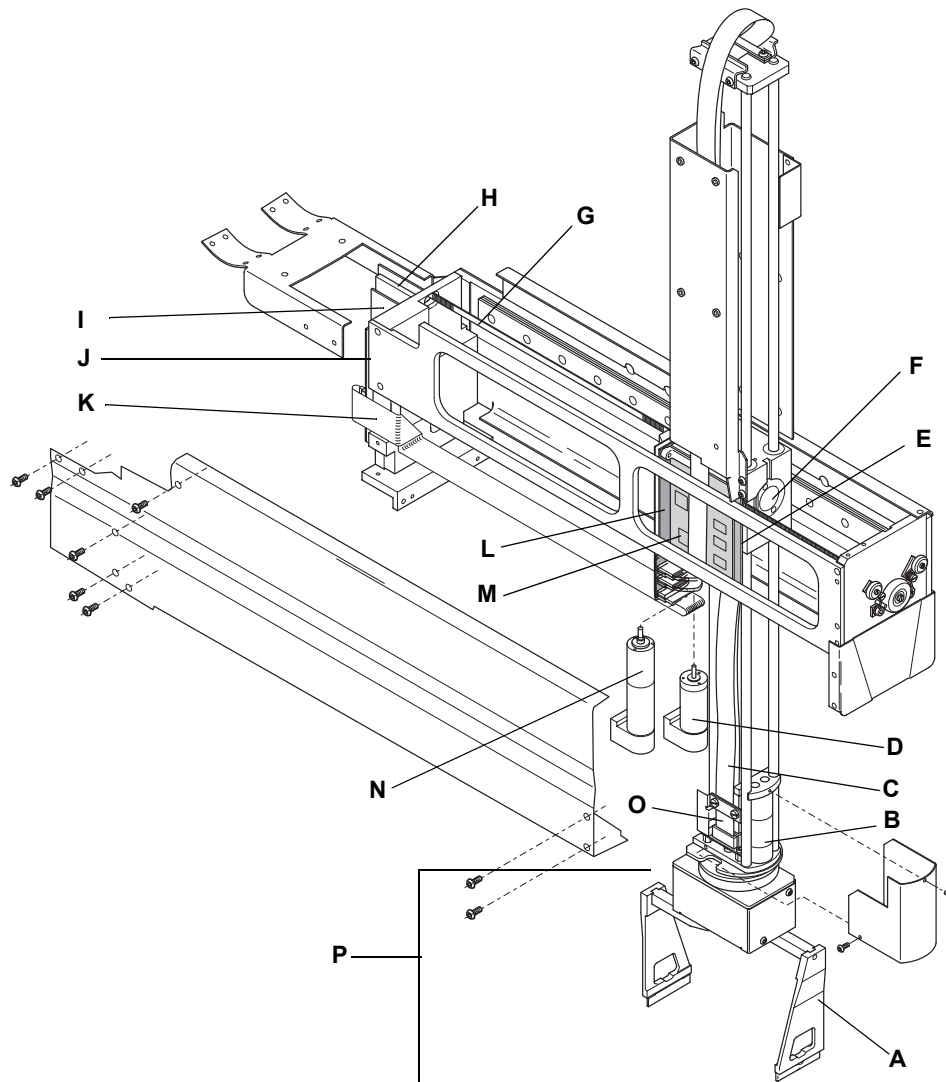


**Fig. 8-58** RoMa standard parts

- |          |                                    |          |   |
|----------|------------------------------------|----------|---|
| <b>A</b> | <i>Eccentric gripper</i>           | <b>I</b> | <i>Device CU</i>                          |
| <b>B</b> | <i>R-motor</i>                     | <b>J</b> | <i>RoMa Freedom backplane</i>             |
| <b>C</b> | <i>Gripper/rotator flex cables</i> | <b>K</b> | <i>Y-flex cable</i>                       |
| <b>D</b> | <i>Y-motor</i>                     | <b>L</b> | <i>RoMa 2 backplane</i>                   |
| <b>E</b> | <i>Y/R-DC servo board</i>          | <b>M</b> | <i>Z/G-DC servo board</i>                 |
| <b>F</b> | <i>Z-brake</i>                     | <b>N</b> | <i>Z-motor</i>                            |
| <b>G</b> | <i>Y-belt</i>                      | <b>O</b> | <i>Gripper board</i>                      |
| <b>H</b> | <i>X-DC servo power board</i>      | <b>P</b> | <i>Gripper module (including gripper)</i> |

**RoMa Long  
 Parts**

The figure shows the main parts of the RoMa long:



**Fig. 8-59** RoMa long parts

- |                                      |   |
|--------------------------------------|---|
| <b>A</b> Centric gripper             | <b>K</b> Y-flex cable                                     |
| <b>B</b> R-motor                     | <b>L</b> RoMa 2 backplane                                 |
| <b>C</b> Gripper/rotator flex cables | <b>M</b> Z/G-DC servo board                               |
| <b>D</b> Y-motor                     | <b>N</b> Z-motor  |
| <b>E</b> Y/R-DC servo board          | <b>O</b> Gripper board                                    |
| <b>F</b> Z-brake                     | <b>P</b> Gripper module (including gripper) <sup>1)</sup> |
| <b>G</b> Y-belt                      |   |
| <b>H</b> X-DC servo power board      |   |
| <b>I</b> Device CU                   |   |
| <b>J</b> RoMa Freedom backplane      |   |

1) The assembly "gripper module" (P) includes the eccentric grippers (A) according to Fig. 8-58 "RoMa standard parts", 8-53 and not the centric grippers (A) shown here.

**8.9.2 Spare Parts RoMa**

**Which Spare Parts are Available?**

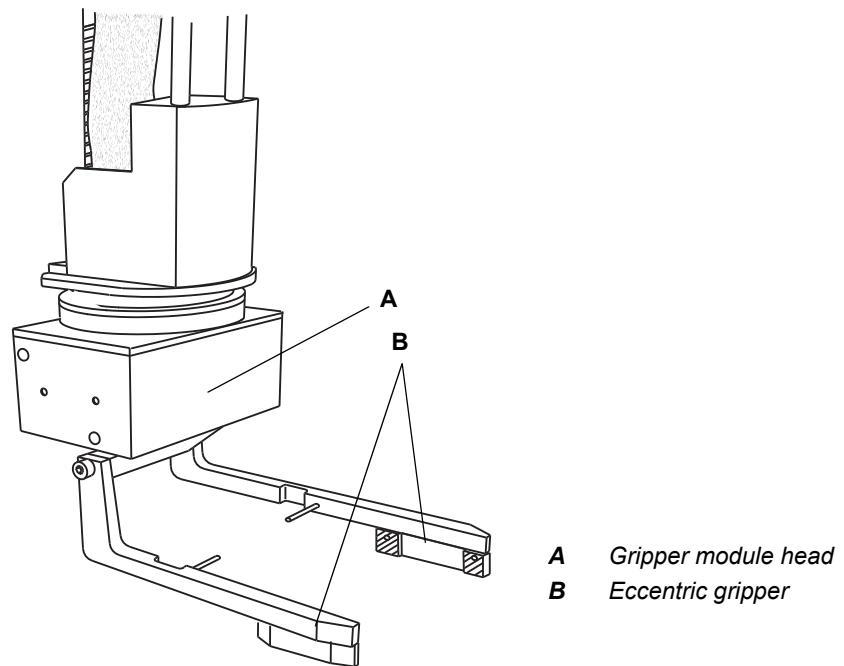
Refer to 10.5 “Robotic Manipulator Arm (RoMa)”, 10-4 to identify the available spare parts and their part numbers.

**Remarks on Some Spare Parts**

Pay attention to the following remarks when ordering spare parts:

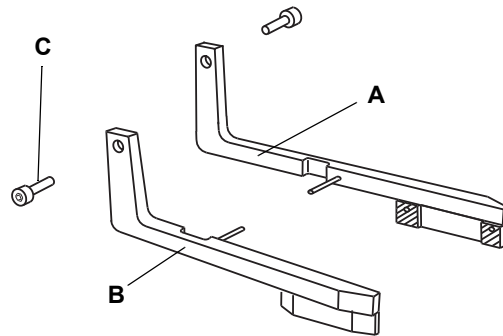
- ♦ Some of the spare parts shown in the figures (see cross references above) are actually sets of spare parts.
- ♦ The RoMa standard and RoMa long do not include the grippers.
- ♦ Eccentric gripper fingers can be used for both RoMa standard and RoMa long.
- ♦ Centric gripper fingers are used for RoMa long only.

**Gripper Module**



**Fig. 8-60** Gripper module

### Eccentric Gripper



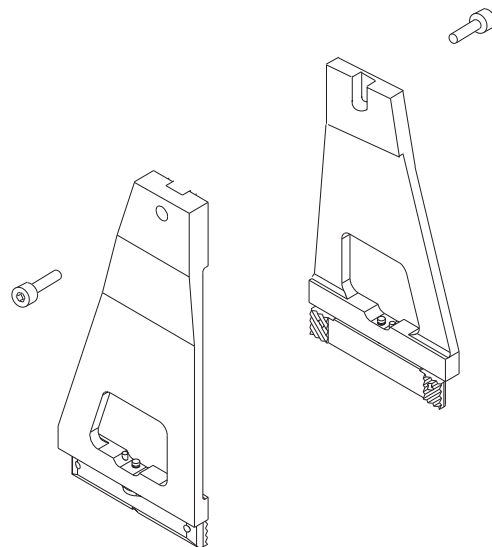
The spare part designated “Eccentric gripper” is a set that includes the following components:

- ♦ Long gripper finger (A); one piece
- ♦ Short gripper finger (B); one piece
- ♦ Fixing screws M4 x 8 (C); two pieces

**Fig. 8-61** Eccentric gripper

**Note:** Eccentric gripper fingers are used with both RoMa standard and RoMa long.

### Centric Gripper



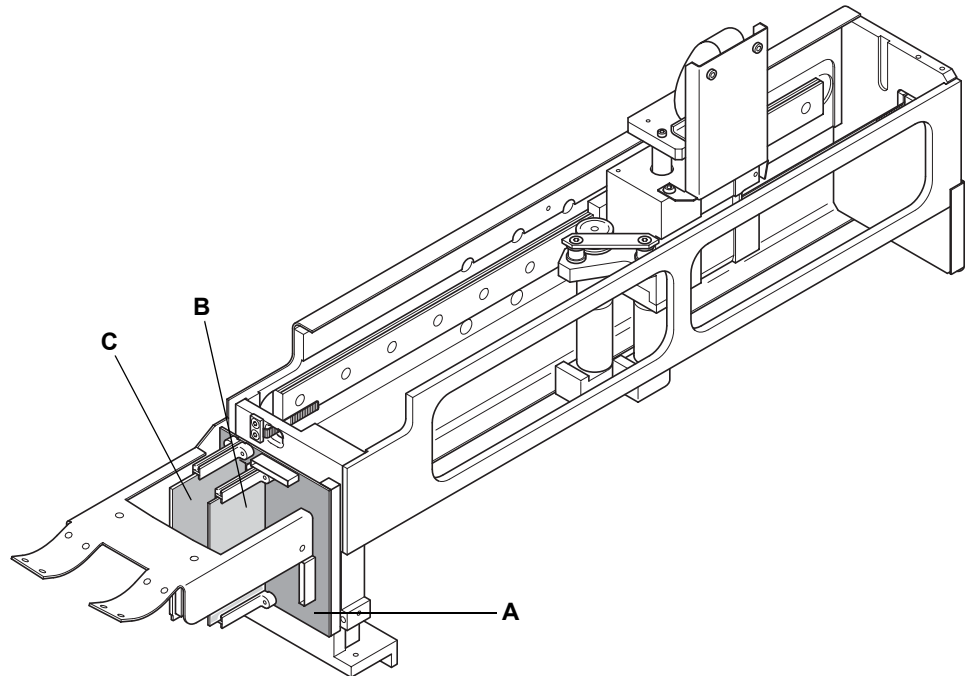
The spare part “Centric gripper” is a set that includes the following components:

- ♦ Left centric gripper finger (A); one piece
- ♦ Right centric gripper finger (B); one piece
- ♦ Fixing screws M4 x 8 (C); two pieces

**Fig. 8-62** Centric grippers

**Note:** Centric gripper fingers are used for RoMa long only.

**RoMa Backplane, Device CU and X-DC Servo Board**



**Fig. 8-63** RoMa standard, RoMa long, electronic boards at the back

- A** RoMa Freedom backplane
- B** Device CU
- C** X-DC servo power board

**Note:** These three boards are the same for RoMa standard and RoMa long.  
 For part numbers, refer to chapter 10 “Spare Parts and Accessories”, 10-1.

**8.9.3 Basic Considerations**

**Note the Name**

The designation RoMa is used for RoMa standard or RoMa long.

**Procedures and Illustrations**

Most procedures apply to both RoMa types:

- ◆ The procedures for removing/installing parts of the RoMa described in the following apply to both the RoMa standard and RoMa long, unless stated otherwise.
- ◆ The illustrations usually show the RoMa standard.

**8.9.4 Complete RoMa Arm**

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Correct X-drive motor	See section 8.6.2, 8-17

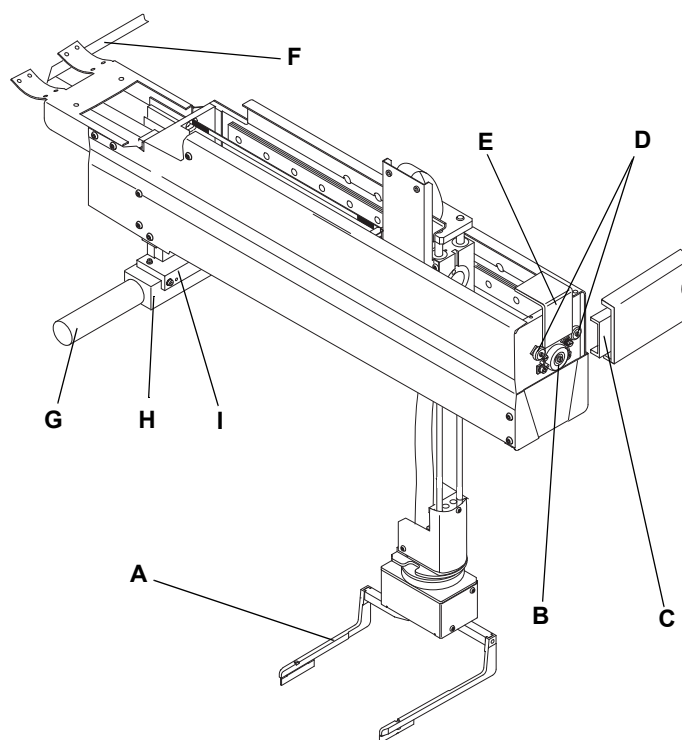
## Removing

To remove the RoMa, proceed as follows:



- 1 Remove the diluter cover (either A or B, depending on the side you want to remove the RoMa).

**Fig. 8-64** Diluter cover



**Fig. 8-65** Removing the RoMa

- |          |                     |          |              |
|----------|---------------------|----------|--------------|
| <b>A</b> | Gripper finger      | <b>F</b> | X-flex cable |
| <b>B</b> | Support roller      | <b>G</b> | X-shaft      |
| <b>C</b> | Guide rail at front | <b>H</b> | X-carriage   |
| <b>D</b> | Guide rollers       | <b>I</b> | X-support    |
| <b>E</b> | Mounting bracket    |          |              |

- 2 Remove the gripper fingers (A).
- 3 Unplug the X-flex cable (F) and remove it from the cable holder at the rear of the RoMa.
- 4 Unscrew the X-support (I) from the X-carriage (H).
- 5 Carefully lift the RoMa out of the guide rail (C) and off the X-carriage (H).

## Installing



To install the RoMa, proceed as follows:

### ATTENTION

Malfunction possible if the DC-servo boards of RoMa are not compatible with the X-drive motor.

- ♦ Make sure you use the correct combination DC-servo boards / X-drive motor.
- ♦ Refer to section “X-Drive Assembly” for detailed information (see cross references above).

- 1 Clean the contact surface of the guide rail as well as the guide rollers and the support roller with a lint-free tissue and some ethyl alcohol.
- 2 Insert the mounting bracket (E) while pulling the guide rollers (D) apart.
- 3 Install in reverse order as described for removal. Pay attention to the following:
  - Do not tighten the fixing screws at this point.
  - Do not install the gripper fingers yet (A, eccentric or centric, respectively).
  - Remove mounting bracket (E).

### 8.9.5 Mechanical Adjustment After Reinstallation

**Cross References**

List of cross references to information provided in other sections:

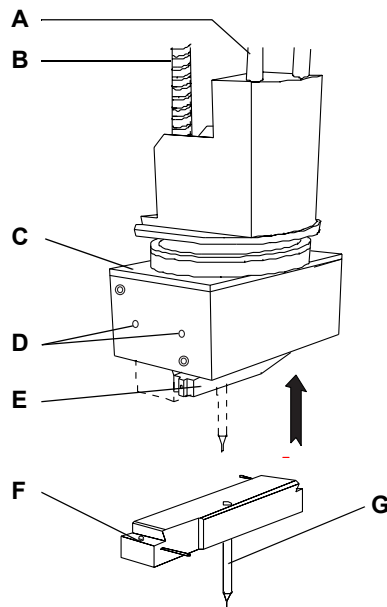
Action	Reference
install grippers	See section 8.9.6, 8-63
Check operating readiness	See section 8.9.20, 8-84

**Why Adjust?**

After the RoMa has been installed so far it must be aligned with the guide pins on the worktable. The purpose of this alignment is to ensure that the RoMa runs parallel to the guide pins when it moves in the Y-axis. (back ↔ front).

**Installing the Reference Tip**

Install the reference tip as follows:



**Fig. 8-66** Fixing the reference tip to the gripper module

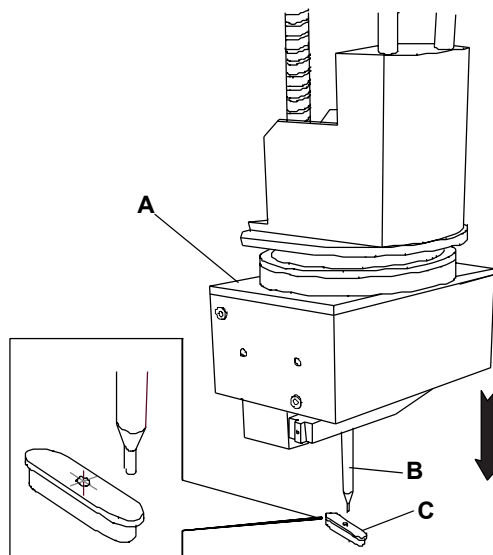
- |  |                                 |
|--|---------------------------------|
| <b>A</b> Z-rods  | <b>E</b> Gripper finger support |
| <b>B</b> Z-spindle   | <b>F</b> Protruding screw       |
| <b>C</b> Gripper module head                                     | <b>G</b> Reference tip          |
| <b>D</b> Screws for positioning gripper finger supports manually |                                 |

- 1 Move the RoMa gripper module head (C) by its Z-rods (A) to the front center above the worktable.
- 2 Insert the reference tip (G) between the two gripper finger supports (E):
  - The protruding screw (F) must be on the side of the screws (D).
  - Turn one of the screws (D) until the reference tip can be inserted between the gripper finger supports (E).
- 3 Fix the reference tip (G) to the gripper module head (C) by turning one of the screws (D) in the opposite direction. Make sure the reference tip (G) is firmly held by the gripper finger supports (E).

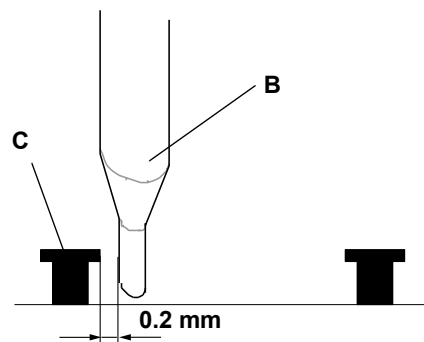
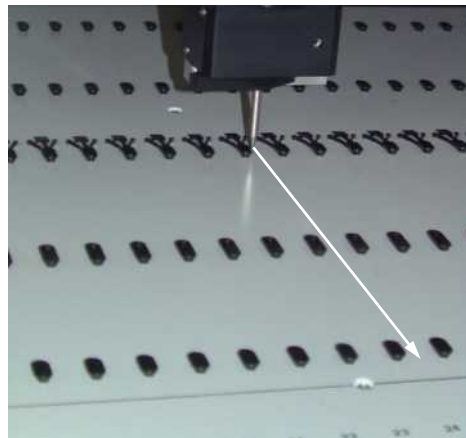


**Checking Alignment Y-Axis**

To check the alignment of the RoMa in the direction of the Y-axis, proceed as follows:



**Fig. 8-67** Positioning the reference tip



**Fig. 8-68** Checking the distance guide pin-reference tip

- 1 Pull the gripper module head (A) downwards.
- 2 Move the reference tip (B) close to the right edge of a guide pin (C) in the third row from the front on the worktable. Distance from guide pin: approx. 0.2 mm.

- 3 Firmly hold the X-carriage with one hand (item G in Fig. 8-69, 8-62).

**Note:**

*Make sure that the RoMa cannot move in the direction of the X-axis during the following test.*

*Or: Start instrument and run arm to a defined position.*

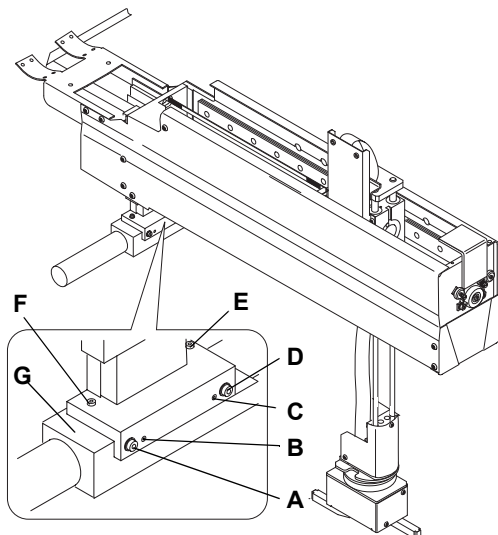
*Refer to the "Instrument Software Manual".*

- 4 Pull the RoMa gripper module head in the Y-axis (from rear to front) past three guide pins (C) towards the front of the Instrument.
- 5 Check the distance between the guide pins (C) and the reference tip (B).  
*The distance between the guide pins and the reference tip must not differ more than 0.2 mm.*
- 6 If the distance is greater, align the RoMa as follows.

**Aligning in Y-axis**

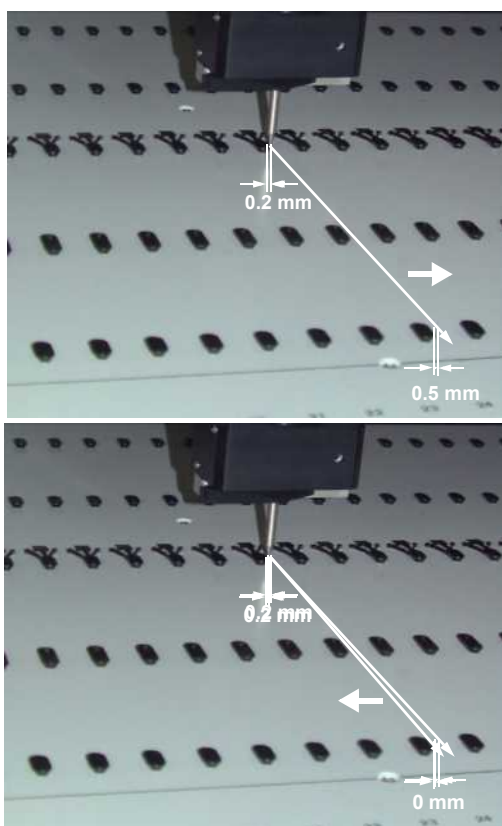
To align the RoMa in the direction of the Y-axis, proceed as follows:

- 1 Use the set screws (B) and (C) to adjust the angle of the Y-axis of the RoMa.



- A Left fixing screw M4 x 12
- B Left set screw M4 x 10
- C Right set screw M4 x 10
- D Right fixing screw M4 x 12
- E Right fixing screw M3 x 10
- F Left fixing screw M3 x 10
- G X-carriage

**Fig. 8-69** Fixing and adjusting screws on X-support



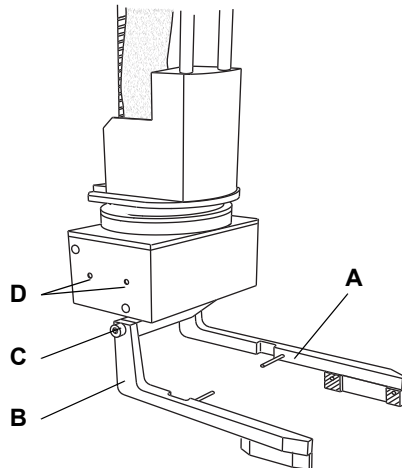
- 2 If the RoMa drifts to the right, turn the right set screw (C) inwards to correct.
- 3 If the RoMa drifts to the left, turn the left set screw (B) inwards to correct.
- 4 Repeat steps 1 to 3 until the RoMa moves parallel to the guide pins.
- 5 Tighten all fixing screws when the alignment is correct (see Fig. 8-69 “Fixing and adjusting screws on X-support”, 8-62).
- 6 Remove the reference pin.
- 7 Install the grippers. Refer to cross references above.
- 8 Carry out the necessary steps to ensure operating readiness. Refer to cross references above.

**Fig. 8-70** Correction of drifts

### 8.9.6 Gripper Fingers

#### Removing

To remove the gripper fingers, proceed as follows:



**Note:** The eccentric gripper fingers are not the same length:

- Short gripper finger: 131 mm
- Long gripper finger: 161 mm (has slotted hole 4.2 mm for height adjustment).

- A** Long gripper finger
- B** Short gripper finger
- C** Fixing screw M4 x 8
- D** Screws for moving gripper fingers manually

Fig. 8-71 Gripper fingers

- 1 Loosen the fixing screws (C) and remove the long gripper finger (A) and the short gripper finger (B).

#### Installing

To instal the gripper fingers, proceed as follows:

- 1 Install the short gripper finger (B) and tighten its fixing screw (C). Make sure that you install it on the correct side as shown in the figure.
- 2 Attach the long gripper finger (A) and fasten it slightly.

#### Adjusting the Gripper Fingers



Fig. 8-72 Adjustment of the right gripper finger

- 3 Carefully pull the gripper module down until the gripper fingers just touch the surface of the worktable.
- 4 If the distance of the gripper fingers to the worktable is not equal adjust the height:
  - Eccentric grippers: Long gripper finger
  - Centric grippers: Right gripper finger (view from front)
  - The difference from one to the other finger must not exceed 0.5 mm.

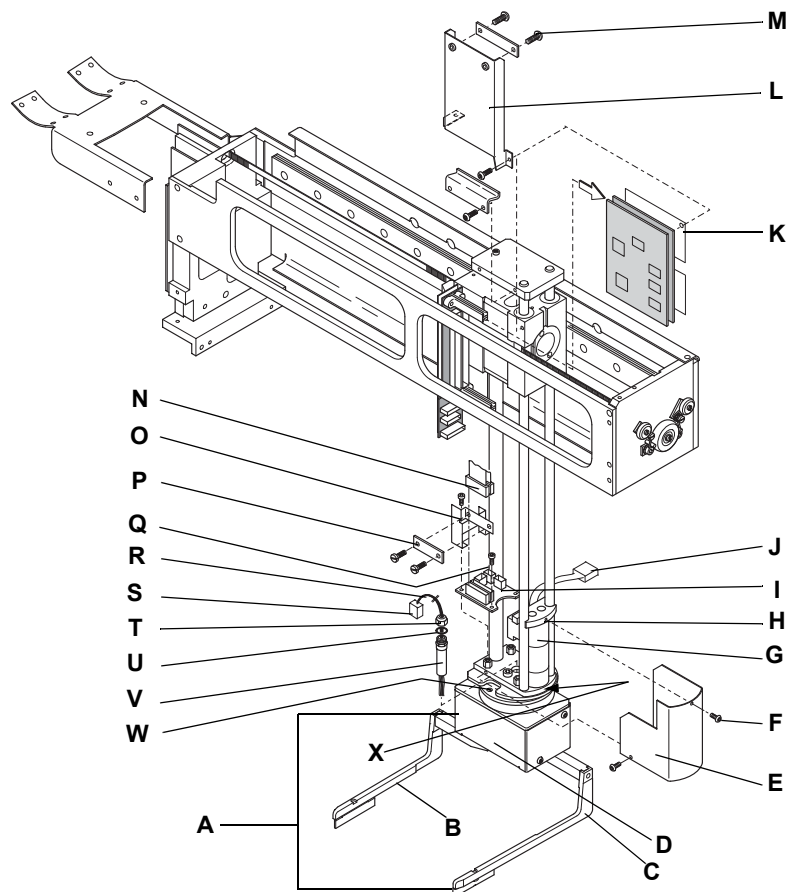
- 5 Tighten the fixing screw of the right gripper finger when the adjustment is done.

### 8.9.7 Gripper Module Head

**Note:** Whenever possible, replace the complete RoMa, i.e. do not take it apart in the field. Reason:

Some parts, such as the gripper module head (D) or the R-motor (G) are rather difficult to remove since their fixing screws are not easily accessible.

#### Overview



**Fig. 8-73** Overview of rotator and gripper modules

<b>A</b>	Gripper module (including grippers)	<b>M</b>	Fixing screw (cable protection) M3 x 5
<b>B</b>	Short gripper finger	<b>N</b>	Gripper/rotator flex cables
<b>C</b>	Long gripper finger	<b>O</b>	Gripper/rotator flex cables holder bracket
<b>D</b>	Gripper module head	<b>P</b>	Gripper/rotator flex cables clamp
<b>E</b>	Rotator cover	<b>Q</b>	Fixing screws (gripper board) M3 x 6
<b>F</b>	Fixing screws M2.5 x 6	<b>R</b>	Gripper motor cable
<b>G</b>	R-motor	<b>S</b>	Cable connector
<b>H</b>	Z-stop	<b>T</b>	Cap nut
<b>I</b>	Gripper board	<b>U</b>	O-ring
<b>J</b>	R-motor cable	<b>V</b>	Bushing
<b>K</b>	Flex cable protection strip	<b>W</b>	Fixing screws (gripper module)
<b>L</b>	Gripper/rotator flex cables protection bracket	<b>X</b>	Fixing screws (rotor motor) M2 x 8

**Removing/Installing the Gripper Module Head**

**Cross  
 References**

List of cross references to information provided in other sections:

Action	Reference
Check operating readiness	See section 8.9.20, 8-84

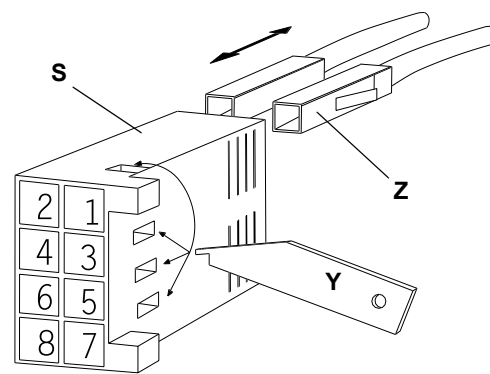
**Note:** Details see Fig. 8-73 “Overview of rotator and gripper modules”, 8-64.

To remove the gripper module head, proceed as follows:

**Unplugging the  
 Cables**

- 1 Unscrew the rotator cover (E).
- 2 Remove the gripper/rotator flex cables clamps (P).
- 3 Unscrew gripper/rotator flex cables holder bracket (O).
- 4 Disconnect the gripper/rotator flex cables from the gripper board (I):
  - for RoMa Standard: short flex cable.
  - for RoMa Long: long flex cable.
- 5 Disconnect the rotor motor cable (J).
- 6 Disconnect the gripper motor cable (R).

**Extracting the  
 Wires**



- 7 Use the crimp release tool (Y) to extract the individual wires from the connector (S).  
*Be careful not to damage the contacts (Z).*

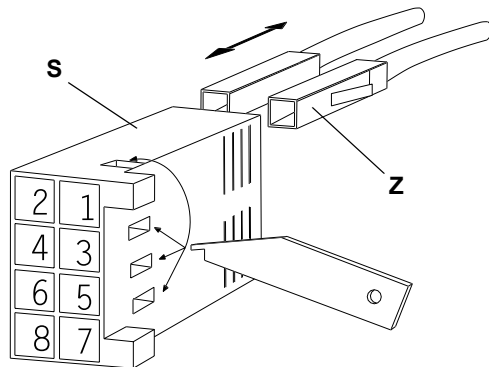
**Fig. 8-74** Gripper motor cable connector:  
 Removing contacts

**Removing the  
 Gripper Module  
 Head**

- 8 Remove the cap nut (T), the O-ring (U) and the bushing (V).
- 9 Unscrew and remove the gripper board (I).
- 10 Now you can unscrew and remove the gripper module head (D).

### Installing the Gripper Module Head

To instal the gripper module head, proceed in reversed order as described for removal. Pay attention to the following:



- 1 Reinsert the contacts (Z) into the housing of the connector (S).
  - Make sure that you insert the contacts correctly into the housing.
  - Pay attention to the wire colors as shown in the table below:

**Fig. 8-75** Gripper motor cable connector: Installing contacts

**Tab. 8-3** Wire colors



Connector	Color	Connector	Color
Pin 1	White	Pin 2	Not used
Pin 3	Yellow	Pin 4	Red
Pin 5	Green	Pin 6	Black
Pin 7	Not used	Pin 8	Violet

- 2 Check operating readiness.  
 Refer to cross references above.

### 8.9.8 R-motor

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Remove/install gripper module head	Refer to <a href="#">8.9.7</a> ,  <a href="#">8-64</a>
Check operating readiness	See section <a href="#">8.9.20</a> ,  <a href="#">8-84</a>

**Note:** Details see [Fig. 8-73](#) “Overview of rotator and gripper modules”,  [8-64](#).

**Removal**

To remove the R-motor, proceed as follows:

- 1 Loosen the gripper module head (D) to gain access to the fixing screws (X) of the R-motor (G).  
Refer to cross references above.
- 2 Unscrew and remove the R-motor.

**Installation**

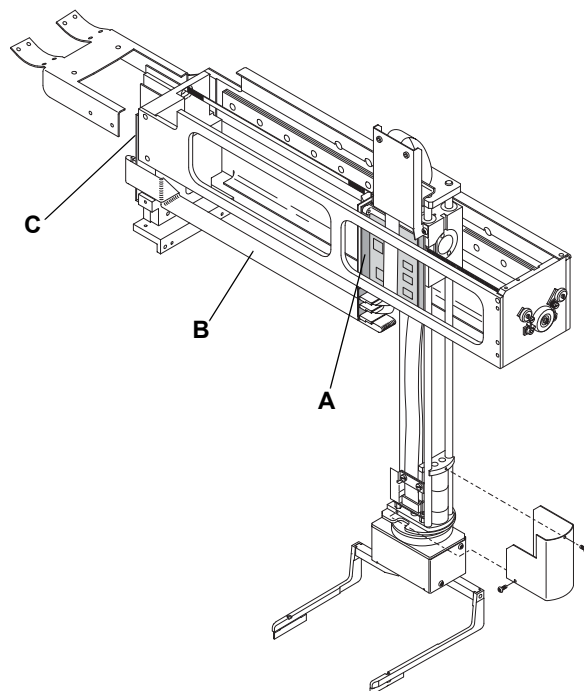
To instal the R-motor, proceed as follows:

- 1 Reinstall the R-motor (G).
- 2 Reinstall the gripper module head (D).  
Refer to cross references above.
- 3 Check operating readiness.  
Refer to cross references above.

### 8.9.9 Y-flex cable

#### Removal

To remove the Y-flex cable, proceed as follows:



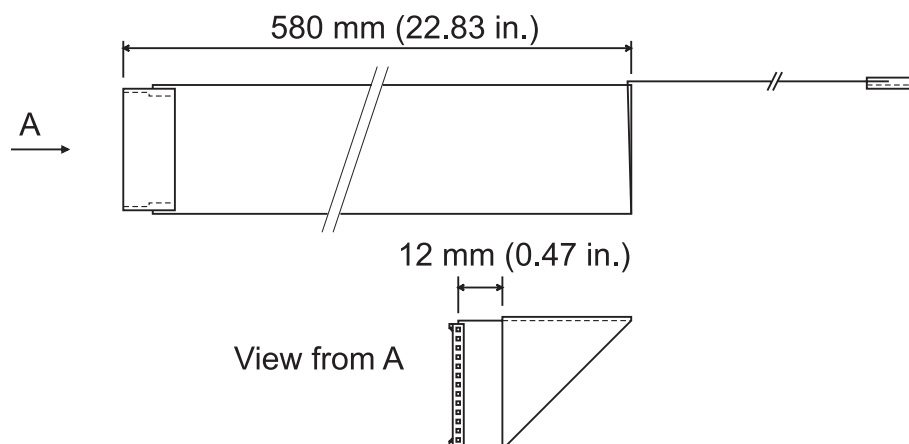
**Fig. 8-76** Y-flex cable

- 1 Remove various cable clamps.
- 2 Disconnect the Y-flex cable (B) from the RoMa backplane (A) and RoMa Freedom backplane (C).

#### Installation

To instal the Y-flex cable, proceed as follows:

- 1 Prepare the Y-flex cable according to the following drawing:



**Fig. 8-77** Y-flex cable RoMa

- 2 Instal the Y-flex cable in reverse order as described for removal.



### 8.9.10 Gripper/Rotator Flex Cables

**Cross  
 References**

List of cross references to information provided in other sections:

Action	Reference
Remove DC servo boards	See section 8.9.11, 8-70
Check operating readiness	See section 8.9.20, 8-84

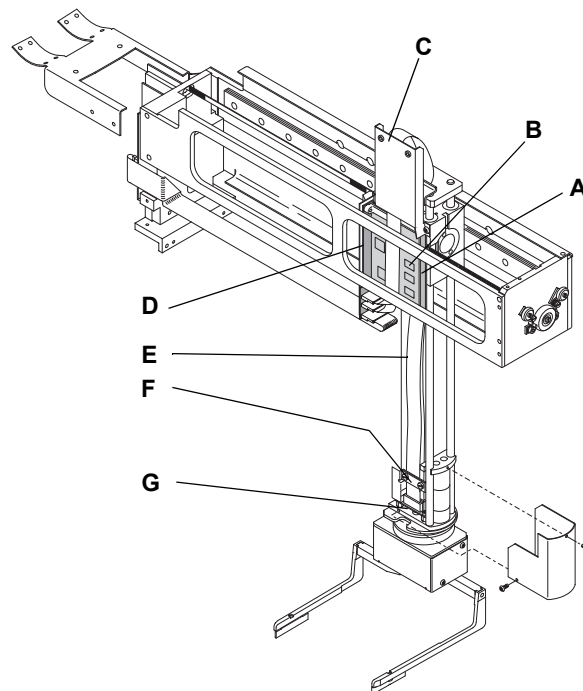
**General**

Please consider the following general remarks:

- ◆ The gripper/rotator flex cables are two parallel cables - for the rotator motor and for the gripper motor - which are connected to the RoMa backplane and to the gripper board.
- ◆ The gripper/rotator flex cables for RoMa standard and RoMa long are not the same length and have different spare part numbers.

**Removal**

To remove the gripper/rotator flex cables, proceed as follows:



**Fig. 8-78** Gripper/rotator flex cables

- 1 Remove various cable clamps (F).
- 2 Unscrew and remove the cable protection bracket (C).
- 3 Remove the Z- and Y/R-DC servo boards (B) and (A). Refer to cross references above.
- 4 Disconnect the respective gripper/rotator flex cable (E) from the RoMa 2 backplane (D) and the gripper board (G).
  - RoMa standard (short flex cables)
  - RoMa long (long flex cables)

**Installation**

To instal the gripper/rotator flex cables, proceed as follows:



**Fig. 8-79** Prepared gripper/rotator flex cable

- 1 Prepare the gripper/rotator flex cables as shown in the figure.
- 2 Install the gripper/rotator flex cables in reverse order as described for removal.
- 3 Check operating readiness. Refer to cross references above.

**8.9.11 Y/R- and Z/G-DC Servo (II) Boards**

**Cross References**

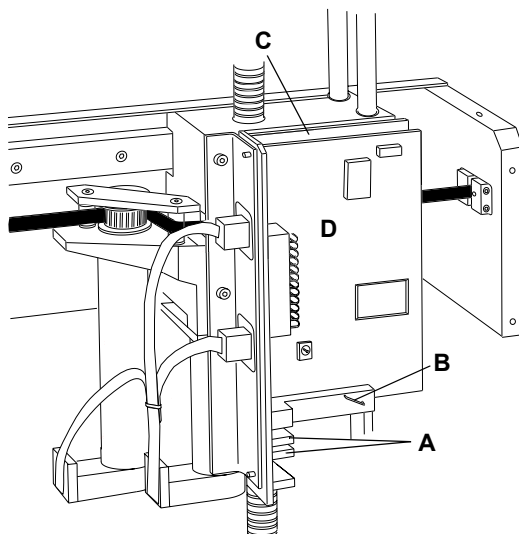
List of cross references to information provided in other sections:

Action	Reference
Check operating readiness	See section 8.9.20, 8-84

**Note:** See [Fig. 8-73](#) "Overview of rotator and gripper modules", 8-64 for items which are not shown in the figure below.

**Removing the Boards**

To remove the boards, proceed as follows:



**Fig. 8-80** Servo boards

- |   |                             |
|---|-----------------------------|
| <b>A</b> Connectors gripper/rotator flex cables | <b>C</b> Y/R-DC servo board |
| <b>B</b> Board locking clip                     | <b>D</b> Z/G-DC servo board |

**Disconnecting  
 the Y-Flex  
 Cable**

- 1 Remove the gripper/rotator flex cables protection bracket.  
 See figure mentioned in cross references above.  
*Important!*  
*Do not remove the flex cable protection strip.*  
*See figure mentioned in cross references above.*
- 2 Disconnect the gripper/rotator flex cables from the connectors.

**Removing the  
 Z/G-DC Servo  
 Board**



**ATTENTION**

Be careful not to damage the gripper/rotator flex cables when you remove the board.  
 Leave the flex cable protection strip in place between the cable and the board until it is removed.

- 3 Open the board locking clip (B).
- 4 Carefully remove the Y/R-DC servo (II) board (C).

**Installing the  
 Boards**

To instal the boards, proceed as follows:

- 1 Make sure that the address selectors are set correctly.

**Address Setting**

*For the address setting of the different PCBs, refer to the table below:*

**Tab. 8-4** DC servo board address setting

Board	Position	Address Setting	Motors
DC servo <sup>a)</sup>	C (Fig. 8-80, 8-70)/right	#6	Y/R
DC servo <sup>a)</sup>	D (Fig. 8-80, 8-70)/left	#7	Z/G
DC servo II <sup>b)</sup>	C (Fig. 8-80, 8-70)/right	#1	Y/R
DC servo II <sup>b)</sup>	D (Fig. 8-80, 8-70)/left	#2	Z/G

a) to instrument serial No. 0283  
 b) from instrument serial No. 0284

- 2 Install the boards in reverse order as described for removal.
- 3 Check operating readiness.  
 Refer to cross references above.

### 8.9.12 RoMa 2 Backplane

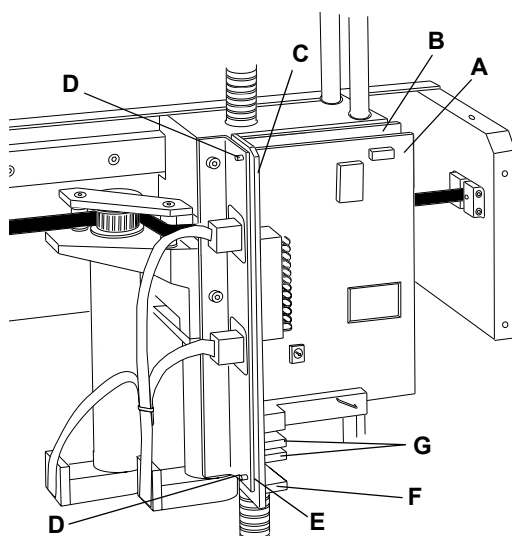
#### Cross References

List of cross references to information provided in other sections:

Action	Reference
Remove servo boards	See section 8.9.11, 8-70
Check operating readiness	See section 8.9.20, 8-84

#### Removing

To remove the RoMa 2 backplane, proceed as follows:



- 1 Disconnect all cables (F, G) from the RoMa 2 backplane (C)
- 2 Remove the Z- and Y/R-DC servo boards (A) and (B). Refer to cross references above.
- 3 Remove the fixing screws (D), the spacers (E) and the RoMa 2 backplane.

Fig. 8-81 DC servo boards

- |                                    |   |
|------------------------------------|---|
| <b>A</b> Z/G-DC servo board        | <b>E</b> Spacer                                 |
| <b>B</b> Y/R-DC servo board        | <b>F</b> Connector for Y-flex cable             |
| <b>C</b> RoMa 2 backplane          | <b>G</b> Connectors Gripper/rotator flex cables |
| <b>D</b> Fixing screws (backplane) |   |

#### Installing

To instal the RoMa 2 backplane, proceed as follows:

- 1 Check the jumper settings (compare with the old board and set jumpers, accordingly).
- 2 Instal the RoMa 2 backplane in reverse order as described for removal.
- 3 Check operating readiness. Refer to cross references above.

**8.9.13 Y-Belt**

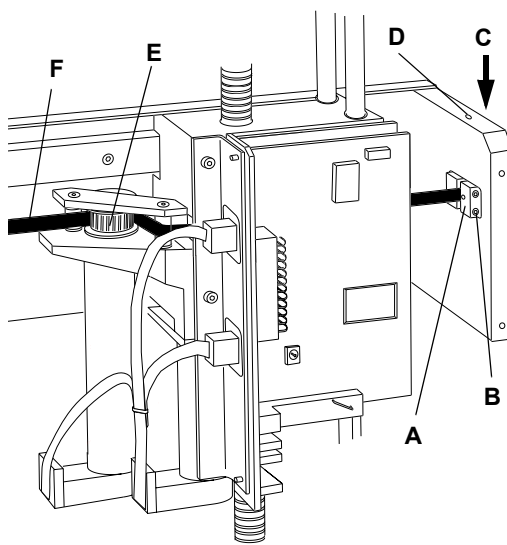
**Cross  
 References**

List of cross references to information provided in other sections:

Action	Reference
Check operating readiness	See section <a href="#">8.9.20</a> , <a href="#">8-84</a>

**Removing**

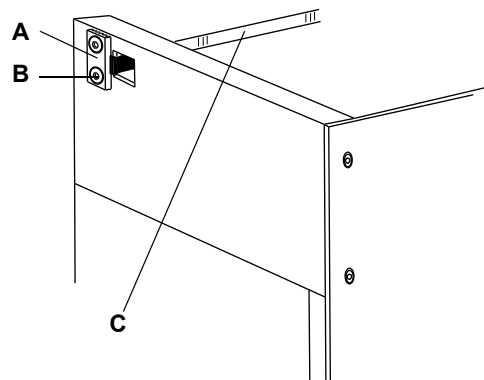
To remove the Y-belt, proceed as follows:



- 1 Loosen the fixing screw (D).
- 2 Remove belt tensioning screw (C) and belt lock (A).
- 3 Loosen the belt fixing screws (B) and separate the Y-belt from the belt lock.

- A Belt lock
- B Belt fixing screw
- C Belt tensioning screw (not directly visible) M3 x 12
- D Y-belt lock fixing screw M3 x 6
- E Y-pulley
- F Y-belt

**Fig. 8-82** Y-belt (front end)




- 4 Loosen the fixing screws (B) of the fixing plate (A) at the rear end of the RoMa until you can remove the Y-belt (C).
- 5 Pull out the Y-belt.

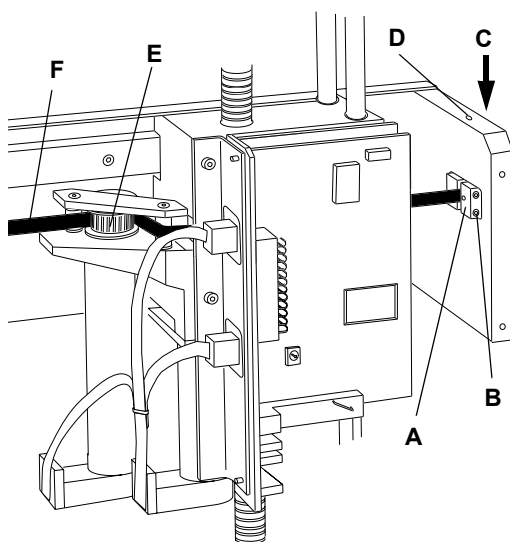
- A Fixing plate
- B Fixing screw M3 x 8
- C Y-belt

**Fig. 8-83** Y-belt (rear end)

**Installing**

To instal the Y-belt, proceed as follows:

- 1 Fix the Y-belt (C) at the rear end of the RoMa with the fixing plate (A) and the fixing screws (B) as shown in [Fig. 8-83 "Y-belt \(rear end\)"](#),  8-73.



- 2 Fix the Y-belt (F) at the front end as shown in the figure.
- 3 Tension the Y-belt by means of the belt tensioning screw (C).
- 4 Secure with Y-belt lock fixing screw (D) when the adjustment is done.

- A *Belt lock*
- B *Belt fixing screw*
- C *Belt tensioning screw (not directly visible)*  
M3 x 12
- D *Y-belt lock fixing screw M3 x 6*
- E *Y-Pulley*
- F *Y-belt*

**Fig. 8-84** Y-belt (front end)

- 5 Check operating readiness.  
Refer to cross references above.

8.9.14 Y-motor

Cross  
 References

List of cross references to information provided in other sections:

Action	Reference
Check operating readiness	See section 8.9.20, 8-84

Removing

To remove the Y-motor, proceed as follows:

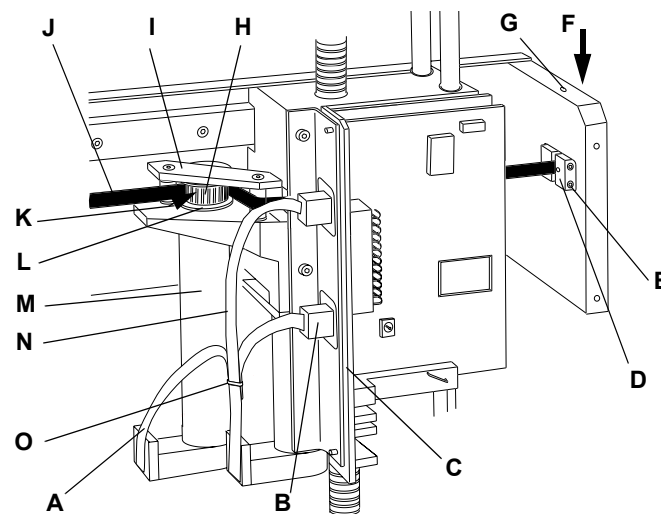


Fig. 8-85 Y-motor

- |   |  |   |                              |
|---|--|---|------------------------------|
| A | Y-motor cable  | H | Y-Pulley                     |
| B | Y-motor connector                                    | I | Mounting plate               |
| C | RoMa 2 backplane                                     | J | Y-belt                       |
| D | Belt lock  | K | Pulley fixing screw          |
| E | Belt fixing screw                                    | L | Y-motor fixing screws M2 x 6 |
| F | Belt tensioning screw (not directly visible) M3 x 12 | M | Y-motor                      |
| G | Y-belt lock fixing screw M3 x 6                      | N | Z-motor cable                |
|   |  | O | Cable tie                    |

- 1 Cut the cable tie (O) and disconnect the motor cables (A) and (N) from the RoMa 2 backplane (C).
- 2 Loosen the Y-belt lock fixing screw (G) and the belt tensioning screw (F) until the belt fixing screws (E) become accessible.  
*This releases the belt tension.*
- 3 Unscrew the mounting plate (I).
- 4 Loosen the pulley fixing screw (K) and remove the Y-pulley (H).
- 5 Remove the Y-motor fixing screws (L) and remove the Y-motor (M).

Installing

To instal the Y-motor, proceed as follows:

- 1 Instal the Y-motor in reverse order as described for removal.
- 2 Check operating readiness.  
 Refer to cross references above.

### 8.9.15 Z-motor

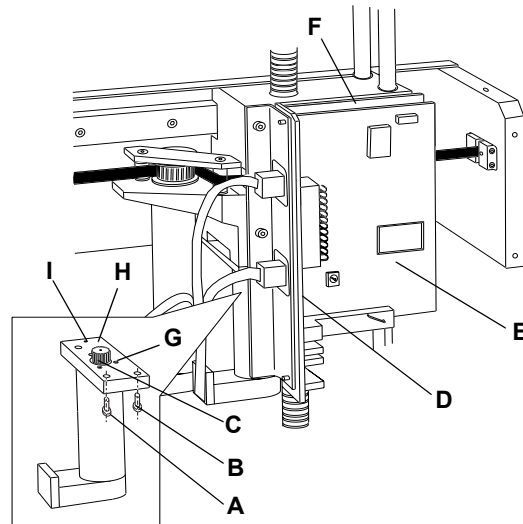
#### Cross References

List of cross references to information provided in other sections:

Action	Reference
Check operating readiness	See section <a href="#">8.9.20</a> , <a href="#">8-84</a>
Remove DC servo boards	See section <a href="#">8.9.11</a> , <a href="#">8-70</a>
Remove RoMa 2 backplane	See section <a href="#">8.9.12</a> , <a href="#">8-72</a>

#### Removing

To remove the Z-motor, proceed as follows:



**Fig. 8-86** Z-motor

- |  |                               |
|--|-------------------------------|
| <b>A</b> Z-motor                       | <b>F</b> Y/R-DC servo board   |
| <b>B</b> Fixing screws Z-motor support | <b>G</b> Fixing screws M2 x 6 |
| <b>C</b> Z-pulley                      | <b>H</b> Z-motor support      |
| <b>D</b> RoMa 2 backplane              | <b>I</b> Positioning hole     |
| <b>E</b> Z/G-DC servo board            |                               |

- 1 Remove the Z/G and Y/R-DC servo boards (E) and (F). Refer to cross references above.
- 2 Remove the RoMa 2 backplane (D). Refer to cross references above.
- 3 Unscrew and remove the Z-motor assembly [Z-motor support (H) and Z-motor (A)].
- 4 Remove the Z-motor (A).

#### Installing

To instal the Z-motor, proceed as follows:

- 1 Instal the Z-motor in reverse order as described for removal.
- 2 Check operating readiness. Refer to cross references above.



### 8.9.16 Z-Brake

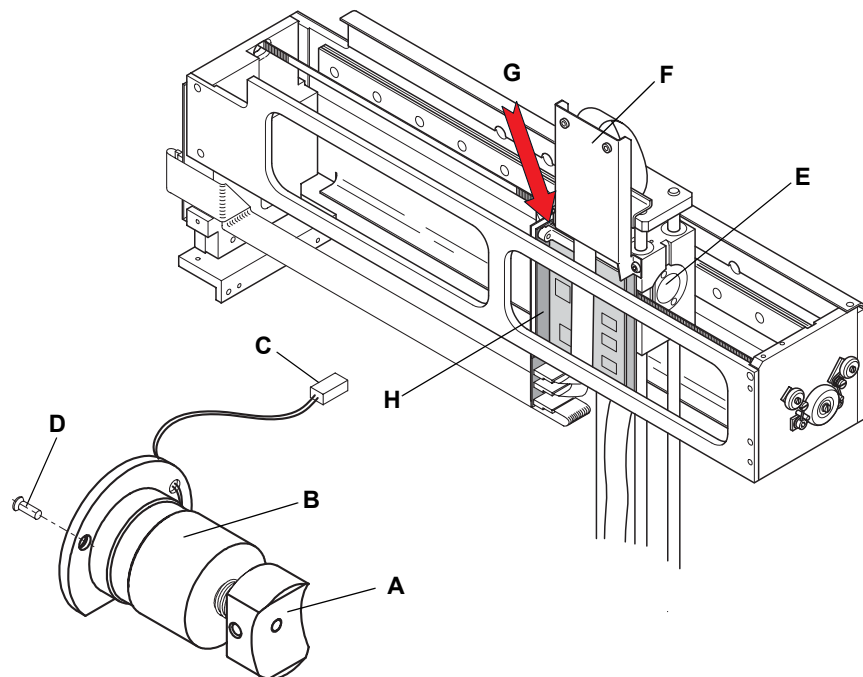
**Cross  
 References**

List of cross references to information provided in other sections:

Action	Reference
Check operating readiness	See section 8.9.20, 8-84

**Removing**

To remove the Z-brake, proceed as follows:



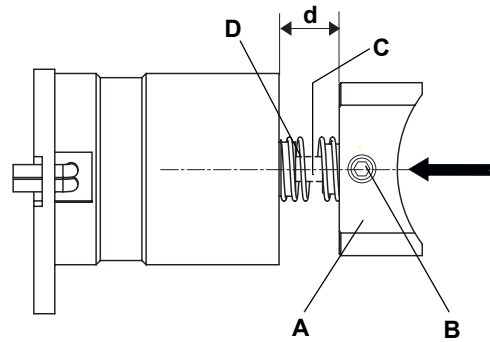
**Fig. 8-87** Z-brake

- |                            |   |
|----------------------------|---|
| <b>A</b> Brake shoe        | <b>E</b> Z-brake  |
| <b>B</b> Z-brake (removed) | <b>F</b> Gripper/rotator flex cables protection bracket |
| <b>C</b> Z-brake cable     | <b>G</b> Strain relief                                  |
| <b>D</b> Fixing screw      | <b>H</b> RoMa 2 backplane                               |

- 1 Disconnect the Z-brake cable (C) from the RoMa 2 backplane (H). The cable is held by the strain relief (G) near the Gripper/rotator flex cables protection bracket (F).
- 2 Unscrew and remove the Z-brake (E).

**Installing**

To instal the Z-brake, proceed as follows:

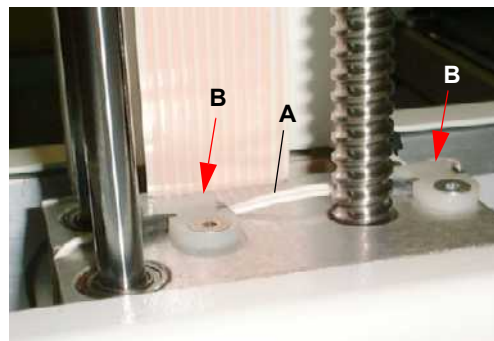


**Fig. 8-88** Checking/adjusting the distance “d”

- |                     |                          |
|---------------------|--------------------------|
| <b>A</b> Brake shoe | <b>C</b> Threaded axle   |
| <b>B</b> Set screw  | <b>D</b> Pressure spring |

**Note:** Brake shoe (A) is screwed to the axle (C) and fixed with the set screw (B).

- 1 Press the brake shoe (A) in the direction of the arrow to the stop.
- 2 Check the distance “d” (= 7.25 mm ± 0.2 mm).
- 3 Adjust it if necessary:
  - Loosen the set screw (B).
  - Hold the axle (C) with a pair of pliers and turn the brake shoe (A) until the distance is correct.
- 4 Fasten the set screw (B) when the adjustment is done.
- 5 Install the Z-brake (B, see Fig. 8-87 “Z-brake”, 8-77) in reverse order as described for removal.



**Fig. 8-89** Fixing of Z-brake cable

**Note:** Pay attention to the following:

- Make sure that the parts of the Z-brake cable (A) which are covered with shrinkable tubing are fixed by means of cable clamps (B) as shown in the figure.
- Push the Y-slide to the rearmost position and check if the cable collides with the base unit when the RoMa arm moves in X-direction. The cable must never touch any part of the base unit.

- 6 Check operating readiness.  
Refer to cross references above.

**8.9.17 RoMa Freedom Backplane**

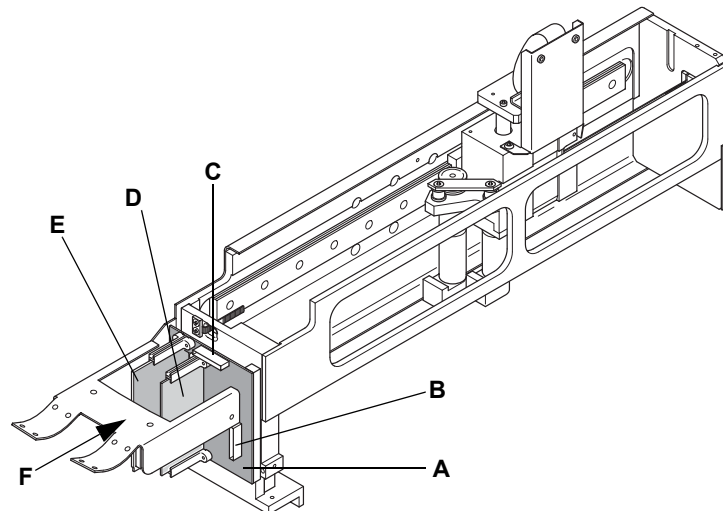
**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Remove device CU	See section 8.9.18, 8-81
Remove X-DC servo power board	See section 8.9.19, 8-82
CAN bus resistance test	See section 4.5, 4-7
Check operating readiness	See section 8.9.20, 8-84

**Replacing**

To replace the RoMa Freedom backplane, proceed as follows:



**Fig. 8-90** RoMa Freedom backplane, device CU and X-DC servo power board

- |          |                            |          |   |
|----------|----------------------------|----------|---|
| <b>A</b> | RoMa Freedom backplane     | <b>D</b> | Device CU   |
| <b>B</b> | Connector for Y-flex cable | <b>E</b> | X-DC servo power board                                  |
| <b>C</b> | Connector for X-flex cable | <b>F</b> | Connector for X-motor cable (bottom left corner of PCB) |

**Removing**

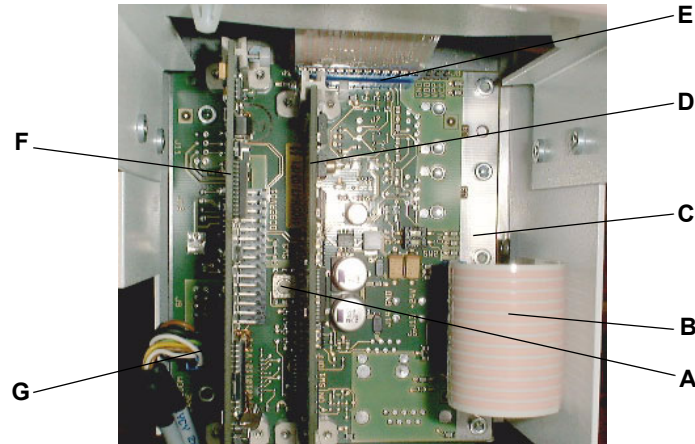
- 1 Disconnect all cables from the RoMa Freedom backplane (A):
  - Y-flex cable (B)
  - X-flex cable (C)
  - X-motor cable (F)
- 2 Remove the device CU (D). Refer to cross references above.
- 3 Remove the X-DC servo power board (E). Refer to cross references above.
- 4 Unscrew and remove the RoMa Freedom backplane.

**Installing**

To instal the RoMa Freedom backplane, proceed as follows:

**Setting the Address**

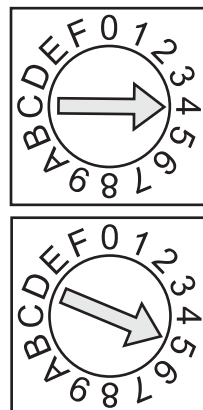
- 1 Set the address for the device CU.  
 The address switch (A) for the device CU (D) is located on the RoMa Freedom backplane (C).



**Fig. 8-91** Address selector; RoMa Freedom backplane

- |                                       |                                 |
|---------------------------------------|---------------------------------|
| <b>A</b> Address switch for device CU | <b>E</b> X-flex cable connector |
| <b>B</b> Y-flex cable connector       | <b>F</b> X-DC servo Board       |
| <b>C</b> RoMa Freedom backplane       | <b>G</b> X-motor cable          |
| <b>D</b> Device CU                    |                                 |

- The setting depends on:
  - whether there are one or two RoMas installed on the Freedom EVO.
  - whether the device CU belongs to RoMa module installed on the left or the right side (viewed from the front).



- ♦ RoMa on the left side (or single RoMa):
  - Address setting: 4
- ♦ RoMa on the right side (if there are two RoMas):
  - Address setting: 5

**Fig. 8-92** Address switch device CU

- 2 Instal the RoMa Freedom backplane in reverse order as described for removal.
- 3 Reconnect the cables.
- 4 Carry out the CAN bus resistance test.  
 Refer to cross references above.

- 5 Check operating readiness.  
 Refer to cross references above.

**8.9.18 Device CU**

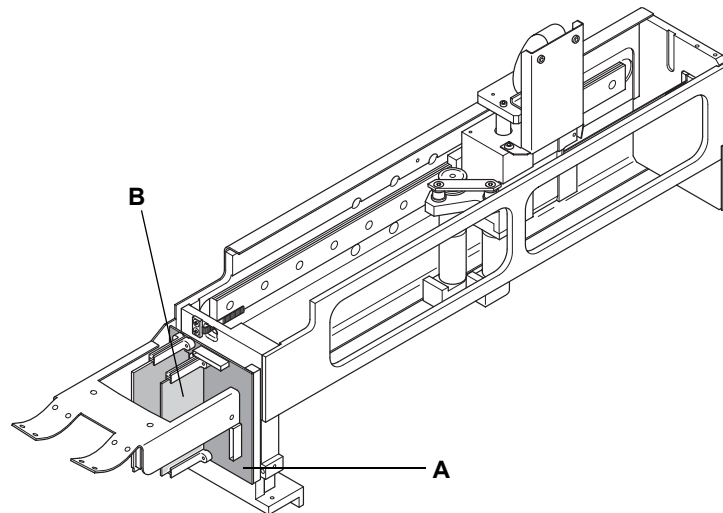
**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Set/check address for device CU	See section 8.9.17, 8-79
Check operating readiness	See section 8.9.20, 8-84

**Replacing**

To replace the device CU, proceed as follows:

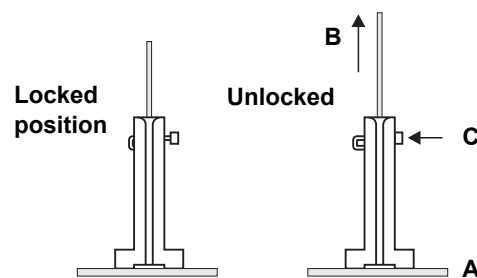


**Fig. 8-93** RoMa Freedom backplane, device CU

**A** RoMa Freedom backplane      **B** Device CU

**Note:** After exchanging the device CU board, a device setup must be performed:

**Removing**



**Fig. 8-94** PCB locking clip

- 1 Press the locking clip (C) to unlock the PCB.
- 2 Unplug the device CU (B) from the RoMa Freedom backplane (A).
- 3 Replace the device CU.

**Installing**

To instal the device CU, proceed as follows:

- 1 Check/set address for device CU.  
Refer to cross references above.
- 2 Plug the device CU into the RoMa Freedom backplane.
- 3 Secure the PCB with the locking clip.
- 4 Perform the following setups.  
For details refer to the “Instrument Software Manual”.
  - Instrument basic setup
- 5 Check operating readiness.  
Refer to cross references above.
- 6 Perform EEPROM backup.

### 8.9.19 X-DC Servo Power Board

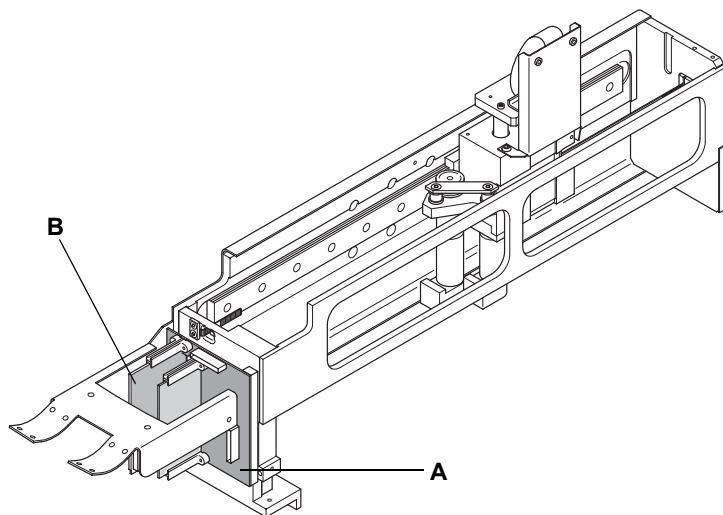
**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Check operating readiness	See section <a href="#">8.9.20</a> , <a href="#">8-84</a>

**Replacing**

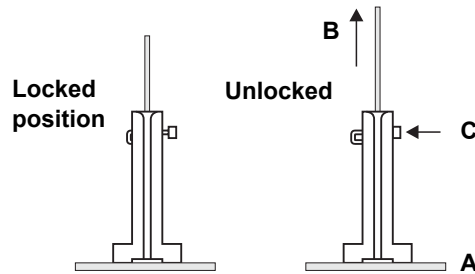
To replace the DC servo (II) power board, proceed as follows:



**Fig. 8-95** RoMa Freedom backplane, X-DC servo (II) power board

- A** RoMa Freedom backplane                      **B** X-DC servo (II) power board

**Removing**



- 1 Press the locking clip (C) to unlock the PCB.
- 2 Unplug the X-DC servo (II) power board (B) from the RoMa Freedom backplane (A).
- 3 Replace the X-DC servo (II) power board.

**Fig. 8-96** PCB locking clip

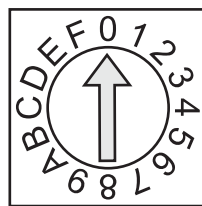
**Installing**

To instal the X-DC servo (II) power board, proceed as follows:

**Setting the Address**

- 1 Check/set the address for the X-DC servo (II) power board.

*Note: The address switch for the X-DC servo (II) power board is located on the board itself.*



- ◆ Set the address switch to position 0 (zero).

**Fig. 8-97** Address switch X-DC servo (II) power board

- 2 Plug the X-DC servo (II) power board into the RoMa Freedom backplane.
- 3 Secure the PCB with the locking clip.
- 4 Check operating readiness.  
 Refer to cross references above.

### 8.9.20 Checking RoMa Operating Readiness

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Adjust RoMa	See section <a href="#">8.9.5</a> , <a href="#">8-60</a>
CAN bus resistance test	See section <a href="#">4.5</a> , <a href="#">4-7</a>

**Purpose**

Most of the RoMa repair procedures require the removal of the entire RoMa before you can replace the damaged part.  
 To ensure the operating readiness of the RoMa, the adjustments and tests described below must always be carried out after reinstallation.

**Required  
Special Tools**

- ◆ Reference tip
- ◆ Test plate

**Adjustments,  
Tests**

- 5** Adjust the RoMa mechanically.  
Refer to cross references above.
- 6** If the complete RoMa arm or one of the RoMa backplanes have been replaced, carry out the CAN bus resistance test.  
Refer to cross references above.
- 7** Perform the following settings and tests:  
Refer to the “Instrument Software Manual”.
  - Verify reference positions
  - Range move test
  - Random move test
  - RoMa reference plate test



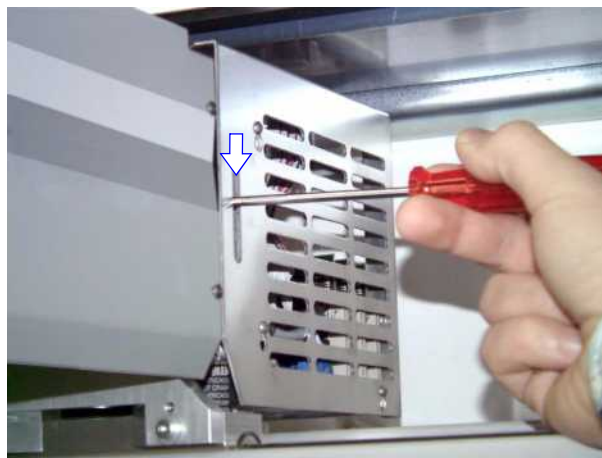
## 8.10 Pick and Place Arm (P&P)

### 8.10.1 General Information

**How to Release the Brake**

In order to move the P&P gripper head up and down with the instrument power off, release the brake by depressing the lever through the slot on the right side of the P&P, using a screwdriver.

See arrow in the figure below:



*Fig. 8-98 Slot for brake release access*

### 8.10.2 Spare Parts P&P

**Which Spare Parts are Available?**

Refer to [10.6 "Pick and Place \(P&P\)"](#), [10-6](#) to identify the available spare parts and their part numbers.

### 8.10.3 Complete P&P Arm

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
CAN bus resistance test	See section <a href="#">4.5</a> , <a href="#">4-7</a>
Connect cables	See section <a href="#">11.2.11</a> , <a href="#">11-13</a> and section <a href="#">11.2.16</a> , <a href="#">11-18</a>

**Removing**

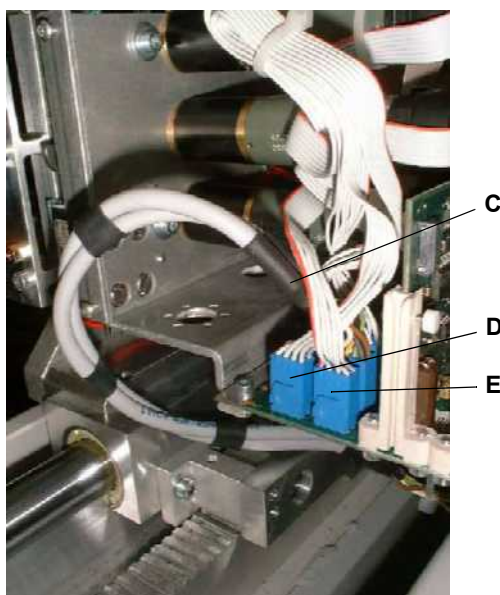
To remove the P&P arm, proceed as follows:

- 1 Switch instrument off.



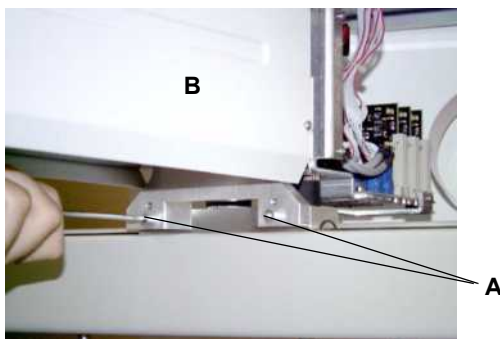
**Fig. 8-99** Side cover

- 2** Loosen the six screws and remove both side covers (A) in the back of the P&P.
- 3** Disconnect flex cable (B).



**Fig. 8-100** Motor cables

- 4** Disconnect the Z-motor cable (D).
- 5** Disconnect the Y-motor cable (E).
- 6** Disconnect the X-motor cable (C).



**Fig. 8-101** Arm fixing screws

- 7** Remove the two screws (A).
- 8** Carefully lift the P&P arm (B) off the X-carriage, move the X-carriage to one side, turn P&P arm away in such a way that the arm guide rollers are out of the arm guide rail, then lift the P&P arm out of the instrument.

**Installing**

To instal the P&P arm, proceed as follows:

- 1 Clean the contact surface of the guide rail as well as the guide rollers and the support roller with a lint-free tissue and some ethyl alcohol.
- 2 Install in reverse order as described for removal.  
Pay attention to the following:
  - For correct cable connections refer to cross references above.
  - Do not confuse the motor connectors (see [Fig. 8-100](#), [8-86](#)).

**Tests and Settings**

- 3 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - CAN bus resistance test.  
Refer to cross references above.
  - Instrument basic setup
  - Verify reference positions
  - Range move test
  - Random move test

**8.10.4 Electronic Boards**

**DC Servo Boards, DC Servo Power Board**

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Set addresses	See section <a href="#">8.16.1</a> , <a href="#">8-160</a>

**Removing**

To remove the DC servo boards, proceed as follows:

- 1 Switch instrument off.

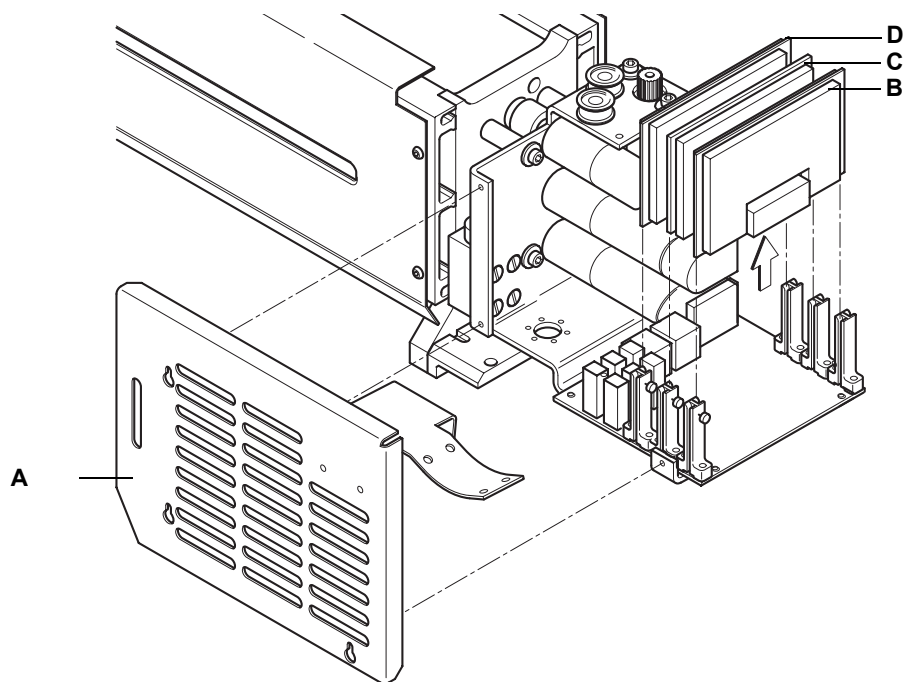
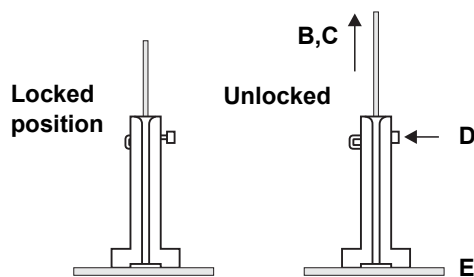


Fig. 8-102 P&P DC servo and DC servo power boards removal

- |  |  |
|--|--|
| <b>A</b> Cover                         | <b>C</b> DC servo board (Y and Z-axis) |
| <b>B</b> DC servo board (R and G-axis) | <b>D</b> DC servo power board (X-axis) |

- Loosen the three screws and remove side cover (A).
- Disconnect flex cable.



- Press the locking clip (D) to unlock the PCB.
- Unplug the DC servo board (B) from the P&P backplane (E).  
Or Unplug the DC servo power board (C) from the P&P backplane.

Fig. 8-103 PCB locking clip

**Installing**

To instal the DC servo boards, proceed as follows:

- Set correct address for each board.  
Refer to cross references above.
- Install the boards in reverse order as described for removal.  
*Note: The DC servo board and the DC servo power board are not identical. Do not mix them up.*

**Tests and Settings**

- To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Random move test

**P&P Backplane**

**Cross References**

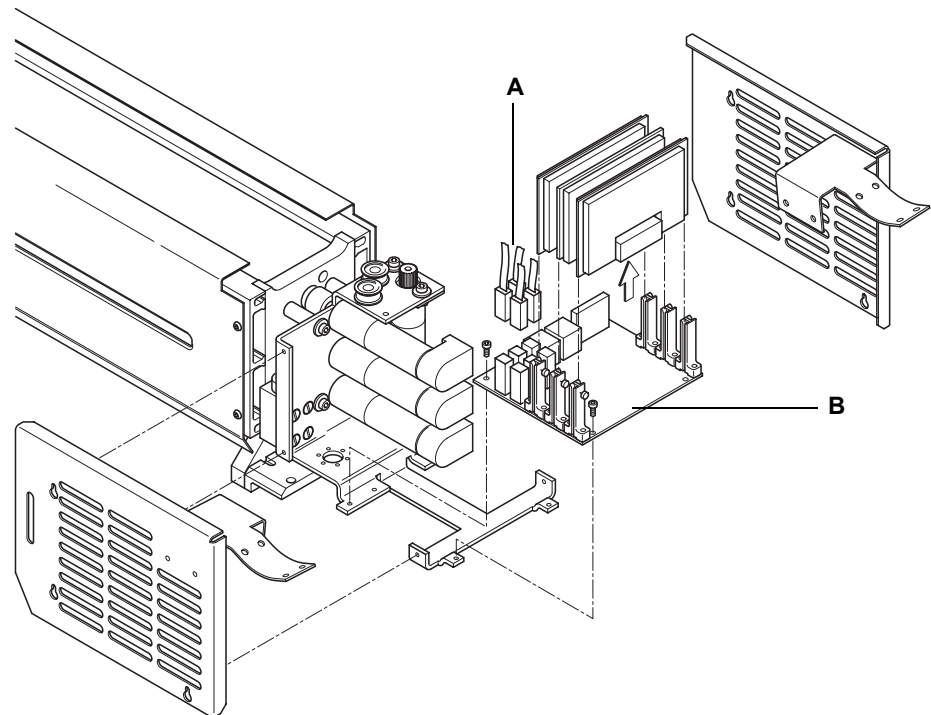
List of cross references to information provided in other sections:

Action	Reference
Remove P&P arm	See section 8.10.3, 8-85
Set jumper	See section 11.2.16, 11-18

**Removing**

To remove the P&P backplane, proceed as follows:

- 1 Remove the complete P&P arm from instrument.  
Refer to cross references above.



**Fig. 8-104 P&P backplane removal**

**A** P&P motor and Z-brake cables      **B** P&P backplane

- 2 Disconnect motor and Z-brake cables (A) from P&P backplane.
- 3 Unscrew six screws and remove P&P backplane (B).

**Installing**

To instal the P&P backplane, proceed as follows:

- 1 Transfer all servo boards from old to new P&P backplane.
- 2 Set jumper J15 for correct termination of the CAN bus.  
Refer to cross references above.
- 3 Install the P&P backplane in reverse order as described for removal.

### 8.10.5 Belts

#### Y-Belt

**Cross  
References**

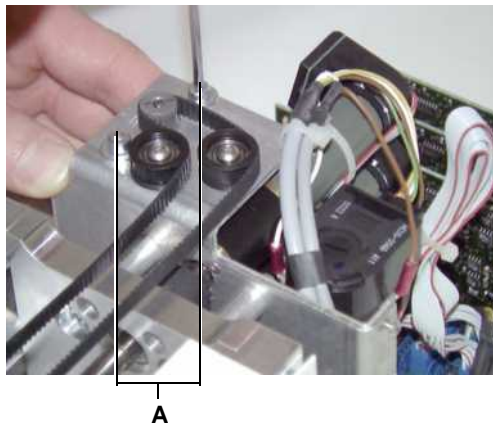
List of cross references to information provided in other sections:

Action	Reference
Remove P&P arm	See section <a href="#">8.10.3</a> , <a href="#">8-85</a>

**Removing**

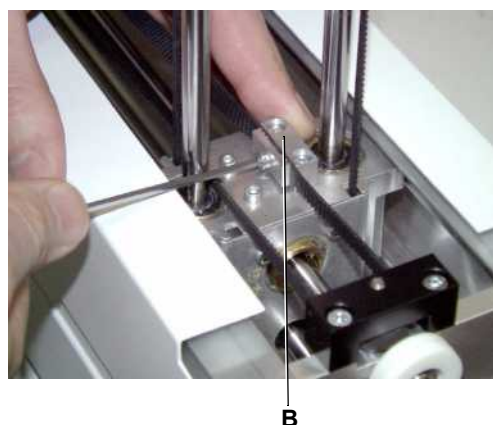
To remove the Y-belt, proceed as follows:

- 1 Remove the complete P&P arm from instrument.  
Refer to cross references above.
- 2 Loosen, but do not remove the two motor screws (A) to slacken the belt.



**Fig. 8-105** Y-motor screws

- 3 Open the belt lock (B).
- 4 Remove the belt.

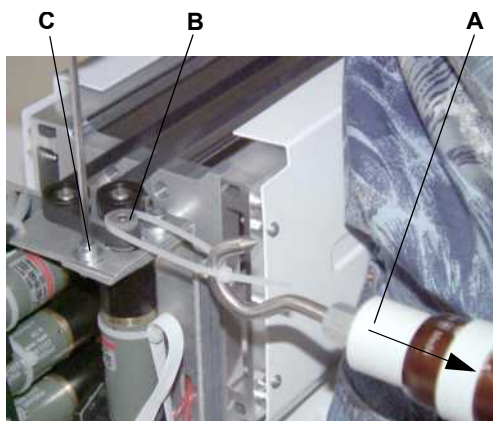


**Fig. 8-106** Y-belt lock

**Installing**

To instal the Y-belt, proceed as follows:

- 1 Cut replacement Y-belt to a length of 1170 mm.
- 2 Install the Y-belt.
- 3 Fix the Y-belt with the belt lock.



- 4 Adjust the Y-belt tension as shown in the figure.
  - Make sure that the Y-motor can move freely along the slotted holes.
  - Connect a tension spring balance (A) to the Y-motor pulley (B), using a cable tie.
  - Pull with force of 50 N in the direction of the arrow.
  - Tighten the Y-motor screws (C).

*Fig. 8-107 Adjusting the Y-belt tension*

**Tests and Settings**

- 5 To ensure operating readiness, perform the following tests: Refer to the “Instrument Software Manual”.
  - Verify reference positions
  - Range move test
  - Random move test

### Z-Belt

#### Cross References

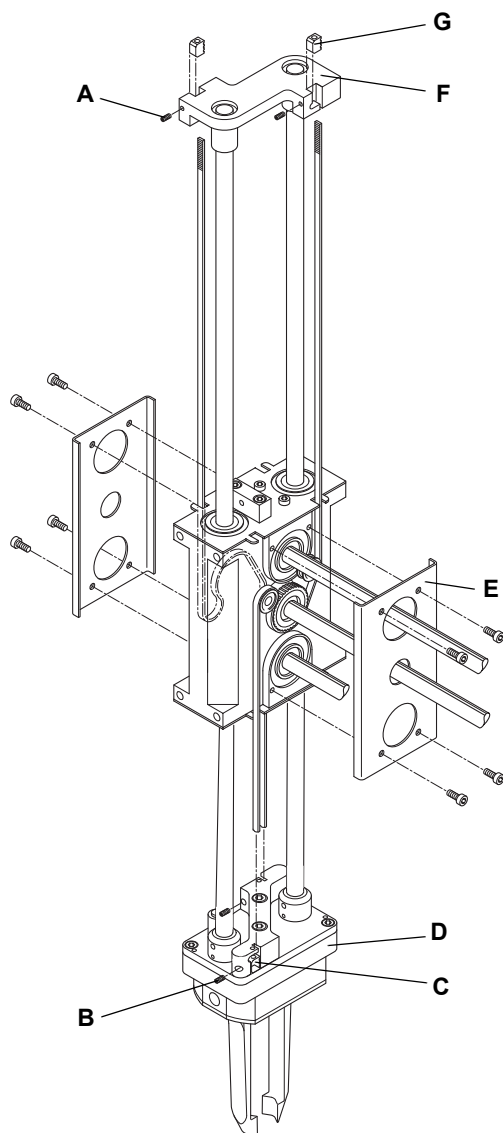
List of cross references to information provided in other sections:

Action	Reference
Grease specifications	See section <a href="#">6.1.3</a> , <a href="#">6-2</a>

#### Removing

To remove the Z-belt, proceed as follows:

**Note:** Always replace both Z-belts at the same time.



- 1 Remove the four screws and both Y-casing covers (E).
- 2 Unscrew the fixing screws Z-belt top (A).
- 3 Unscrew the fixing screws Z-belt on gripper head (B).
- 4 Remove the Z-belts.

- A Fixing screw Z-belt top
- B Fixing screw Z-belt on gripper head
- C Lower belt tensioner
- D P&P gripper head
- E Y-casing cover
- F Upper belt holder
- G Upper belt tensioner

Fig. 8-108 P&P Z-belt removal

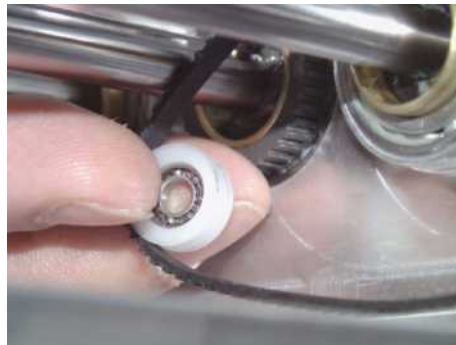
#### Installing

To instal the Z-belt, proceed as follows:



**Note:** While installing, always pull the belts tight. The belt tensioners allow tightening of approximately one tooth length only.

- 1 Mount both Z-belts on the P&P gripper head (D, see [Fig. 8-108 "P&P Z-belt removal"](#), [§ 8-92](#)). Keep the belt tensioners in the "slack" position.



**Fig. 8-109** Correct deflection roller orientation - bearing fully visible



**Fig. 8-110** False deflection roller orientation - bearing partly covered

- 2 Instal the Z-belt on the side closer to the motors.

- 3 Instal the Z-belt on the opposite side.

*Note:* Pay attention to the deflection roller orientation. The bearing must be fully visible on the outward side.

- 4 Pull belts tight and mount them to the upper belt holder (F, see [Fig. 8-108](#), [§ 8-92](#)).

Keep the belt tensioners in "slack" position.

- 5 Lightly fix upper belt tensioners (G, see [Fig. 8-108](#), [§ 8-92](#)) in such a way that the belts stay in place.

- 6 Position the Z-shafts in such a way that they protrude evenly at the top and bottom end of the P&P.

- 7 Tighten the lower part of both belts evenly.

Fix both lower belt tensioners (C, see [Fig. 8-108](#), [§ 8-92](#)).

- 8 Tighten the upper part of both belts evenly.

Fix both upper belt tensioners (G, see [Fig. 8-108](#), [§ 8-92](#)).

- 9 Check for smooth movement.

– Disable brake and move Z-shafts up and down.

- 10 Apply an even coating of special grease on the inside of the Y-casing covers. Refer to (E) in [Fig. 8-108](#), [§ 8-92](#) and cross references above.

- 11 Mount Y-casing covers.

**Tests and Settings**

- 12 To ensure operating readiness, perform the following tests: Refer to the "Instrument Software Manual".

- Verify reference positions
- Range move test
- Random move test

### 8.10.6 Motors

#### Y-Motor

#### Cross References

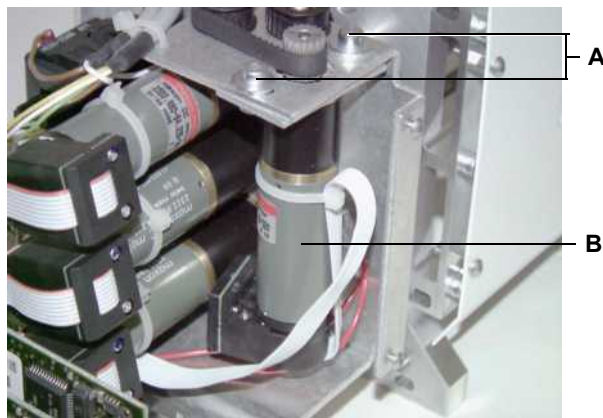
List of cross references to information provided in other sections:

Action	Reference
Remove P&P arm	See section <a href="#">8.10.3</a> , <a href="#">8-85</a>
Adjust belt tension	See section <a href="#">8.10.5</a> , <a href="#">8-90</a>

#### Removing

To remove the Y-motor, proceed as follows:

- 1 Remove the complete P&P arm from instrument.  
Refer to cross references above.
- 2 Disconnect the Y-motor from the backplane.



*Fig. 8-111 P&P Y-motor removal*

- 3 Remove the two screws (A) and the Y-motor (B).

#### Installing

To instal the Y-motor, proceed as follows:

- 1 Install in reverse order as described for removal.
- 2 Adjust the belt tension.  
Refer to cross references above.

#### Tests and Settings

- 3 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Verify reference positions
  - Range move test
  - Random move test

**Z/R/G-Motor**

**Cross  
References**

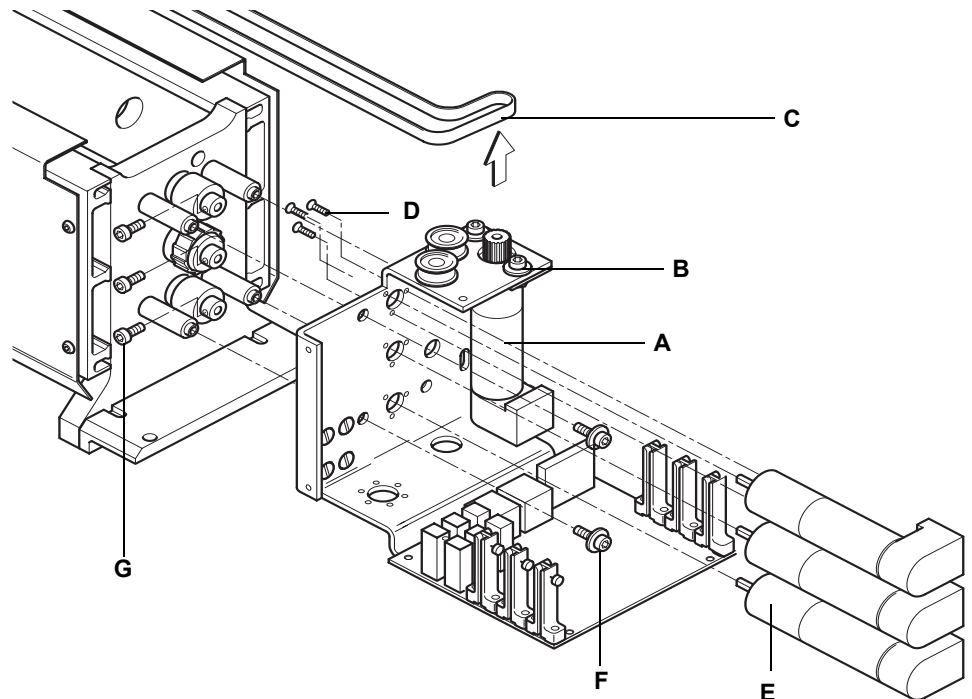
List of cross references to information provided in other sections:

Action	Reference
Remove P&P arm	See section 8.10.3, 8-85
Remove DC servo boards	See section 8.10.4, 8-87
Adjust Y-belt tension	See section 8.10.5, 8-90

**Removing**

To remove the Z, R, or G-motor, proceed as follows:

- 1 Remove the complete P&P arm from instrument.  
Refer to cross references above.



**Fig. 8-112 P&P Z/R/G-motor removal**

- |                            |                                      |
|----------------------------|--------------------------------------|
| <b>A</b> Y-motor           | <b>E</b> R/Z/G-motor                 |
| <b>B</b> Y-motor screw     | <b>F</b> Motor assembly screw        |
| <b>C</b> Y-belt            | <b>G</b> Coupling/break fixing screw |
| <b>D</b> R/Z/G-motor screw |                                      |

- 2 Loosen the two screws (B) of the Y-motor (A).
- 3 Disengage the Y-belt (C).
- 4 Unscrew the four motor assembly screws (F).
- 5 Loosen the fixing screws (G) of the two couplings and the brake.
- 6 Move gripper to the mid position of the Y-travel.
- 7 Remove complete motor assembly from P&P arm.

- 8** Remove the three DC servo boards.  
Refer to cross references above.
- 9** Unscrew the three motor screws (D) of the respective motor (E).
- 10** Disconnect motor from backplane.

**Installing**

To instal the Z, R, or G-motor, proceed as follows:

- 1** Install the respective motor in reverse order as described for removal.  
*Secure motor screws with chemical thread lock.*
- 2** Adjust the Y-belt tension.  
Refer to cross references above.

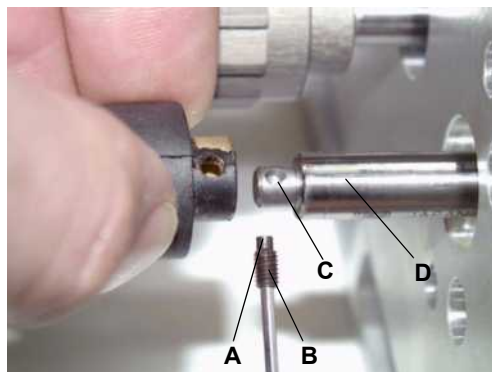
**Tests and Settings**

- 3** To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Verify reference positions
  - Range move test
  - Random move test

**Couplings**

**Replacing**

When replacing the couplings between the motor assembly and the P&P arm, pay attention to the following:



**Note:**  
*Make sure that the half-dog point (A) of the set screw (B) fits into the hole (C) of the shafts (D).*

**Fig. 8-113** Coupling and shaft on arm side

### 8.10.7 Gripper Head and Fingers

#### Gripper Head

**Cross References**

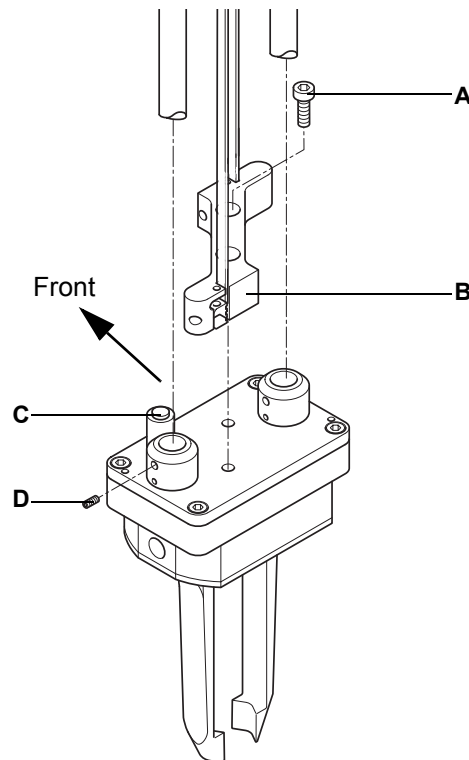
List of cross references to information provided in other sections:

Action	Reference
Release brake	See section 8.10.1, <a href="#">8-85</a>

**Removing**

To remove the gripper head, proceed as follows:

- 1 Move gripper along Y-axis to the front.
- 2 Release brake and lower gripper head. Refer to cross references above.



**Fig. 8-114 P&P gripper head removal**

- |  |                                |
|--|--------------------------------|
| <b>A</b> Lower belt holder fixing screws | <b>C</b> Init bolt             |
| <b>B</b> Lower belt holder               | <b>D</b> Z-shaft fixing screws |

- 3 Remove the two screws (A).
- 4 Separate the lower belt holder (B) from the gripper head and put it on top of the P&P arm.
- 5 Hold the gripper head in such a way that it cannot fall down. Loosen the four screws (D) and remove the gripper head.

**Installing**

To install the gripper head, proceed as follows:

**Tests and Settings**

- 1 Install the gripper head in reverse order as described for removal.  
*Make sure that the init bolt (C) points towards the front part of the instrument (see arrow).*
- 2 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Verify reference position
  - Range move test
  - Random move test

**Gripper Finger**

**Cross References**

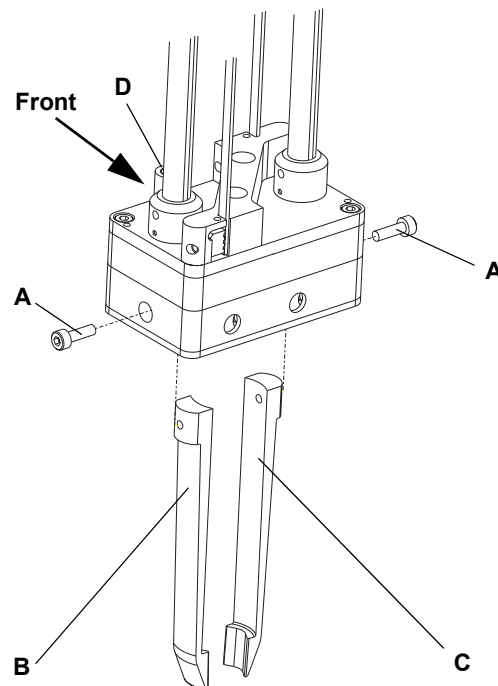
List of cross references to information provided in other sections:

Action	Reference
Release brake	See section <a href="#">8.10.1</a> , <a href="#">8-85</a>

**Removing**

To remove the gripper fingers, proceed as follows:

- 1 Move gripper along Y-axis to the front.
- 2 Release brake and lower gripper head.  
Refer to cross references above.



**Fig. 8-115 P&P gripper finger removal**

- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| <b>A</b> Gripper finger fixing screw | <b>C</b> Rubber-coated gripper finger |
| <b>B</b> Uncoated gripper finger     | <b>D</b> Init bolt                    |

- 3 Hold the gripper finger, remove the gripper finger fixing screw (A) and separate the gripper finger from the gripper head.

**Note:**

*The gripping surface of one of the gripper fingers is rubber-coated. Make sure not to mix up the gripper fingers.*

**Installing**

To instal the gripper fingers, proceed as follows:

- 1 Install the gripper fingers in reverse order as described for removal. Pay attention to the following:
  - Only use the original gripper finger fixing screws.
  - After initialization of the P&P arm, the coated gripper finger must be on the left side (viewed from the front of the instrument, see arrow).

**Note:**

*To identify the initialization position press the init bolt (D) down and rotate the lower part of the gripper head until the initialization pin engages, i.e. until the lower part of gripper head cannot be rotated all the way round. Align the lower part of the gripper head with the upper part to bring the gripper head into initialization position. Then check if the fingers are installed correctly.*

**Tests and Settings**

- 2 To ensure operating readiness, perform the following tests: Refer to the “Instrument Software Manual”.
  - Verify reference position
  - Range move test
  - Random move test

### 8.10.8 Solenoid Z-Brake

#### Cross References

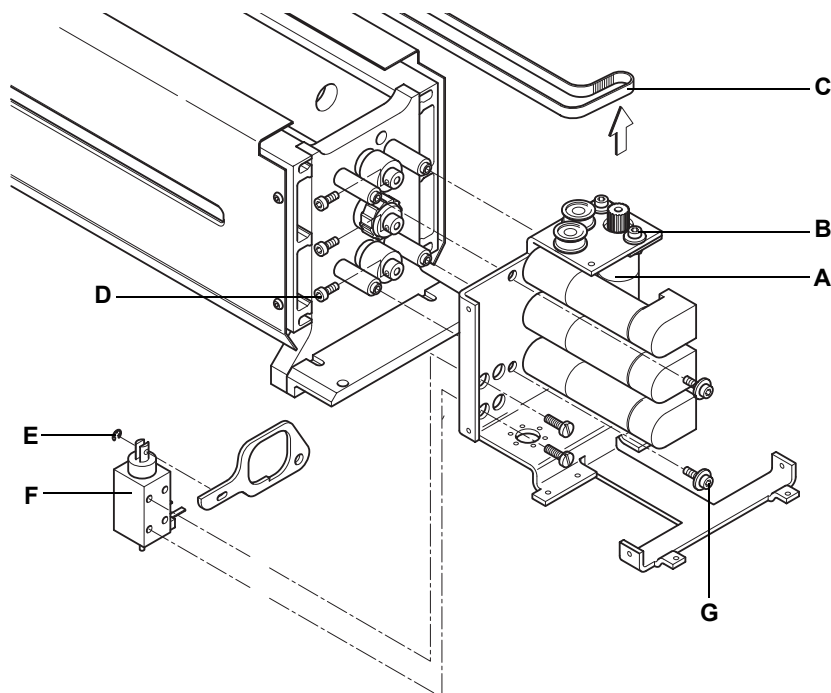
List of cross references to information provided in other sections:

Action	Reference
Remove P&P arm	See section <a href="#">8.10.3</a> , <a href="#">8-85</a>
Remove DC servo boards	See section <a href="#">8.10.4</a> , <a href="#">8-87</a>
Adjust Y-belt tension	See section <a href="#">8.10.5</a> , <a href="#">8-90</a>

#### Removing

To remove the Z-brake solenoid, proceed as follows:

- 1 Remove the complete P&P arm from instrument.  
Refer to cross references above.



**Fig. 8-116** P&P solenoid Z-brake removal

- |                                      |                               |
|--------------------------------------|-------------------------------|
| <b>A</b> Y-motor                     | <b>E</b> Circlip              |
| <b>B</b> Y-motor screw               | <b>F</b> Z-brake solenoid     |
| <b>C</b> Y-belt                      | <b>G</b> Motor assembly screw |
| <b>D</b> Coupling/break fixing screw |                               |

- 2 Loosen the two screws (B) of the Y-motor (A).
- 3 Disengage the Y-belt (C).
- 4 Unscrew the four motor assembly screws (G).
- 5 Loosen the fixing screws (D) of the two couplings and the brake.
- 6 Move gripper to the mid position of the Y-travel.
- 7 Remove complete motor assembly from P&P arm.

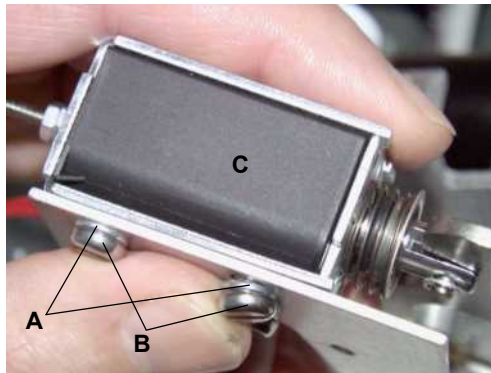


- 8 Remove the three DC servo boards.  
Refer to cross references above.
- 9 Remove circlip (E).
- 10 Remove axle of the solenoid armature.
- 11 Unscrew the fixing screws and remove the Z-brake solenoid (F) from the motor assembly.

**Installing**

To instal the Z-brake solenoid, proceed as follows:

- 1 Install the Z-brake solenoid in reverse order as described for removal. Pay attention to the following:



**Note:**

*Make sure to mount spring washers (A) under the solenoid mounting screws (B).*

*Without the washers the screws are too long and will damage the solenoid (C).*

**Fig. 8-117 Solenoid on mounting plate**

- 2 Adjust the Y-belt tension.  
Refer to cross references above.
- 3 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Verify reference positions
  - Range move test
  - Random move test

**Tests and Settings**

## 8.11 X-Flex Cables

### 8.11.1 Installing X-Flex Cables

#### Cross References

List of cross references to information provided in other sections:

Action	Reference
Prepare flex cable	See section <a href="#">8.11.2</a> , <a href="#">8-104</a>
Connect flex cables	See section <a href="#">11.2.2</a> , <a href="#">11-4</a>

The RoMa and the P&P arm are provided with flex cables for the electric supply.

#### Installing

When installing X-flex cables, pay attention to the following:



**Fig. 8-118** How the flex cable is fixed to the arm

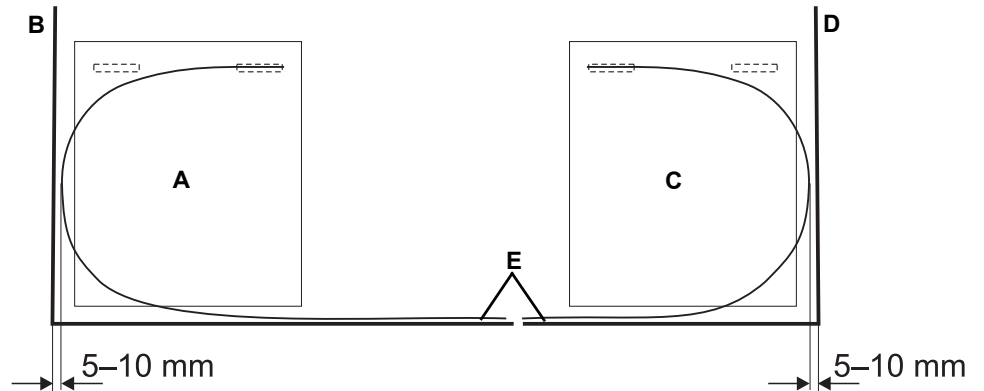
- 1 If the flex cable is new: Prepare flex cable according to the fold drawing. Refer to cross references above.
- 2 Fix the flex cable to the arm as shown in the figure (Example of an arm on the left side; for an arm on the right side proceed symmetrically).



**Fig. 8-119** How the flex cable is fixed to the base unit

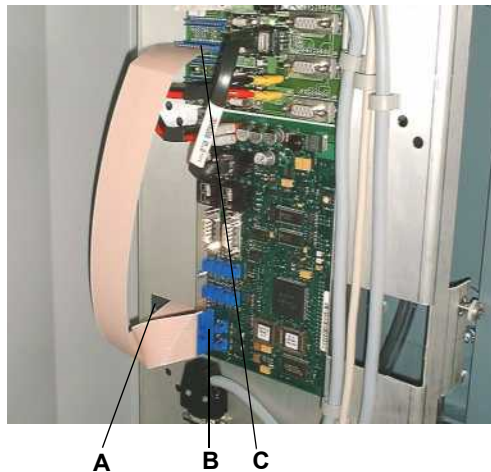
- 3 Lead the flex cable through the slot (C) in the base unit.
- 4 Apply the cable clamp (B).
- 5 Adjust the length of the loop of the flex cable as per [Fig. 8-120](#) "Correct loop length of flex cables", [8-103](#).
- 6 Fix the flex cable with the cable clips (A).

**Note:** If the arm is shifted to the extreme left (or right, accordingly) position, the flex cable must not touch the side wall of the instrument, but there must be a clearance as shown in the figure below:



**Fig. 8-120** Correct loop length of flex cables

- |          |  |          |                               |
|----------|--|----------|-------------------------------|
| <b>A</b> | Arm on the left side or single arm <sup>1)</sup> | <b>C</b> | Arm on the right side         |
| <b>B</b> | Left side wall of instrument                     | <b>D</b> | Right side wall of instrument |
| <hr/>    |  | <b>E</b> | Flex cable                    |
- 1) Irrespective of a LiHa presence



**Fig. 8-121** Flex cable connection

- 7 Lead the flex cable through the hole (A) behind the left access door.
- 8 Connect the flex cable properly on the Optibo DCU (C) or the gate board (B). Refer to cross references above.

**Tests and Settings**

- 9 To ensure operating readiness, perform the following tests: Refer to the "Instrument Software Manual".
  - Random move test for corresponding X-axis

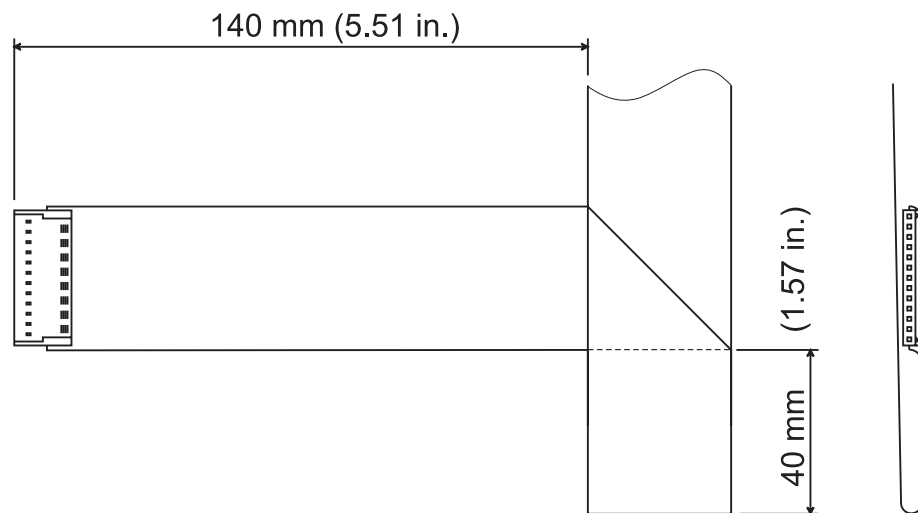
### 8.11.2 X-Flex Cable Bend Drawings

Prepare the X-flex cables according to the following drawings.

**Note:** Pay attention to the following:

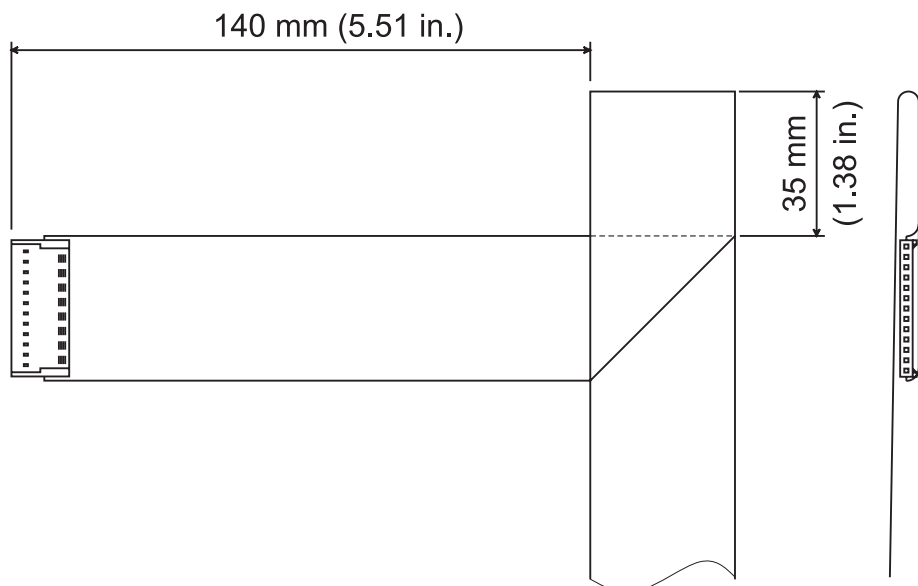
- Though the lengths of the X-flex cables vary with the instrument size, all drawings are valid for the instrument sizes 100, 150 and 200, since the dimensions are measured from one side only.
- Note that the X-flex cable of a RoMa may loop to the left (single or left arm) or to the right side.

#### RoMa Arm (Left Side)



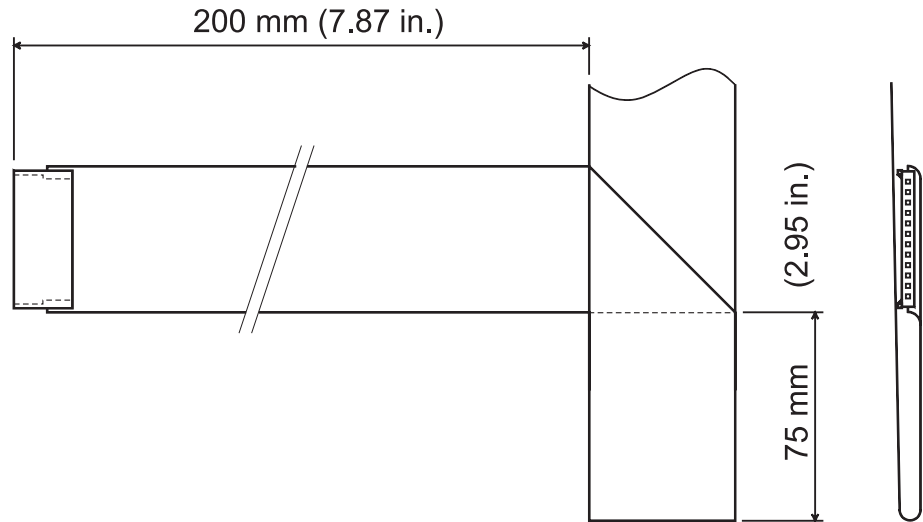
**Fig. 8-122** RoMa X-flex cable loops to the left side

#### RoMa Arm (Right Side)



**Fig. 8-123** X-flex cable loops to the right side

**P&P Arm**



*Fig. 8-124 X-flex cable always loops to the left side*

**8.12 PosID 2**



**WARNING**

Laser light (CLASS 2 LASER PRODUCT).

- ◆ Do not stare into beam.
- ◆ Caution – Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

**8.12.1 Spare Parts PosID 2**

**Which Spare Parts are Available?**

Refer to [10.7 "PosID"](#), [10-7](#) to identify the available spare parts and their part numbers.

### 8.12.2 Complete PosID 2 Assembly

#### Cross References

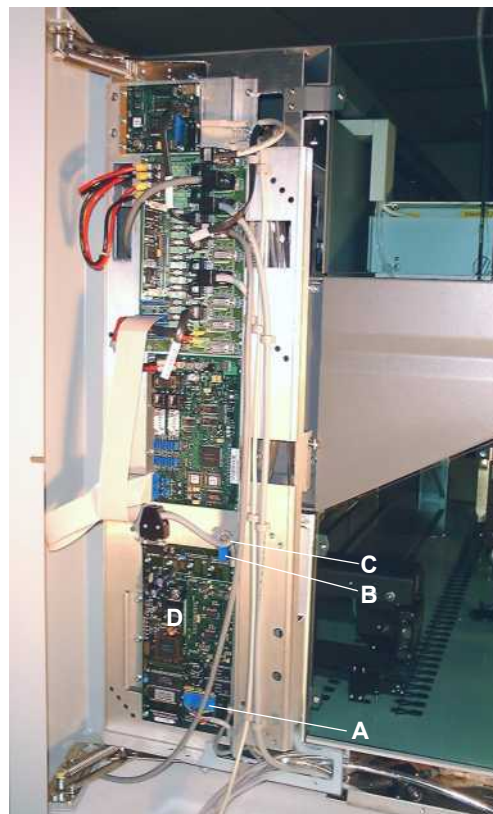
List of cross references to information provided in other sections:

Action	Reference
Remove worktable	See section 8.3,  8-5
CAN bus resistance test	See section 4.5,  4-7

#### Removing

To remove the PosID 2, proceed as follows:

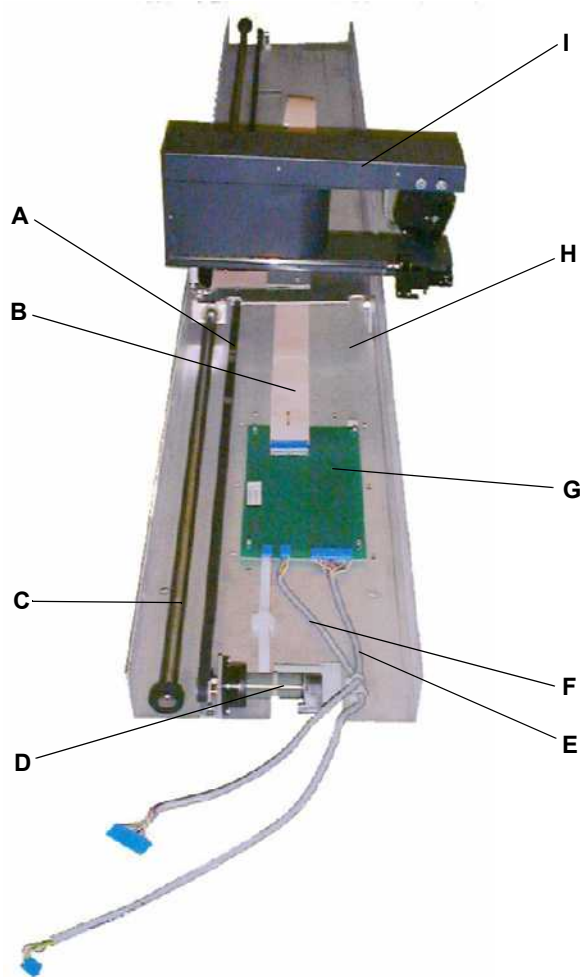
- 1 Remove the worktable.  
Refer to cross references above.



**Fig. 8-125** PosID 2 cable connections

- |                           |                              |
|---------------------------|------------------------------|
| <b>A</b> Connection cable | <b>C</b> Communication cable |
| <b>B</b> X-motor cable    | <b>D</b> CU PosID 2 board    |

- 2 Disconnect the PosID 2 connection cable (A).
- 3 Disconnect the X-motor cable (B) from the CU PosID 2 board.
- 4 Remove the PosID 2 assembly fixing screws.



**Fig. 8-126** PosID 2 module

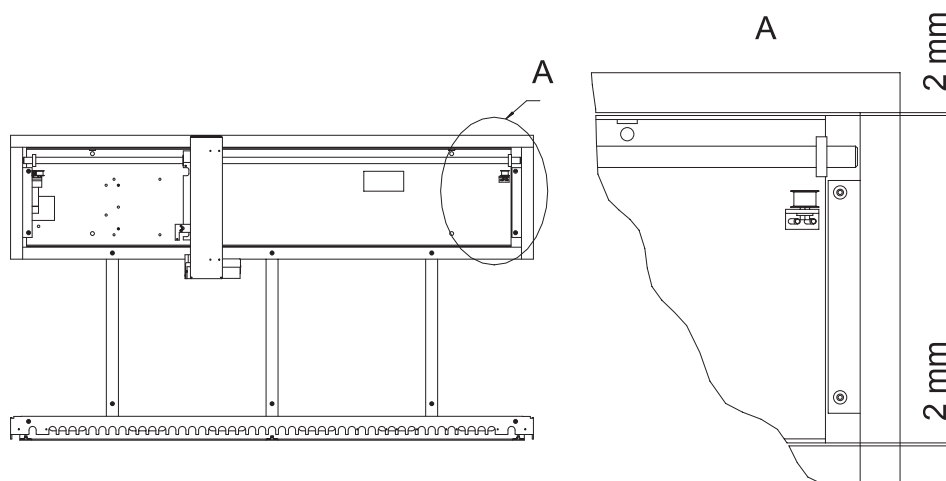
<b>A</b>	<i>X-belt</i>	<b>F</b>	<i>X-motor cable</i>
<b>B</b>	<i>X-flex cable</i>	<b>G</b>	<i>PosAda board</i>
<b>C</b>	<i>X-shaft</i>	<b>H</b>	<i>Base plate</i>
<b>D</b>	<i>X-motor</i>	<b>I</b>	<i>PosID 2 scanner assembly</i>
<b>E</b>	<i>Connection cable</i>		

- 5** Slide the PosID 2 scanner assembly (I) to the left side.
- 6** Seize the assembly by the base plate (H), lift the right side first and then carefully lift the complete PosID 2 module out of the instrument.

### Installing

To instal the PosID 2, proceed as follows:

- 1** Install the PosID in reverse order as described for removal.  
Pay attention to the following:
  - Move the base plate to the very left of the instrument and make sure that a space of 2 mm is left in front and behind the base plate before fixing it in the instrument frame.



**Fig. 8-127** Installation of PosID 2 assembly into instrument

- Before installing the worktable
  - check for smooth and even motion of the PosID 2 scanner assembly (I).
  - check for correct movement of the X-flex cable (B, see [Fig. 8-126](#), [Fig. 8-107](#)).
  - make sure that the X-shaft (C, see [Fig. 8-126](#), [Fig. 8-107](#)) and the base plate (H) are clean.
- 2** To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - CAN bus resistance test  
Refer to cross references above.
  - Instrument basic setup
  - Verify reference positions
  - PosID tests
  - Range move test
  - Random move test
  - EEPROM backup



### 8.12.3 X-Drive Assembly

The X-drive assembly comprises the X-belt, the X-motor and the X-flex cable.

**Note:** For X-DC servo board refer to section 8.12.4 “Electronic Boards”, 8-113.

#### X-Belt

#### Cross References

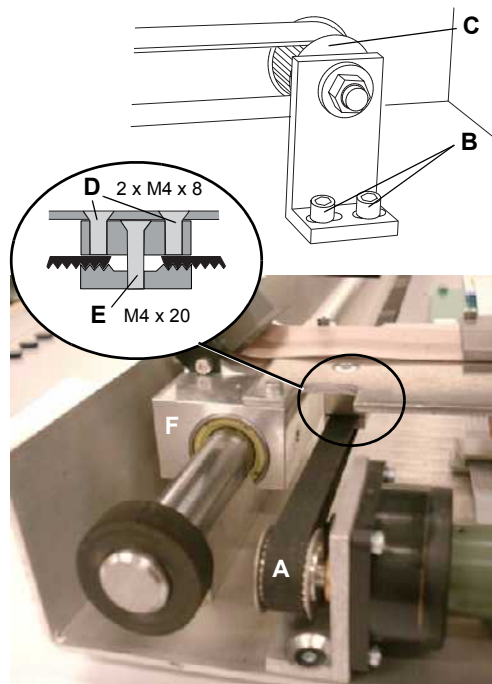
List of cross references to information provided in other sections:

Action	Reference
Remove worktable	See section 8.3, 8-5

#### Removing

To remove the X-belt, proceed as follows:

- 1 Remove the worktable.  
Refer to cross references above.



- 2 Loosen the belt tensioning screws (B).
- 3 Unscrew the two screws (D) of the X-belt fixture.
- 4 Move X-slide to one side.
- 5 Unscrew the X-belt fixing screw (E).
- 6 Remove X-belt.

- A X-motor drive pulley
- C Deflection pulley
- B Tensioning screw
- D Screw of X-belt fixture
- E X-belt fixing screw
- F X-slide

Fig. 8-128 X-drive assembly, details

#### Installing

To instal the X-belt, proceed as follows:



- 1 New belt: Cut the X-belt to the required length:
  - PosID 2/100: 1680 mm
  - PosID 2/150: 2430 mm
  - PosID 2/200: 3630 mm
- 2 Pull the X-belt around the drive pulley (A) of the X-motor and the deflection pulley (C).
- 3 Insert belt ends into the X-belt fixture, tighten the X-belt fixing screw (E).

- 4 Move the X-slide (F) into place.
- 5 Fasten the X-belt fixture with the screws of the X-belt fixture (D).
- 6 Adjust the belt tension and tighten the tensioning screws (B): The belt should be tight and must not sag, but do not overtighten.
- 7 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - Verify reference positions
  - PosID tests
  - Range move test
  - Random move test

### X-Motor

#### Cross References

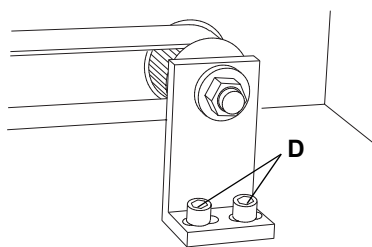
List of cross references to information provided in other sections:

Action	Reference
Remove worktable	See section 8.3,  8-5
Adjust belt tension	See section “X-Belt”,  8-109

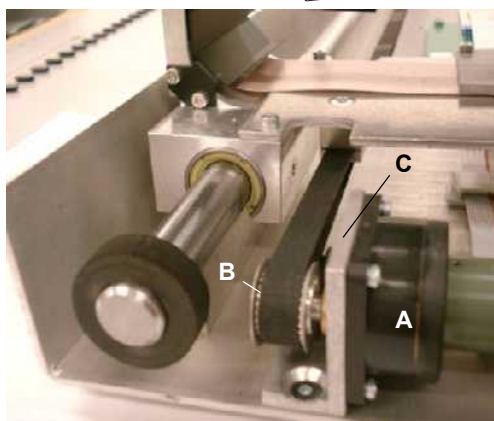
#### Removing

To remove the X-motor, proceed as follows:

- 1 Remove the worktable.  
Refer to cross references above.
- 2 Disconnect the X-motor cable from the PosAda board.



- 3 Loosen the belt tensioning screws (D) to slacken the X-belt.
- 4 Disengage the X-belt.
- 5 Loosen the set screw and remove the drive pulley (B) from the X-motor assembly.
- 6 Unscrew the fixing screws and remove the X-motor (A) from bracket (C).



- A** X-motor
- B** Drive pulley
- C** X-motor bracket
- D** Tensioning screw

**Fig. 8-129** X-motor bracket

**Installing**

To instal the X-motor, proceed as follows:

- 1** Install the X-motor in reverse order as described for removal. Pay attention to the following:
  - Adjust the distance between drive pulley and bracket to approx. 5.5 mm.
  - Adjust the X-belt tension.  
Refer to cross references above.
- 2** To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - Verify reference positions
  - PosID tests
  - Range move test
  - Random move test

**X-Flex Cable**

**Cross References**

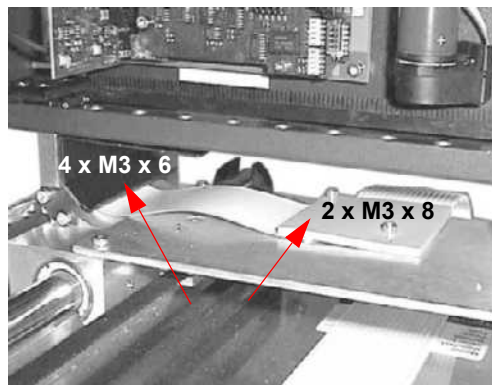
List of cross references to information provided in other sections:

Action	Reference
Remove worktable	See section 8.3, <a href="#">8-5</a>
Remove casing/unscrew Y/B board fixing screws	See section “Y/B Board, Y/B-DC Servo Board”, <a href="#">8-114</a>

**Removing**

To remove the X-flex cable, proceed as follows:

- 1** Remove the worktable.  
Refer to cross references above.
- 2** Remove casing of PosID scanner assembly.  
Refer to cross references above.



**Fig. 8-130** Flex cable fixtures

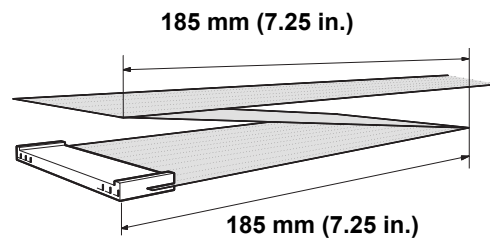
- 3** Remove the flex cable fixtures as shown in the figure (see arrows).
- 4** Unscrew the Y/B board fixing screws in order to make the X-flex cable connector accessible.  
Refer to cross references above.
- 5** Disconnect the X-flex cable from Y/B board.

## Installing

To instal the X-flex cable, proceed as follows:

**Note:** The X-flex cable is available in two lengths:

- For instruments of the size 100/150
- For instruments of the size 200



**Fig. 8-131** X-flex cable for instruments size 100

- 1** Prepare the X-flex cable:  
For instruments of the size 100, fold the X-flex cable according to the figure (on the side where it will be connected to the PosAda board).

*For instruments of the size 150 and 200 no additional preparation is necessary.*

- 2** Install the X-flex cable in reverse order as described for removal. Pay attention to the following:
  - Before installing the worktable check for correct movement of the X-flex cable, adjust if necessary.
- 3** To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - Verify reference positions
  - PosID tests
  - Range move test
  - Random move test

### 8.12.4 Electronic Boards

#### CU PosID 2 Board, X-DC servo Board

##### Cross References

List of cross references to information provided in other sections:

Action	Reference
Check settings	See section <a href="#">11.2.1</a> , <a href="#">11-3</a> and section <a href="#">11.2.15</a> , <a href="#">11-17</a>
Cable connections	See section <a href="#">11.2.12</a> , <a href="#">11-14</a>
Check CAN bus resistance	See section <a href="#">4.5</a> , <a href="#">4-7</a>

##### Location

The CU PosID 2 board is located behind the left access door.

To replace the board, proceed as follows:

##### Removing

- 1 Make sure that the instrument is switched off and the mains cable is disconnected.
- 2 Open the left access door of the instrument.
- 3 Disconnect all cables from the CU PosID 2 board.
- 4 Unscrew the fixing screws of the X-DC servo board.
- 5 Remove the X-DC servo board.
- 6 Unscrew the fixing screws of the CU PosID 2 board.
- 7 Remove the CU PosID 2 board.

##### Installing

- 1 Check if the jumpers J6 and J8 (CAN termination) on the CU PosID 2 are set correctly according to the configuration of the instrument. Refer to cross references above.
- 2 DC servo board (X-axis): Check if address switch is set to #0.
- 3 Install the PCB in reverse order as described for removal.  
*For correct cable connection refer to cross references above.*

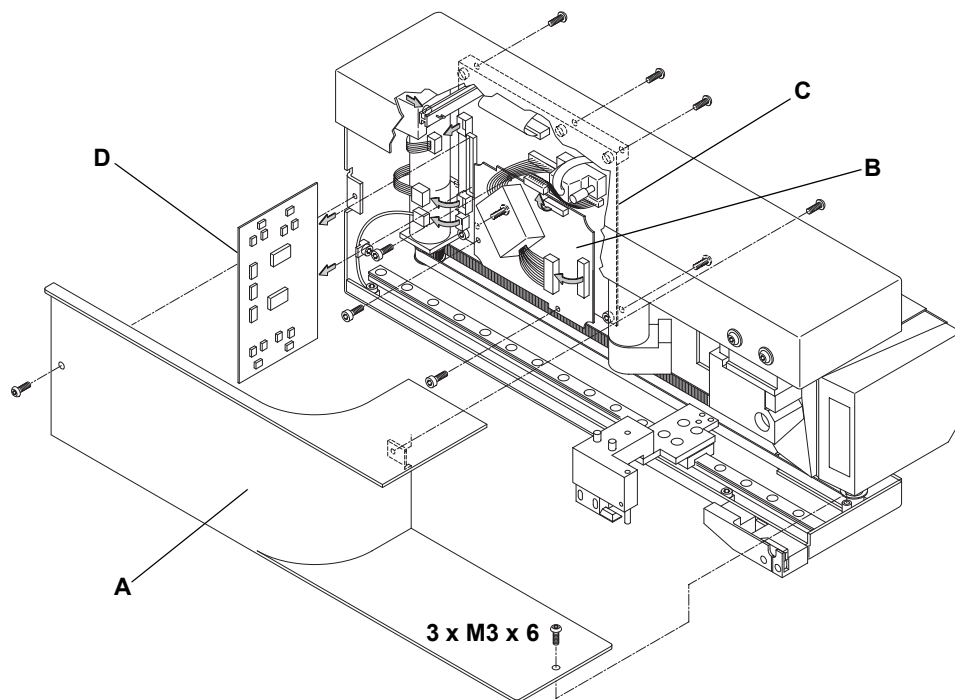
##### Tests and Settings

- 4 To ensure operating readiness, perform the following setups and tests: Refer to the "Instrument Software Manual".
  - CAN bus resistance test  
Refer to cross references above.
  - Instrument basic setup
  - Verify reference positions
  - PosID tests
  - Range move test
  - Random move test
  - EEPROM backup

### Y/B Board, Y/B-DC Servo Board

#### Removing

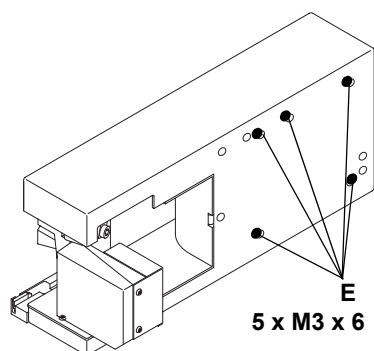
To remove the boards, proceed as follows:



**Fig. 8-132** PosID scanner assembly

- |                             |                             |
|-----------------------------|-----------------------------|
| <b>A</b> Casing             | <b>C</b> Y/B board          |
| <b>B</b> DSP decoding board | <b>D</b> Y/B-DC servo board |

- 1 Remove the casing (A) of the PosID scanner assembly.
- 2 Disconnect all cables from Y/B board (C).



**Fig. 8-133** Y/B board fixing screws

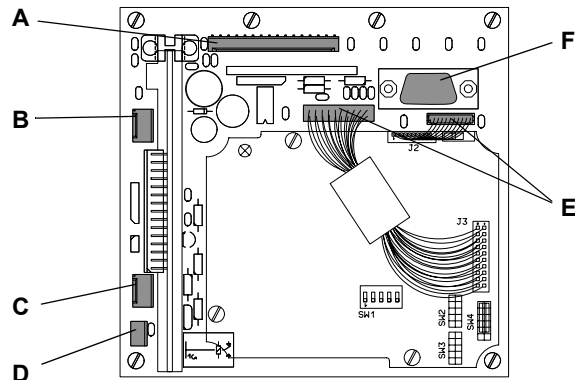
- 3 On the exterior of the PosID 2, unscrew fixing screws (E) and remove Y/B board.
- 4 Remove Y/B-DC servo board (D).
- 5 Remove DSP decoding board (B).

#### Installing

To instal the boards, proceed as follows:

- 1 Y/B-DC servo board: Check if address switch is set to #2.

- 2** Install the boards in reverse order as described for removal. Make sure that the cables are connected correctly as shown in the figure:



**Fig. 8-134** Y/B board cable connections

- |          |                      |          |                                 |
|----------|----------------------|----------|---------------------------------|
| <b>A</b> | <i>X-flex cable</i>  | <b>D</b> | <i>No tube sensor cable</i>     |
| <b>B</b> | <i>Y-motor cable</i> | <b>E</b> | <i>Connections to DSP board</i> |
| <b>C</b> | <i>B-motor cable</i> | <b>F</b> | <i>Scanner cable</i>            |

- 3** To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
- Verify reference positions
  - PosID tests
  - Range move test
  - Random move test

## DSP Decoding Board

### Cross References

List of cross references to information provided in other sections:

Action	Reference
Remove casing/DSP decoding board	See section <a href="#">“Y/B Board, Y/B-DC Servo Board”</a> , 8-114

### Removing

To remove the DSP decoding board, proceed as follows:

- 1 Remove the casing of the PosID scanner assembly.  
Refer to cross references above.
- 2 Disconnect cables from DSP decoding board.
- 3 Remove DSP decoding board.  
Refer to cross references above.

### Installing

To instal the DSP decoding board, proceed as follows:

- 1 Install the DSP decoding board in reverse order as described for removal.
- 2 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - Verify reference positions
  - PosID tests
  - Range move test
  - Random move test



### 8.12.5 Scanner Assembly

The scanner assembly comprises the B-motor, the scanner head and the cable.

#### B-Motor

#### Cross References

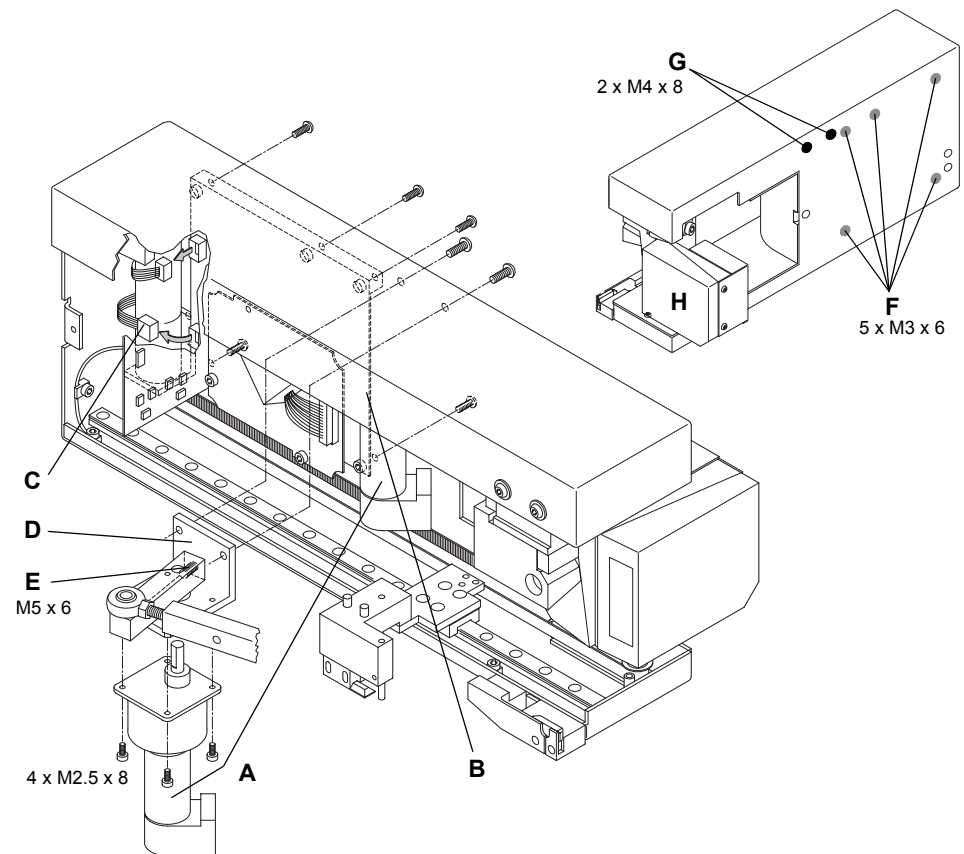
List of cross references to information provided in other sections:

Action	Reference
Remove casing	See section "Y/B Board, Y/B-DC Servo Board", 8-114

#### Removing

To remove the B-motor, proceed as follows:

- 1 Remove casing of the scanner assembly. Refer to cross references above.



**Fig. 8-135 B-motor**

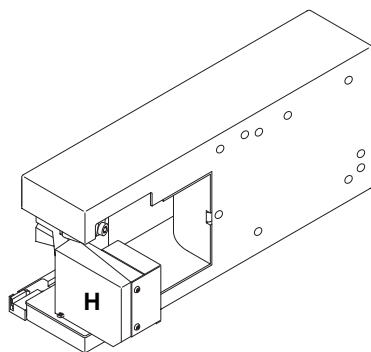
- |          |               |          |                        |
|----------|---------------|----------|------------------------|
| <b>A</b> | B-motor       | <b>E</b> | Set screw              |
| <b>B</b> | Y/B board     | <b>F</b> | Y/B board fixing screw |
| <b>C</b> | B-motor cable | <b>G</b> | B-motor fixing screw   |
| <b>D</b> | Bracket       | <b>H</b> | Scanner head           |

- 2 On the exterior of the PosID 2, unscrew the Y/B board fixing screws (F) to make the B-motor cable accessible.
- 3 Disconnect the B-motor cable (C) from the Y/B board (B).
- 4 On the exterior of the PosID 2, unscrew fixing screws (G) to remove the B-motor assembly.
- 5 Loosen the set screw (E), remove gearing assembly.
- 6 Remove bracket (D) from B-motor (A).

### Installing

To instal the B-motor, proceed as follows:

- 1 Instal the B-motor in reverse order as described for removal. Pay attention to the following:
  - When installing the gearing assembly to the motor, make sure that the set screw rests on the flat part of the motor shaft.



- Correct positioning of the scanner head as shown in the figure.

**Fig. 8-136** Correct position of scanner head

- 2 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Verify reference positions
  - PosID tests
  - Range move test
  - Random move test

**Scanner Head, Scanner Cable**

**Cross References**

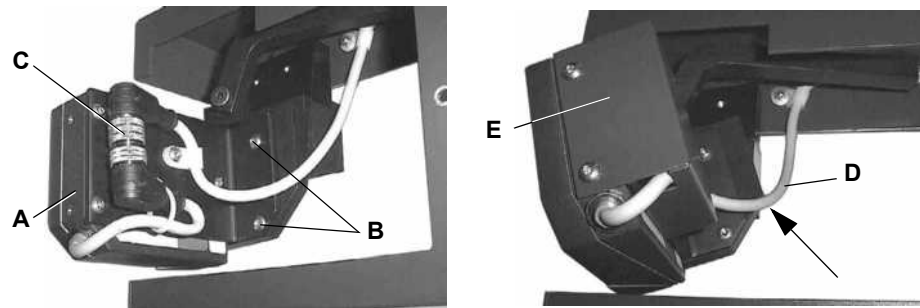
List of cross references to information provided in other sections:

Action	Reference
Remove casing	See section “Y/B Board, Y/B-DC Servo Board”, 8-114

**Removing**

To remove the scanner head, proceed as follows:

- 1 Remove casing of the scanner assembly. Refer to cross references above.



**Fig. 8-137** Scanner head assembly

- |                          |                               |
|--------------------------|-------------------------------|
| <b>A</b> Scanner head    | <b>D</b> Scanner cable        |
| <b>B</b> Fixing screw    | <b>E</b> Scanner head housing |
| <b>C</b> Cable connector |                               |

- 2 Remove the scanner head housing (E).
- 3 Unscrew the cable holders as well as the cable connector (C).
- 4 Disconnect scanner cable (D) from Y/B board.
- 5 Loosen fixing screws (B).
- 6 Remove scanner head (A).

**Installing**

To instal the scanner head, proceed as follows:

- 1 Instal the scanner head in reverse order as described for removal. Pay attention to the following:
  - Swivel the scanner head up and down and arrange the scanner cable (D) in such a way
    - that it does not touch the scanner head.
    - that it cannot be caught at the point indicated with the arrow (see figure above).
- 2 To ensure operating readiness, perform the following tests: Refer to the “Instrument Software Manual”.
  - Verify reference positions
  - PosID tests
  - Range move test
  - Random move test

### 8.12.6 Y-Drive Assembly

The Y-drive assembly comprises the Y-belt, the gripper assembly and the Y-motor.

#### Y-Belt, Gripper Assembly

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Remove casing	See section <a href="#">“Y/B Board, Y/B-DC Servo Board”</a> , ¶ 8-114

**Required  
Special Tools**

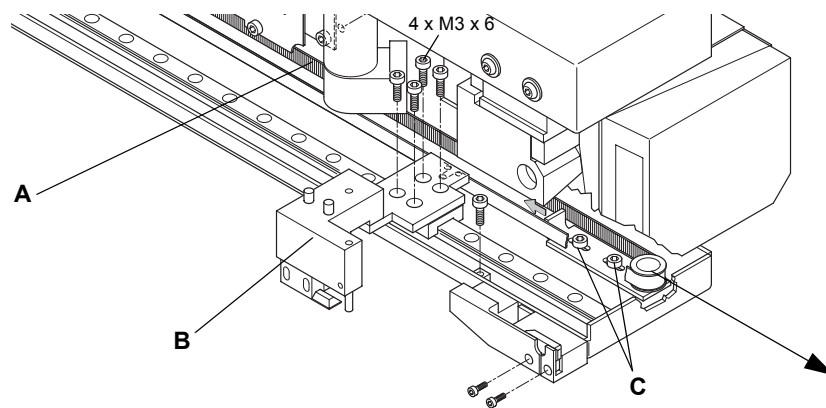
The following special tools are needed for this repair job:

- ◆ Spring balance (5 N)

**Removing**

To remove the Y-belt and the gripper assembly, proceed as follows:

- 1 Remove casing of the scanner assembly.  
Refer to cross references above.



**Fig. 8-138** Y-belt, gripper assembly

- A** Y-belt
- B** Gripper assembly
- C** Belt tensioner screw

- 2 Loosen the belt tensioner screws (C).
- 3 Remove the four screws and the gripper assembly (B).
- 4 Remove the Y-belt (A).

**Installing**

To instal the Y-belt and the gripper assembly, proceed as follows:

- 1 Insert the Y-belt in the Y-drive assembly.



**Fig. 8-139** Y-belt connection to the gripper assembly

- 2 Place the Y-belt around the driver pins of the gripper assembly (B) as shown in the figure.
- 3 Fix the gripper assembly to the Y-slide with the four screws.

- 4 Adjust the tension of the Y-belt.  
*Use a spring balance to tension the Y-belt.*
  - Pull at the belt tensioner with a force of 3–5 N in the direction of the arrow in [Fig. 8-138](#), [Fig. 8-120](#).
  - Tighten the belt tensioner screws (C).
- 5 To ensure operating readiness, perform the following tests: Refer to the “Instrument Software Manual”.
  - Verify reference positions
  - PosID tests
  - Range move test
  - Random move test

**Y-Motor**

**Cross  
References**

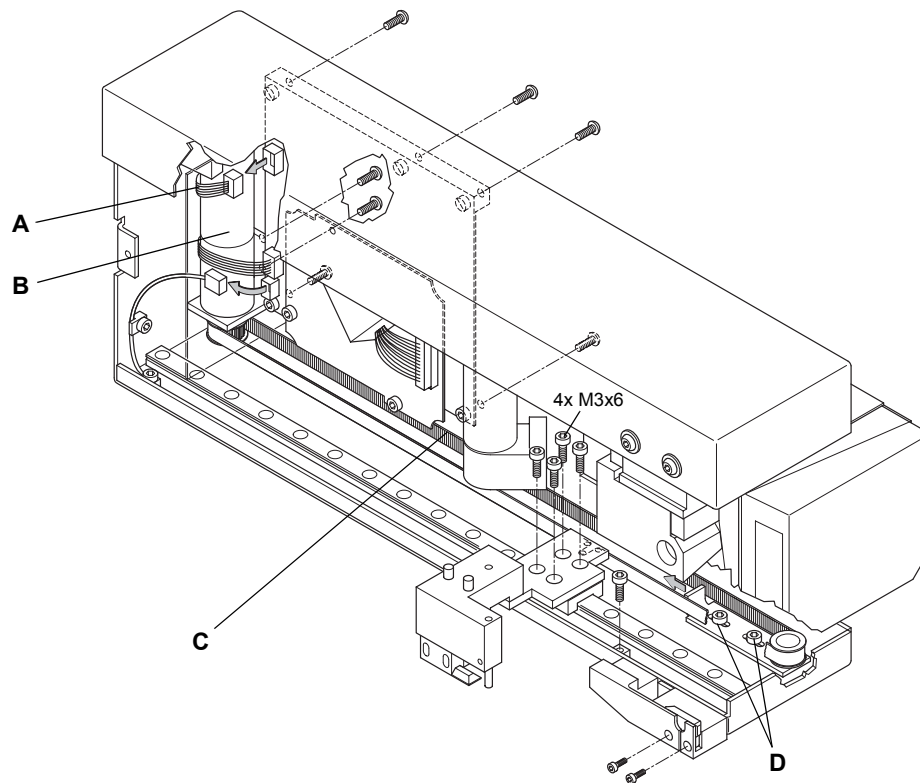
List of cross references to information provided in other sections:

Action	Reference
Remove casing	See section “Y/B Board, Y/B-DC Servo Board”, <a href="#">Fig. 8-114</a>
Adjust tension of Y-belt	See section “Y-Belt, Gripper Assembly”, <a href="#">Fig. 8-120</a>

**Removing**

To remove the Y-motor, proceed as follows:

- 1 Remove casing of the scanner assembly. Refer to cross references above.



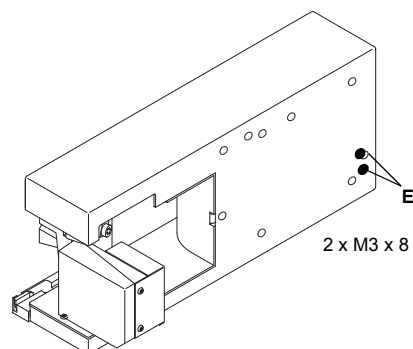
**Fig. 8-140** Y-drive assembly

**A** Y-motor cable  
**B** Y-motor

**C** Y-belt  
**D** Belt tensioner screw

- 2 Loosen the belt tensioner screws (D).
- 3 Disengage the Y-belt (C) from the motor (B).
- 4 Disconnect Y-motor cable (A) from Y/B board.

- 5 On the exterior of the PosID 2, unscrew the fixing screws (E) as shown in the figure.
- 6 Remove the Y-motor assembly (B).




**Fig. 8-141** Y-motor fixing screws

- 7 Loosen the set screw of the drive pulley.
- 8 Remove the drive pulley.
- 9 Remove the fixing screws and separate the Y-motor from the bracket.

**Installing**


To instal the Y-motor, proceed as follows:

- 1 Instal the Y-motor in reverse order as described for removal.  
Pay attention to the following:
  - Note the correct orientation of the scanner head (see [Fig. 8-141 “Y-motor fixing screws”](#),  8-122).
  - When installing the drive pulley to the motor, make sure that the set screw rests on the flat part of the motor shaft.
  - Adjust the tension of the Y-belt.  
Refer to cross references above.
  - Make sure that the gripper finger initializes properly, i.e that the slide runs to a stop at the back panel and does not collide with other parts, e.g. an incorrectly installed cable clamp.
- 2 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - Verify reference positions
  - PosID tests
  - Range move test
  - Random move test

**8.12.7 No Tube Sensor**

**Cross  
References**

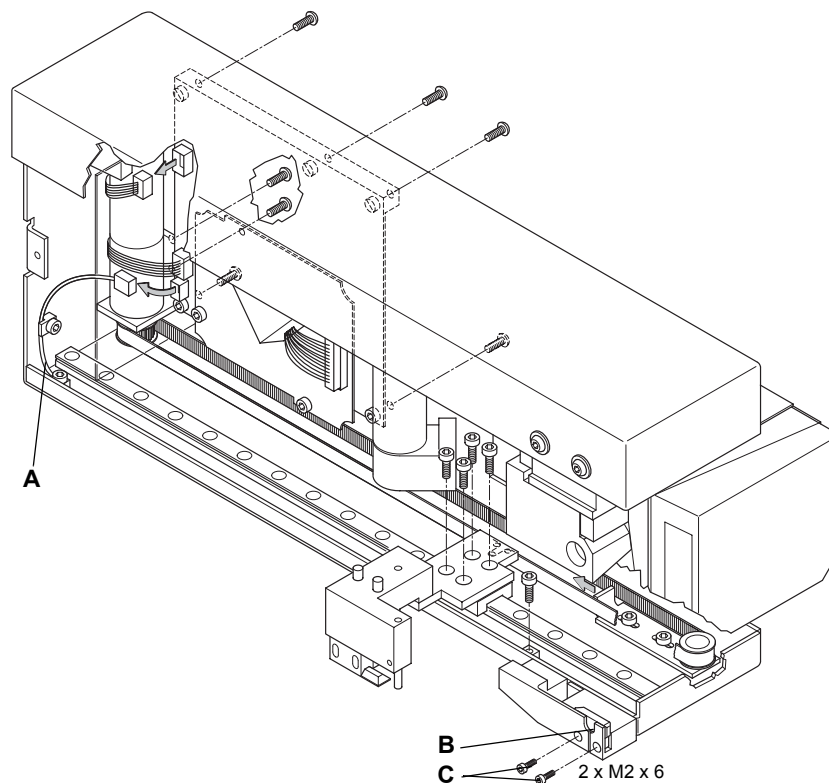
List of cross references to information provided in other sections:

Action	Reference
Remove casing	See section <a href="#">“Y/B Board, Y/B-DC Servo Board”</a> ,  8-114

**Removing**

To remove the no tube sensor, proceed as follows:

- 1 Remove casing of the scanner assembly.  
Refer to cross references above.



**Fig. 8-142** No tube sensor

**A** No tube sensor cable  
**B** Sensor fixing screw

**C** No tube sensor

- 2 Unscrew cable clamps of no tube sensor cable (A).
- 3 Disconnect no tube sensor cable from Y/B board.
- 4 Unscrew sensor fixing screws (C).
- 5 Remove no tube sensor (B).

### Installing

To instal the no tube sensor, proceed as follows:


- 1 Instal no tube sensor in reverse order as described for removal.  
Pay attention to the following:
  - Make sure that the gripper finger initializes properly, i.e that the slide runs to a stop at the back panel and does not collide with other parts, e.g. an incorrectly installed cable clamp.
- 2 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - Verify reference positions
  - PosID tests
  - Range move test
  - Random move test



## 8.13 Te-Link

### 8.13.1 Spare Parts




**Which Spare Parts are Available?**

Refer to 10.8 “Te-Link”,  10-8 to identify the available spare parts and their part numbers.

### 8.13.2 Complete Te-Link

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Check address setting	See section 11.2.1,  11-3 and section 11.2.28,  11-30
Check CAN bus resistance	See section 4.5,  4-7

**Replacing**

Check address setting of new Te-Link.  
Refer to cross references above.

**Tests and Settings**

After replacing the complete Te-Link, perform the following setups and tests.  
Refer to the “Instrument Software Manual”.

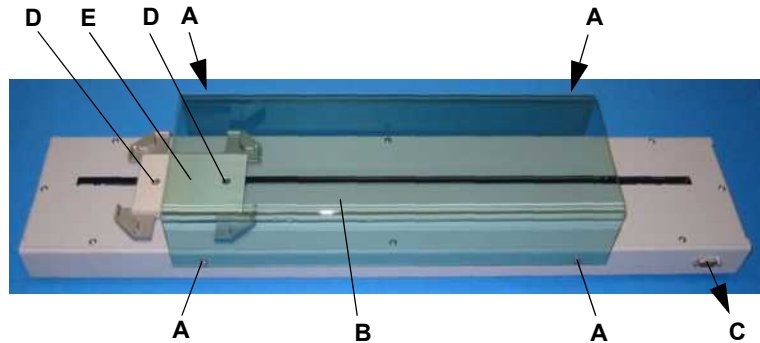
- CAN bus resistance test.  
Refer to cross references above.
- Instrument basic setup
- Range move test
- Random move test
- EEPROM backup

### 8.13.3 Making the Parts Accessible

**Opening the Housing**

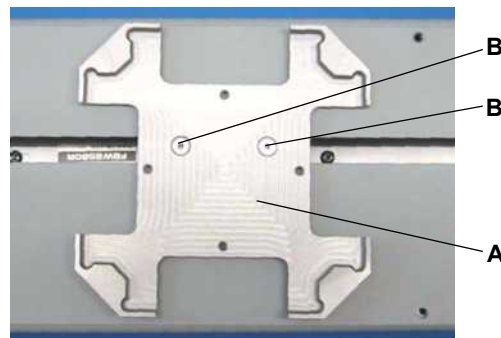
To open the housing of the Te-Link in order to make the parts accessible, proceed as follows:

- 1 Note the position of the Te-Link on the worktable.
- 2 Disconnect the CAN bus cable (C) from the Te-Link.



**Fig. 8-143** Protective cover/carrier plate

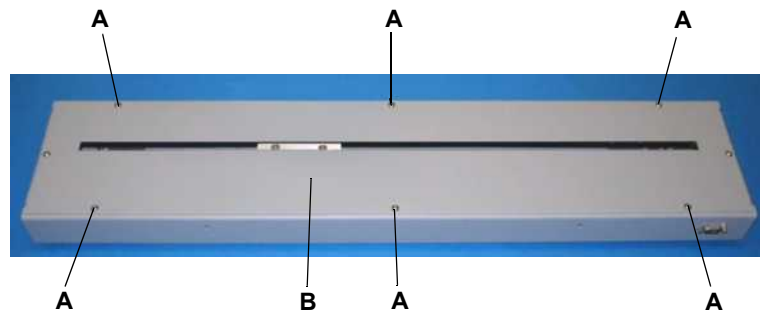
- 3 Remove the Te-Link from the worktable.
- 4 Remove the four screws (A) and the protective cover (B).
- 5 If installed: Remove the two screws (D) and the carrier plate (E) from the MP carrier.



- 6 Remove the two screws (B).
- 7 Remove the MP carrier (A) from the slide.

**Fig. 8-144** MP carrier

- 8 Remove the eight screws (A).

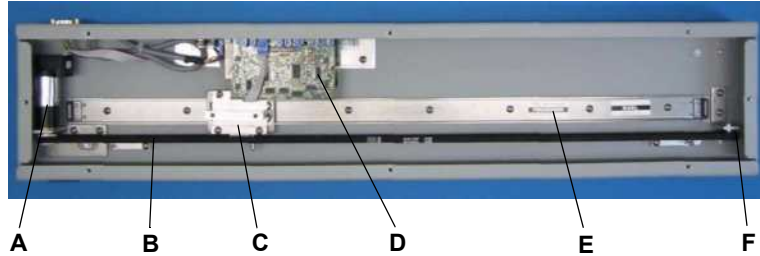


**Fig. 8-145** Cover plate

- 9 Remove the cover plate (B).

**Which Parts are Accessible Now?**

The figure shows the open Te-Link with its accessible parts:



**Fig. 8-146** Open Te-Link

- |                       |                       |
|-----------------------|-----------------------|
| <b>A</b> Motor        | <b>D</b> PCBs         |
| <b>B</b> Toothed belt | <b>E</b> Guide        |
| <b>C</b> Slide        | <b>F</b> Idler roller |

**Installing**

Instal all removed parts in reversed order as described for removal.

**8.13.4 Toothed Belt**

**Cross References**

List of cross references to information provided in other sections:

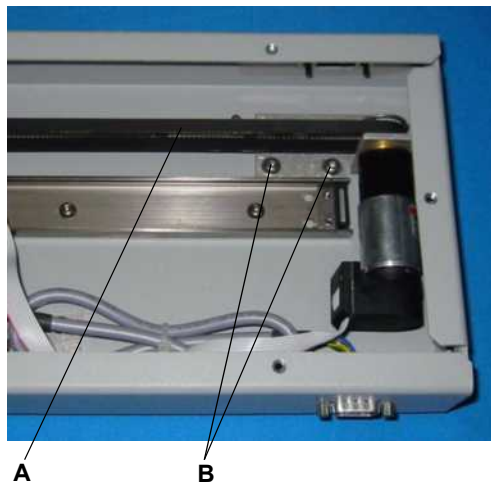
Action	Reference
Open housing	See section <a href="#">8.13.3</a> , <a href="#">8-125</a>

**Replacing**

To replace the toothed belt, proceed as follows:

- 1 Open the housing of the Te-Link. Refer to cross references above.

**Removing**



**Fig. 8-147** Relief of belt tension

- 2 Loosen the motor fixing screws (B) to release the tension of the toothed belt (A).

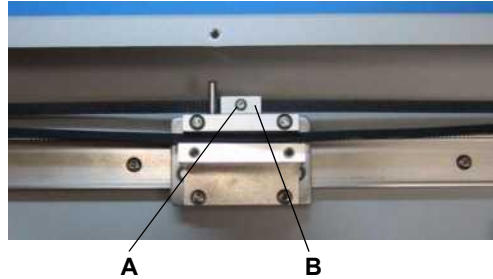


Fig. 8-148 Belt lock

- 3 Remove the belt lock screw (A) and the plate (B) of the belt lock.
- 4 Remove the toothed belt.

### Installing

- 5 Cut the new toothed belt to the correct length.  
*The belt length amounts to 1380 mm (54.33 in.).*

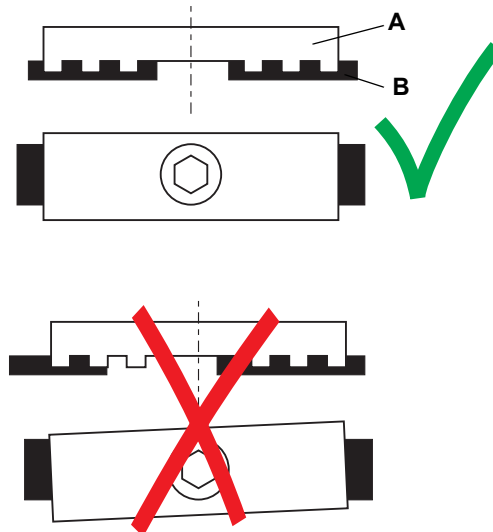


Fig. 8-149 Proper fixing of belt lock

- 6 Lay the new toothed belt in and fix it in the belt lock as shown in the figure.

*Make sure that the teeth of the belt lock plate (A) engage properly in the teeth of the belt (B).*

*Make sure that the belt lock plate is in a straight line with the belt.*

- 7 Adjust the tension of the toothed belt by shifting the motor support to the appropriate position and tighten the motor fixing screws.  
*Make sure that the motor axis is positioned at a right angle to the belt axis in order to prevent the belt from running to one side.*

- 8 Instal all removed parts in reverse order as described for removal.

### Tests and Settings

- 9 To ensure operating readiness, perform the following setups and tests: Refer to the "Instrument Software Manual".
  - Autorange
  - Range move test
  - Random move test

### 8.13.5 Motor Assembly

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Open casing	See section 8.13.3, 8-125
Adjust belt tension	See section 8.13.4, 8-127
Cable connections	See section 11.2.14, 11-16 and section 11.2.28, 11-30

**Replacing**

**Note:** The whole motor assembly (motor + pulley + support) is now available as a spare part.

To replace the motor assembly, proceed as follows:

- 1 Open the casing of the Te-Link.  
Refer to cross references above.

**Removing**

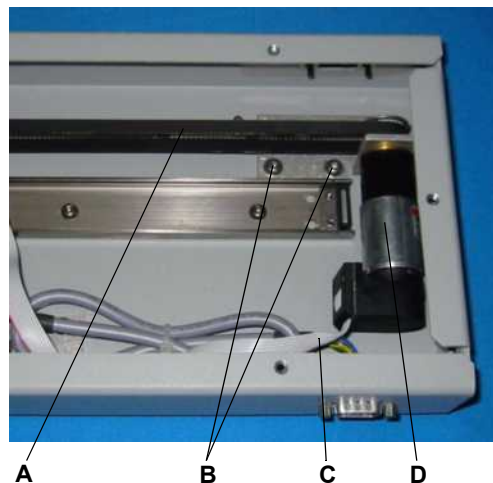


Fig. 8-150 Removal of motor

- 2 Remove the motor fixing screws (B).
- 3 Disengage the toothed belt (A) from the motor (D).
- 4 Disconnect the flat cable (C) from the Te-Stack backplane.
- 5 Remove the motor assembly.

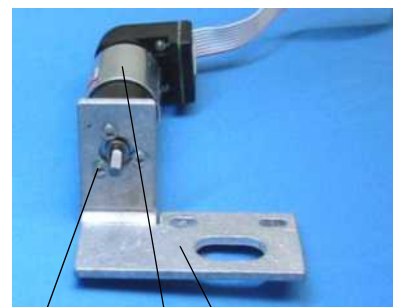
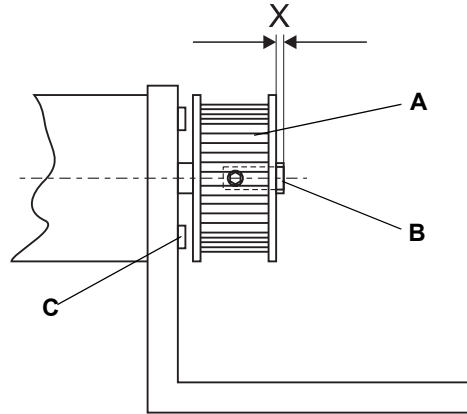


Fig. 8-151 Motor assembly (motor + pulley + support)

## Installing

To install the motor assembly:

- 1 First check and, if necessary, adjust the pulley according to the following:



*The distance “x” must be 2 mm. Make sure that the pulley (A) does not touch the screws (C) of the motor fixing.*

*Make sure that the set screw of the pulley rests on the flat part (B) of the motor shaft.*

**Fig. 8-152** Pulley on motor shaft

- 2 Engage the toothed belt and fix the motor support in the Te-Link.
- 3 Adjust the tension of the toothed belt.  
Refer to cross references above.
- 4 Connect the flat cable of the motor to the Te-Stack backplane.  
Refer to cross references above.
- 5 Instal all removed parts in reverse order as described for removal.

## Tests and Settings

- 6 To ensure operating readiness, perform the following setups and tests:  
Refer to the “Instrument Software Manual”.
  - Autorange
  - Range move test
  - Random move test

### 8.13.6 DC Servo II Board

**Cross  
References**

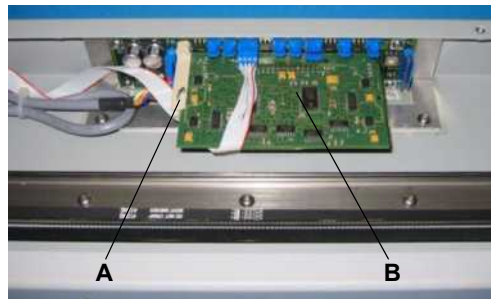
List of cross references to information provided in other sections:

Action	Reference
Open casing	See section 8.13.3, 8-125

**Replacing**

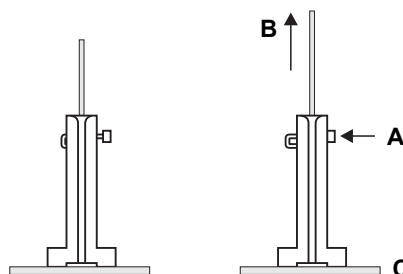
To replace the DC servo II board, proceed as follows:

- 1 Open the casing of the Te-Link.  
Refer to cross references above.



The DC servo II board (B) is secured with a locking clip (A).

Fig. 8-153 DC servo II board

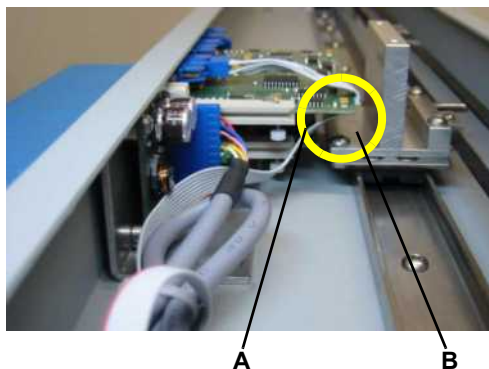


- 1 Press the locking clip (A) to unlock the PCB.
- 2 Unplug the DC servo II board (B) from the Te-Stack backplane (C).

Fig. 8-154 PCB locking clip

**Installing**

Instal all removed parts in reversed order as described for removal.  
Pay attention to the following:



- ♦ Make sure that the flat cable (A) is not caught by the slide (B) when the axis moves.
- ♦ Fix all cables properly.
- ♦ Do not forget to secure the PCB with the locking clip.

Fig. 8-155 Possible collision point of flat cable and slide

**Tests and Settings**

To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.

- ◆ Range move test
- ◆ Random move test

**8.13.7 Device CU Board**

**Cross References**

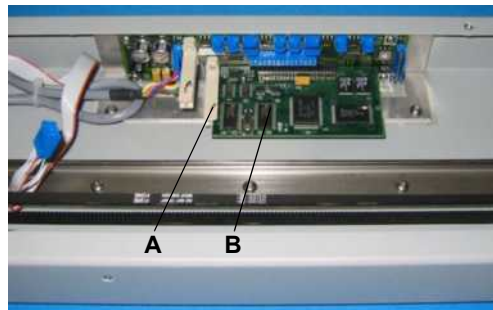
List of cross references to information provided in other sections:

Action	Reference
Open casing	See section <a href="#">8.13.3</a> , <a href="#">8-125</a>
Remove/install DC servo II board	See section <a href="#">8.13.6</a> , <a href="#">8-131</a>

**Replacing**

To replace the device CU board, proceed as follows:

- 1 Open the casing of the Te-Link.  
Refer to cross references above.
- 2 Remove the DC servo II board.  
Refer to cross references above.



- 3 Remove the device CU board (B).  
*The device CU board is secured with a locking clip (A).*

*Fig. 8-156 Device CU board*

**Installing**

Instal all removed parts in reversed order as described for removal.

**Tests and Settings**

To ensure operating readiness, perform the following setups and tests:  
Refer to the “Instrument Software Manual”.

- ◆ Instrument basic setup
- ◆ Range move test
- ◆ Random move test
- ◆ EEPROM backup



### 8.13.8 Te-Stack Backplane

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Open casing	See section 8.13.3, 8-125
Remove/install DC servo II board	See section 8.13.6, 8-131
Remove/install device CU board	See section 8.13.7, 8-132
Check settings	See section 11.2.1, 11-3 and section 11.2.28, 11-30
Cable connections	See section 11.2.14, 11-16
Check CAN bus resistance	See section 4.5, 4-7

**Replacing**

To replace the Te-Stack backplane, proceed as follows:

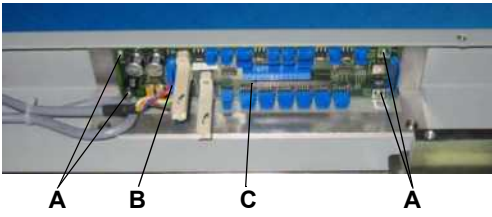
- 1 Open the casing of the Te-Link.  
Refer to cross references above.
  - 2 Remove the DC servo II board.  
Refer to cross references above.
  - 3 Remove the device CU board.  
Refer to cross references above.
- 
- 4 Unplug the connector (B) of the CAN bus cable from the Te-Stack backplane (C).
  - 5 Remove the four screws (A).
  - 6 Remove the Te-Stack backplane and the spacers below the PCB.

Fig. 8-157 Te-Stack backplane

**Installing**

- 1 Check if the switch SW20 (CAN termination) on the Te-Stack backplane is set correctly according to the configuration of the instrument.  
Refer to cross references above.
- 2 Check if the address switch SW40 is set correctly.  
Refer to cross references above.
- 3 Install the PCB in reverse order as described for removal.  
*Make sure that the spacers between the PCB and the Te-Link housing are correctly installed.*  
*For correct cable connection refer to cross references above.*


**Tests and  
Settings**

- 4 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - CAN bus resistance.  
Refer to cross references above.
  - Range move test
  - Random move test

## 8.14 Centrifuge

### 8.14.1 Spare Parts

#### Which Spare Parts are Available?

Refer to 10.10 “Centrifuge”,  10-12 to identify the available spare parts and their part numbers.

**Note:** The replacement of the following spare parts is described in this Service Manual:

- Temperature sensors
- Fuses

For all other spare parts refer to the separate documentation of the centrifuge.

### 8.14.2 Removal of the Centrifuge

#### Removing

To remove the centrifuge from the Freedom EVO, proceed as follows:

- 1 Close the loading hatch.
- 2 Switch the centrifuge off.
- 3 Switch the Freedom EVO off.
- 4 Disconnect the power and the communication cable from the centrifuge.
- 5 Remove lock pin.
- 6 Pull centrifuge out from under the instrument.

#### Installing

To install the centrifuge, proceed in reverse order as described for removal.

### 8.14.3 Removal of Upper Front Panel

#### Removing

To remove the upper front panel, proceed as follows:



- 1 Pull Open/Close button (A) off.
- 2 Unscrew 3 screws at the bottom of front panel.
- 3 Tilt away bottom of front panel and lift off.

**Fig. 8-158**

#### Installing

install all removed parts in reversed order as described for removal.

**8.14.4 Temperature Sensors**

**8.14.4.1 Temperature Sensor at Rubber Lid**

**Cross  
References**

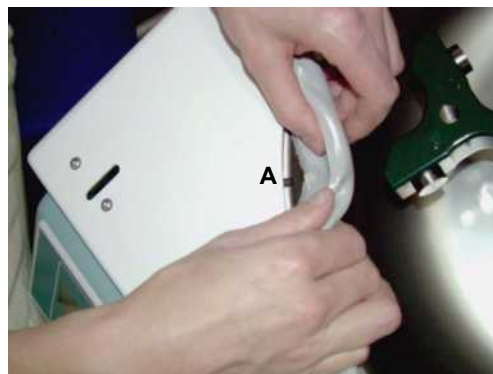
List of cross references to information provided in other sections:

Action	Reference
Pull centrifuge out	See section <a href="#">8.14.2</a> , <a href="#">8-134</a>
Remove upper front panel	See section <a href="#">8.14.3</a> , <a href="#">8-134</a>
Perform the temperature calibration	See section <a href="#">6.3.3.3</a> , <a href="#">6-9</a>

**Replacing**

To replace the sensor, proceed as follows:

- 1** Pull the centrifuge out from under the instrument.  
Refer to cross references above.
- 2** Remove the upper front panel.  
Refer to cross references above.



- 3** Carefully remove the rubber lid at the sensor position (A).
- 4** Disconnect the sensor from the control panel, free cable and remove the sensor.

*Fig. 8-159 Rubber lid at sensor position*

- 5** Install the sensor in reverse order as described for removal. Pay attention to the following:
  - Free the hole in the isolation foam using a screwdriver.
  - The sensor is held in position by the rubber lid.

**Tests and  
Settings**

To ensure operating readiness, perform the following setups and tests:  
Refer to cross references above.

- Temperature calibration

### 8.14.4.2 Temperature Sensor at Chamber Bottom

**Cross References**

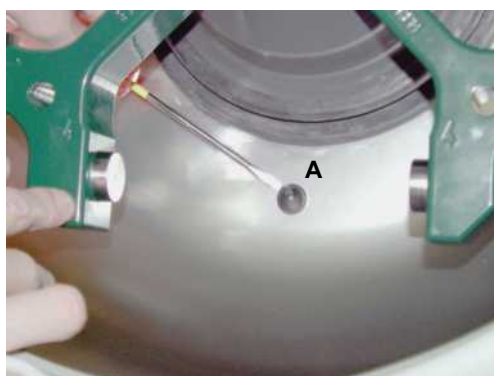
List of cross references to information provided in other sections:

Action	Reference
Pull centrifuge out	See section <a href="#">8.14.2</a> , <a href="#">8-134</a>
Perform the temperature calibration	See section <a href="#">6.3.3.3</a> , <a href="#">6-9</a>

**Replacing**

To replace the sensor, proceed as follows:

- 1 Pull the centrifuge out from under the instrument.  
Refer to cross references above.



- 2 Lever the sensor (A) out using a screwdriver.
- 3 Disconnect sensor from supply board and replace.

*Fig. 8-160 Sensor at chamber bottom*

- 4 Install the sensor in reverse order as described for removal.

**Tests and Settings**

To ensure operating readiness, perform the following setups and tests:  
Refer to cross references above.

- Temperature calibration

### 8.14.4.3 Temperature Sensor at Condenser

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Pull centrifuge out	See section <a href="#">8.14.2</a> , <a href="#">8-134</a>
Remove upper front panel	See section <a href="#">8.14.3</a> , <a href="#">8-134</a>
Perform the temperature calibration	See section <a href="#">6.3.3.3</a> , <a href="#">6-9</a>

**Replacing**

To replace the sensor, proceed as follows:

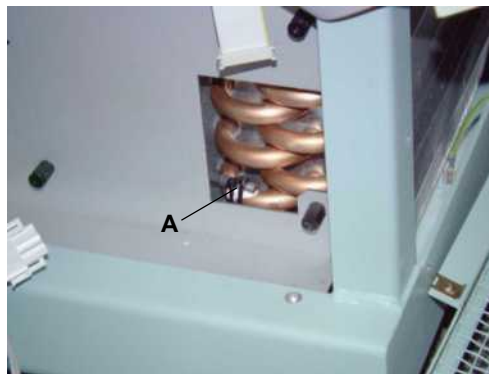
- 1 Pull the centrifuge out from under the instrument.  
Refer to cross references above.

- 2 Remove both front panels.  
Refer to cross references above.
- 3 Remove the left panel.



**Fig. 8-161** Positioning board

- 4 Remove the positioning board (A).



**Fig. 8-162** Sensor on condenser

- 5 Free the cable, disconnect the sensor (A) from the supply board and remove the sensor from the condenser.

- 6 Install the sensor in reverse order as described for removal.

**Tests and  
Settings**

To ensure operating readiness, perform the following setups and tests:  
Refer to cross references above.

- Temperature calibration

### 8.14.5 Fuses

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Remove upper front panel	See section <a href="#">8.14.3</a> , <a href="#">8-134</a>

**Different  
Centrifuge  
Types**

Depending on the centrifuge type (date of manufacture) there are different fuses installed:

- ◆ Newer centrifuges are equipped with a temperature fuse. If this fuse has triggered, e.g. in case of a blocked hatch, switch the centrifuge off and wait for a few minutes until the temperature fuse has cooled down. It will recover automatically.
- ◆ Older centrifuges are equipped with fuses on the positioning board and the supply board. These fuses need replacement after overload.

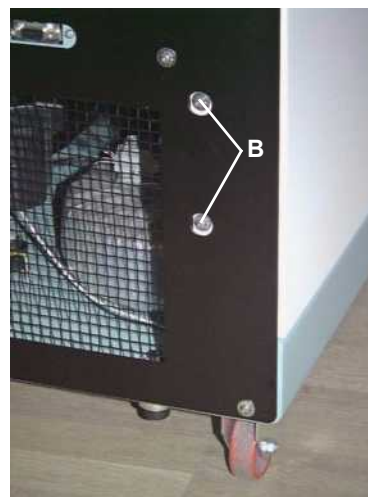
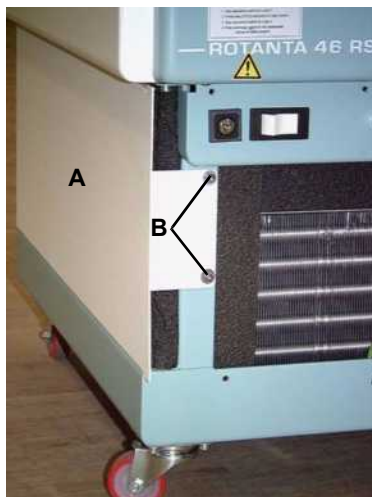
**Access to  
Fuses**

**Note:** Before removing parts to replace fuses, check if your centrifuge is not equipped with a temperature fuse (see above).

**Positioning  
Board**

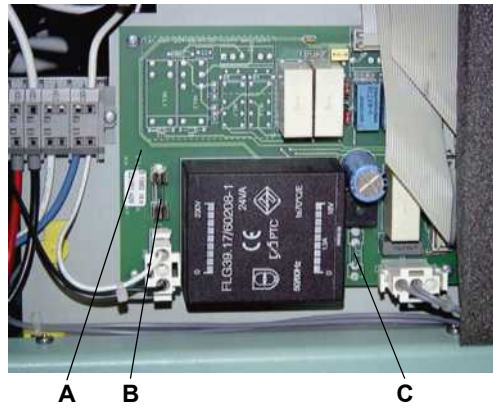
To gain access to the positioning board, proceed as follows:

- 1 Remove the lower front panel (7 screws).



**Fig. 8-163** Fixing screws of the left panel

- 2 Remove the fixing screws (B).
- 3 Remove the left panel (A).



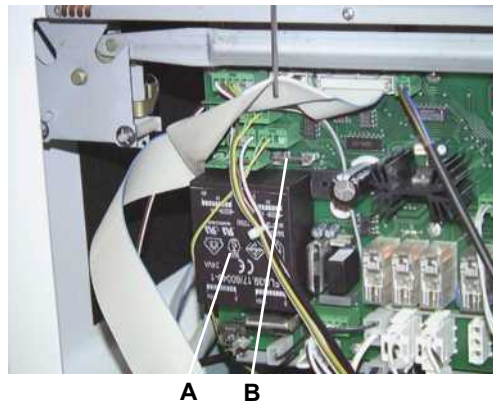
- A** Positioning board
- B** Fuse 2 A slow-blow type
- C** Jumper (in older centrifuges:  
Fuse 2 A slow-blow type)

**Fig. 8-164** Fuses on positioning board

**Supply Board**

To gain access to the supply board, proceed as follows:

- 1 Remove the upper front panel.  
Refer to cross references above.



- A** Supply board
- B** Fuse 2 A slow-blow type

**Fig. 8-165** Fuse on supply board

### 8.14.6 Imbalance Switch Adjustment

**Cross  
References**

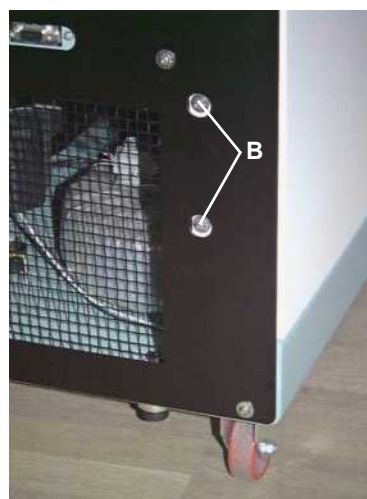
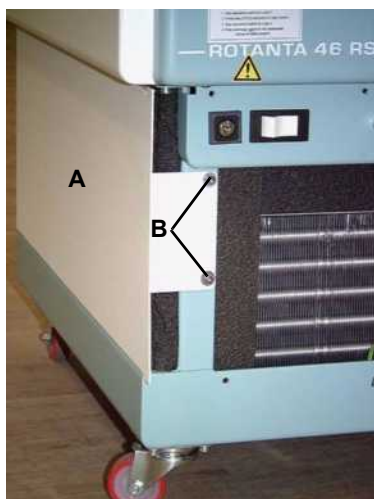
List of cross references to information provided in other sections:

Action	Reference
Perform the imbalance test	See section 6.3.3.1, 6-6

**Adjusting**

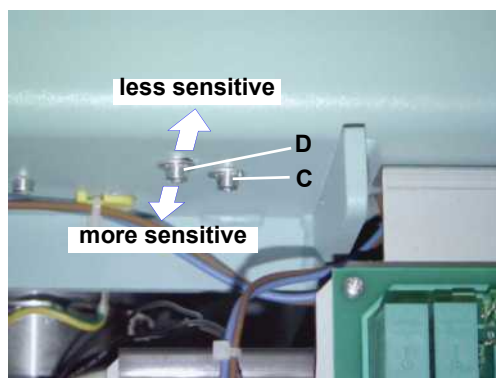
To adjust the imbalance switch, proceed as follows:

- 1 Remove the lower front panel (7 screws).



**Fig. 8-166** Fixing screws of the left panel

- 2 Remove the fixing screws (B).
- 3 Remove the left panel (A).



- 4 Slightly slacken the right screw (C).
- 5 Slacken the left screw (D) and slightly move it in appropriate direction to increase/decrease sensitivity.
- 6 Tighten both screws.

**Fig. 8-167** Screws of imbalance switch

**Tests and  
Settings**

To ensure operating readiness, perform the following setups and tests:  
Refer to cross references above.

- Imbalance test



## 8.15 Liquid System

### 8.15.1 Overview

#### Definition of Liquid System

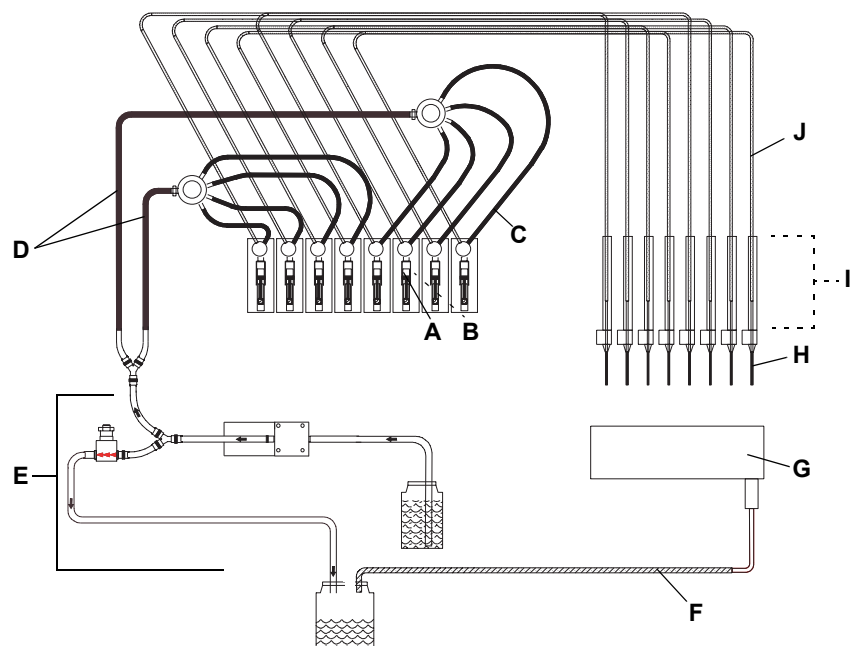
The term “liquid system” refers to all instrument modules and parts which contain or directly influence liquid. These main components are:

- ◆ LiHa 1536 (see 8.7 “Liquid Handling Arm (LiHa)”, 8-22)
- ◆ Tips (refer to Freedom EVO Operating Manual)
- ◆ Tubing system (see 8.15.2 “Tubing System”, 8-142)
- ◆ Diluter/Dilback (see 8.15.5 “Diluters”, 8-154)
- ◆ MPO/FWO\* (see 8.15.4 “Monitored Pump Option/Fast Wash Option”, 8-147)
- ◆ Low volume option\* (see 8.15.3 “Low Volume Option”, 8-144)
- ◆ Nanopipetting System NPS\* (refer to separate documents of NPS system)

**Note:** Components marked with an asterisk (\*) are optional and therefore not available on all instruments.

#### Standard Liquid System

The following figure shows the main components of a standard liquid system with optional FWO/MPO.




**Fig. 8-168** Overview of standard liquid system with MPO/FWO


<b>A</b>	Diluter	<b>F</b>	Waste tubing
<b>B</b>	Dilback	<b>G</b>	Wash station
<b>C</b>	Interconnecting tubing	<b>H</b>	Tips
<b>D</b>	Aspirating tubing	<b>I</b>	LiHa 1536
<b>E</b>	MPO/FWO	<b>J</b>	Pipetting tubing

### 8.15.2 Tubing System

This section describes the customary tubing system which is available in three material variants:




- ◆ Standard
- ◆ High resistant type A (FEP/PVDF)
- ◆ High resistant type B (FEP/PP)

For the MPO/FWO tubing system refer to [8.15.4 "Monitored Pump Option/Fast Wash Option"](#),  8-147.

For the Low volume option tubing system refer to [8.15.3 "Low Volume Option"](#),  8-144.

#### Which Spare Parts are Available?

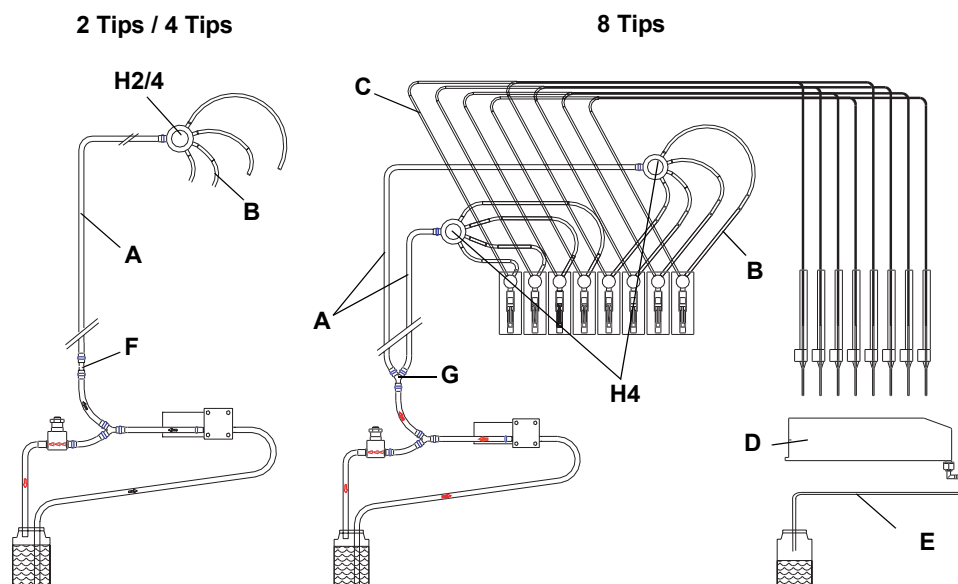
Refer to

- ◆ [10.9.1 "Standard Tubing"](#),  10-8
- ◆ [10.9.2 "High Resistant Tubing Type A"](#),  10-9
- ◆ [10.9.3 "High Resistant Tubing Type B"](#),  10-9

to identify the available spare parts and their part numbers.

#### Standard Tubing

The figure shows the components of the standard tubing system:

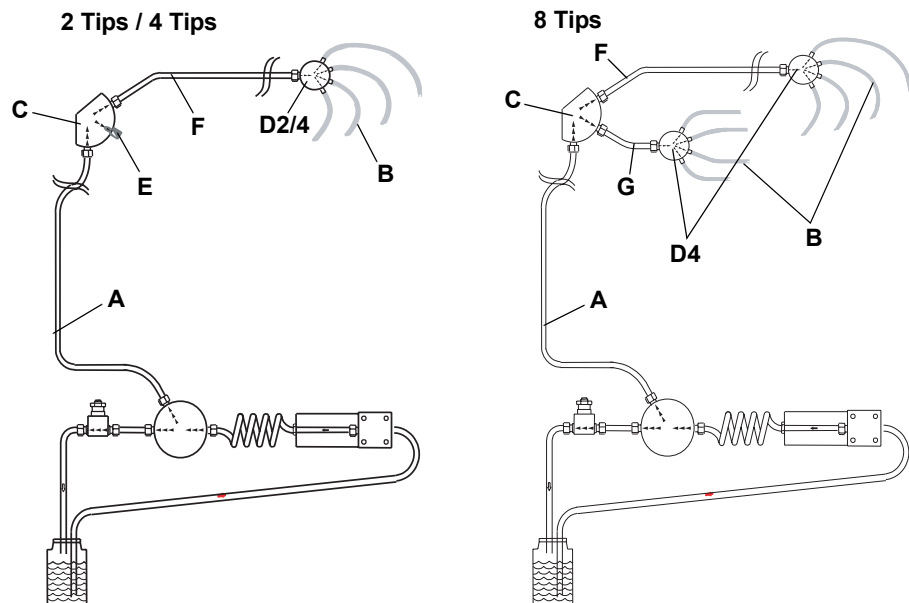


**Fig. 8-169** Standard tubing

- |                                 |   |
|---------------------------------|---|
| <b>A</b> Aspirating tubing      | <b>F</b> I-connector                                |
| <b>B</b> Interconnecting tubing | <b>G</b> Y-connector                                |
| <b>C</b> Pipetting tubing       | <b>H2</b> Distributor one to two (2-tip LiHa)       |
| <b>D</b> Wash station           | <b>H4</b> Distributor one to four (4 or 8-tip LiHa) |
| <b>E</b> Waste tubing           |   |

**High Resistant  
Tubing**

The figure shows the components of the high resistant tubing (type A and type B) system:



**Fig. 8-170** High resistant tubing type A and B

- |           |                                     |           |   |
|-----------|-------------------------------------|-----------|---|
| <b>A</b>  | Aspirating tubing                   | <b>D4</b> | Distributor one to four (4 or 8-tip LiHa) |
| <b>B</b>  | Interconnecting tubing              | <b>E</b>  | Screw plug                                |
| <b>C</b>  | Distributor one to two              | <b>F</b>  | Tubing to distributor one to four         |
| <b>D2</b> | Distributor one to two (2-tip LiHa) | <b>G</b>  | Tubing to distributor one to four         |

**Removing**

To remove the tubing, proceed as follows:

- 1 Empty the liquid system.
- 2 Switch the instrument off.

**WARNING**

Biological or chemical hazard and/or radioactive radiation.  
The liquid system may contain substances hazardous to your health.  
Make sure that the complete liquid system has been properly decontaminated before you perform any service task.



- 3 Remove the relevant parts of the tubing.
  - Disconnect the tubings from the diluters and from the tips.
  - Cut the cable tie which holds them together at the end of the cable holder chain.
  - Carefully pull them out of the cable holder chain.

**Note:** The LiHa cable is also laid through the cable holder chain.

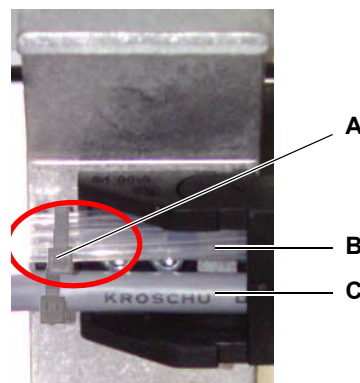
## Installing

To install the tubing, proceed as follows (also see the following figures):

- 1 Draw the new tubings through the cable holder chain:
- 2 Connect them to the corresponding diluters and tips:
  - Diluter No.1 (leftmost) is connected to tip No.1 (rearmost)
  - Diluter No.2 to tip No.2, etc.



**Fig. 8-171** Cable holder chain for tubings and LiHa cable



- A** Cable tie for tubings
- B** Tubings
- C** LiHa cable

- 3 Use a cable tie to secure the tubings at the end of the cable holder chain as shown in the figure.

**Fig. 8-172**

## Tests and Settings

- 4 To ensure operating readiness, perform the following tests:  
Refer to the “Freedom EVO Operating Manual” and the “Instrument Software Manual”.
  - Check tightness (visual inspection)
  - FaWa pump test
  - Gravimetric (precision) test

### 8.15.3 Low Volume Option

#### What is the Option Used For?

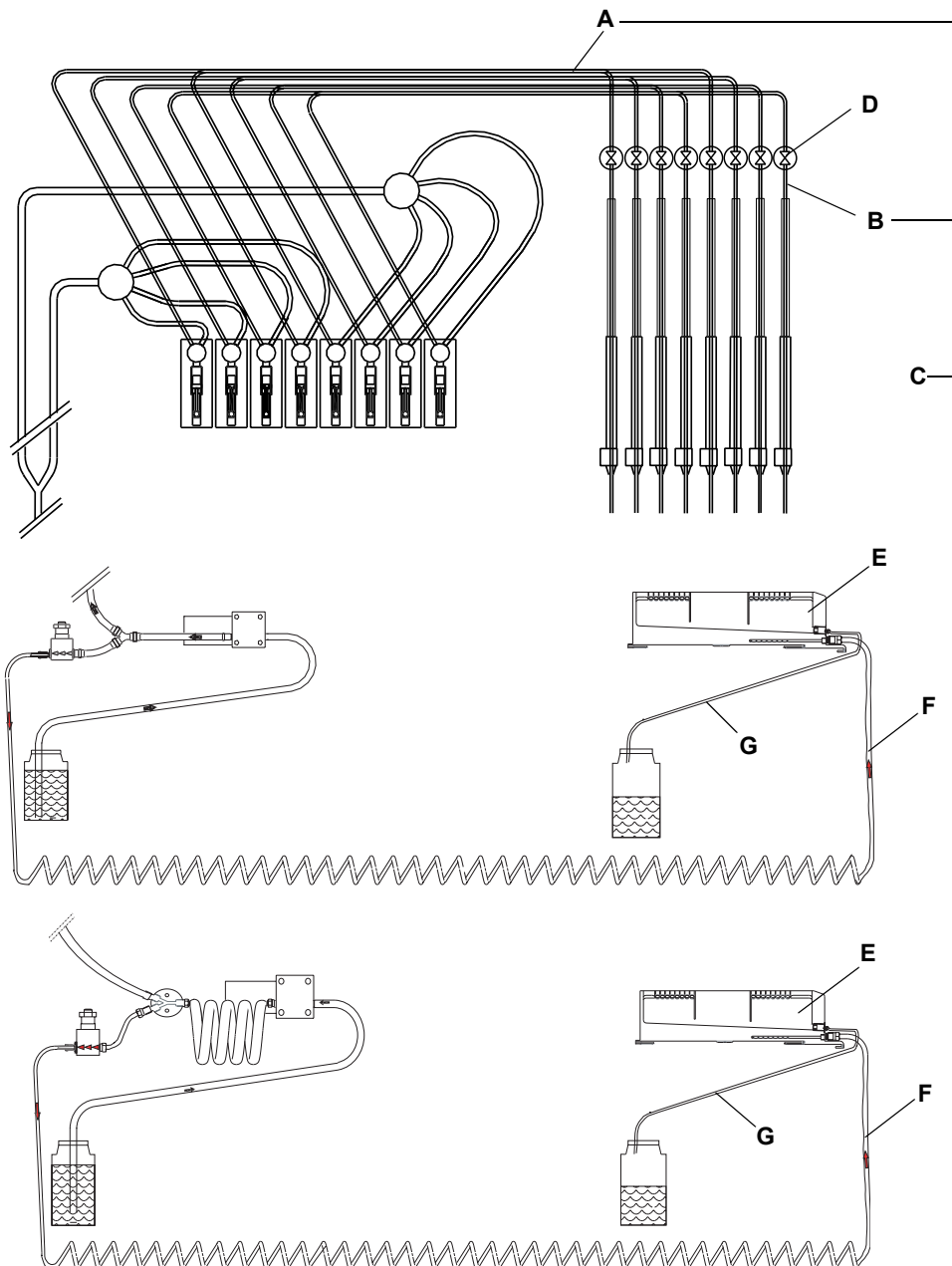
The low volume option allows precise and reliable pipetting of low volumes with free dispensing. A droplet is pumped to the tip end by means of the diluter. The solenoid/pinch valve releases the pulse for cutting off the droplet.

#### Which Spare Parts are Available?

Refer to [10.9.4 “Low Volume Option”](#), [10-10](#) to identify the available spare parts and their part numbers.

The figure on the next page shows the main components of the low volume option:

**Low Volume  
Option  
Overview**



**Fig. 8-173** Low volume option: Main components

- |          |                                     |          |                                   |
|----------|-------------------------------------|----------|-----------------------------------|
| <b>A</b> | <i>Pipetting tubing, upper part</i> | <b>E</b> | <i>Wash station low volume PP</i> |
| <b>B</b> | <i>Pipetting tubing, lower part</i> | <b>F</b> | <i>Fill tubing</i>                |
| <b>C</b> | <i>Tubing set</i>                   | <b>G</b> | <i>Waste tubing</i>               |
| <b>D</b> | <i>Pinch valve</i>                  |          |                                   |

### Solenoid Valve

#### Replacing

To replace a solenoid valve, proceed as follows:

- 1 Empty the liquid system.
- 2 Switch the instrument off.

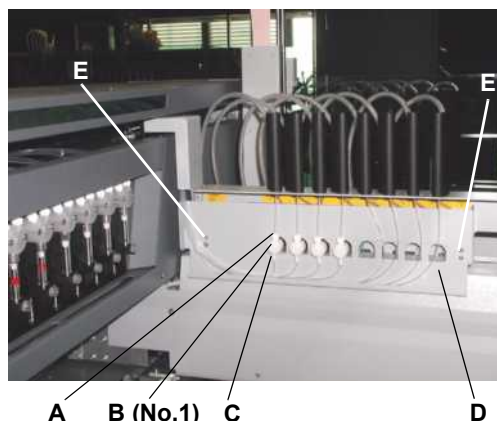


Fig. 8-174 Low volume option

- 3 Unscrew the fittings (A, C) of the pipetting tubing from the valve (B).

*If you need to replace several valves, mark all tubing with the corresponding channel number.*

- 4 Remove the four screws (E) and the tubing shelf cover (D).

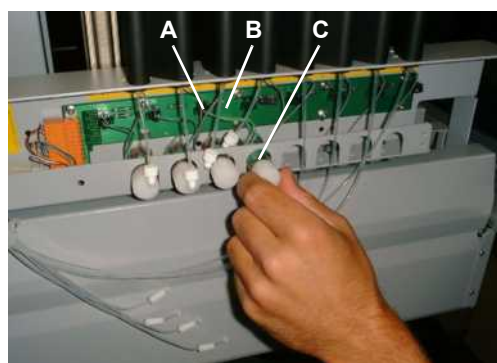


Fig. 8-175 Removal of the solenoid valve

- 5 Disconnect the valve cables (A) from the low volume distributor board (B).

*Depress the nose on the connector to unlock it from the socket.*

- 6 Pull the solenoid valve out of its clip bracket.

#### Installing

- 7 Install the solenoid valve in reverse order as described for removal. Pay attention to the following:
  - Be careful not to damage the cable of the solenoid valve when installing it.
  - Make sure that the pipetting tubing from diluter No.1 (leftmost) is connected to valve No.1 (rearmost), etc.
  - Make sure that the pipetting tubing from valve No.1 is connected to tip No.1, etc.

#### Tests and Settings

- 8 To ensure operating readiness, perform the following tests: Refer to the "Instrument Software Manual".
  - Check tightness (visual inspection)
  - FaWa pump test
  - Gravimetric (precision) test

### 8.15.4 Monitored Pump Option/Fast Wash Option

#### Definition

The following table explains the difference between the options and gives an overview of the available types:

*Tab. 8-5 MPO/FWO option*

Designation	Consists of	Variants
Monitored Pump Option (MPO)	Fast wash pump and liquid level sensors (LICOS)	Standard Type A Type B
Fast Wash Option (FWO)	Fast wash pump without liquid level sensors	Standard Type A Type B

#### Spare Parts MPO/FWO

**Which Spare Parts are Available?**

Refer to [10.9.5 "Monitored Pump Option/Fast Wash Option"](#), [10-10](#) to identify the available spare parts and their part numbers.

#### Complete MPO/FWO

**Cross References**

List of cross references to information provided in other sections:

Action	Reference
Cable connections	See section <a href="#">11.2.8</a> , <a href="#">11-10</a>
Tubing connections	See " <a href="#">MPO/FWO Tubing</a> ", <a href="#">8-151</a>



#### WARNING

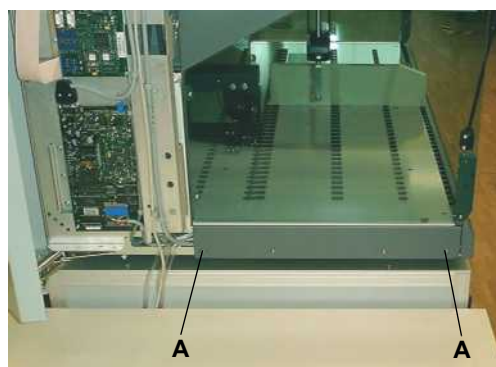
Biological or chemical hazard and/or radioactive radiation.

The liquid system may contain substances hazardous to your health. Make sure that the complete liquid system has been properly decontaminated before you perform any service task.

## Removing

To remove the complete MPO/FWO, proceed as follows:

- 1 Empty the liquid system.
- 2 Switch the instrument off.



- 3 Remove the two outer screws (A) of the left worktable cover.

*Fig. 8-176 Removal of MPO/FWO assembly*



- 4 Pull the MPO/FWO assembly out of the instrument as shown in the figure.
- 5 Disconnect the tubing (A) and the connection cable (B).

*Fig. 8-177 MPO/FWO assembly*

## Installing

To instal the complete MPO/FWO, proceed as follows:

- 1 Install the MPO/FWO assembly in reverse order as described for removal. Pay attention to the following:
  - For correct cable connection refer to cross references above.
  - For tubing connections refer to cross references above.

## Tests and Settings

- 2 To ensure operating readiness, perform the following tests: Refer to the “Instrument Software Manual”.
  - Check tightness (visual inspection)
  - FaWa pump test
  - LICOS test



**Fast Wash Pump**

**Cross  
References**

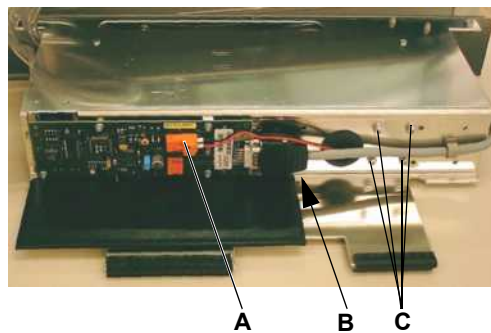
List of cross references to information provided in other sections:

Action	Reference
Remove MPO/FWO assembly	See "Complete MPO/FWO", 8-147
Cable connections	See section 11.2.8, 11-10
Tubing connections	See "MPO/FWO Tubing", 8-151

**Replacing**

To replace the fast wash pump, proceed as follows:

- 1 Remove the MPO/FWO assembly from the instrument. Refer to cross references above.
- 2 Remove the tubing from the fast wash (FaWa) pump.



*Fig. 8-178 FaWa pump fixing screws*

- 3 Disconnect the FaWa pump connector (A) from the MPO board.
- 4 Remove the ground cable (B, below PCB connector) of the FaWa motor.
- 5 Remove the four fixing screws (C).

- 6 Remove the FaWa pump from the MPO/FWO assembly.
- 7 Install the FaWa pump in reverse order as described for removal. Pay attention to the following:
  - For correct cable connection refer to cross references above.
  - For tubing connections refer to cross references above.

**Tests and  
Settings**

- 8 To ensure operating readiness, perform the following tests: Refer to the "Instrument Software Manual".
  - Check tightness (visual inspection)
  - FaWa pump test

### Pressure Relief Valve

#### Cross References

List of cross references to information provided in other sections:

Action	Reference
Remove MPO/FWO assembly	See <a href="#">“Complete MPO/FWO”</a> , 8-147
Tubing connections	See <a href="#">“MPO/FWO Tubing”</a> , 8-151

#### Replacing

To replace the pressure relief valve, proceed as follows:

- 1 Remove the fast wash pump assembly from the instrument.  
Refer to cross references above.



**Fig. 8-179** MPO/FWO assembly

- 2 Remove the tubing (A, D) from the pressure relief valve (C).
- 3 Remove the fixing screw (B).  
*Be careful not to confuse the fixing screw with the regulating screw. Do not alter the setting of the regulating screw.*

- 4 Remove the pressure relief valve from the fast wash pump assembly.

#### Installing

- 5 Install the pressure relief valve in reverse order as described for removal. Pay attention to the following:
  - For tubing connections refer to cross references above.

#### Tests and Settings

- 6 To ensure operating readiness, perform the following tests:  
Refer to the “Instrument Software Manual”.
  - FaWa pump test

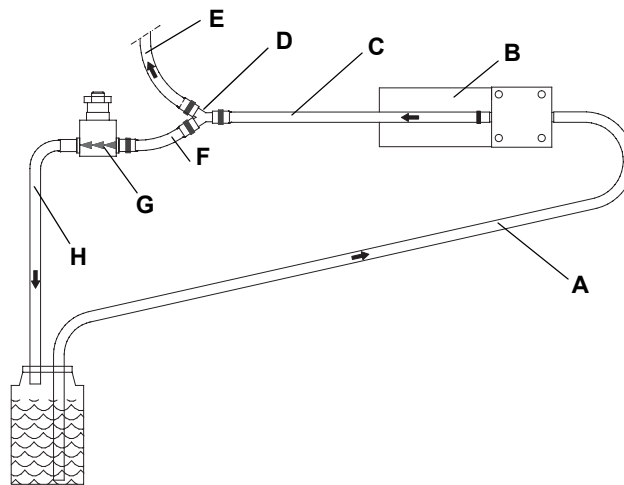
**MPO/FWO Tubing**

**Replacing**

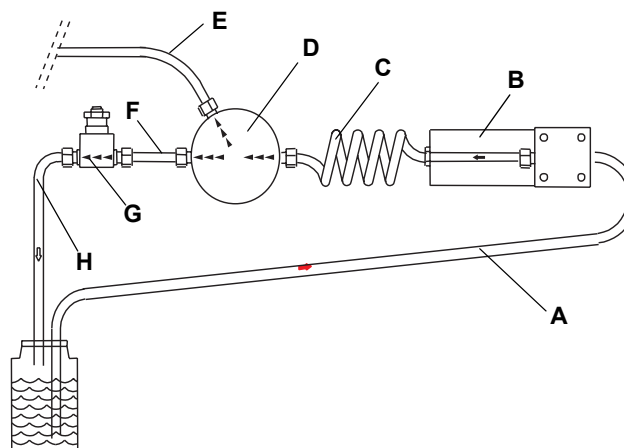
To replace the tubing, proceed as follows:

- 1 Remove the fast wash pump assembly from the instrument.
- 2 Remove the tubing.
- 3 Install the tubing in reverse order as described for removal. Pay attention to the following:

*The bypass tubing from the pressure relief valve may be lead into the waste container to prevent contamination of the system liquid with liquid flowing back.*



**Fig. 8-180** MPO/FWO standard tubing



**Fig. 8-181** MPO/FWO type A and B tubing

- |                                     |   |
|-------------------------------------|---|
| <b>A</b> Supply tubing to FaWa pump | <b>E</b> Tubing to diluter                        |
| <b>B</b> FaWa pump                  | <b>F</b> Tubing to pressure relief valve          |
| <b>C</b> Pressure tubing            | <b>G</b> Pressure relief valve                    |
| <b>D</b> Distributor one to two     | <b>H</b> Bypass tubing from pressure relief valve |

**Tests and Settings**

- 4 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - Check tightness (visual inspection)
  - FaWa pump test
  - LICOS test

**LICOS Sensors**

**Cross References**

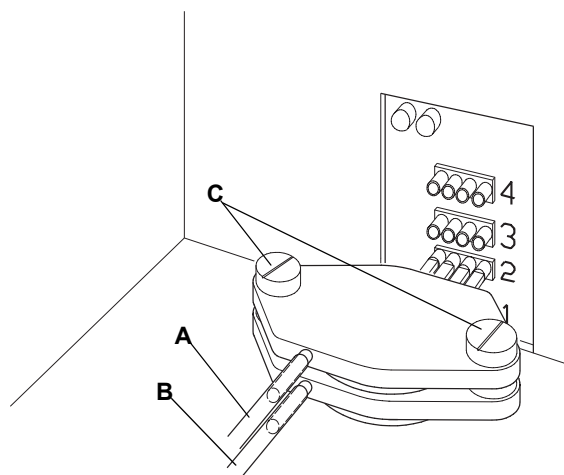
List of cross references to information provided in other sections:

Action	Reference
Remove MPO/FWO assembly	See <a href="#">"Complete MPO/FWO"</a> , 8-147

**Replacing**

To replace the LICOS sensor, proceed as follows:

- 1 Remove the fast wash pump assembly from the instrument.  
Refer to cross references above.
- 2 Remove the tubing (A) to waste container from the LICOS sensor.
- 3 Remove the tubing (B) to system liquid container from the LICOS sensor.



**Fig. 8-182 LICOS Sensors**

- 4 Unscrew the LICOS sensor fixing screws (C).
- 5 Remove the LICOS sensor(s).
- 6 Install in reverse order as described for removal. Pay attention to the following:
  - LICOS sensor on position 1: system liquid
  - LICOS sensor on position 2: waste

**Tests and Settings**

- 7 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".
  - FaWa pump test
  - LICOS test

**MPO Board**

**Cross  
References**

List of cross references to information provided in other sections:

Action	Reference
Remove MPO/FWO assembly	See <a href="#">“Complete MPO/FWO”</a> , <a href="#">8-147</a>
Remove LICOS sensor	See <a href="#">“LICOS Sensors”</a> , <a href="#">8-152</a>
Cable connections	See section <a href="#">11.2.8</a> , <a href="#">11-10</a>
Check address	See section <a href="#">11.2.1</a> , <a href="#">11-3</a> and section <a href="#">11.2.27</a> , <a href="#">11-29</a>
Check CAN bus resistance	See section <a href="#">4.5</a> , <a href="#">4-7</a>

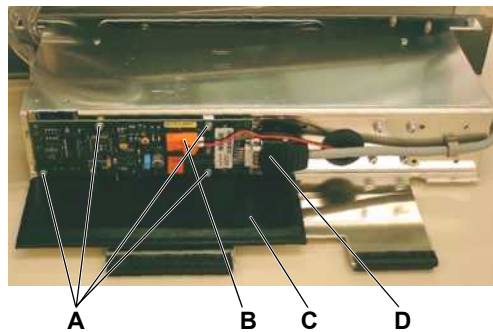
**Location**

The MPO board is located at the backside of the assembly.

**Replacing**

To replace the MPO board, proceed as follows:

- 1 Remove the MPO/FWO assembly from the instrument.  
Refer to cross references above.
- 2 Disconnect the LICOS sensors from the MPO board.  
Refer to cross references above.
- 3 Disconnect the FaWa pump connector (B) from the MPO board.
- 4 Disconnect the CAN bus connection cable (D).
- 5 Remove the four screws (A).



*Fig. 8-183 MPO board*

- 6 Remove the MPO board.
- 7 Install the MPO board in reverse order as described for removal. Pay attention to the following:
  - Check the rubber apron (C, [Fig. 8-183](#), [8-153](#)) for damage. Replace, if necessary.
  - For correct cable connection refer to cross references above.
  - Check CAN bus address setting. Refer to cross references above.
- 8 To ensure operating readiness, perform the following setups and tests: Refer to the “Instrument Software Manual”.

**Installing**

**Tests and  
Settings**

- CAN bus resistance.  
Refer to cross references above.
- Instrument basic setup
- Check tightness (visual inspection)
- FaWa setup
- LICOS setup
- FaWa pump test
- LICOS test

### 8.15.5 Diluters

#### Spare Parts Diluters

**Which Spare  
Parts are  
Available?**

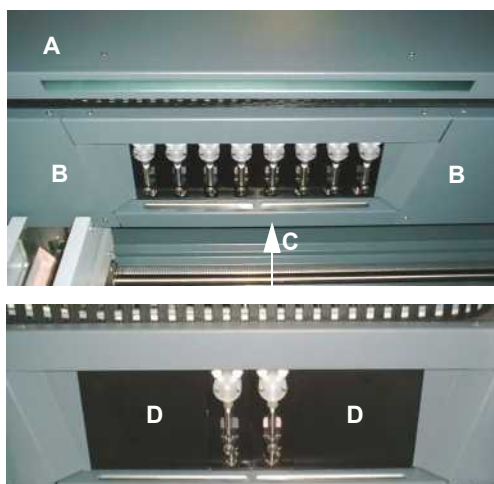
Refer to [10.9.6 "Diluters"](#), [10-11](#) to identify the available spare parts and their part numbers.

#### Complete Diluter

**Removing**

To remove the diluter, proceed as follows:

- 1 Empty the liquid system.
- 2 Switch the instrument off.



**Fig. 8-184** Diluter casing

- 3 Open the top cover (A).
- 4 Remove the diluter cover (B).
- 5 Remove the tubing from the diluter.
- 6 Remove the diluter fixing screw (One screw M3x12 with washer underneath each diluter, C).

**Note:**

*In instruments with less than 8 diluters (4 or 2 diluters) the diluters are centered and there are covers (D) installed on each side.*

- 7 Carefully pull the diluter out of the instrument.

**Installing**

To install the diluter, proceed as follows:

- 1 Install the diluter in reverse order as described for removal.  
Pay attention to the following:

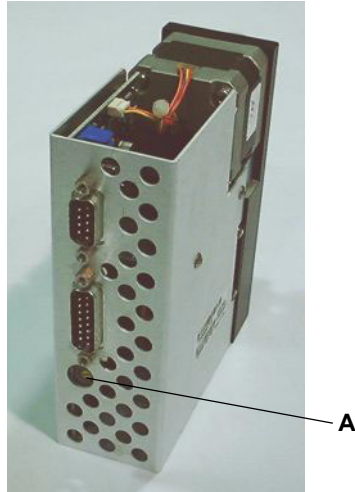


Fig. 8-185 Diluter rear side

- ◆ Check the address settings (adjust with the address switch (A)):
  - Diluter No.1: #0
  - Diluter No.2: #1
  - Diluter No.3: #2
  - Diluter No.4: #3
  - Diluter No.5: #4
  - Diluter No.6: #5
  - Diluter No.7: #6
  - Diluter No.8: #7

*Diluter No. 1 is the leftmost diluter, irrespective of the number of diluters installed.*

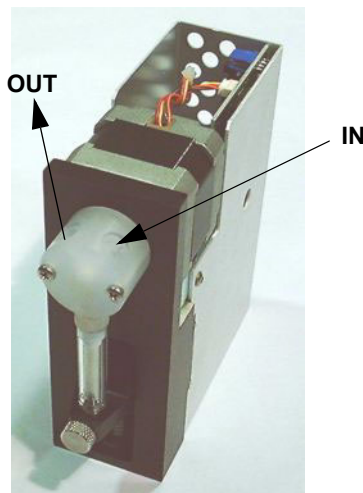


Fig. 8-186 Diluter front side

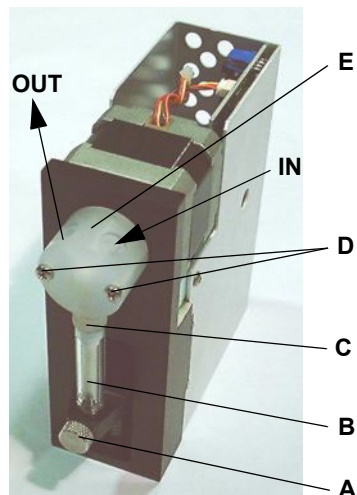
- ◆ Tubing connection
  - IN: Inlet; from one to four distributor
  - OUT: Outlet; to the tip

**Tests and Settings**

- 2 Make sure the liquid system is tight (visual inspection).
- 3 To ensure operating readiness, perform the following setups and tests: Refer to the “Instrument Software Manual”.
  - Instrument basic setup
  - Random move test
  - Liquid detection test
  - FaWa pump test
  - Gravimetric (precision) test

## Repairs on Diluter

### Diluter Parts



The figure shows the main parts of the diluter XP SMART.

- A** Plunger lock screw
- B** Syringe
- C** Knurled connector
- D** Valve fixing screws (M3 x 25)
- E** 3-way valve
- IN** Inlet
- OUT** Outlet; to the tip

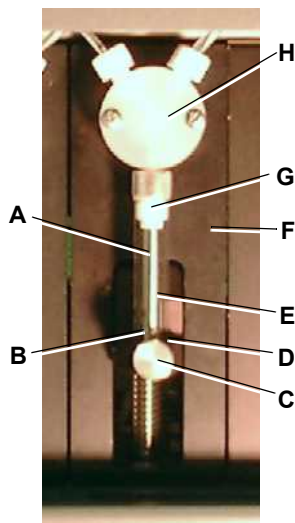
Fig. 8-187 Diluter XP SMART

### Syringe

#### Removing

To remove the syringe, proceed as follows:

- 1 Empty the liquid system:
  - Pull tube out of system liquid container.
  - Run **Fill Liquid System**. Refer to the Freedom EVO Operating Manual.
- 2 Switch the instrument off.



- 3 Loosen the plunger lock screw.
- 4 Manually move the plunger drive down.
- 5 Unscrew syringe from 3-way valve.

- A** Syringe
- B** Plunger
- C** Plunger lock screw
- D** Plunger drive
- E** Syringe barrel (glass)
- F** Diluter front plate
- G** Syringe seal (plunger to barrel seal)
- H** 3-way valve

Fig. 8-188 Syringe

#### Installing

To install the syringe, proceed as follows:

- 1 Manually move the plunger drive down.



- 2 Screw the syringe into the 3-way valve.
- 3 Pull the plunger down into the plunger drive and tighten the plunger lock screw.

*Tighten the plunger lock screw firmly.*

- 4 Tighten syringe in 3-way valve.

### Tests and Settings

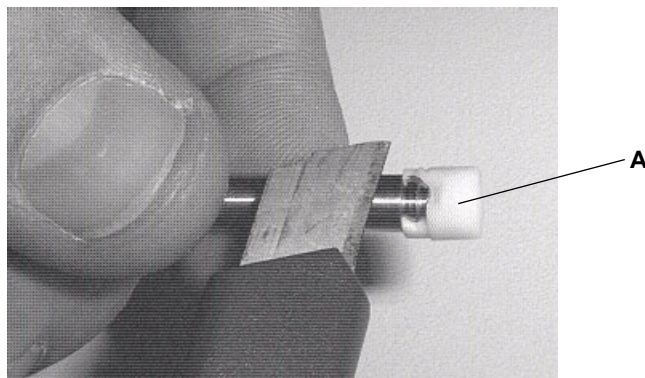
- 5 To ensure operating readiness, perform the following tests:  
Refer to the "Instrument Software Manual".

- Check tightness (visual inspection)
- FaWa pump test
- Gravimetric (precision) test

### Replacing Syringe Seal

To replace the syringe seal, proceed as follows:

- 1 Remove syringe.
- 2 Pull plunger out of syringe barrel.
- 3 Carefully cut out a piece of the old syringe seal as shown in the figure:



**Fig. 8-189** Syringe seal

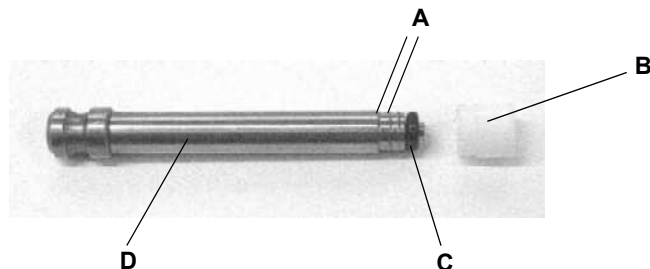
**A** Used syringe seal



#### ATTENTION

Improper seat of the syringe seal due to damaged O-ring.  
Do not cut the O-ring.

- 4 Remove seal from plunger.



**Fig. 8-190** Syringe plunger and seal

- |          |              |          |         |
|----------|--------------|----------|---------|
| <b>A</b> | Sharp edges  | <b>C</b> | O-ring  |
| <b>B</b> | Syringe seal | <b>D</b> | Plunger |

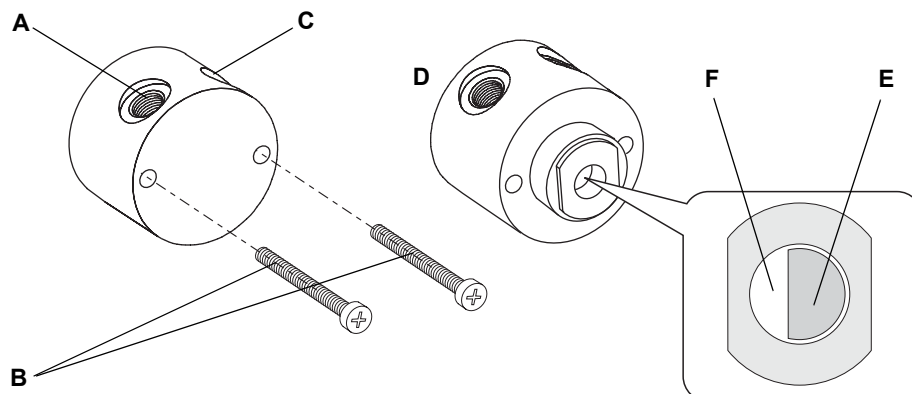
- 5 Moisten O-ring with distilled or de-ionized water. Place seal on a table and press the plunger as straight as possible into the seal opening.
- 6 Press seal wall onto sharp edges on the plunger for anchoring.
- 7 Moisten seal and push plunger into syringe barrel.
- 8 Reinstall syringe.

### 3-Way Valve

#### Replacing

To replace the 3-way valve of the diluter, proceed as follows:

- 1 Empty the liquid system:
  - Pull tube out of system liquid container.
  - Run **Fill Liquid System**. Refer to the Freedom EVO Operating Manual.
- 2 Switch the instrument off.
- 3 Remove syringe.
- 4 Unscrew tubing from the valve.



**Fig. 8-191** Diluter XP SMART valve

- |          |                     |          |                    |
|----------|---------------------|----------|--------------------|
| <b>A</b> | Valve outlet        | <b>D</b> | Rear view of valve |
| <b>B</b> | Valve fixing screws | <b>E</b> | Drive shaft        |
| <b>C</b> | Valve inlet         | <b>F</b> | Coupling           |

- 5 Remove the two valve fixing screws.
  - 6 Remove valve.
  - 7 Install in reverse order as described for removal. Pay attention to the following:
    - When mounting the valve do not apply force but turn the valve until the drive shaft engages properly in the coupling. Refer to the figure above.
    - Tighten the valve fixing screws moderately.
- Tests and Settings**
- 8 To ensure operating readiness, perform the following tests: Refer to the “Instrument Software Manual”.
    - Check tightness (visual inspection)
    - Gravimetric (precision) test

**VCC Dilback**

List of cross references to information provided in other sections:

**Cross References**

Action	Reference
Remove diluter	See section <a href="#">8.15.5</a> , <a href="#">8-154</a>
Check settings	See section <a href="#">11.2.1</a> , <a href="#">11-3</a> and section <a href="#">11.2.26</a> , <a href="#">11-28</a>
Cable connections	See section <a href="#">11.2.4</a> , <a href="#">11-6</a>
Check CAN bus resistance	See section <a href="#">4.5</a> , <a href="#">4-7</a>

**Location** The VCC-Dilback is located in the diluter case behind the diluters.

**Replacing** To replace the VCC-Dilback, proceed as follows:

- 1 Remove all diluters from the instrument. Refer to cross references above.
- 2 Disconnect the cable leading to the Optibo DCU.
- 3 Remove the board fixing screws.
- 4 Remove the VCC-Dilback.

**Installing**

- 5 Check if the jumper J10 (CAN termination) on the VCC Dilback is set correctly. Refer to cross references above.
- 6 Install the VCC Dilback in reverse order as described for removal.  
*For correct cable connection refer to cross references above.*

**Tests and Settings**

- 7 To ensure operating readiness, perform the following tests: Refer to the “Instrument Software Manual”.
  - CAN bus resistance. Refer to cross references above.
  - Liquid detection test

## 8.16 Settings

### 8.16.1 Address Settings Overview

#### Default Settings

The following table gives an overview of the default address settings for the CAN bus systems.

**Note:** In certain cases the address setting may differ from the default settings (special configurations).

**Tab. 8-6** Default address settings

CAN Level	Module/Option	Board	Address Setting
Option CAN	Device CU liquid system (LiHa, diluters)	Optibo DCU	#6
Local CAN	LiHa	DC servo II (position 1 <sup>a</sup> ) DC servo II (position 2) DC servo II (position 3) DC servo II (position 4) DC servo II (position 5) DC servo II power (position 6)	#4 #3 #2 #1 #0 #5
Local CAN	Diluters XP SMART	Diluter 1 <sup>b</sup> ) Diluter 2 Diluter 3 Diluter 4 Diluter 5 Diluter 6 Diluter 7 Diluter 8	#0 #1 #2 #3 #4 #5 #6 #7
Local CAN	Monitored pump option	MPO	#0
Local CAN	Te-PS	Sensor plate	#2
Option CAN	Access functions	SMIO/SAFY	#0
Option CAN	P&P	Gate board	#0
Local CAN	P&P	DC servo 1 (position 1, back <sup>c</sup> ) DC servo 2 (position 2, middle) DC servo power (position 3, front <sup>d</sup> )	#2 #1 #0
Option CAN	Device CU RoMa left <sup>e</sup> ) or single RoMa (C1)	RoMa Freedom backplane	#4
Option CAN	Device CU RoMa right <sup>e</sup> ) (C3)	RoMa Freedom backplane	#5
Local CAN	RoMa (DC servo) <sup>f</sup> )	DC servo power (on RoMa Freedom backplane)	#0

**Tab. 8-6** Default address settings

CAN Level	Module/Option	Board	Address Setting
Local CAN	RoMa (DC servo II) <sup>g)</sup>	DC servo II power (on RoMa Freedom backplane)	#0
Local CAN	RoMa (DC servo) <sup>f)</sup>	DC servo left <sup>e)</sup> (on RoMa 2 backplane) DC servo right (on RoMa 2 backplane)	#7 #6
Local CAN	RoMa (DC servo II) <sup>g)</sup>	DC servo II left <sup>e)</sup> (on RoMa 2 backplane) DC servo II right (on RoMa 2 backplane)	#2 #1
Local CAN	PosID 2	DC servo (on CU PosID 2)	#0
Local CAN	PosID 2	DC servo (on Y/B board)	#2
Option CAN	Device CU Te-Link	Te-Stack backplane (Te-Link)	#0
Local CAN	Te-Link	DC servo II	#0
Option CAN	Te-Stack	h)	#8
Option CAN	Te-VacS	h)	#1
Option CAN	6-way valve	h)	#2
Option CAN	Te-MagS	h)	#3
Option CAN	Incubator	h)	#4
Option CAN	Te-Sonic	h)	#7
Option CAN	Te-MO */*_**	h)	#0
Option CAN	Te-Shake	h)	#5
Option CAN	WRC 2	h)	#6

a) PCB position counted from top to bottom (does not correspond with the connector marking on the backplane PCB, see 8.7.5 "Electronic Boards and Cables", 8-29)

b) Position counted from left to right (viewed from the position facing the instrument)

c) PCB back position: Farthest, viewed from the position facing the instrument

d) PCB front position: Nearest, viewed from the position facing the instrument

e) Viewed from the position facing the instrument.

f) to instrument serial No. 0283

g) from instrument serial No. 0284

h) Option with separate documentation, refer to corresponding manual

Also refer to the communication overview in section 11.2.1, 11-3.

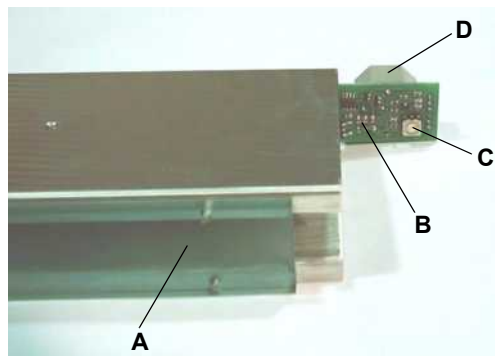
### 8.16.2 Volume of the Acoustic Alarm Device

**Purpose**

This procedure describes how to set the volume (loudness) of the acoustic alarm device.

**Location of Parts**

The volume switch is located on the PCB of the status lamp.



- A** Status lamp
- B** Printed circuit board
- C** Volume switch
- D** Acoustic alarm (buzzer)

**Fig. 8-192** Status lamp/acoustic alarm device

**Volume Switch**

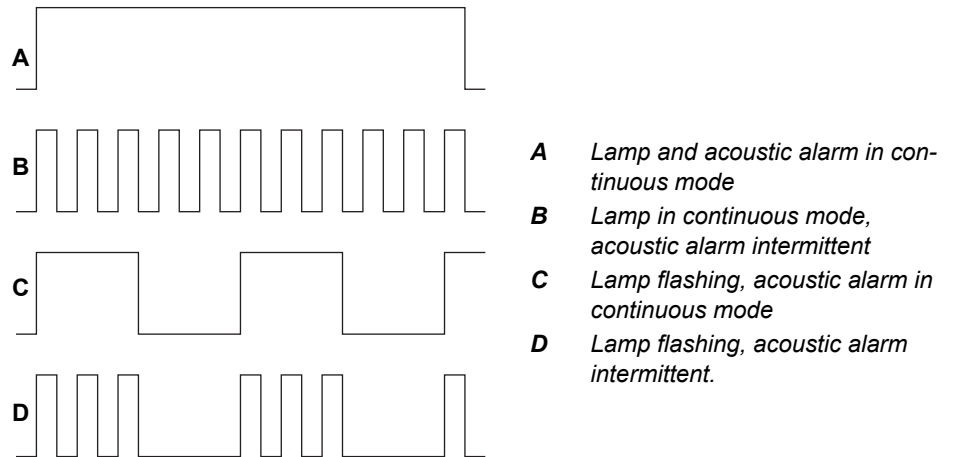
The volume switch (C) is a rotary switch with 16 positions, 0 to F. You can set four volume levels with intermittent or continuous sound as shown in the following table:

**Tab. 8-7** Volume switch

Switch position	Volume	Mode
0	high	Intermittent (frequency approx. 3 to 5 Hz)
1	medium	
2	low	
3	very low	
4	high	Continuous sound
5	medium	
6	low	
7	very low	
8 to F	Off	Disabled

**Sound Diagrams**

If the acoustic alarm is enabled (switch positions 0 to 7) it is switched on and off together with red status lamp. The following four diagrams illustrate how the alarm sounds in the various modes.



**Fig. 8-193** Sound diagrams

**Note:** On/off frequency of the acoustic alarm in intermittent mode:

- The on/off frequency is between 3 and 5 Hz and depends on the volume. The lower the volume is set, the higher the on/off frequency becomes.
- The on/off frequency of the alarm is higher than the one of the flashing lamp.

**Setting the Volume**

To set the volume level and the mode, proceed as follows:

- 1 Open the top cover.
- 2 Start the Setup & Service Software to manually switch the status lamp and the acoustic alarm on. Refer to the "Instrument Software Manual".
- 3 Set the volume switch to the appropriate position.
- 4 Close the top cover to check the sound.

**Switching the Alarm off**

To switch the acoustic alarm off, proceed as follows:

- 1 Open the top cover.
- 2 Set the switch to one of the positions 8 to F.
- 3 Close the top cover.





## 9 Shutdown, Storage and Shipping

### Purpose of This Chapter

This chapter instructs how to shut down the Freedom EVO, how to pack it for storage or transport, and specifies the storage and shipping conditions.


### 9.1 Shutdown

#### How to Shutdown the Freedom EVO

For instructions on how to shutdown the Freedom EVO consult the Freedom EVO Operating Manual, chapter “Shutdown, Storage and Shipping”.

### 9.2 Storage

#### How to Store the Instrument

Use the original packaging to store the Freedom EVO. Refer to [9.2.1 “Packaging”](#),  9-2.

#### Storage Conditions

For the climatic environmental requirements consult the Freedom EVO Operating Manual, chapter “Technical Data”.



#### ATTENTION

To prevent the instrument from being damaged during storage, mind the following:

- ◆ Do not stack other goods on the packaging of the Freedom EVO.
- ◆ Do not tilt the packaging.

### 9.2.1 Packaging

#### Cross References

List of cross references to information provided in other sections:

Action	Reference
Use of transport handles	See section 4.3,  4-3
Loosen Z-brake of P&P arm	See section 8.10.1,  8-85

**Note:** The Freedom EVO is a precision instrument with sensitive parts. Only lift it by the main structure, using the special transport handles. Refer to cross references above.



#### WARNING

Transporting or moving the Freedom EVO wrongly may result in serious instrument damage or even injuries to the personnel (e.g. in case a cover breaks off).

- ◆ Never attempt to lift the instrument by the arm guide, one of the panels or access doors.
- ◆ Always use the special transport handles.

#### Packaging dimensions

The figure shows the packaging of the Freedom EVO:



**Fig. 9-1** Wooden pallet/cardboard box, outside dimensions

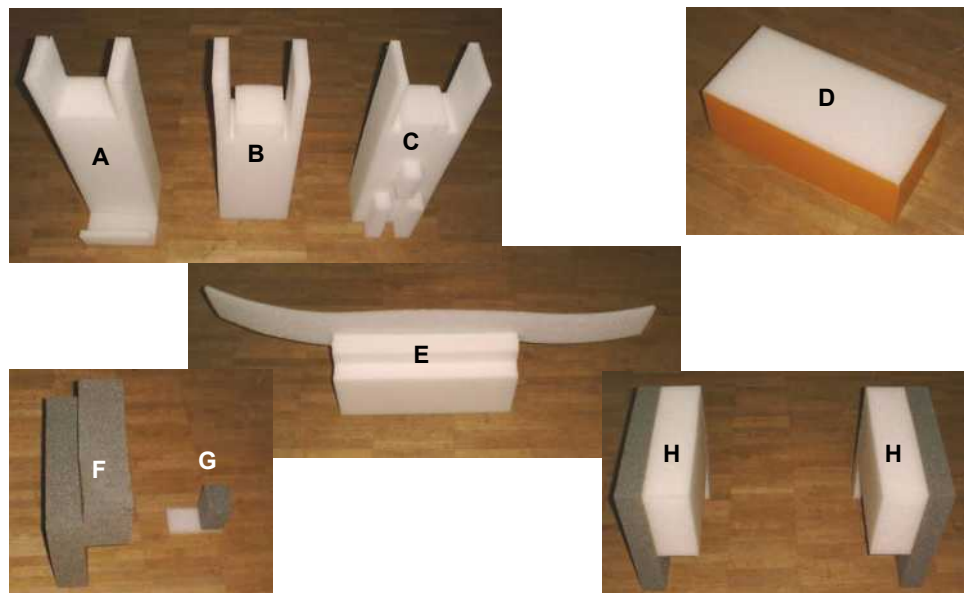
**Tab. 9-1** Dimensions and weights

Instrument	Length	Width	Height	Gross weight <sup>a)</sup>
Freedom EVO 100	118.5 cm approx. 46.7 in.	92 cm approx. 36.2 in.	120 cm approx. 47.2 in.	approx. 180 kg approx. 396 lbs
Freedom EVO 150	156 cm approx. 61.4 in.	92 cm approx. 36.2 in.	120 cm approx. 47.2 in.	approx. 250 kg approx. 551 lbs
Freedom EVO 200	216 cm approx. 85 in.	92 cm approx. 36.2 in.	120 cm approx. 47.2 in.	approx. 300 kg approx. 661 lbs

a) Instrument configuration with max number of arms and PosID

The packaging consists of

- ♦ a wooden pallet with specially shaped foam parts
- ♦ the cardboard box for accessories
- ♦ a packaging strap, edge protection, buckle and brackets to fix the cardboard box to the X-bay
- ♦ the outside cardboard box with a lid, packaging straps
- ♦ transport lock devices
- ♦ cardboard strips to block the axes
- ♦ cardboard strips to protect the worktable
- ♦ foam blocks as shown in the figure:



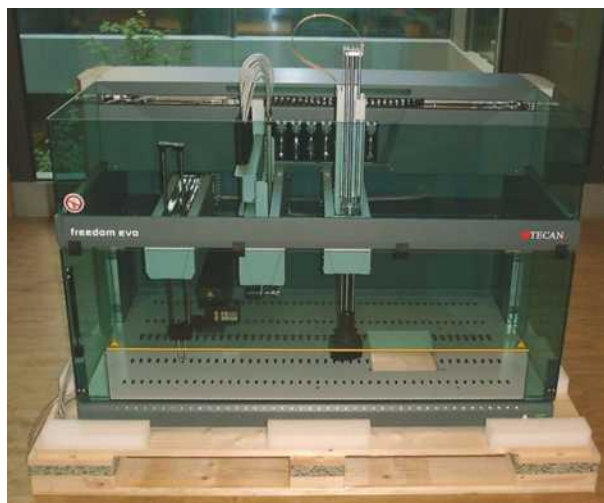
**Fig. 9-2** Foam blocks of the packaging

- |  |                                |
|--|--------------------------------|
| <b>A</b> Foam block for RoMa arm (example shows block for RoMa long) | <b>E</b> Diluter support block |
| <b>B</b> Foam block for LiHa arm                                     | <b>F</b> Foam block for PosID  |
| <b>C</b> Foam block for P&P arm                                      | <b>G</b> Support below PosID   |
| <b>D</b> Foam block with adhesive tape to be placed instead of arm   | <b>H</b> Box corner protection |

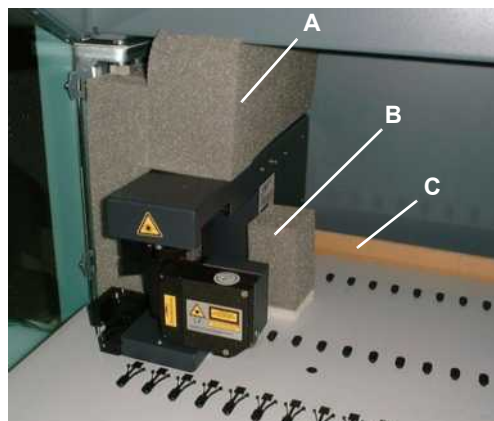
### How to Pack the Freedom EVO

To pack the Freedom EVO, proceed as follows:

- 1 Put the Freedom EVO on the pallet as shown in the figure:



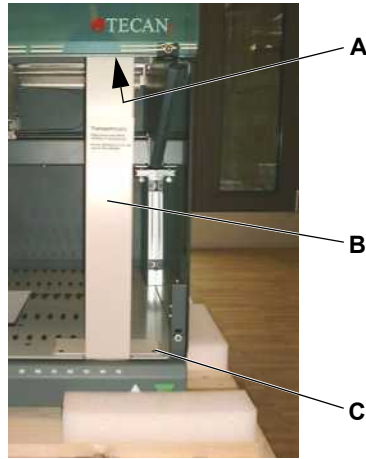
**Fig. 9-3** Pallet



**Fig. 9-4** PosID

- 2 Slide the PosID to the left side.
- 3 Protect the PosID with the upper foam block (A) and the support (B) as shown in the figure.
- 4 Insert the cardboard strip (C) to prevent the PosID from moving to the right.

**Transport Locks**



**Fig. 9-5** Transport lock

- 5** Mount the transport locks (B) on either side of the Freedom EVO.
  - Lower part: Fix the transport lock with the screw (C).
  - Upper part (A): Engage the nut for T-slots in the arm guide and tighten the screw of the transport lock.

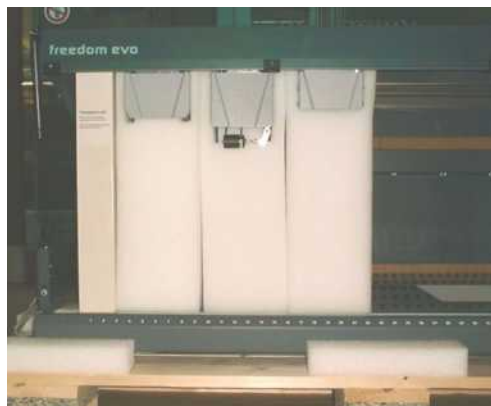


**Fig. 9-6** Foam block for arm

- 6** Protect the arms with the corresponding foam block.
- 7** Move the RoMa and the P&P gripper head downwards in such a way that it fits into the recess of the foam block.
 

*With the P&P arm the Z-brake must be loosened to move the P&P head into position.*

*Refer to cross references above.*



**Fig. 9-7** Supported arms

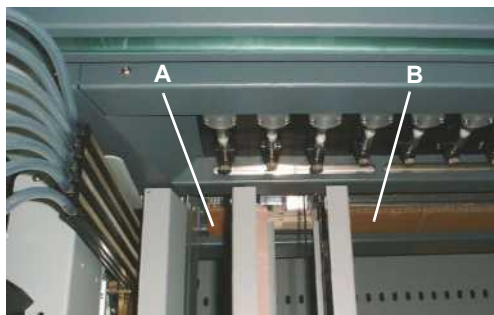
- 8** Arrange all arms with foam blocks as shown in the figure.
 

*Depending on the instrument size, the arms must be placed on the right or the left side.*

*Freedom EVO 100/150:  
All arms on the left side.*

*Freedom EVO 200:  
Two arms on the left, one arm on the right side.*

Or if there are arms missing, place the foam block with adhesive tape (D in Fig. 9-2, Fig. 9-3) instead of one or two arms (stick it endwise horizontal or vertical to the adjacent block).

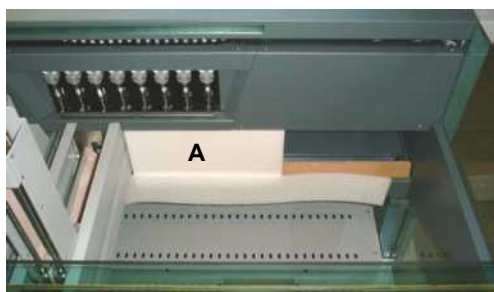


**Fig. 9-8** Cardboard strips

**9** Insert the short cardboard strips (A) between the arms.

**10** Insert the cardboard strips (B) on the right and the left side of the arms to prevent them from moving in X-direction.

*The long cardboard strip matches an instrument with a single arm. Cut it to the corresponding length for instruments with several arms.*



**Fig. 9-9** Diluter support block

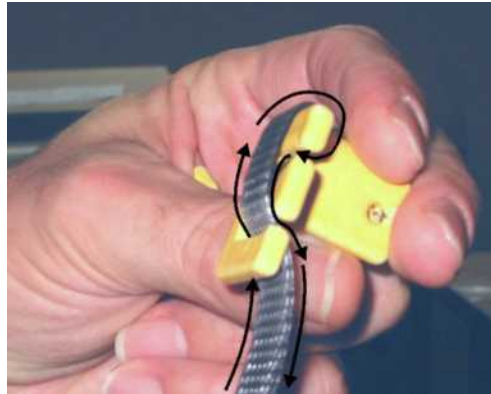
**11** Place the diluter support block (A) below the diluters as shown in the figure.



**Fig. 9-10** Cardboard strips worktable

**12** Place the two cardboard strips (A) onto the worktable to prevent it from being scratched by the accessory box.

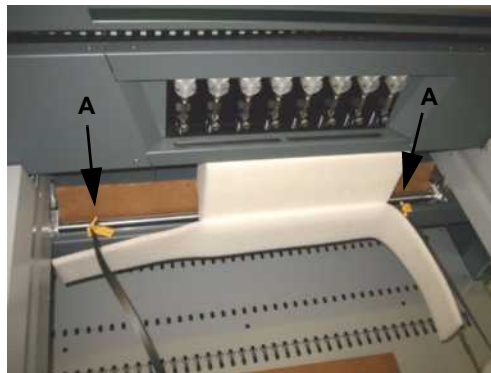
**Fixing the  
Accessory Box**



**Fig. 9-11** Packaging strap/bracket

**13** Prepare the packaging strap as follows:

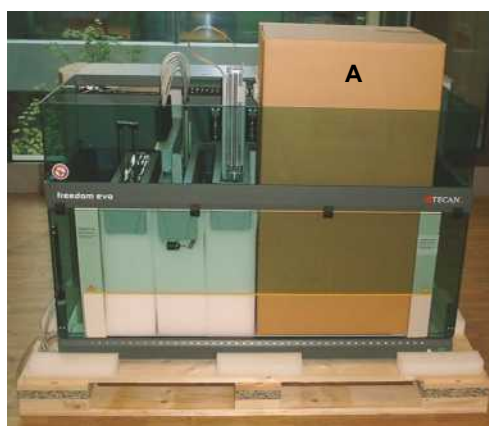
- Cut two pieces of packaging strap to a length of approx. 1 m (40 in.).
- Insert one side of the straps in the brackets as shown in the figure.



**Fig. 9-12** Brackets engaged in X-bay

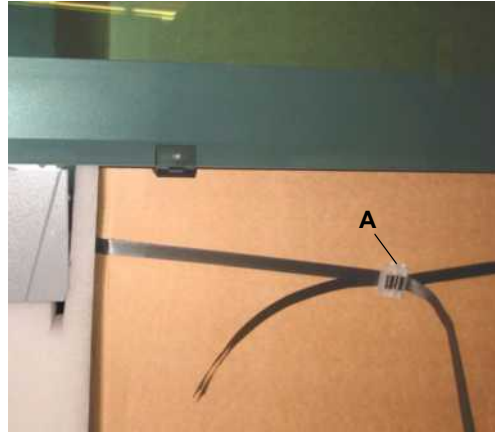
- Engage the brackets (A) at the X-bay as shown in the figure.

*Place the bracket in the correct position, since the paint of the instrument's surface may be scratched when the bracket slides along the X-bay.*



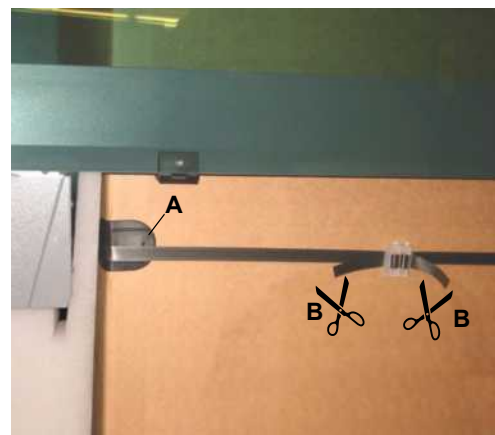
**Fig. 9-13** Accessory box

**14** Place the accessory box (A) into the gap as shown in the figure.



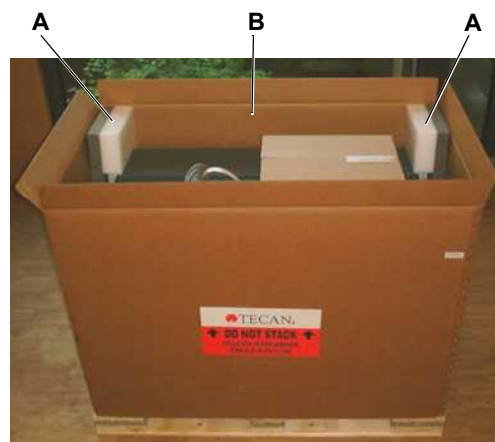
**Fig. 9-14** Accessory box/buckle

- 15** Fasten the accessory box as follows:
- Attach the straps to the buckle (A) as shown in the figure.



**Fig. 9-15** Edge protection

- At the corner of the accessory box, apply edge protection (A) between the strap and the box as shown in the figure.
- Tension the strap.
- Cut the excess strap (B).  
*Make sure that there is no gap between the cardboard box and the left foam block (arm support).*



**Fig. 9-16** Outer carton

- 16** Place the outer carton (B) on the pallet.
- 17** Put corner protection blocks (A) into place.





- 18** Place the lid (A) on top of the packaging.
- 19** Apply packing straps as hinted in the figure.  
*Freedom EVO 100: 3 straps*  
*Freedom EVO 150: 3 straps*  
*Freedom EVO 200: 5 straps*
- 20** Stick the dispatch label to the front side of the packaging (see arrow).

**Fig. 9-17** Lid

**Unpacking**

To unpack the Freedom EVO, follow the instructions for packing in reverse order.

**Note:** Tecan recommends you to keep the original packaging for future transport or storage of the Freedom EVO.  
The packaging has been carefully designed to prevent damage to the instrument or its parts.

**9.3 Shipping**

**Shipping Conditions**

For shipping, the same climatic environmental requirements apply as for storage. Consult the Freedom EVO Operating Manual, chapter "Technical Data".



**ATTENTION**

To prevent the instrument from being damaged during shipping, mind the following:

- ◆ Do not stack other goods on the packaging of the Freedom EVO.
- ◆ Do not tilt the packaging.



# 10 Spare Parts and Accessories

<b>Purpose of This Chapter</b>	This chapter lists and identifies spare parts and accessories that are needed for maintenance and repair of the Freedom EVO, and offers the respective ordering information.
<b>How to Find Spare Parts</b>	Look up the ordering information in the tables.
<b>How to Order Spare Parts</b>	Always state the designation and the part number when ordering spare parts.
<b>Ordering Address</b>	Order the parts from Tecan. See reverse side of title page.

## 10.1 Base Unit

Refer to the table below to find out the designation and the part number.

**Tab. 10-1** Basic spare parts

Item No.	Designation	p/n
1	Worktable	10614100–10614231 <sup>a)</sup>
2	Set of positioning pins (25 guide pins, 20 stop pins, 5 reference guide pins, 5 reference lock pins)	10619001
3	Set of lock pins (15 lock pins, 1 reference lock pin)	10619007
4	Set of stop pins (100 pcs)	10619030
5	Set of lock pins (100 pcs)	10619017
6	Set of guide pins (25 pcs)	10619439
7	Set of screw covers (20 pcs)	10619103
8	Sealing strip	10619003
9	Cable holder chain	10619853
10	Right/left access door Freedom EVO including hinges	10649038

a) Refer to "Order configuration/packing list"

## 10.2 Safety Panels

Refer to the table below to find out the designation and the part number.

**Tab. 10-2** Safety panels spare parts

Item No.	Designation	p/n
1	Side safety panel	10649030
2	Top safety panel for Freedom EVO 100	10649032
3	Top safety panel for Freedom EVO 150	10649033
4	Top safety panel for Freedom EVO 200	10649034
5	Front safety panel for Freedom EVO 100 (closed)	10649035
6	Front safety panel for Freedom EVO 150 (closed)	10649036
7	Front safety panel for Freedom EVO 200 (closed)	10649037
8	Front safety panel for Freedom EVO 100 (open)	10649042
9	Front safety panel for Freedom EVO 150 (open)	10649043
10	Front safety panel for Freedom EVO 200 (open)	10649044
11	Set of hinges	10649018
12	Door lock right	10649020
13	Door lock left	10649021
14	Gas spring	10649031

## 10.3 System Electronics

Refer to the table below to find out the designation and the part number.

**Tab. 10-3** Electronics spare parts

Item No.	Designation	p/n
1	Te-CU board	10619104
2	Optibo DCU	10649000
3	SMIO/SAFY board	10619850
4	ON/OFF/Pause/Resume switch	10649001
5	Power supply module Freedom EVO 100	10649002

**Tab. 10-3** Electronics spare parts

Item No.	Designation	p/n
6	Power supply module Freedom EVO 150/200	10649003
7	Set of fuses (10x2A, 10x8A, 10x10A)	10649017
8	VCC Dilback	10619259
9	Status lamp	10649007

## 10.4 Liquid Handling Arm (LiHa)

Refer to the table below to find out the designation and the part number.

**Tab. 10-4** LiHa spare parts

Item No.	Designation	p/n
1	Replacement LiHa 2 tips	10649024
1	Replacement LiHa 4 tips	10649004
1	Replacement LiHa 8 tips	10649008
2	Set of Y-belts (2 pcs)	10619215
3	Coupling Z-axis	10619205
4	Square shaft (4 pcs)	10619244
5	Pinion gear Z-axis	10619464
6	X-drive assembly complete including motor	10649045
7	X-drive belt	10619855
8	X-carriage	10649022
9	DCU 2 board	10649013
10	DC Servo II board	10649011
11	DC Servo II power board	10649012
12	ILID Freedom protected board	10619862
13	ILID chip (IC)	10619309
14	Set of ILID cables (4 pcs)	10619863
15	LiHa 1536 backplane	10649014
16	Y-motor	10649005
17	Z-motor	10626210
18	Flat cable (ILID to backplane)	10619861
19	Connecting cable for Freedom EVO 100/150	10649010

**Tab. 10-4** LiHa spare parts

Item No.	Designation	p/n
20	Connecting cable for Freedom EVO 200	10649009
21	Tip adapter	10619893
22	Set of spacers (Z-rod spacing)	10649019
23	Front guide roller	10619245
24	Support tubing	10619872
25	Support tubing guide block black	10619874
26	Solenoid for lower DiTi eject option	10619520
27	Low volume liquid channel (solenoid valve and tubing for 1 channel)	10612817
28	Solenoid valve for low volume option	10612814
29	Low volume tubing set	10612818
30	Low volume pipetting tubing	10612819

## 10.5 Robotic Manipulator Arm (RoMa)

Refer to the table below to find out the designation and the part number.

**Tab. 10-5** RoMa spare parts

Item No.	Designation	p/n
1	Replacement RoMa standard	10649040
2	Replacement RoMa long	10649041
3	Y-belt	10619513
4 <sup>a)</sup>	X-drive assembly complete including motor (500 inc.)	10619854
4 <sup>b)</sup>	X-drive assembly complete including motor (1000 inc.)	10649006
5	X-drive belt	10619855
6	X-carriage	10649022
7	Gripper module head	10612601
8	Eccentric grippers	10614006
9	Centric grippers	10614007
10	Gripper board	10619300
11	Left gripper finger	10619511
12	Right gripper finger	10619512

**Tab. 10-5** *RoMa spare parts*

<b>Item No.</b>	<b>Designation</b>	<b>p/n</b>
13	Gripper fingers for Te-MO option	10619568
14	R-motor	10619345
15	Z-flex cable	10619344
16 <sup>a)</sup>	DC servo board	10619303
16 <sup>b)</sup>	DC servo II board	10649011
17	RoMa 2 backplane	10619343
18	Y- motor	10619323
19	Z- motor	10619346
20	Z-brake complete	10612632
21	Flex cable, Y-axis, backplane to backplane	10619339
22	Flex cable, gripper interface, 10 pins, 0.91 m, RoMa standard	10619344
23	Flex cable, gripper interface, 10 pins, 1.61 m, RoMa long	10619877
24	Flex cable, 13 pins, 1.7 m, for Freedom EVO 100	10619865
24	Flex cable, 13 pins, 2.05 m, for Freedom EVO 150	10619866
25	Flex cable, 13 pins, 2.65 m, for Freedom EVO 200	10619867
26	RoMa Freedom backplane	10619868
27	Device CU board	10619050
28 <sup>a)</sup>	DC servo power board	10626201
28 <sup>b)</sup>	DC servo II power board	10649012

a) to instrument serial No. 0283

b) from instrument serial No. 0284

## 10.6 Pick and Place (P&P)

Refer to the table below to find out the designation and the part number.

*Tab. 10-6 P&P spare parts*

Item No.	Designation	p/n
1	Replacement P&P	10649050
2	Gripper fingers	10625407
3	P&P gripper head	10625408
4	Set of Z-belt (2 pcs)	10625403
5	Y-belt	10625402
6	X-drive complete including motor	10619854
7	X-drive belt	10619855
8	X-carriage	10649022
9	Adapter plate X-carriage	10649023
10	Gate board	10619857
11	DC servo board	10619303
12	DC servo power board	10626201
13	P&P backplane board	10626206
14	Flex cable, 12 pins, 1.75 m, for Freedom EVO 100	10619669
15	Flex cable, 12 pins, 2.1 m, for Freedom EVO 150	10619670
16	Flex cable, 12 pins, 2.7 m, for Freedom EVO 200	10619671
17	Z-brake	10625410
18	Z/R/G-motor	10626210
19	Y-motor	10625405
20	Coupling	10625413



## 10.7 PosID

Refer to the table below to find out the designation and the part number.

**Tab. 10-7** PosID spare parts

Item No.	Designation	p/n
1	PosID 2 assembly, for Freedom EVO 100	10612411
2	PosID 2 assembly, for Freedom EVO 150	10612412
3	PosID 2 assembly, for Freedom EVO 200	10612413
4	PosID module (without PosID base and X-drive)	10619608
5	X-belt	10619611
6	X-flex cable, for Freedom EVO 100/150	10619602
7	X-flex cable, for Freedom EVO 200	10619604
8	X-motor	10619321
10	CU PosID 2 board	10619600
11	DC servo board	10619303
12	Y/B board	10619605
13	Y/B-DC servo board	10619303
14	DSP decoding board	10619607
15	B-motor	10619601
16	Scanner head	10619610
17	Laser scanner with DSP board	10619613
18	Scanner cable	10619609
19	Y-belt	10619612
20	Gripper assembly	10619622
21	Y-motor	10619323
22	No tube sensor	10619606

## 10.8 Te-Link

Refer to the table below to find out the designation and the part number.

**Tab. 10-8** *Te-Link spare parts*

Item No.	Designation	p/n
1	DC-motor	30013895
2	Toothed belt (2 pcs)	10619215
3	Te-Stack backplane	10619051
4	DC servo II board	10649011
5	DCU board	10619050

## 10.9 Liquid System

### 10.9.1 Standard Tubing

Refer to the table below to find out the designation and the part number.

**Tab. 10-9** *Tubing spare parts*

Item No.	Designation	p/n
1	I-connector (5 pcs)	10619412
2	Y-connector (5 pcs)	10619410
3	Aspirating tubing (5 pcs)	10619401
4	Distributor 1 to 2	10649025
5	Distributor 1 to 4	10619406
6	Interconnecting tubing	10619402
7	Pipetting tubing for Freedom EVO 100/150	10619403
8	Pipetting tubing for Freedom EVO 200	10619408
9	Waste tubing	10619404
10	Wash station	10613001
11	L-connector (10 pcs)	10619461
12	X-connector (5 pcs)	10619411
13	Hose clamps (set of 10 pcs each $\varnothing$ 9.1 mm/ $\varnothing$ 9.6 mm)	10619414
14	Fitting for tubing (M6/ $\varnothing$ 9x6 mm)	235200
15	Tubing set DMSO resistant	10619417

### 10.9.2 High Resistant Tubing Type A

Refer to the table below to find out the designation and the part number.

**Tab. 10-10** HR tubing type A (FEP/PVDF) spare parts

Item No.	Designation	p/n
1	Aspirating tubing for Freedom EVO 100	10619486
2	Aspirating tubing for Freedom EVO 150	10619487
3	Aspirating tubing for Freedom EVO 200	10619488
4	Distributor 1 to 2	10619484
5	Screw plug	10619806
6	Tubing to distributor (157/65 mm)	10619495 / 10619496
7	Distributor 1 to 4	10619482
8	Top tubing set	10612120
9	Tubing set, type A, for Freedom EVO 100	10619492
10	Tubing set, type A, for Freedom EVO 150	10619493
11	Tubing set, type A, for Freedom EVO 200	10619494

### 10.9.3 High Resistant Tubing Type B

Refer to the table below to find out the designation and the part number.

**Tab. 10-11** HR tubing type B (FEP/PP) spare parts

Item No.	Designation	p/n
1	Aspirating tubing for Freedom EVO 100	10619486
2	Aspirating tubing for Freedom EVO 150	10619487
3	Aspirating tubing for Freedom EVO 200	10619488
4	Distributor 1 to 2	10619804
5	Screw plug	10619807
6	Tubing to distributor (157/65 mm)	10619495 / 10619496
7	Distributor 1 to 4	10619803
8	Top tubing set	10612119
9	Tubing set, type B, for Freedom EVO 100	10619800
10	Tubing set, type B, for Freedom EVO 150	10619801
11	Tubing set, type B, for Freedom EVO 200	10619802

### 10.9.4 Low Volume Option

Refer to the table below to find out the designation and the part number.

**Tab. 10-12** Low volume option spare parts

Item No.	Designation	p/n
1	Solenoid valve	10612814
2	Low volume tubing set	10612811
3	Wash station low volume	10613033
4	Waste tubing	10619491
5	Fill tubing	10619490

### 10.9.5 Monitored Pump Option/Fast Wash Option

Refer to the table below to find out the designation and the part number.

**Tab. 10-13** MPO spare parts

	Standard	Type A (FEP/PVDF)	Type B (FEP/PP)
<b>MPO complete</b>	10612702	10619542	10619544
<b>FWO complete</b>	10612704	10619525	10619510
<b>Fast wash pump</b>	10619509	10619538	10619539
<b>LICOS with tubing<sup>a)</sup></b>	10619418	10619418	10619418
<b>LICOS tube<sup>b)</sup></b>	10619514	10619514	10619514
<b>LICOS sensor</b>	10619501	10619501	10619501
<b>MPO board</b>	10619312	10619312	10619312
<b>Grounding strip</b>	10919898	10919898	10919898
<b>Connector cable 100/150</b>	10619415	10619415	10619415
<b>Connector cable 200</b>	10619416	10619416	10619416
<b>Pressure relief valve std.</b>	10619523	10619541	10619540
<b>Distributor 1 to 2</b>	10619410	10619485	10619805
<b>Aspirating tubing</b>	10619405	10619499	10619499
<b>Pressure tubing</b>	10619434	10619498	10619498

**Tab. 10-13 MPO spare parts**

	Standard	Type A (FEP/PVDF)	Type B (FEP/PP)
<b>Tubing to pressure relief valve</b>	-	10619497	10619497
<b>Waste tubing</b>	-	10619489	10619489
<b>Upgrade kit for DMSO</b>	10619448	-	-
<b>Fast wash tubing, silicone (5 m)</b>	10619405	-	-

a) Including sensor and tube

b) Without tubing

### 10.9.6 Diluters

Refer to the table below to find out the designation and the part number.

**Tab. 10-14 Diluter spare parts**

Item No.	Designation	p/n	
1	Diluter XP SMART	10649015	
2	3-way-valve, 120°, M6 fittings	10649016	
3	Syringe, with flat cap	0.05 ml	10619470
		0.25 ml	10619423
		0.5 ml	10619424
		1.0 ml	10619425
		2.5ml	10619426
		5.0 ml	10619427
4	Syringe caps, flat (8 pcs)	0.25 ml	10619428
		0.5 ml	10619429
		1.0 ml	10619430
		2.5ml	10619431
		5.0 ml	10619432
5	Syringe with conical cap	0.25 ml	10619530
		0.5 ml	10619531
		1.0 ml	10619532
6	Syringe caps, conical (8 pcs)	0.25 ml	10619533
		0.5 ml	10619534
		1.0 ml	10619535

 VCC Dilback (diluter backplane): See [10.3 "System Electronics"](#), [10-2](#).

## 10.10 Centrifuge

Refer to the table below to find out the designation and the part number.

**Tab. 10-15** Centrifuge spare parts

Item No.	Designation	p/n
1	Centrifuge Hettich Rotanta 46 RSC European version 230V, 50 Hz. This part is traced by the SN.	10614050
2	Centrifuge Hettich Rotanta 46 RSC International ver- sion (different supply ratings). This part is traced by the SN.	10615051
3	Tachometer	10625302
4	Encoder	10625303
5	Bearing rubber-metal (set of 3 pcs)	10625304
6	Shock absorber	10625305
7	Control panel c/w display, keyboard and EPROM	10625306
8	Encoder board	10625307
9	Interface board	10625308
10	Cable set	10625309
11	Electrical supply board	10625310
12	Positioning (rotor pos.) board	10625311
13	Frequency converter	10625312
14	Brake resistor	10625313
15	Chopper brake	10625314
16	Imbalance switch	10625315
17	Leaf spring	10625316
18	Temperature sensor (rubber lid)	10625317
19	Temperature sensor (chamber bottom)	10625318
20	Temperature sensor (condenser)	10625319
21	Lid seal	10625320
22	Cover for chamber-motor	10625321
23	Seal chamber-motor	10625322
24	Grease for centrifuge hangers (Hettich No.4051)	10625105

## 10.11 Reader

Refer to the tables below to find out the designations and the part numbers.

**Parts for  
Installation on  
Worktable  
Extension**

*Tab. 10-16 Parts needed for installation on worktable extension*

Item No.	Designation	p/n
3	Front safety panel for Freedom EVO 100 (closed)	10649060
4	Front safety panel for Freedom EVO 150 (closed)	10649062
5	Front safety panel for Freedom EVO 200 (closed)	10649064
6	Front safety panel for Freedom EVO 100 (open)	10649061
7	Front safety panel for Freedom EVO 150 (open)	10649063
8	Front safety panel for Freedom EVO 150 (open)	10649065
9	Worktable extension	10612651
10	External cabinet for worktable extension	10614025
11	Side safety panel for Safire <sup>2</sup> and Ultra	10649028
12	Side safety panel for GENios Pro	30013376
13	Adapter plate for Safire <sup>2</sup>	10649066
14	Adapter plate for GENios Pro	10649067
15	Adapter plate for Ultra (same plate as for cabinet)	10612052
16	Door lock repositioning kit	30012892

**Parts for  
Installation in  
Cabinet**

*Tab. 10-17 Parts needed for installation in cabinet*

Item No.	Designation	p/n
16	Trolley set, includes guiding bracket + retaining pin	10614026
17	Adapter plates for Safire <sup>2</sup>	30012973
18	Adapter plate for GENios Pro	30012975
19	Adapter plate for Ultra (same plate as for worktable extension)	10612052

## 10.12 Accessories and Options

Refer to the table below to find out the designation and the part number.

**Tab. 10-18** Accessories and options

Item No.	Designation	p/n
1	Cable RJ45, 3.5 m	10619894
2	Cable RJ45, 0.6 m	10619740
3	Te-PS sensor plate	10642025
4	Te-Link	10649055
5	Low volume option hardware	10612816
6	Lower DiTi eject option for 2-channel LiHa	10612551
7	Lower DiTi eject option for 4-channel LiHa	10612549
8	Lower DiTi eject option for 8-channel LiHa	10612550
9	Cover waste slide lower DiTi eject	10613030

## 10.13 Tools

Refer to the table below to find out the designation and the part number.

**Tab. 10-19** Tools and consumables

Item No.	Designation	p/n
1	CAN bus check cable	10625006
2	Te-PS tubing widener	10643003
3	Te-PS key for lock nut	10643007
4	Reference tip for Freedom EVO steel tip	10612503
5	Calibrator tool for RoMa (w/o gripper)	10612622
6	RoMa adjustment tool teach plate	10613101
7	Service rack PosID	10613100
8	Reference tip Pick & Place	10625002
9	Transport handles, 1 set for Freedom EVO instrument	10612003
10	Grease for Freedom EVO including Klüberplex BEM 34-123 (X-axis) and Klübersynth UH1 14-151 (LiHa Z-axis)	10626104



# 11 Diagrams

**Purpose of This Chapter**

This chapter depicts all relevant diagrams, such as block diagrams, wiring diagrams, etc. that are useful for maintenance or repair.

## 11.1 Overview

The table gives an overview of the diagrams:

**Tab. 11-1** List of diagrams

Diagram Title	Reference
Communication overview	See section <a href="#">11.2.1</a> , <a href="#">11-3</a> .
Arm configurations	See section <a href="#">11.2.2</a> , <a href="#">11-4</a> .
Wiring diagram Freedom EVO	See section <a href="#">11.2.3</a> , <a href="#">11-5</a> .
Wiring diagram diluters	See section <a href="#">11.2.4</a> , <a href="#">11-6</a> .
Wiring diagram LiHa 2-channel	See section <a href="#">11.2.5</a> , <a href="#">11-7</a> .
Wiring diagram LiHa 4-channel	See section <a href="#">11.2.6</a> , <a href="#">11-8</a> .
Wiring diagram LiHa 8-channel	See section <a href="#">11.2.7</a> , <a href="#">11-9</a> .
Wiring diagram MPO	See section <a href="#">11.2.8</a> , <a href="#">11-10</a> .
Wiring diagram RoMa (DC servo)	See section <a href="#">11.2.9</a> , <a href="#">11-11</a> .
Wiring diagram RoMa (DC servo II)	See section <a href="#">11.2.10</a> , <a href="#">11-12</a> .
Wiring diagram P&P	See section <a href="#">11.2.11</a> , <a href="#">11-13</a> .
Wiring diagram PosID 2	See section <a href="#">11.2.12</a> , <a href="#">11-14</a> .
Wiring diagram access functions	See section <a href="#">11.2.13</a> , <a href="#">11-15</a> .
Wiring diagram Te-Link	See section <a href="#">11.2.14</a> , <a href="#">11-16</a> .
CU PosID (PCB)	See section <a href="#">11.2.15</a> , <a href="#">11-17</a> .
P&P backplane (PCB)	See section <a href="#">11.2.16</a> , <a href="#">11-18</a> .
Gate board (PCB)	See section <a href="#">11.2.17</a> , <a href="#">11-19</a> .
SMIO/SAFY board (PCB)	See section <a href="#">11.2.18</a> , <a href="#">11-20</a> .
RoMa Freedom backplane (PCB)	See section <a href="#">11.2.19</a> , <a href="#">11-21</a> .
RoMa 2 backplane (PCB)	See section <a href="#">11.2.20</a> , <a href="#">11-22</a> .
DC servo [II], [power] (PCB)	See section <a href="#">11.2.21</a> , <a href="#">11-23</a> .
Te-CU (PCB)	See section <a href="#">11.2.22</a> , <a href="#">11-24</a> .
Optibo DCU (PCB)	See section <a href="#">11.2.23</a> , <a href="#">11-25</a> .

**Tab. 11-1** List of diagrams

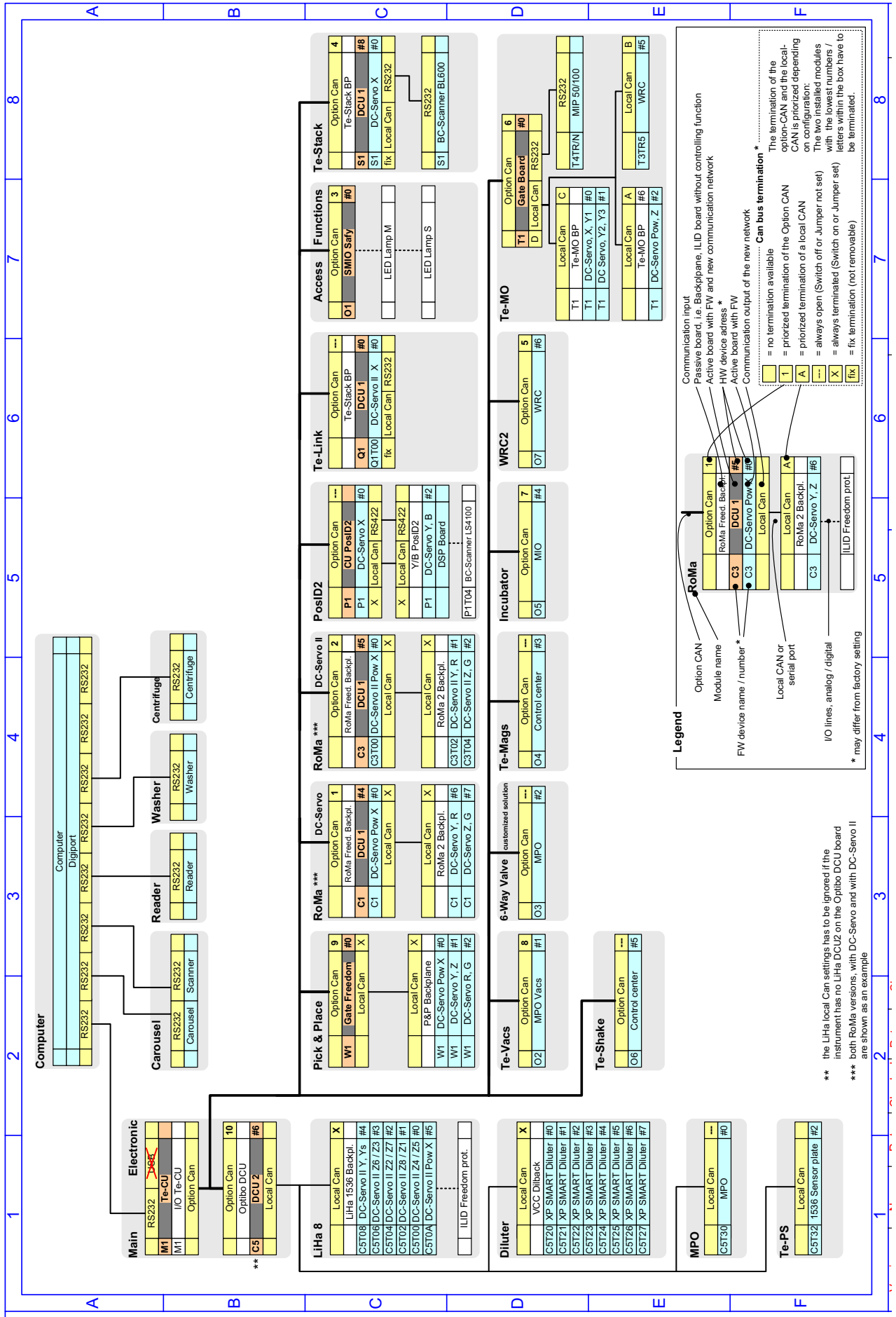
Diagram Title	Reference
LiHa 1536 backplane (PCB)	See section <a href="#">11.2.24</a> , <a href="#">11-26</a> .
ILID-Freedom protected (PCB)	See section <a href="#">11.2.25</a> , <a href="#">11-27</a> .
VCC Dilback (PCB)	See section <a href="#">11.2.26</a> , <a href="#">11-28</a> .
MPO board (PCB)	See section <a href="#">11.2.27</a> , <a href="#">11-29</a>
Te-Stack backplane (PCB) <sup>a)</sup>	See section <a href="#">11.2.28</a> , <a href="#">11-30</a> .

a) Used as backplane in the Te-Link (option)

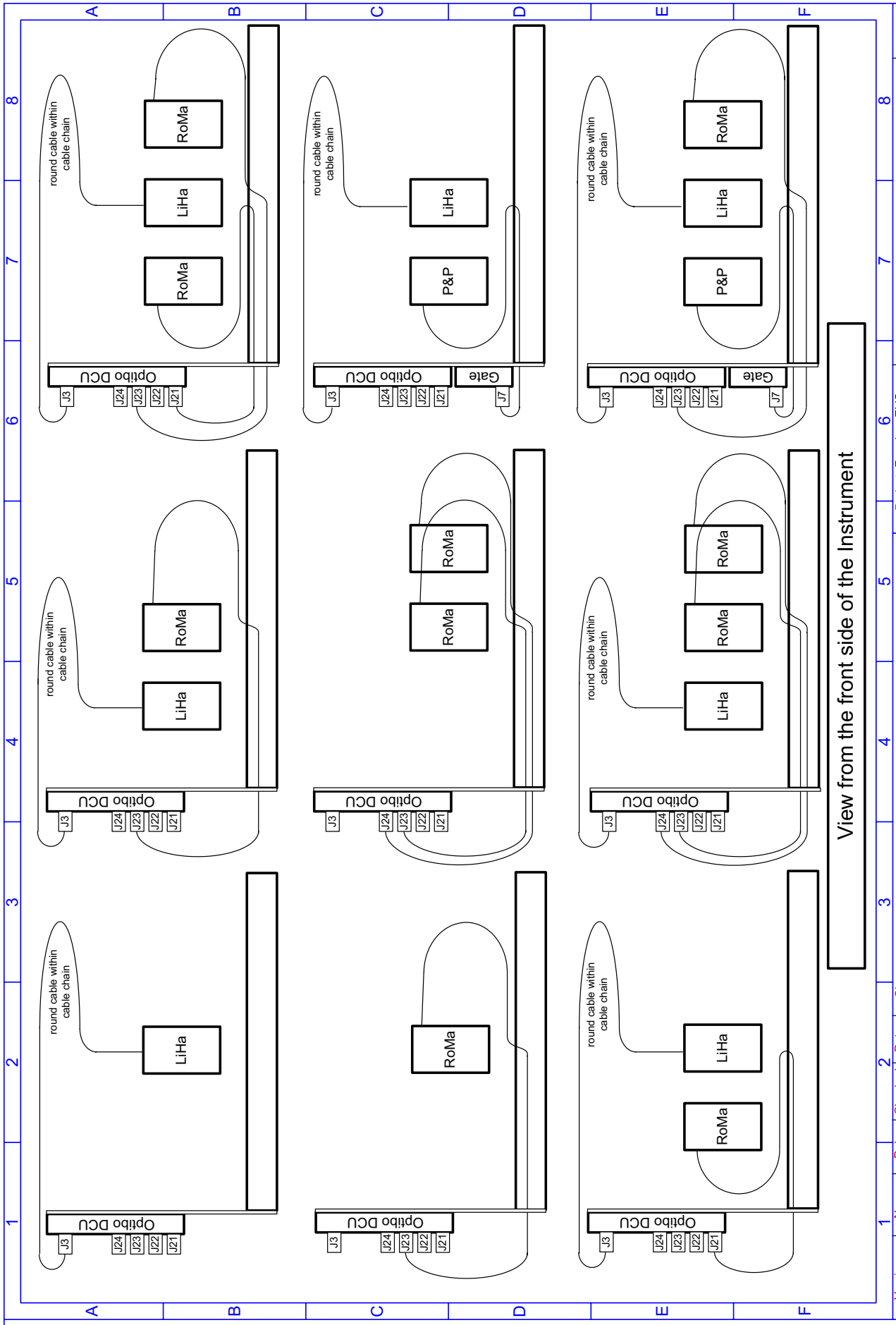
## 11.2 Diagram Pages

On the next few pages you find the diagrams.

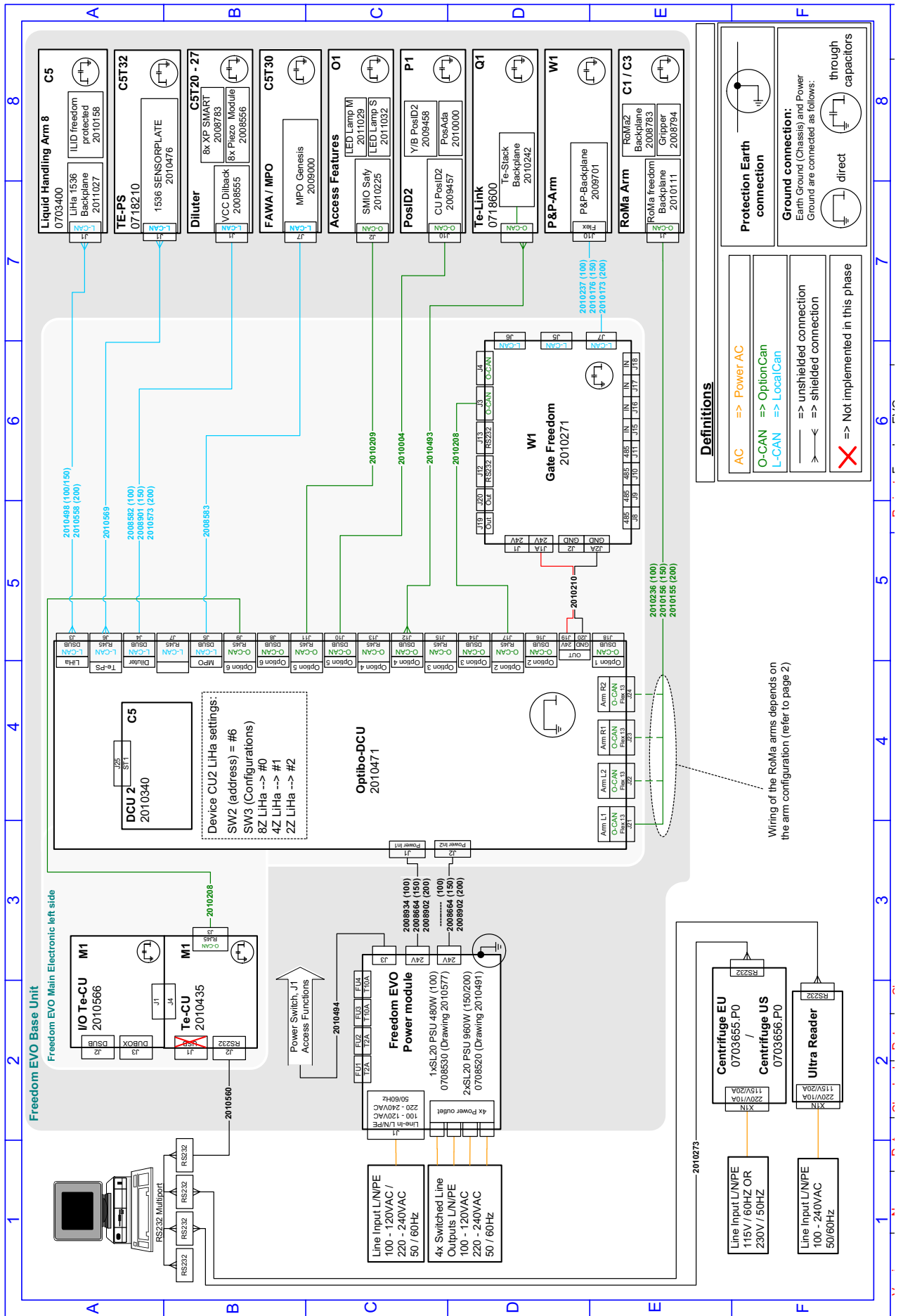
# 11.2.1 Communication Overview



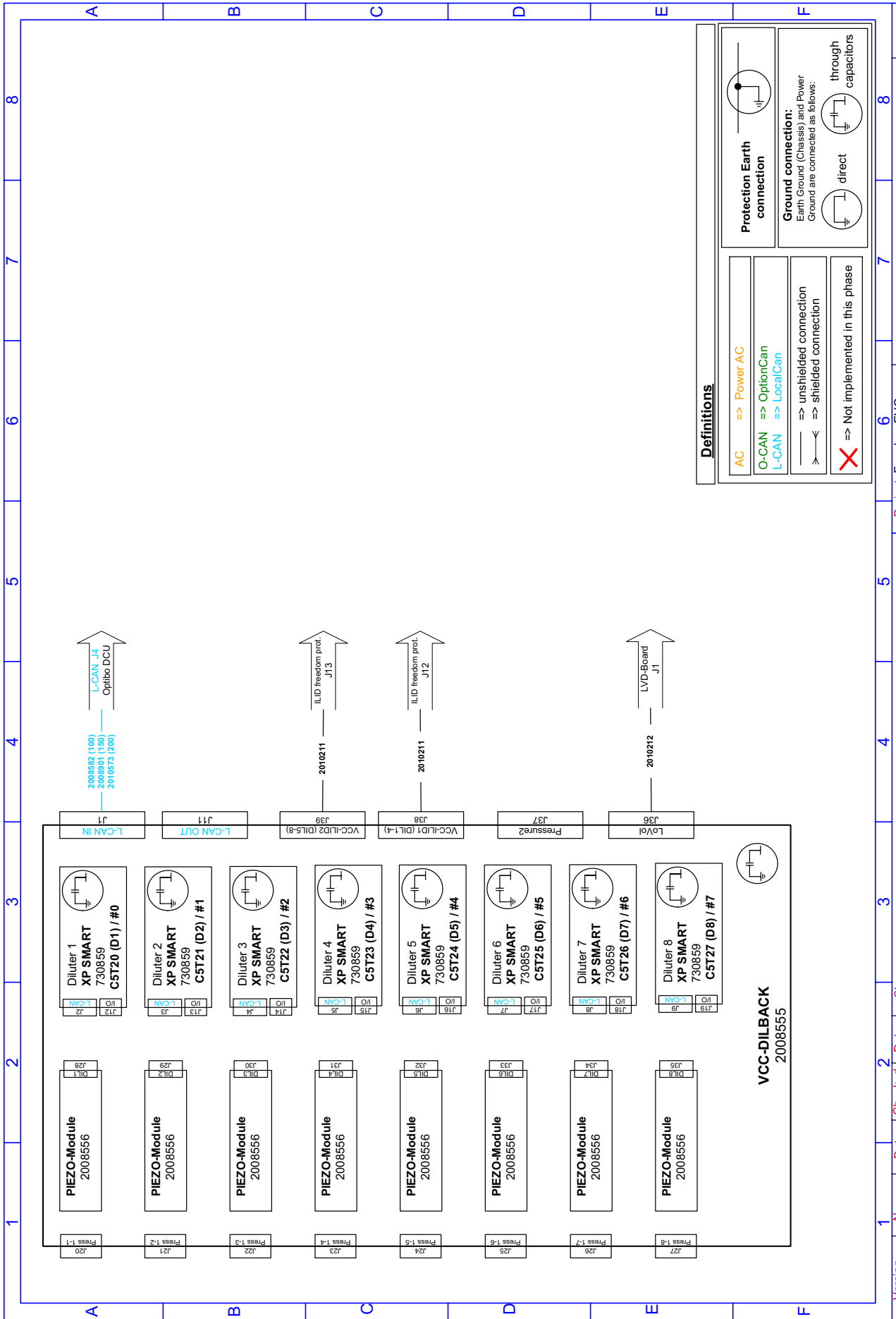
## 11.2.2 Arm Configurations



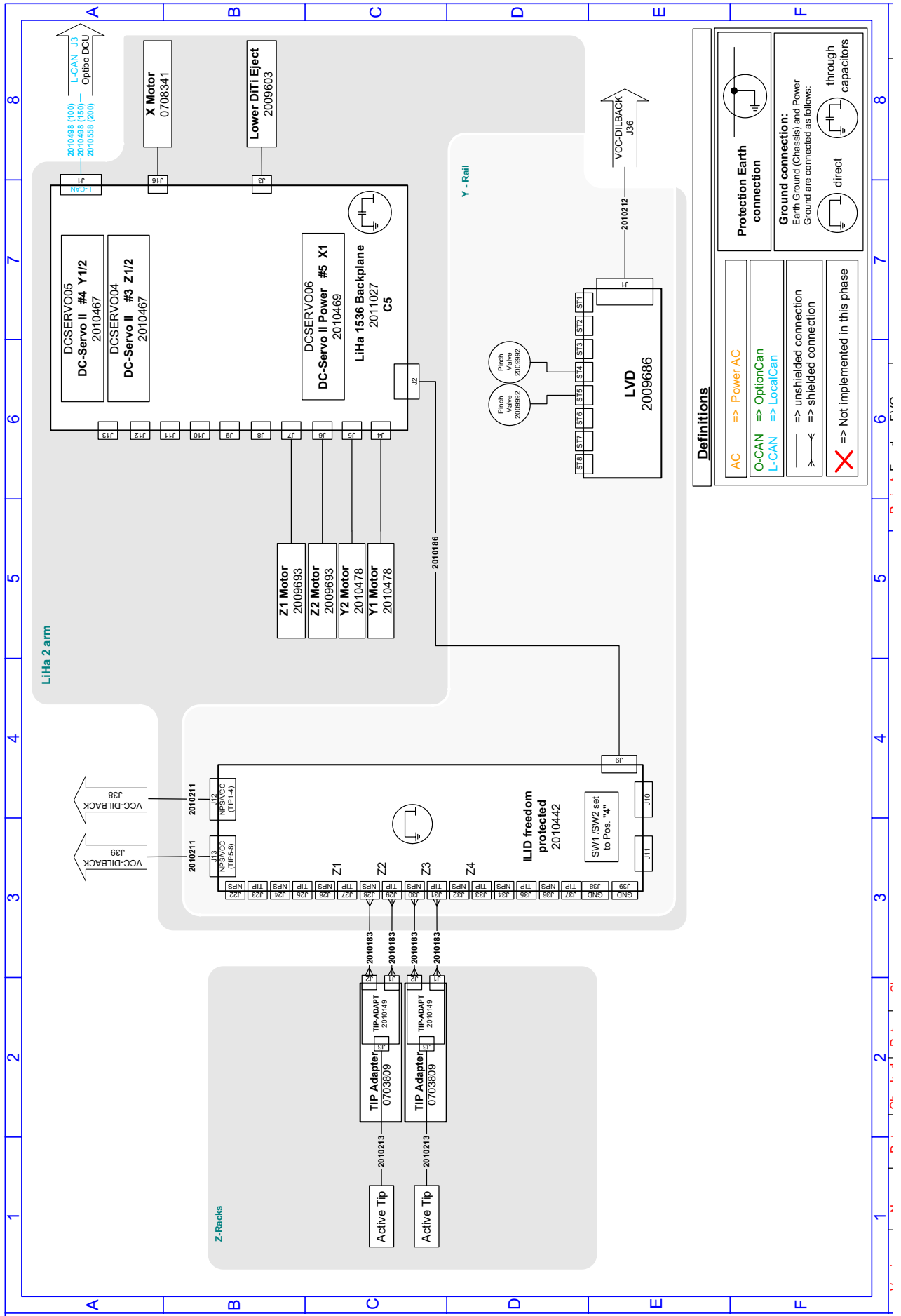
## 11.2.3 Wiring Diagram Freedom EVO



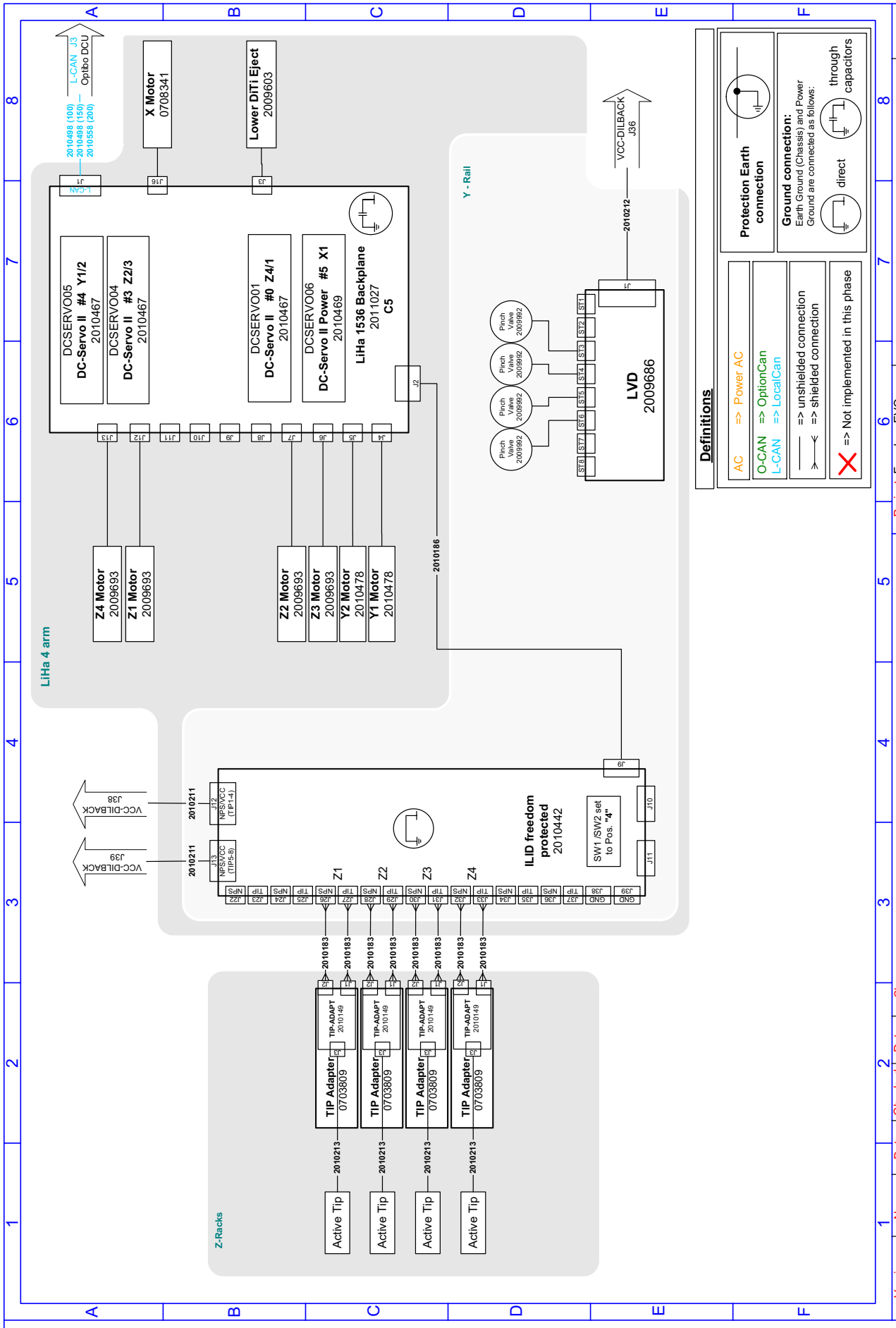
## 11.2.4 Wiring Diagram Diluters



## 11.2.5 Wiring Diagram LiHa 2-Channel

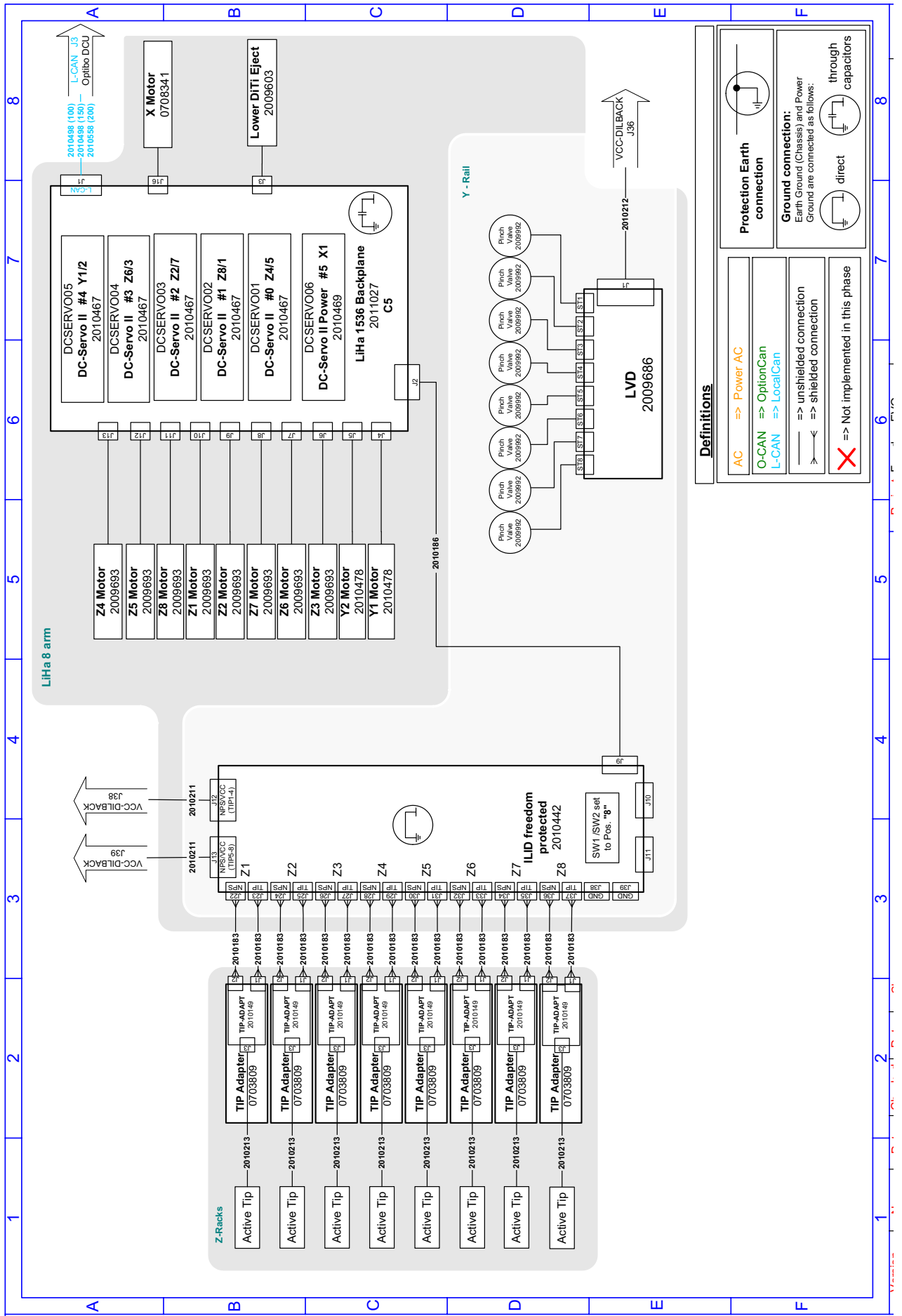


## 11.2.6 Wiring Diagram LiHa 4-Channel

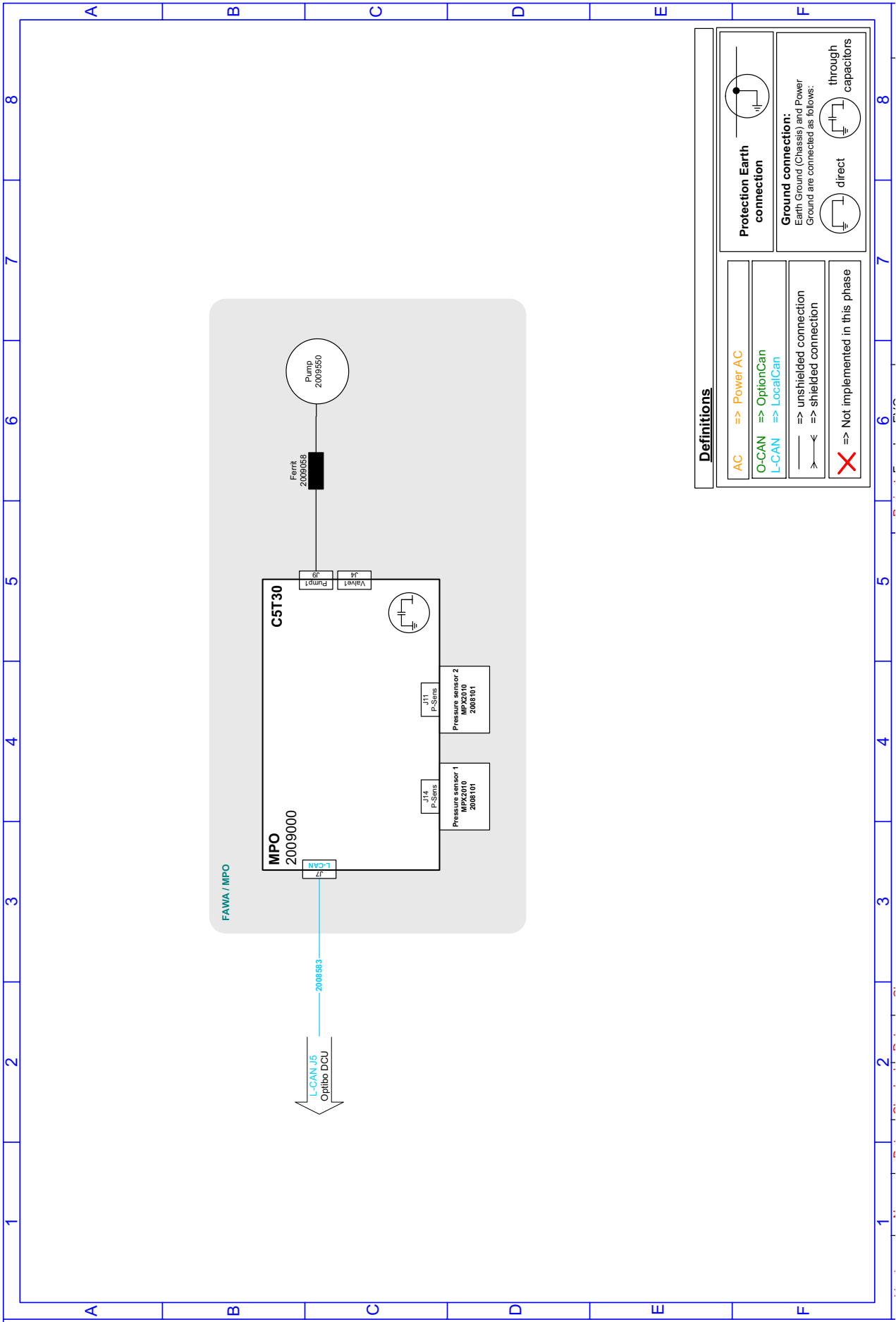




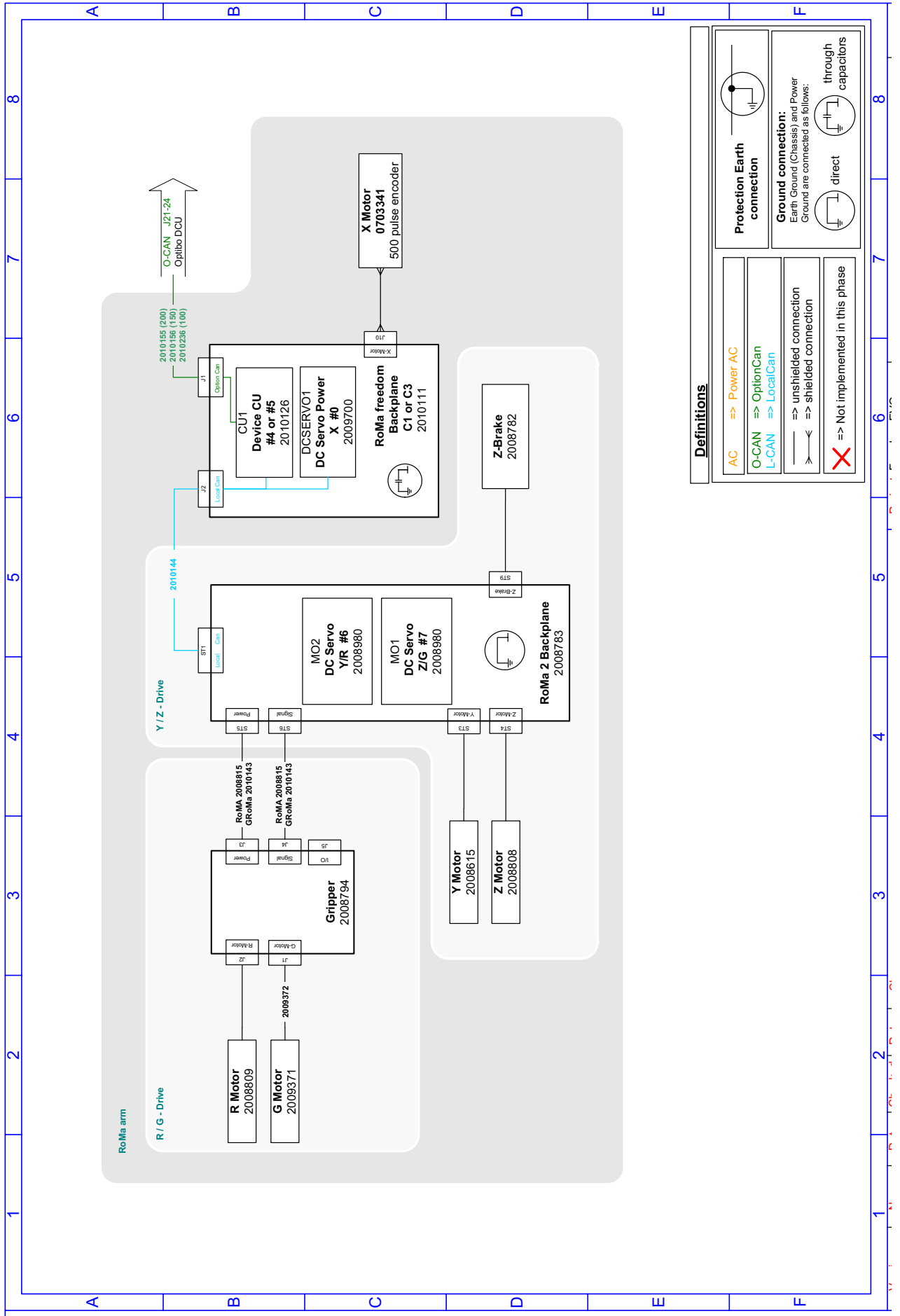
# 11.2.7 Wiring Diagram LiHa 8-Channel



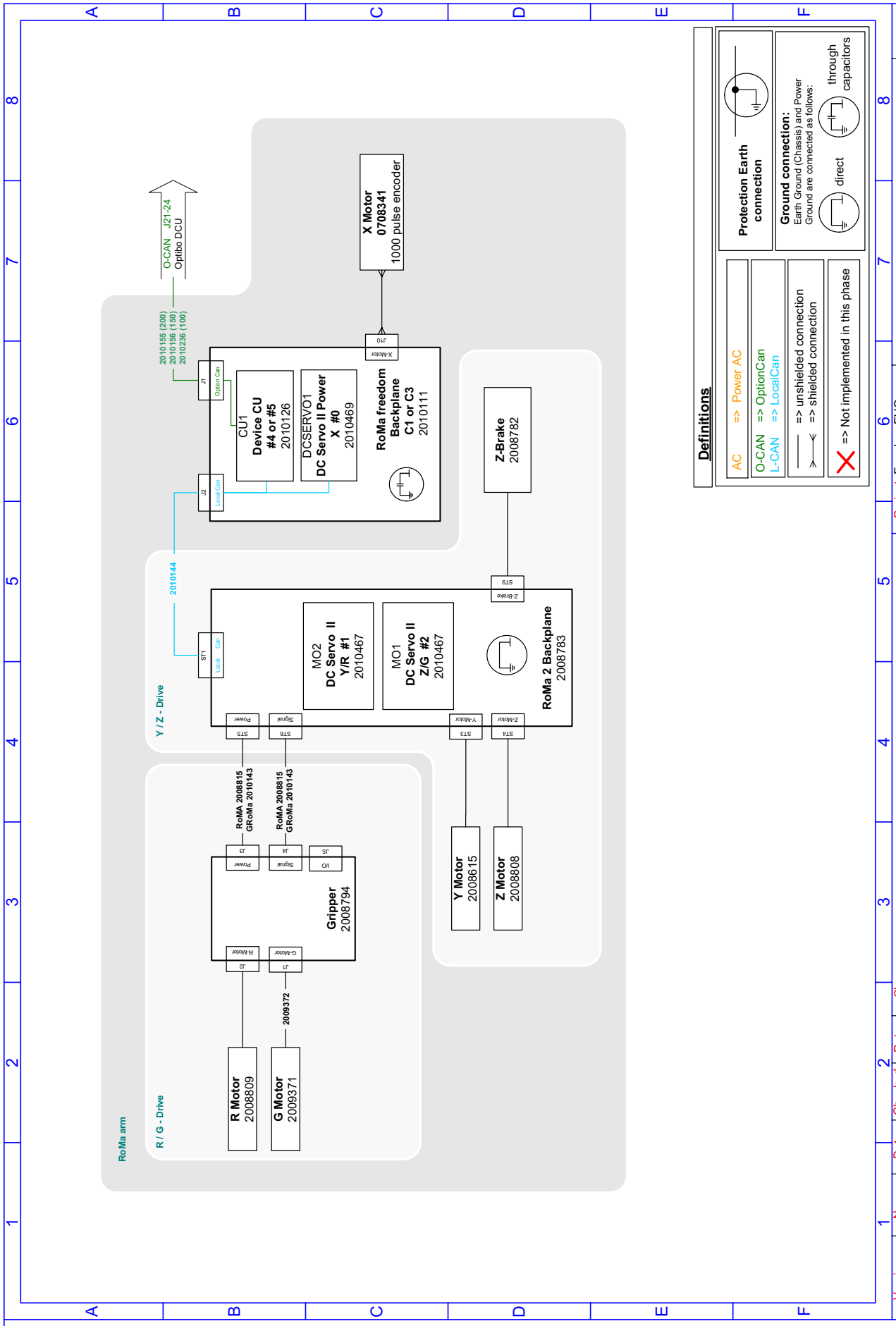
# 11.2.8 Wiring Diagram MPO



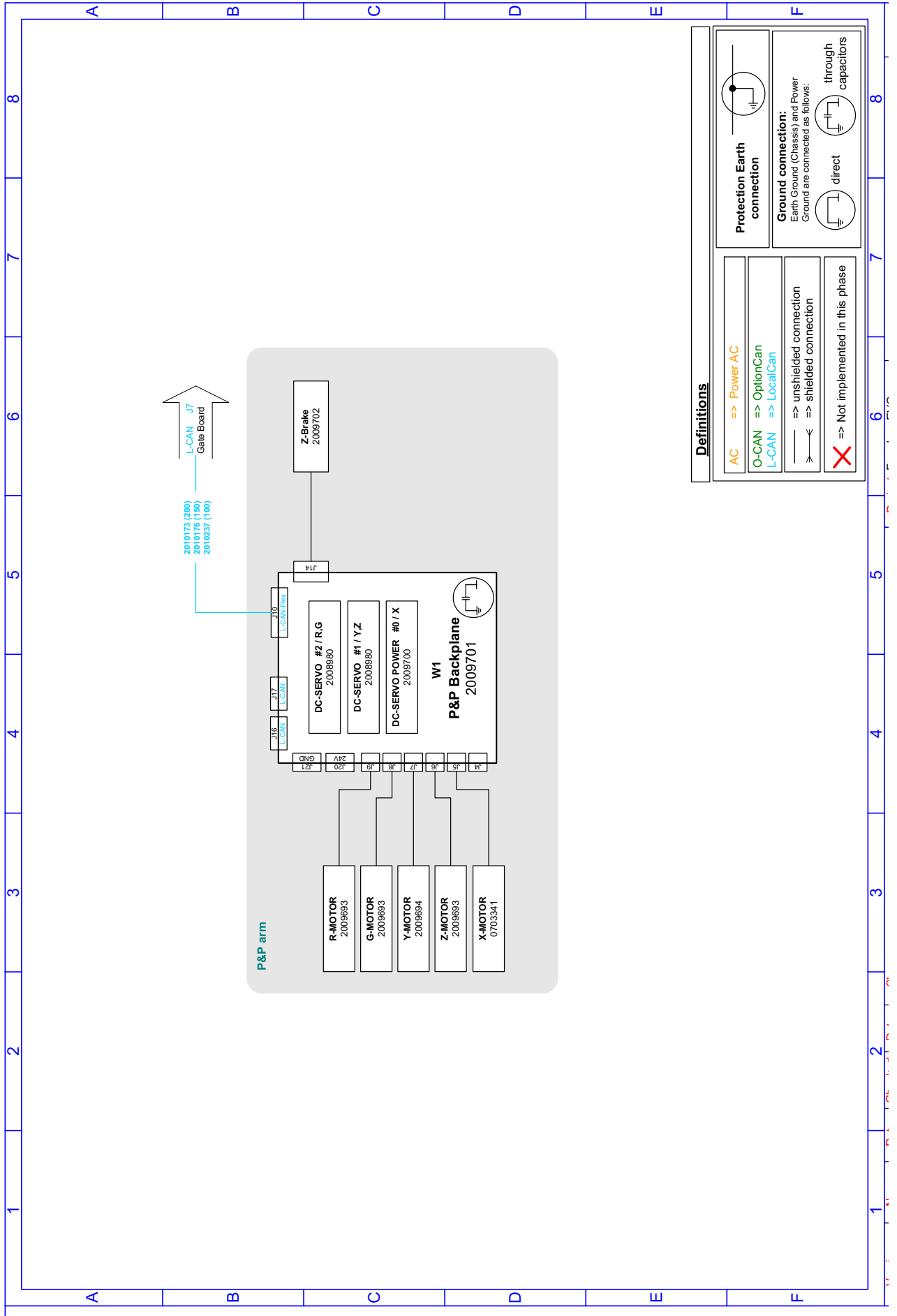
## 11.2.9 Wiring Diagram RoMa (DC Servo)



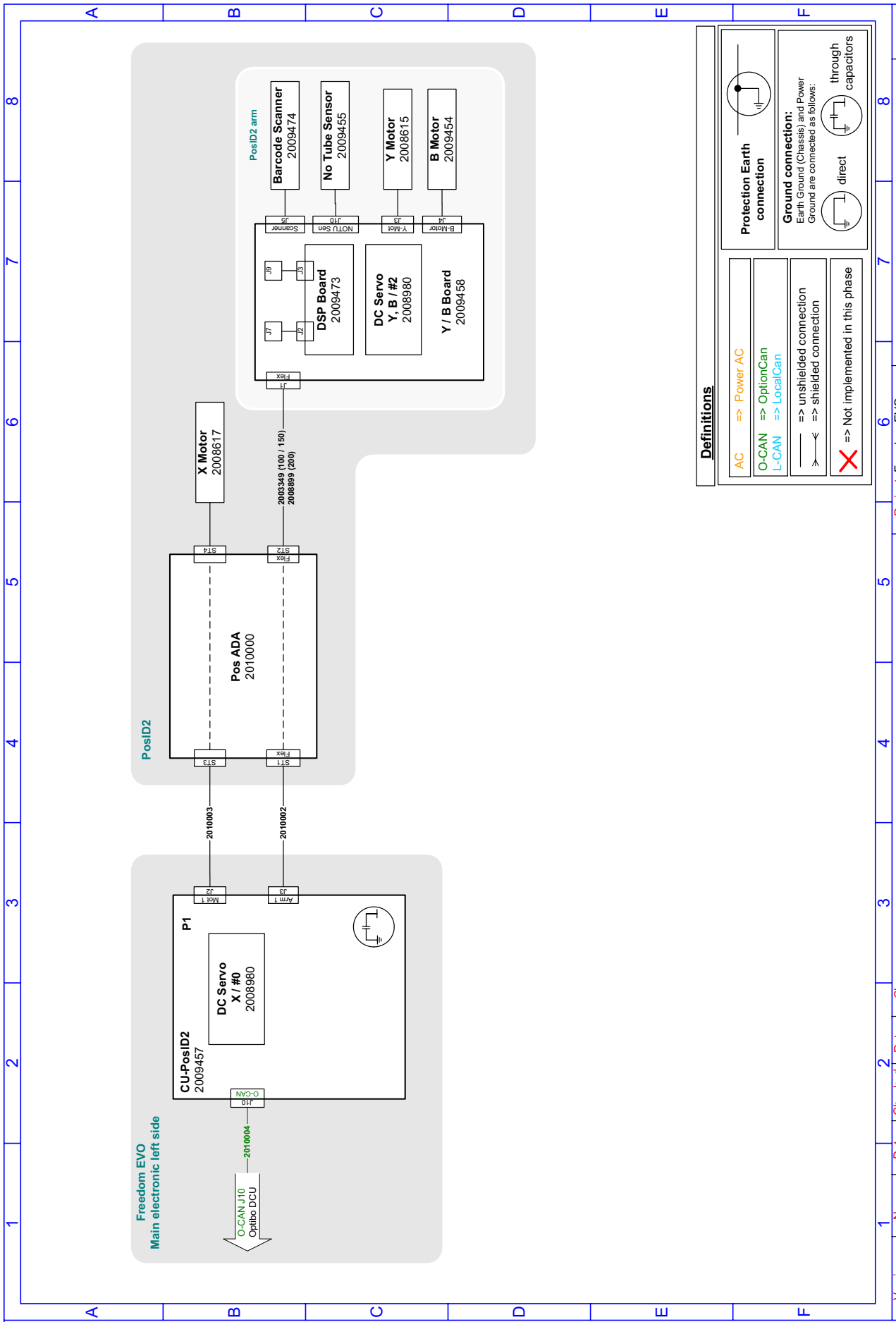
## 11.2.10 Wiring Diagram RoMa (DC Servo II)



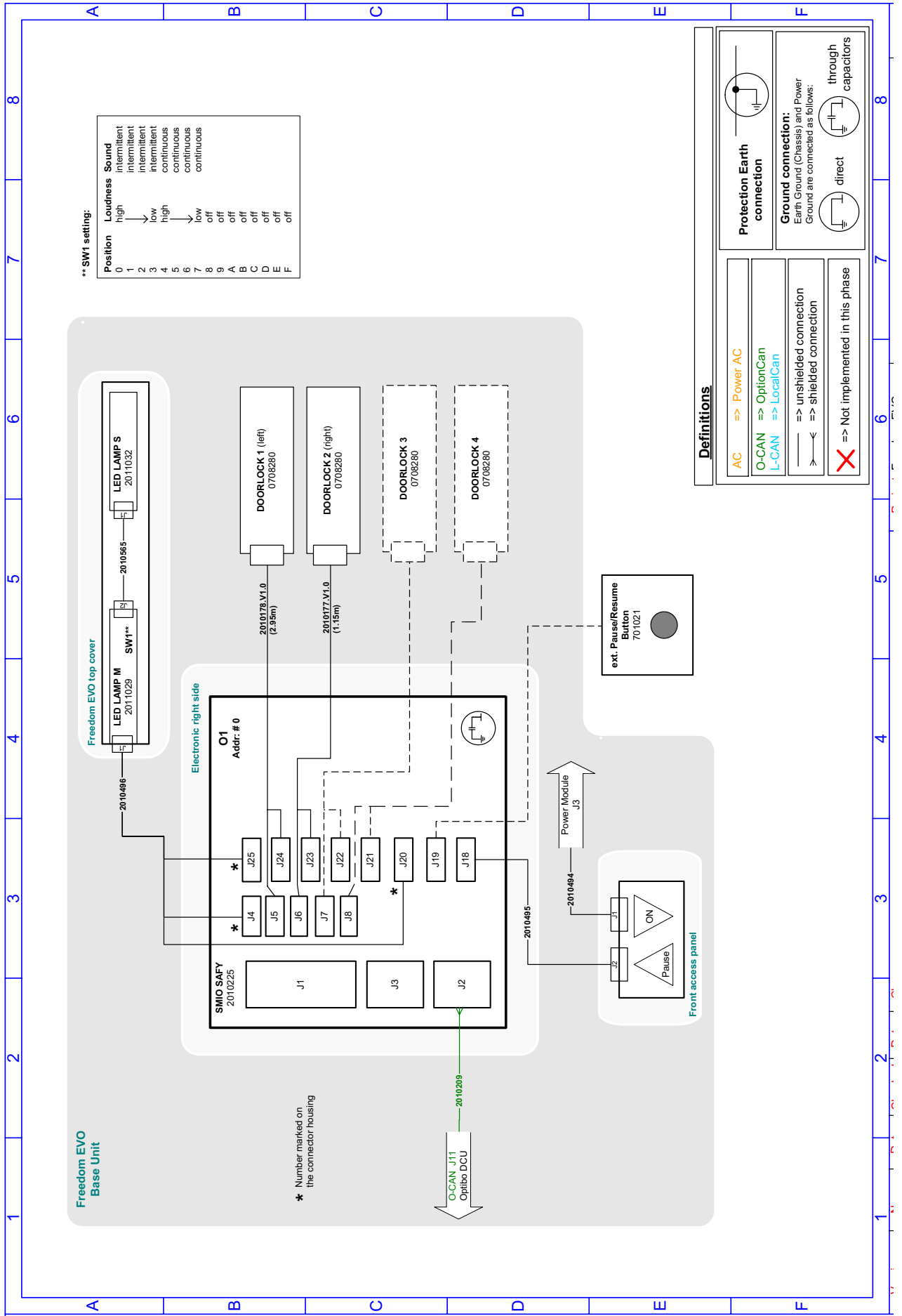
## 11.2.11 Wiring Diagram P&P



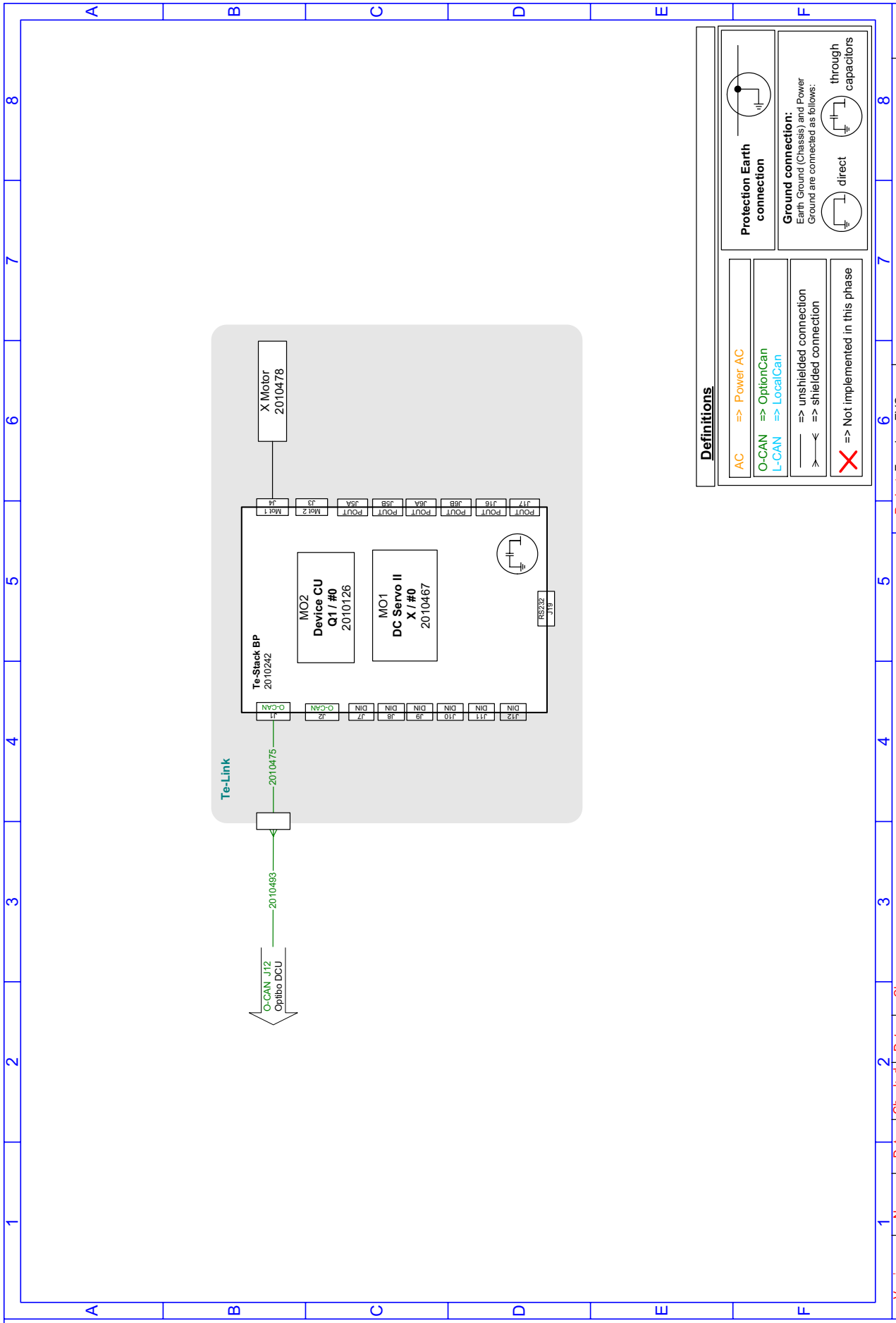
## 11.2.12 Wiring Diagram PosID 2



# 11.2.13 Wiring Diagram Access Functions

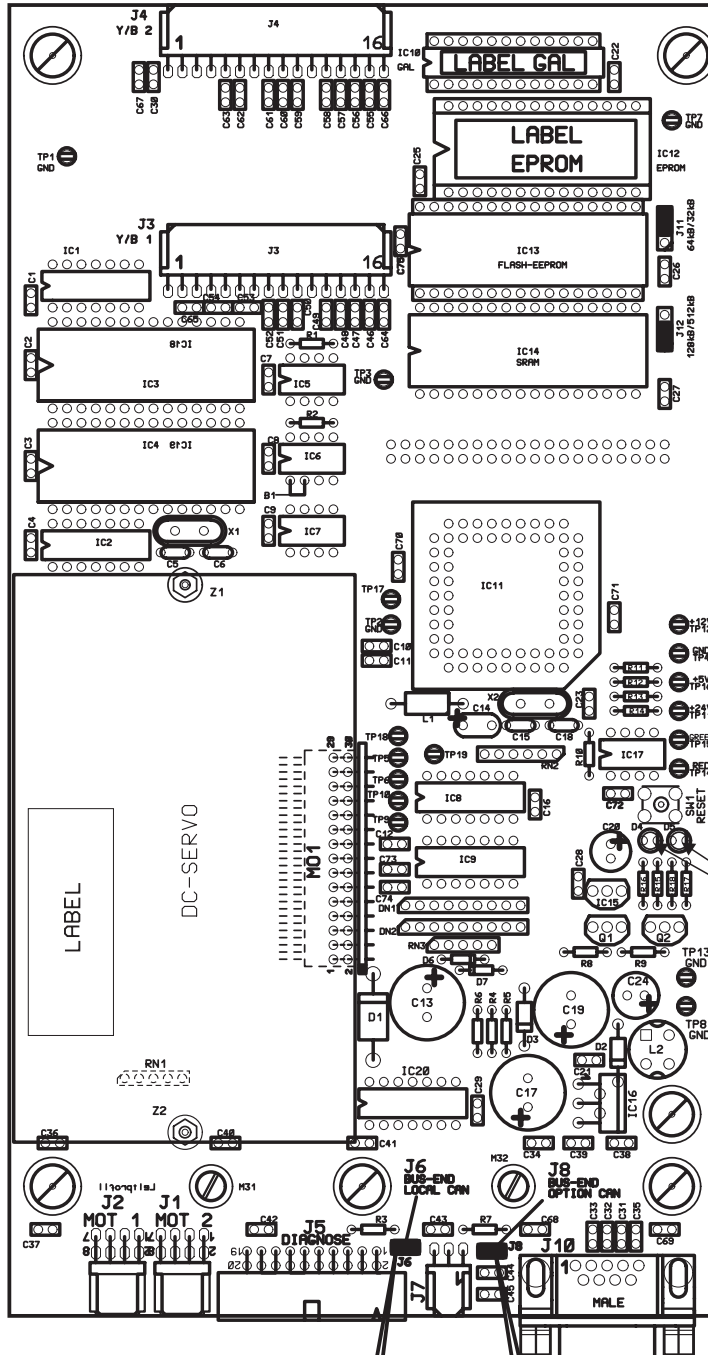


## 11.2.14 Wiring Diagram Te-Link





## 11.2.15 CU PosID 2 (PCB)

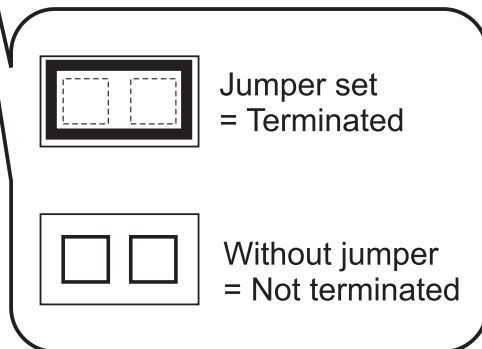
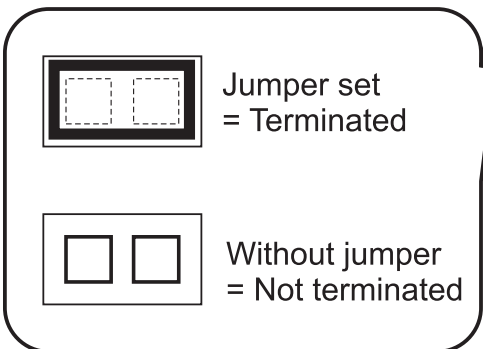


J11 JUMPER, IC7, IC12 NOT ASSEMBLED ON CU POSID 2

Status LED

J6 Local CAN bus termination

J8 Option CAN bus termination



## 11.2.16 P&P Backplane (PCB)

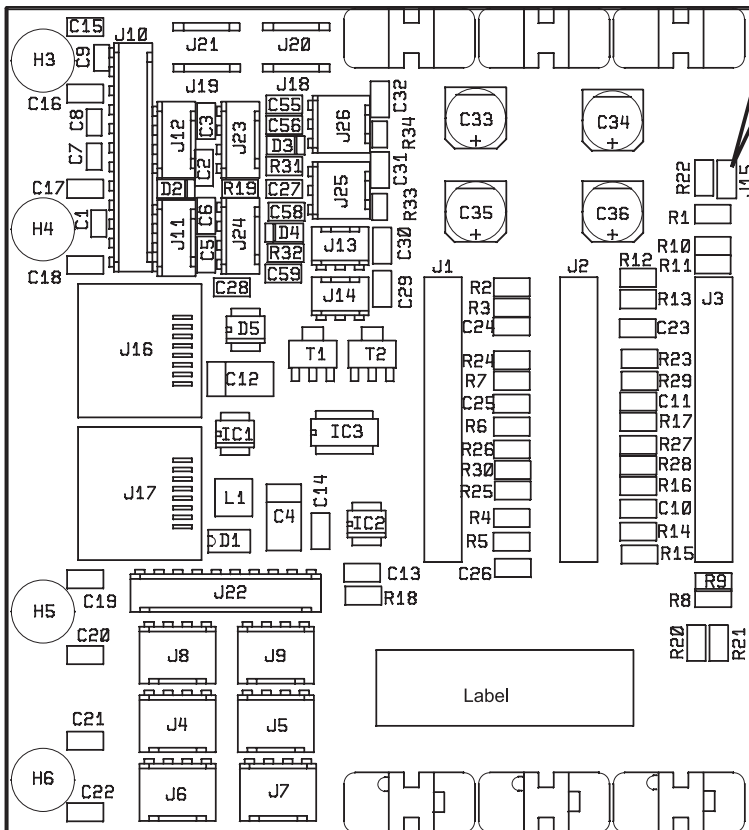
J15 Local CAN bus termination



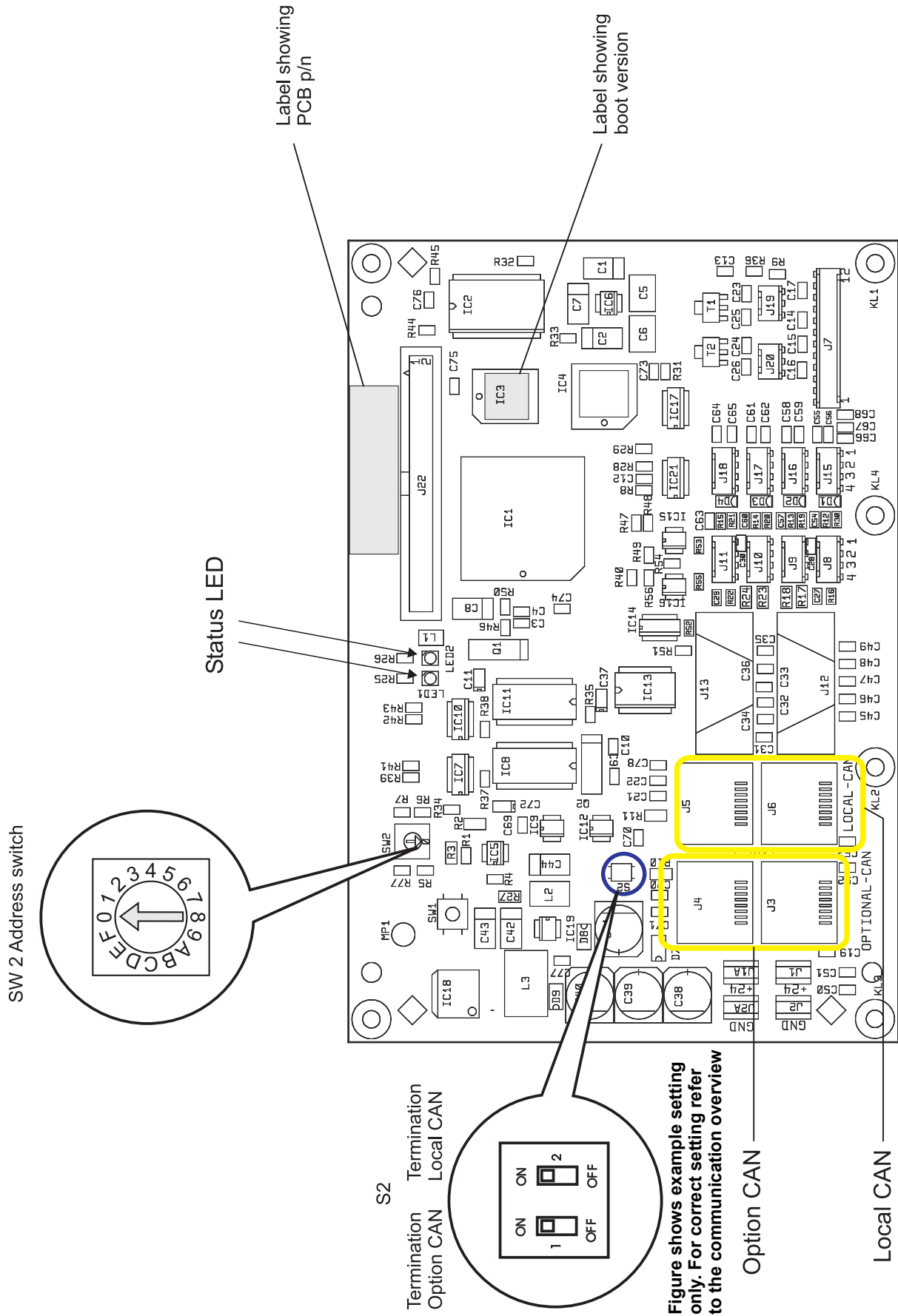
Jumper set  
= Terminated



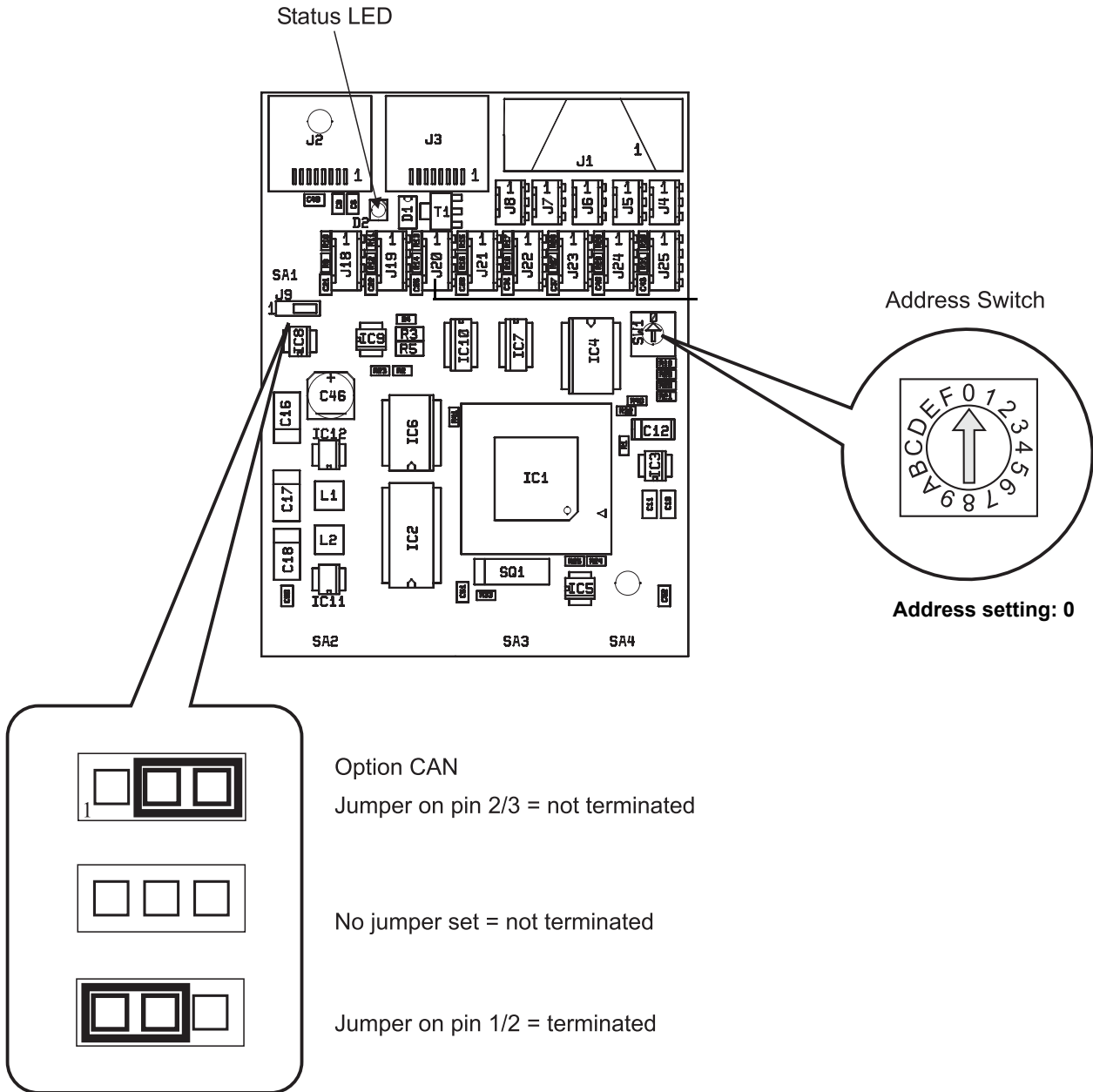
Without jumper  
= Not terminated



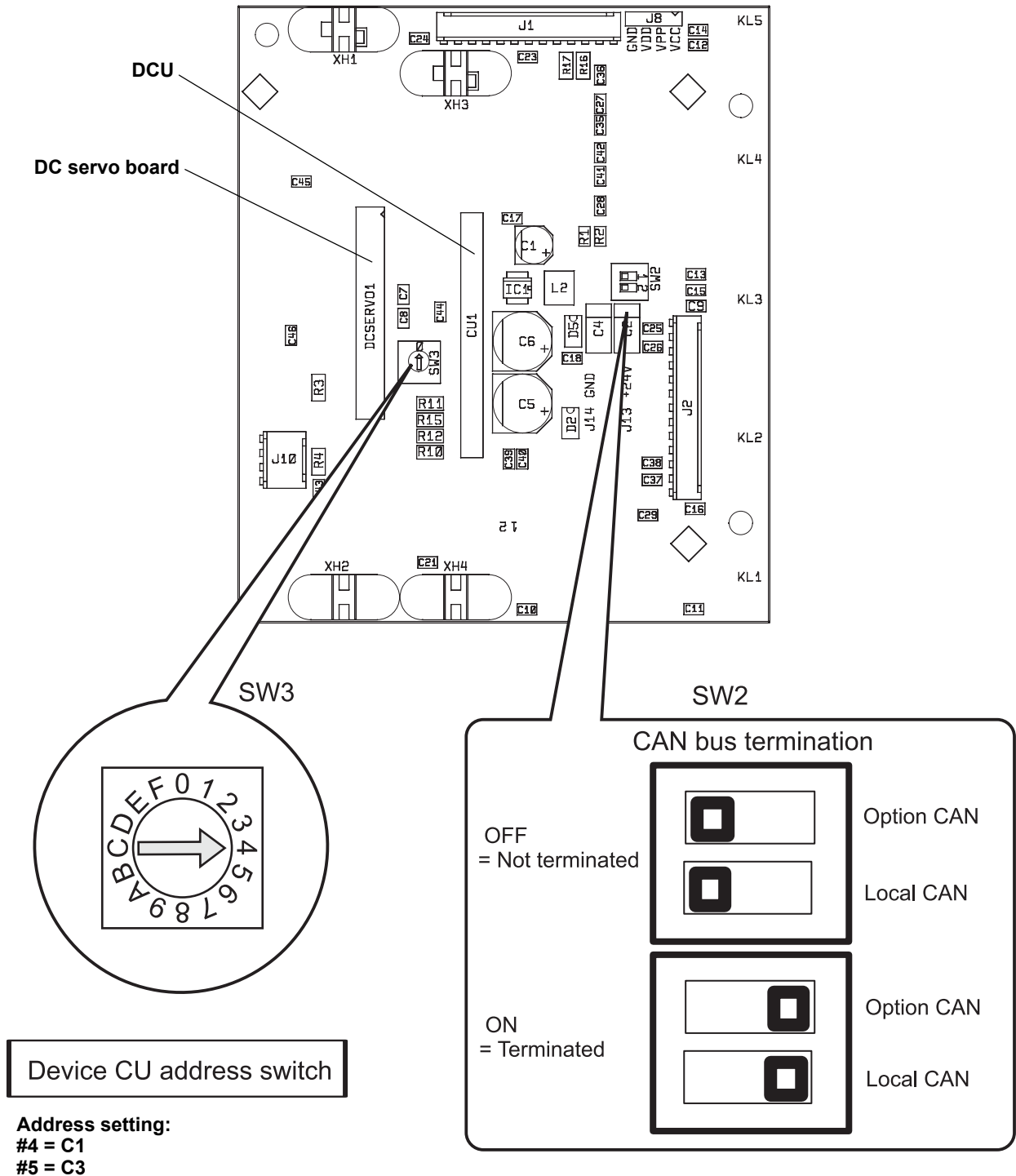
## 11.2.17 Gate Board (PCB)



## 11.2.18 SMIO/SAFY Board (PCB)



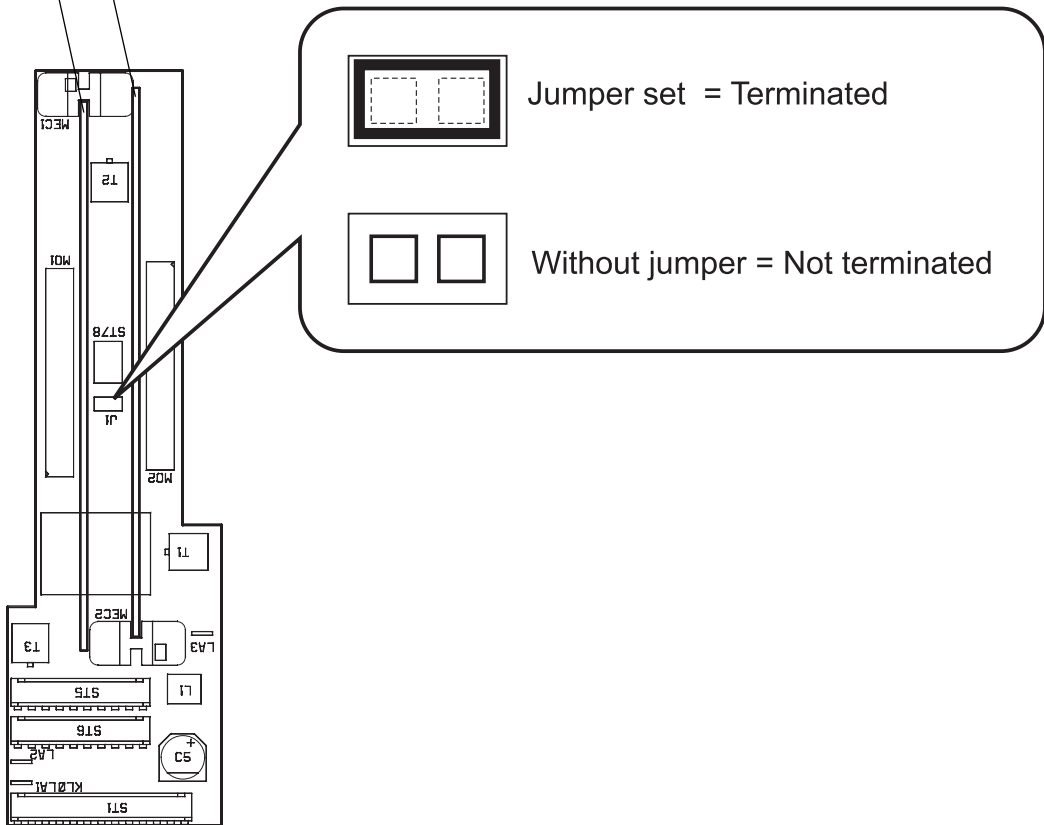
## 11.2.19 RoMa Freedom Backplane (PCB)



## 11.2.20 RoMa 2 Backplane (PCB)

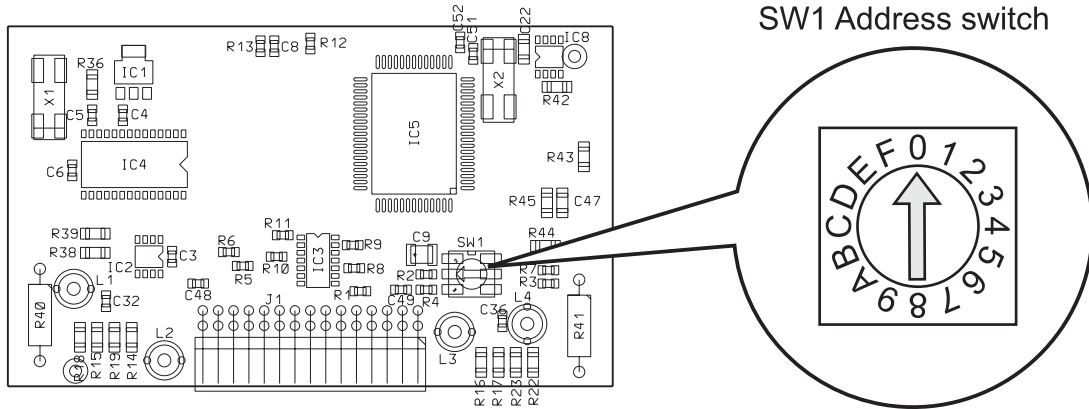
Y/R-DC servo board  
Z/G-DC servo board

CAN bus termination

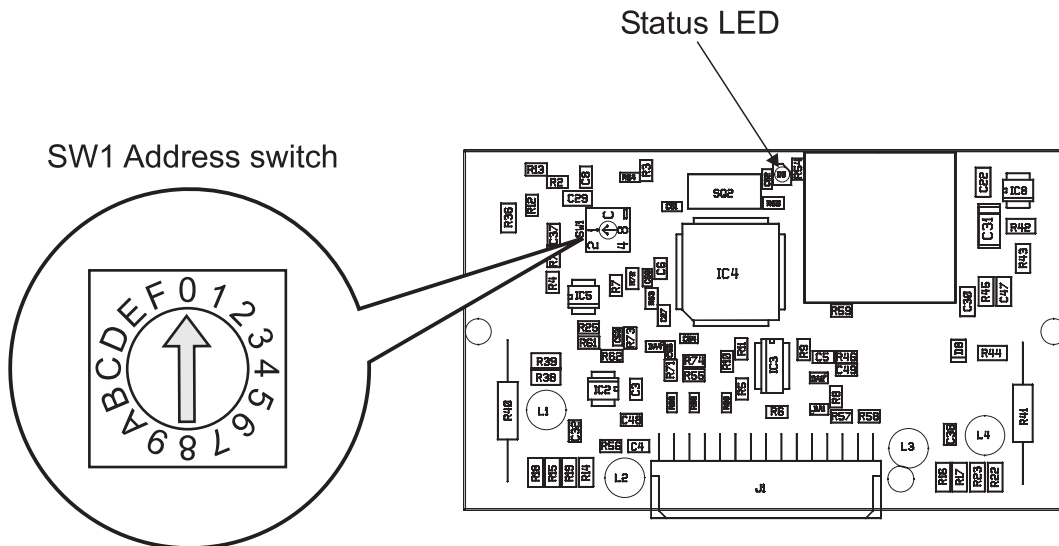


## 11.2.21 DC Servo [II], [Power] (PCB)

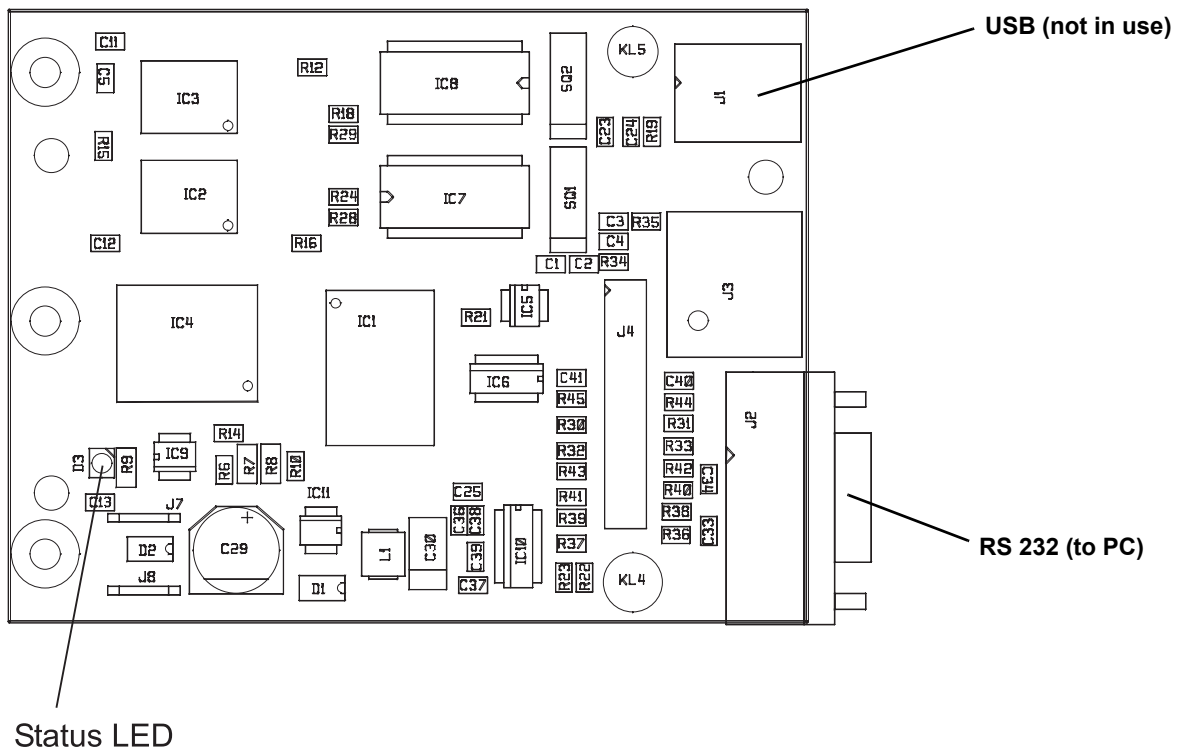
DC servo  
DC servo power



DC servo II  
DC servo II power



## 11.2.22 Te-CU (PCB)



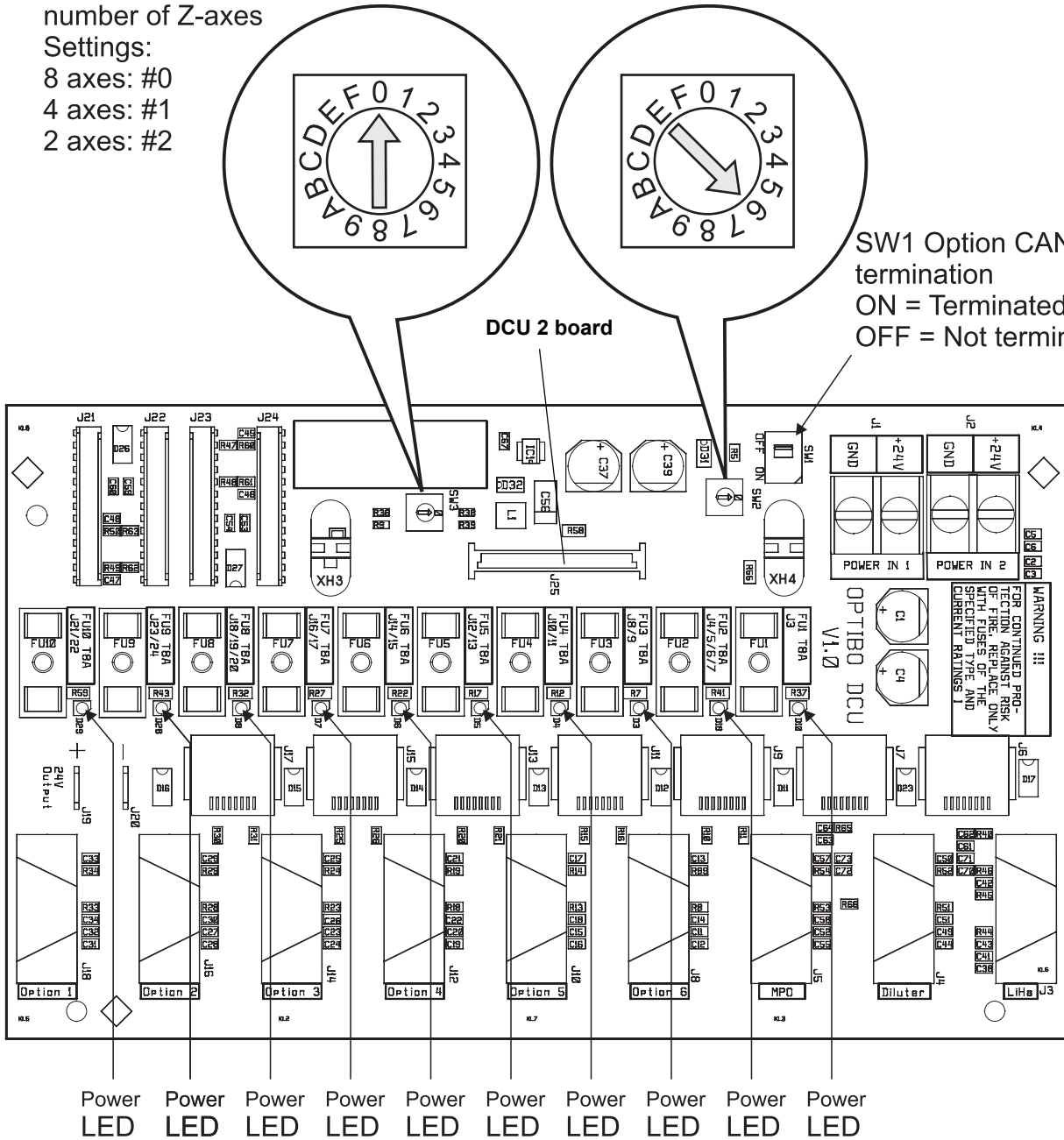


## 11.2.23 Optibo DCU (PCB)

SW3 LiHa configuration;  
number of Z-axes  
Settings:  
8 axes: #0  
4 axes: #1  
2 axes: #2

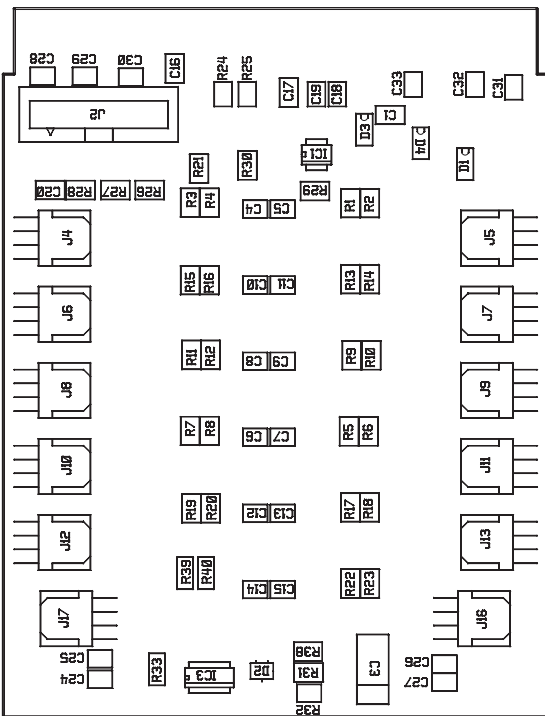
SW2 Address switch for DCU2 (LiHa)

SW1 Option CAN  
termination  
ON = Terminated  
OFF = Not terminated

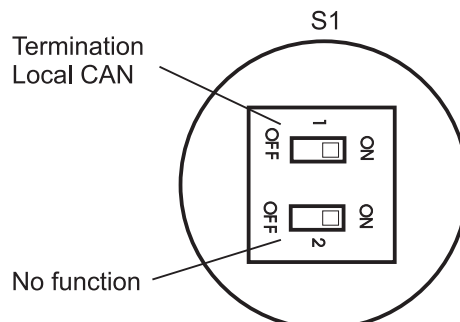
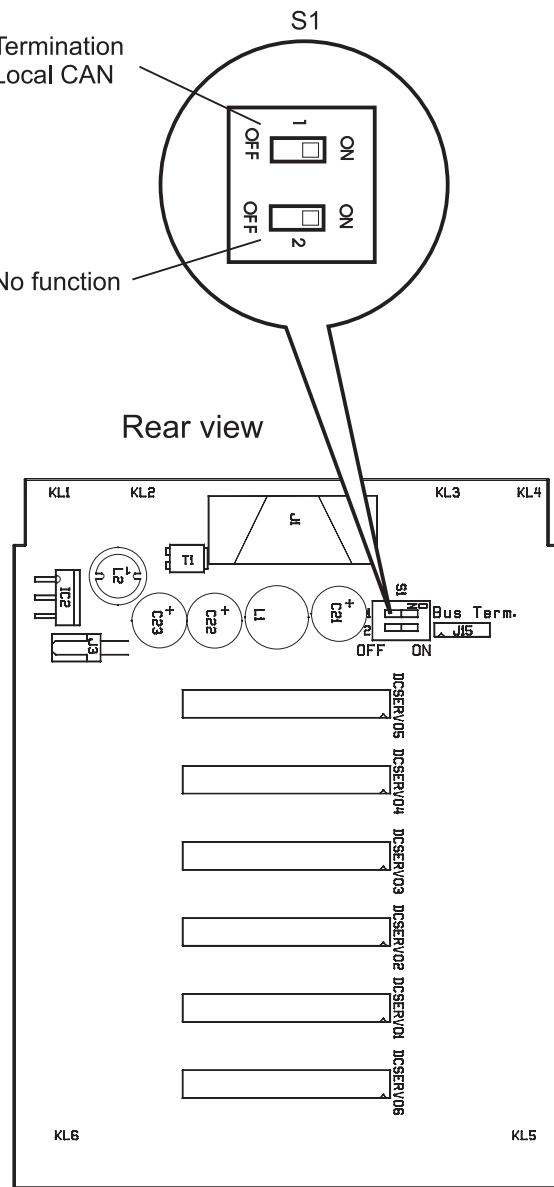


## 11.2.24 LiHa 1536 Backplane (PCB)

View from LiHa arm side

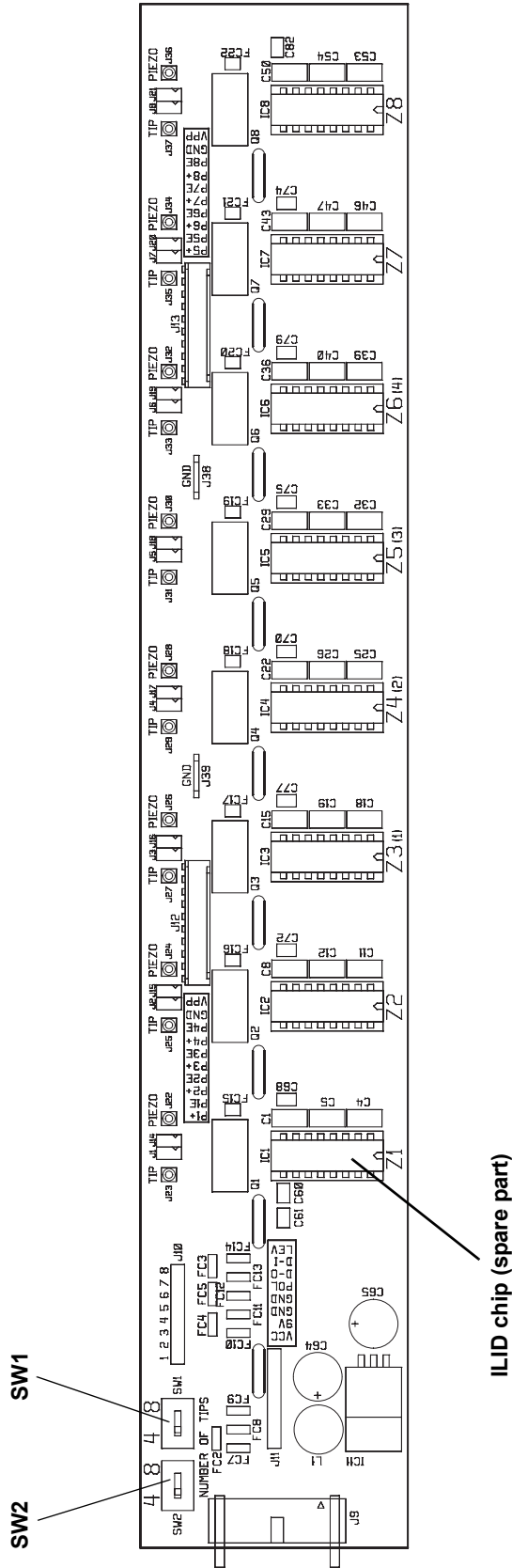


Rear view



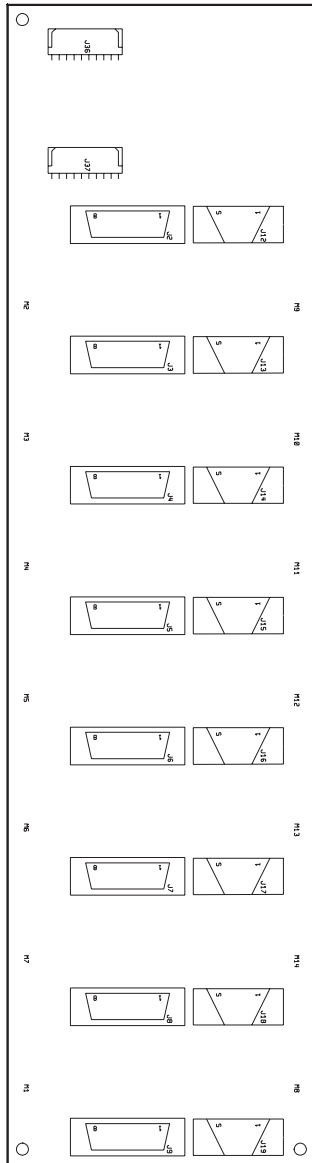
## 11.2.25 ILID-Freedom Protected (PCB)

Switches to select the number of tips the LiHa is equipped with  
 For 2-tip LiHa: set both switches to "4"  
 For 4-tip LiHa: set both switches to "4"  
 For 8-tip LiHa: set both switches to "8"

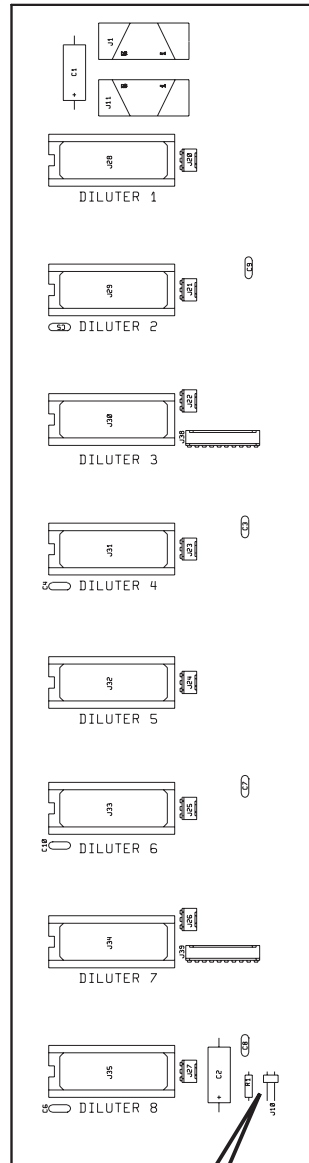


## 11.2.26 VCC Dilback (PCB)

Diluter side



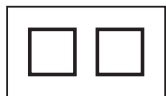
Rear side



Jumper J10: CAN bus termination

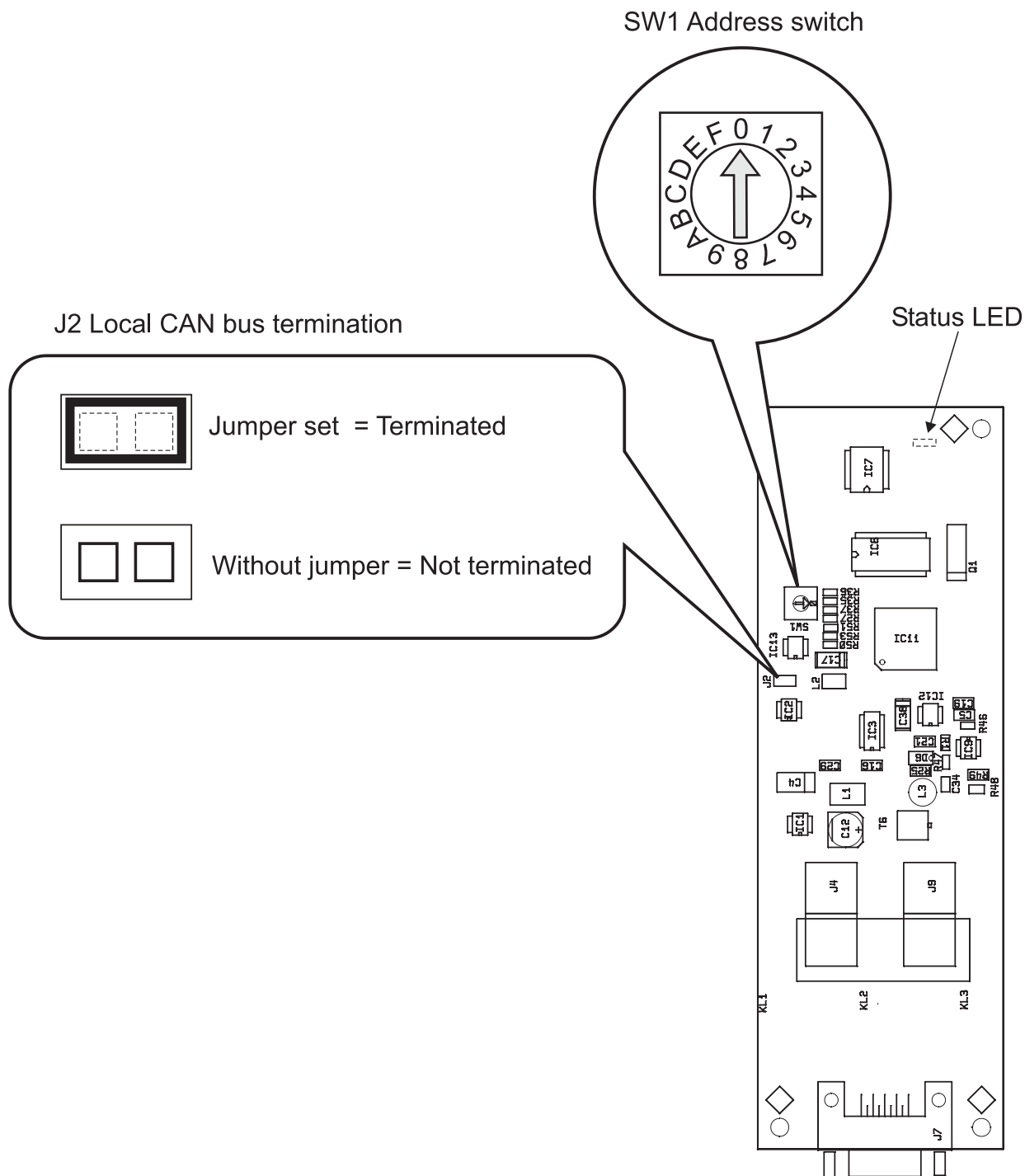


Jumper set = Terminated



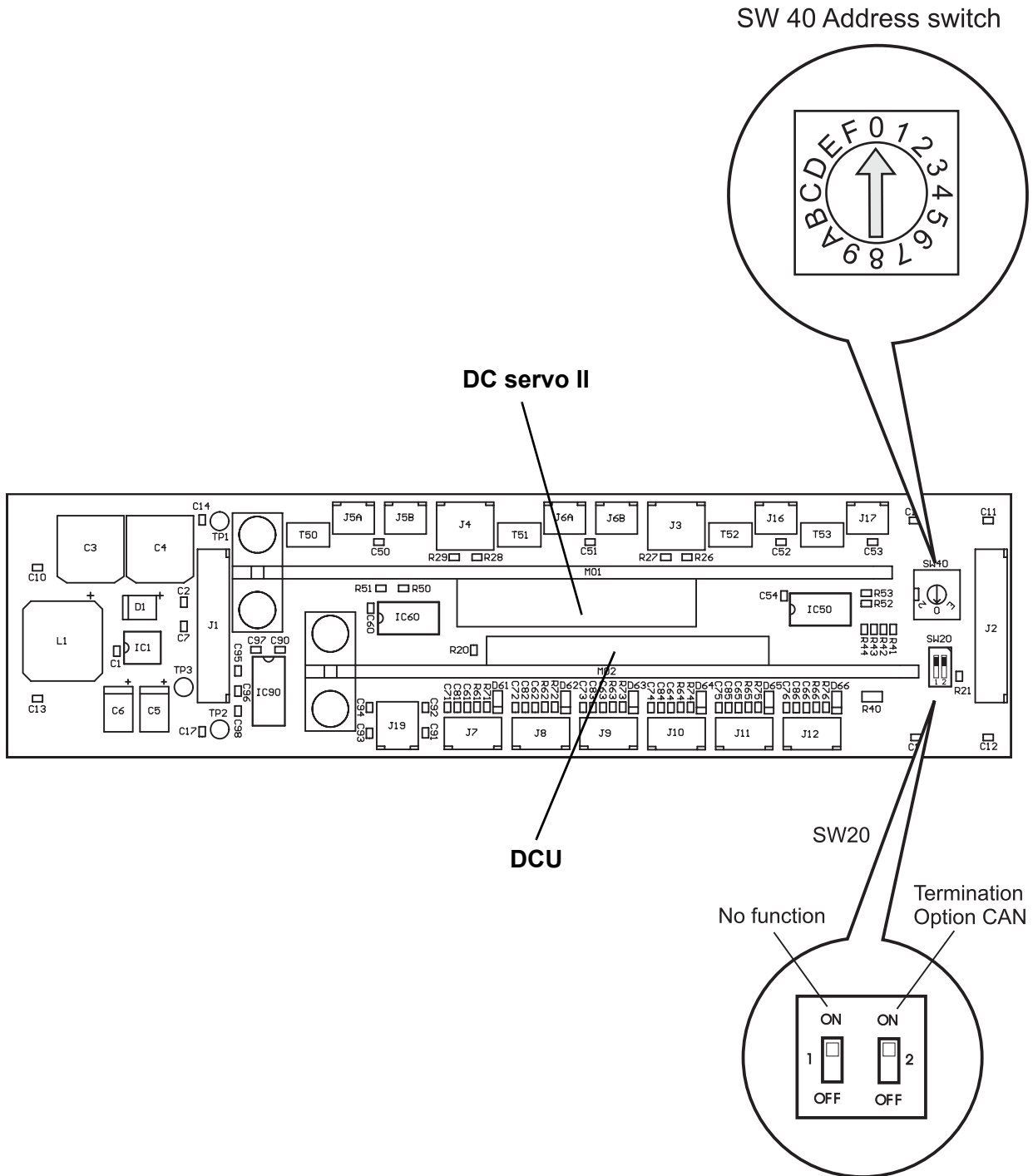
Without jumper = Not terminated

## 11.2.27 MPO Board (PCB)



## 11.2.28 Te-Stack Backplane (PCB)

**Note:**  
The Te-Stack backplane is used in the Te-Link (option)



**Figure shows example setting only. For correct setting refer to the communication overview**

# 12 Index

## Purpose of This Chapter

This chapter contains an alphabetical index which offers you help in finding information more quickly.

### A

Acoustic alarm device . . . . . 8-162  
 Adapter plate . . . . . 5-12  
     GENios Pro . . . . . 5-12, 5-16  
     Safire2 . . . . . 5-12, 5-16  
     Ultra . . . . . 5-12, 5-16  
 Addresses of CAN-Bus . . . . . 8-160  
 Arm configuration . . . . . 3-8

### C

CAN-Bus  
     Addresses . . . . . 8-160  
 CAN-Bus termination . . . . . 4-7  
 Cleaning agents . . . . . 6-1

### D

Diagrams . . . . . 11-1  
 Door lock . . . . . 8-4  
 DSP decoding board . . . . . 8-116

### F

Firmware . . . . . 3-15  
 Flex cables . . . . . 8-68, 8-104  
 Fuses  
     Optibo DCU . . . . . 8-8  
     Power supply module . . . . . 8-14

### G

Gas spring . . . . . 8-3  
 GENios Pro . . . . . 4-17  
     Adapter plate . . . . . 5-12, 5-16  
 Grease . . . . . 6-2  
 Guiding bracket . . . . . 5-13, 5-15

### H

High resistant tubing . . . . . 8-143

### I

ILID chip . . . . . 8-36  
 ILID Freedom protected . . . . . 8-32  
 Installation  
     Unpacking . . . . . 4-3

### L

LED  
     Power . . . . . 7-11  
     Status . . . . . 7-10  
 Liquid system . . . . . 8-141  
 Low volume option . . . . . 8-144  
 Lower DiTi eject option . . . . . 5-25  
 Lubricants . . . . . 6-2

### M

Maintenance  
     Schedule . . . . . 6-2  
 Maintenance tables  
     Explanation . . . . . 6-2

### O

ON/OFF switch . . . . . 8-10  
 Options . . . . . 3-11

### P

Pause switch . . . . . 8-10, 8-12  
 PCB layouts . . . . . 11-1  
 PCBs  
     Location . . . . . 3-5  
 Power LED . . . . . 7-11  
 Power supply module . . . . . 8-13

### R

Reader . . . . . 4-17  
     Adapter plate . . . . . 5-12, 5-16  
     Distance brackets . . . . . 5-11  
     GENios Pro . . . . . 4-17  
     Guiding bracket . . . . . 5-13, 5-15  
     In cabinet (left) . . . . . 5-12  
     In cabinet (right) . . . . . 5-15  
     Installation . . . . . 4-17  
     On worktable extension . . . . . 5-17  
     Parts for installation . . . . . 5-10  
     Retaining pin . . . . . 5-12  
     Safire2 . . . . . 4-17  
     Spare parts . . . . . 10-13  
     Trolley . . . . . 5-12, 5-15  
     Ultra . . . . . 4-17  
 Retaining pin . . . . . 5-12

- RoMa  
 Centric gripper . . . . . 8-56  
 Gripper module . . . . . 8-55  
 Orientation . . . . . 3-3
- S**  
 Safire2 . . . . . 4-17  
 Adapter plate . . . . . 5-12, 5-16  
 Trolley . . . . . 5-16
- Schedule  
 Maintenance . . . . . 6-2
- Software requirements . . . . . 3-4
- Status lamp . . . . . 8-12
- Status LED . . . . . 7-10
- T**  
 Te-Link . . . . . 8-125  
 Termination CAN-Bus . . . . . 4-7  
 Tip adapter . . . . . 8-27  
 Transport lock . . . . . 9-5  
 Trolley . . . . . 5-15  
 GENios Pro . . . . . 5-12, 5-16
- Safire2 . . . . . 5-12, 5-16  
 Ultra . . . . . 5-12, 5-16
- Troubleshooting  
 Table . . . . . 7-1
- Tubing  
 High resistant . . . . . 8-143  
 Standard . . . . . 8-142
- U**  
 Ultra . . . . . 4-17, 5-12  
 Adapter plate . . . . . 5-16
- W**  
 Wiring diagrams . . . . . 11-1  
 Worktable  
 Spare parts . . . . . 8-5  
 Worktable cutouts . . . . . 3-2
- X**  
 X-drive assembly . . . . . 8-17  
 XP SMART . . . . . 8-154