USER MANUAL

MEGADRIVE-LCI

Air-cooled

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1. About this manual

1.1. Equipment covered by this manual

This manual covers a standard drive and provides generic information on the drive. The manual does not claim to cover all variations and details of the drive, nor to consider all eventualities that may arise during installation, commissioning, operation and maintenance of the drive.

If the drive is adapted to specific customer needs or applications, and handling, installation and operation of the drive are affected by these modifications, information on these modifications is provided in the appropriate documentation (eg, layout drawings, wiring diagrams, technical data, engineering notes).

If information is required beyond the instructions in this manual, refer the matter to ABB.

1.2. Terms and definitions

The following table lists terms and abbreviations you should be familiar with when using this user manual. Some of the terms and abbreviations used in this user manual are unique to ABB and might differ from the normal usage.

Term	Definition
AC 800PEC	Controller for power electronic applications
BPU	Bypass disconnector unit
CCB	Control circuit board
CIO unit	Combined Input/Output unit
Converter	Short form for frequency converter
COU	Control unit
DTL operation	Direct-To-Line operation The motor is connected to the fixed frequency power supply.
Drive	Short form for frequency converter
Drive system	The drive system includes all equipment used to convert electrical into mechanical power to give motion to the machine.
Equipment	Frequency converter and related equipment
EMC	Electromagnetic Compatibility All measures to suppress electromagnetic disturbances caused by different electrical equipment in the same electromagnetic environment, and to strengthen the immunity of the equipment to such disturbances.
Ground	Earth
To ground	The conducting path (eg, conductor) between the electric equipment (eg, frequency converter) and the earth. The electric equipment is connected to the earth, eg, by a grounding set or a grounding switch.
ICB	Input Circuit Breaker The ICB is a major protection device of the drive system. The circuit breaker connects / disconnects the main power supply to the drive.
LCI	Load Commutated Inverter
LCI.A	MEGADRIVE-LCI
LCT	LCI Control Terminal Local drive control device incorporating a touchscreen and a panel PC.
LIN	LCI Converter Interface Board
Line voltage	RMS voltage of the main power supply of the drive
PE	Protective Earth

Term	Definition
PPE	Personal Protective Equipment
TEU	Terminal unit

1.3. Structure of the user documentation

The documentation for a standard drive consists of this document and project-specific appendices.

IMPORTANT! The appendices are NOT included in this document. They are delivered separately and generated specifically for your project.

Appendix A – Technical data
Technical data sheets for the drive.

Appendix B – Mechanical drawings
Contains the outline drawings for the drive.

Appendix C – Electrical drawings including parts list
Circuit diagrams with device identification, cross-references, and identification conventions. The diagrams are generated according to the customer-specific project. “Setting of protective devices” is generated for your project. The parts list is a complete list of all components with identification information.

Appendix D – Signal and parameter table
Contains descriptions of actual signals, control and status words, control parameters, and their default settings.

Appendix F – Test reports and certificates
Contains the test reports for the drive. This appendix can also include quality certificates, and applicable codes and standards if they are necessary for your project.

Appendix G – Additional manuals / options
Manuals for additional equipment (pulse encoders, fieldbus interfaces) and information about modifications to the standard drive.

1.4. Related documents

1.4.1. Service documents

Title	Document ID.
MEGADRIVE-LCI preventive maintenance schedule	3BHS855047 E01
Ethernet - NETA-21 remote monitoring tool user manual	3AUA0000096939

1.4.2. Specifications and guidelines

Title	Document ID.
Auxiliary power and control cables guideline	3BHS813742 E01
Power cables engineering guideline	3BHS542290 E01

1.4.3. Manuals

Title	Document ID.
Functional safety Manual	3BHS919411 E77
Recycling Instruction	3BHS003100 E71
DCS880 Manual	3ADW000462R0601
DCT880 Manual	3ADW000441R0401
Synchrotact 6 Manual	3BHS846201 E01

1.5. Target groups and required qualifications

The drive presented in this manual is part of an industrial environment where voltages are present that contain a potential hazard of electric shock and/or burn. For this reason, only personnel who have a thorough knowledge of the drive and the industrial environment and have obtained the required qualification must handle, install, operate, or maintain the drive.

The manual addresses personnel who are responsible for unpacking, transportation, installation, operation and maintenance of the equipment. The personnel must carry out the below listed tasks in a manner that does not cause physical harm or danger, and to ensure the safe and reliable functioning of the drive.

IMPORTANT! Commissioning of drive equipment must only be performed by qualified and certified personnel.

1.5.1. Handling

The personnel must be skilled and experienced in unpacking and transporting heavy equipment.

1.5.2. Mechanical installation

The personnel must be qualified to prepare the installation site according to the site and equipment requirements and to perform the installation accordingly.

1.5.3. Electrical installation

The personnel must have a sound knowledge of the relevant electrical codes and specifications covering low and medium voltage equipment, be experienced with electrical wiring principles, and know the electrical symbols typically used in wiring diagrams.

1.5.4. Operation

The personnel include all persons who operate the equipment from the local operating panel of the drive. The personnel must know the functions of the operating panel, be adequately trained for the drive, and know the driven process. Special knowledge of frequency converter technology is not required.

1.5.5. Maintenance

The personnel include all persons who:

- Are qualified to carry out preventive and corrective maintenance on the drive as described in this manual
- Are thoroughly familiar with the drive
- Have a sound knowledge of the relevant electrical codes and specifications covering low and medium voltage equipment
- Are able to assess the hazards associated with the energy sources of the drive system and act correspondingly
- Know the safe shutdown and grounding procedures for the drive system

1.6. Intended use of the equipment

Those in charge of the drive must ensure that the equipment is only used as specified in the contractual documents, operated under the conditions stipulated in the technical specifications and on the rating plate of the drive, and serviced in the intervals as specified by ABB.

Use of the drive outside the scope of the specifications is not permitted.

Intended equipment use also implies that only spare parts recommended and approved by ABB must be used.

Unauthorized modifications and constructional changes of the drive are not permitted.

1.7. Cyber security features

The following sections describe the cyber security features of the drive.

1.7.1. Software security

The cyber security robustness of the drive is achieved with technical solutions (security features on the component level) as well as using the following best practices when you integrate the drive into your system and when you interact with the drive:

– Isolate drive control network (`172.16.0.0`) from other networks.

– Restrict drive connections to the interfaces in Table 1.

Table 1 – Drive connection interfaces

Connection type	Interface
Drive control (remote)	Hardwired IO or fieldbus
Data collection (local)	USB ports on control terminal (LCT)
Data collection and monitoring (remote)	Remote access gateway

– Scan USB flash drives for viruses/malware before you connect them to the LCT.

– Route Ethernet-based bus communication (if existing) for the plant control system through a protected control network infrastructure that is isolated from the Internet.

– Follow the remote access gateway setup recommendations to establish a network connection to the ABB Ability platform.

– Restrict physical access to the drive and control network access to authorized personnel.

– Only allow control network access for drive servicing by qualified personnel.

1.7.2. PEC controller security features

The PEC controller software fulfills the minimum cyber-security requirements by using security features of AC 800PEC platform. The following Ethernet ports are open by default to ensure that the system operates properly.

Table 2 – Open Ethernet ports for PEC controller software

Port	Service	Usage
22/tcp	ssh/sftp	Secure communication with AC 800PEC controller (used by AC 800PEC Tool, LCT, Shell Terminal)
8080 / tcp	http-proxy, gSOAP soap2.8	SOAP communication with AC 800PEC controller
8081 / tcp	blackice-icecap, gSOAP soap2.8	SOAP communication with AC 800PEC controller
102 / tcp	mms/IEC61850	MMS Server (only running with Industrial IT), IEC61850
123 / udp	ntp	Network Time Protocol: Synchronize computer clock times in a network of computers.
5002 / udp	rfe/PEC Scanner	For scanning controller over network (used by AC 800PEC Tool)
23 / tcp	telnet	Remote access through PEC tool
68 / tcp	dhcp	DHCP Scanning controller over network (used by AC800 PEC Tool)
147 / tcp	iso-ip	Remote Job entry
502 / tcp	mbap	Modbus Application Header
2423 / tcp	rnrp	Resource Naming and Reservation

Table 2 – Open Ethernet ports for PEC controller software (continued)

Port	Service	Usage
2757 / tcp	cnrp	Remote access and control of network devices

The AC 800PEC controller is also equipped with a serial port that provides a root shell for a user to directly change a password. This port must be secured and only made accessible to authorized persons.

IMPORTANT! Connecting the serial port to a remote terminal server to gain access the serial port remotely can create security risks. Exposure of the Ethernet ports, serial port or controller password to unauthorized persons can create significant security risk.

1.7.3. Control terminal (LCT) security features

The LCT Ethernet interface (AC 800PEC) is used for the internal exchange of drive data.

The main security features of the LCT are:

– System files are write-protected
  A few storage locations for user data and settings do not have write protection.

– LCT regularly reboots from write-protected system storage to restore the original state and configuration of the LCT operating system

– Unused ports (Ethernet and others) are disabled or blocked.
  Ports and services that are required by the system are left open and are described in Table 3.

Table 3 – Opens ports for the LCT

Port	Service	Usage
102 / tcp	MMS	Communication with AC 800PEC controller
135 / tcp	msrpc	Windows service
139 / tcp	NetBIOS-ssn	Windows service
445 / tcp	Microsoft-ds?	Windows service
3050 / tcp	Gds_db	Database access
3389 / tcp	ms-wbt-server	Windows service
5040 / tcp	CDP	Windows external devices communication
7680 / tcp	WUDO	Windows Updates Optimization
49664 / tcp	WinInit	Windows startup
49665 / tcp	EventLog	Logging windows events
49666 / tcp	Schedule	Task scheduling
49667 / tcp	SessionEnv	Remote Desktop configuration
49668 / tcp	Spooler	Printer communication
49669 / tcp	PolicyAgent	Securing TCP/IP connections
49670 / tcp	Services.exe	Windows services control
49672 / tcp	Vaultsvc, KeyIso, SamSS	Windows credential and accounts management
137 / udp	NetBIOS-ns	Windows service
138 / udp	NetBIOS-dgm	Windows service
147 / udp	iso-ip	Used for automatic detection of other OPC nodes on the network
500 / udp	ISAKMP	Cryptographic key management
2423 / udp	RNRP	Routing in redundant industrial networks

Table 3 – Opens ports for the LCT (continued)

Port	Service	Usage
3339 / udp	RNRP	Routing in redundant industrial networks
3389 / udp	ms-wbt-server	
4500 / udp	NAT-T.IKE	NAT traversal
5050 / udp	CDP	As 5040/tcp but connectionless
49665 / udp	unknown	Used for automatic detection of other OPC nodes on the network

1.7.4. List of software accounts

The following tables contain the login credentials.

Table 4 – Control terminal software accounts

Account description	User	Password
Windows user account (local user account)	LCTuser	N/A (undisclosed)
Windows account (administrator)	LCT	N/A (undisclosed)
LCT Application [a]	Operator Level 1	ABB1
LCT Application [a]	Operator Level 2	ABB2
LCT Application [a]	Operator Level 3	ABB3
LCT Application [a]	Administrator	N/A (undisclosed)

[a] See 9.2.4 User passwords on page 91.

Table 5 – AC 800PEC, LIN-boards, and CIO-boards software accounts

Account description	User	Password
FTP and telnet access	user	N/A (undisclosed)

Table 6 – NETA-21 software account

Account description	User	Password
Configuration interface	Admin	N/A (undisclosed)

1.8. Quality certificates and applicable standards

The following certificates and conformity declarations are available with ABB:

– ISO 9001 and ISO 14001 certificates stating that ABB Switzerland Ltd has implemented and maintains a management system that fulfills the requirements of the normative standards

Table 7 – Standards

Standard	Title
ANSI Z535.6	American national standard for product safety information in product manuals, instructions, and other collateral materials
ISO 3864-2	2004 (E) - Graphical symbols – Safety colors and safety signs – Part 2: Design principles for product safety labels
ISO 7010	2011 (E) - Graphical symbols - Safety colours and safety signs - Registered safety sign
EN 50110	European standard code for electrical work safety
ISO 13849-1	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design, section 6.2.6 Category 3
IEC 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
IEC 60721-3-1	Classification of environmental conditions - Part 3-1: Classification of groups of environmental parameters and their severities - Storage
IEC 60721-3-2	Classification of environmental conditions - Part 3-2: Classification of groups of environmental parameters and their severities - Transportation and Handling
IEC 60721-3-3	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 3: Stationary use at weather-protected locations
IEC 62477-2	Safety requirements for power electronic converter systems and equipment - Part 2: Power electronic converters from 1 000 V AC or 1 500 V DC up to 36 kV AC or 54 kV DC

1.9. Document conventions

The document uses the following signal words, font formats, and symbols.

Safety signal words

Signal word	Description
DANGER!	Risk of death or serious injury.
WARNING!	Possible risk of death or serious injury.
CAUTION!	Possible risk of minor or moderate injury.
NOTICE	Possible risk of equipment damage or incorrect results.

For detailed information on safety signal words, see 2.1.1 Safety signal words on page 21

Information signal words

Signal word	Description
IMPORTANT!	Critical information that you must know.
NOTE –	Additional helpful information.

Font formats

Font format	Description
✓	A condition that must be true, or an action you must do, before you start a task.
1.	A numbered list shows the order of steps in a task. Numbers also refer to items in a figure. For example: “Lift fan (1, Figure 2)” or “Remove cover (3, Figure 2) and…”.
→	A single action you must do, or a list of actions you can do in any order. For example: → Always transport the load in an upright position.
↳	The result after you complete a step.
– •	An item in a list.
☐	An item in a checklist.
`Monospace text`	Software parameters, file names, or code text. For example: `16.02 PARAMETER LOCK`.
Bold text	A safety hazard, a value to enter, or the name of a button, or user interface element. For example, the **Open** command on a software menu.
Blue text	A link to another topic, figure, or table in this document. Blue text can also link to a web page or document on the Internet (for example, a PDF).

Symbols

Symbol	Description
① ② ③	A callout identifies a specific item in a figure. It is close to the item or connected to it with a line. The legend below or beside the figure shows what each callout means.
	A pictogram shows the subject of the text.
	A safety symbol helps to explain a safety message. The symbol can also add to the message or replace part of all of it. For detailed information on safety symbols, see 2.1.2 Safety symbols on page 22.

2. Important safety information

Read this safety information carefully before you work on or near the equipment. If you do not follow these instructions, serious Injury or DEATH can occur. Keep this information for future reference.

2.1. Safety messages and symbols in this document

A safety message explains a hazard, its potential consequences, and the actions required to avoid it. Safety messages can include signal words, symbols, or graphics.

This document uses ANSI Z535.6 signal words, ISO 7010 and IEC 60417 symbols, and ISO 3864-2 colors for safety messages.

2.1.1. Safety signal words

Safety signal words identify the level of risk to personnel in a safety message or indicate possible equipment damage. Where the risk is obvious, a general warning symbol may be used without a signal word.

Signal word	Definition
⚠DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠CAUTION	CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	NOTICE is used to address practices not related to physical injury, but which can result in equipment damage.

2.1.1.1. Signal word formats

This document uses signal words in two formats:

– Signal word panels

– Embedded signal words

Signal word panels
Signal word panels are used at the beginning of a section. They are followed by a safety message that applies to the topics in the section.

Example:

⚠DANGER

Hazardous voltage! Contact with energized components can cause serious injury or DEATH!

→ Keep the doors closed during operation.

Embedded signal words
Embedded signal words are used in procedures or other text. They are followed by a safety message at the point of use.

Example:

1. Tighten the mounting bolt to the torque that is specified in Table xx.

   NOTICE Excessive torque can break the bolt.

2.1.2. Safety symbols

This is the ISO 7010 general warning symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Symbol	Description
	Refer to the instruction manual
	Electrostatic discharge susceptibility
	Warning, electrical hazard
	Warning, arc flash
	Warning, overhead load
	Warning, heavy load

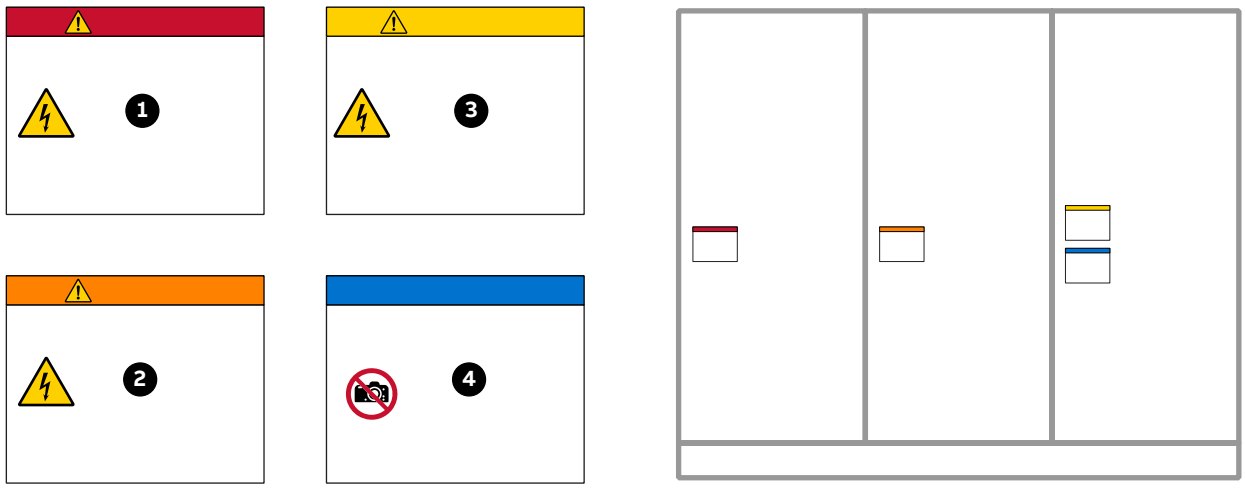
2.2. Product safety labels

Product safety labels on the equipment alert you to the hazards that can occur when you work on or operate the equipment.

– Always follow the instructions on the labels to avoid the hazard

– Keep the labels in a perfectly legible condition

For the location of the labels, see the label placement document for the drive.



Key

1. Danger label
2. Warning label
3. Caution label
4. Notice label

Figure 1 – Product warning label examples (label placement depends on the drive)

2.3. Electrical safety

The following electrical safety instructions are based on EN 50110.

2.3.1. General safety instructions

1. **Minimize hazards.**
2. **Before energizing the drive:**
   - Remove all foreign objects are from the drive
   - Fasten all internal and external covers securely
   - Close, lock, and/or bolt all doors
   - Move the release dial of the door safety switches into the locked position
3. **Before working on the drive:**
   - Turn off, lock out, and tag out the main and auxiliary power supplies to the drive
   - De-energize the drive
   - Ensure that the safety ground connections are in place
   - Ensure that the appropriate personal protective equipment (PPE) is available and used when required
   - Inform the involved personnel about the potential safety hazards
   - Wear hearing protection when a drive is running.
4. **Before working simultaneously on the drive and on other drive system equipment:**
   - Observe the relevant safety codes and standards
   - Turn off all energy sources for the equipment
   - Ensure that all lockout and tagout devices are in place
   - Install barriers around and use appropriate covers on the equipment that is still energized
   - Inform the involved personnel about the potential safety hazards
5. **In case of fire in the drive room:**
   - Observe the established rules and regulations for fire safety
   - Only allow firefighters with the appropriate PPE to enter the drive room

2.3.2. The 7 steps that save lives

ABB's 7 steps that save lives concept is a series of actions that must take place prior to commencing work on or near electrical installations.

1. **Prepare for the work: do an on-site risk assessment or job hazard analysis that considers the limits of approach for shock and arc-flash.**
   - Be in possession of a clear work order to execute the work.
   - When required, the access or work permit is to be obtained by a person who is authorized for the specific electrical system.
   - Engage the person responsible for electrical equipment or system to review single-line diagrams, schematics, switching plans, etc.
   - Ensure the competence of workers.
   - Check for proper tools for the job.
   - Determine and select the proper arc-rated Personal Protective Equipment (PPE).
   - Decide of the appropriate work methods and initiate the Permit To Work (PTW) process.

2. **Clearly identify the work location and equipment.**
   - Use your senses (sight, hearing and smell) to identify problem areas.
   - Define the work area via barriers and barricading and label equipment.
   - Avoid distractions such as talking or texting on the phone.
3. **Disconnect all sources of supply and secure against reconnection by applying Lockout/ Tagout.**
   - If ABB is responsible for switching and it cannot be done remotely, then the person performing the switching must be properly trained and wearing the proper PPE identified in step 1.
   - The Person in Charge of Work (PICW) must ensure that switching is performed in the proper manner by witnessing it from a safe distance if present on site or by engaging the person responsible for switching to identify all isolation points.
   - Apply Lockout/Tagout (LOTO) to the energy isolation device and if multiple energy isolation devices are involved, then Group LOTO must be implemented with the PICW serving as the Group LOTO Leader.
4. **Verify the absence of operating voltage: always test before you touch!**
   Only use properly rated and inspected voltage detection devices and wear proper PPE identified in step 1:
   - Test voltage detection device
   - Test for voltage
   - Test voltage detection device

   It is highly important that the voltage detection device is tested on a known voltage source such as a Proving Unit or by performing an internal self-test, according to the manufacturer's instructions, before and after testing for the absence of operating voltage.
5. **Carry out earthing and short-circuiting.**
   - Close and lock the earthing switch if the electrical equipment is designed for this purpose or apply portable equipment for earthing and short-circuiting.

   If this is carried out by the customer, then the PICW must ensure that this equipment is properly earthed as a part of the integration/verification and during step **7** when the PICW walks the PTW.
6. **Protect against adjacent live parts and take special precautions when close to bare conductors.**
   - Determine minimum approach distances, apply screening or shrouding, and when applicable, padlock both cable and busbar shutters.
   - If working within the restricted approach boundary or vicinity zone where inadvertent movement could cause contact with live parts, special precautions must be employed, such as the use of the properly rated insulated gloves and tools.
7. **Complete the permit to work and "Walk the Permit".**
   - Check isolation points
   - Verify that all circuits are isolated and secured
   - Ensure all parties are integrated with the Lockout/Tagout
   - Check the earths are properly applied
   - Answer specific questions from the working group
   - Ensure the work can proceed without danger
   - Complete and verify the "Permit to Work"

2.3.3. Possible residual risks

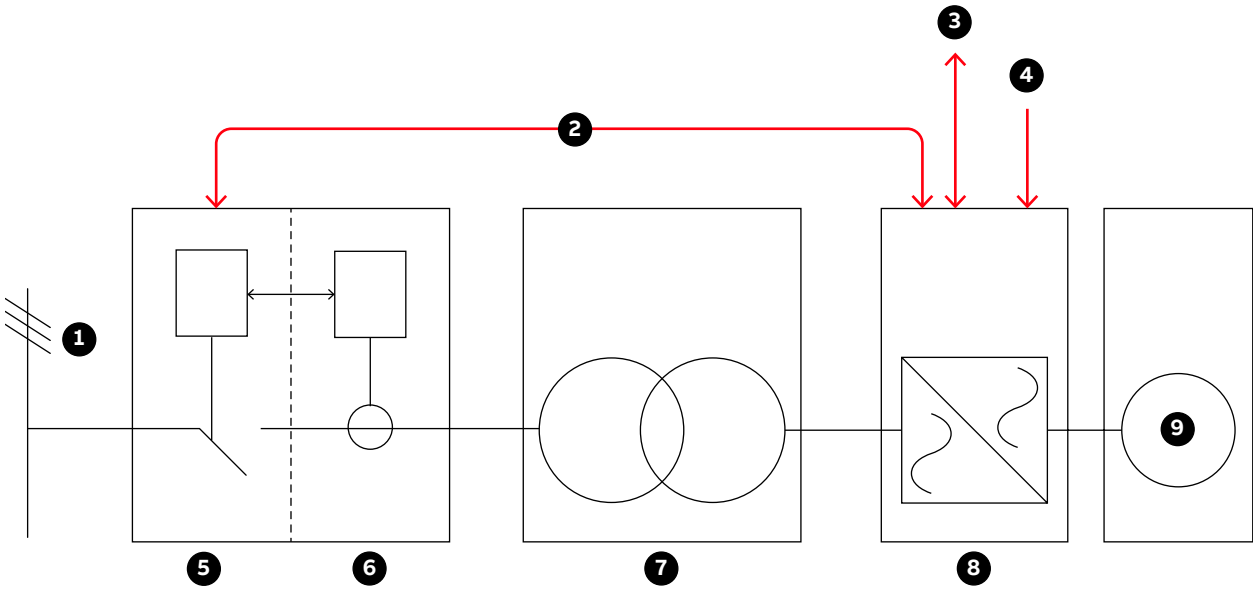
Residual risks must be considered by the drive system integrator and/or plant owner when assessing the hazards of the equipment to personnel. The following risks can pose a hazard to drive system personnel:

1. **Electric power equipment generates electro-magnetic fields which can cause a hazard to people with metal implants and / or a pacemaker.**
2. **Drive system components can move unintentionally when being commissioned, operated, or serviced due to:**
   - Operation of the equipment outside the scope of the specifications
   - Incorrectly assembled or installed equipment
   - Wrongly connected cables
   - External influence on, or damage of the equipment
   - Wrong parameter settings
   - Software errors
   - Faulty hardware
3. **Hazardous touch voltages can be present on drive system components, which can be caused by:**
   - Operation of the equipment outside the scope of the specifications
   - External influence on, or damage of the equipment
   - Induced voltages by external equipment
   - Condensation on equipment components, or pollution
   - Faulty hardware
4. **High temperatures, noise, particles, or gases can be emitted from drive system components caused by:**
   - Operation of the equipment outside the scope of the specifications
   - External influence on or damage of the equipment
   - Incorrect parameter settings
   - Software errors
   - Faulty hardware
5. **Hazardous substances can be emitted from drive system components due to incorrect disposal of components.**

2.4. Important note - main circuit breaker

The input circuit breaker (ICB) is a major protection device of the drive. If a serious fault occurs in the drive, the ICB must disconnect the main power supply to the drive immediately. The main power supply must be disconnected without delay on an open or trip command from the drive to prevent hazard to the personnel and further damage to the equipment.

Depending on the main power supply configuration of the drive system, the ICB is either located on the primary side of the converter transformer or on the primary side of the drive if the drive is connected directly to the line (DTL).



Key

1. Main power supply
2. ICB control interface
3. Higher-level control system
4. Local ICB control
5. ICB
6. Protection relay
7. Converter transformer
8. Drive
9. Motor

Figure 2 – Drive system overview

Figure 2 shows the conceptual single-line diagram of a typical drive system, including main power supply, ICB, converter transformer, drive and electrical motor.

The ICB is defined as a switching device to disconnect the power supply whenever required by the process or when a fault occurs.

Typical ICBs are:

– Vacuum circuit breakers

– SF6 circuit breakers

A dedicated protection relay is used for:

– Transformer or drive primary cable protection (DTL)

– Transformer protection (if applicable)

– Transformer secondary cable protection (if applicable)

– Backing up the drive protection

2.4.1. Safety and protection requirements

For safety and protection reasons, the ICB must meet the stipulated minimum requirements of the specifications of ABB Medium Voltage AC drives. It is the system integrator's responsibility to ensure that the minimum requirements are met. The minimum requirements for the ICB are stated in this note and in the respective ICB specifications, which are available for each medium voltage drive from ABB.

The safety requirements for the drive are based on the following standards:

– ISO 13849-1

– IEC 60204-1

2.4.2. Minimum requirements for ICB and ICB control

– ICB open and/or trip command must be wired directly from the drive to the ICB.

  It is not permitted to wire the trip command through any PLC or DCS system if it is not certified to meet SIL 3 level requirements and to fulfill the timing requirements outlined below.

– Maximum opening time of the ICB must never exceed the product or project-specific maximum time defined in the ICB specifications.

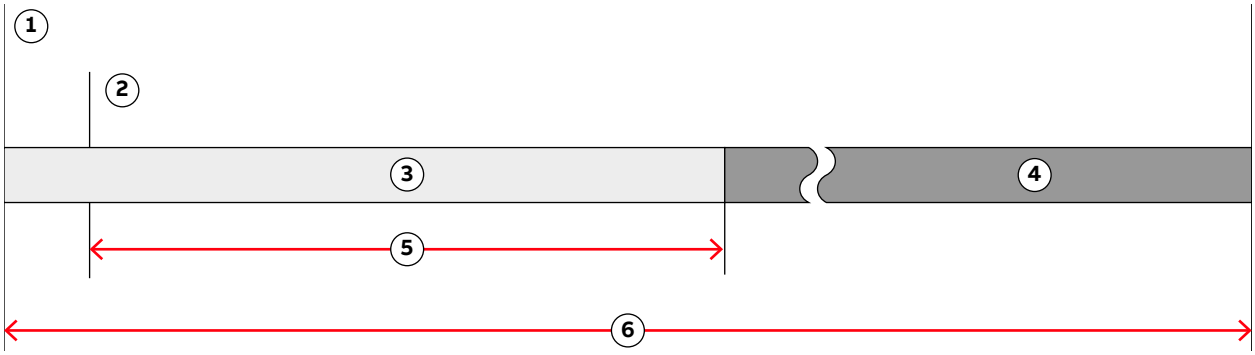
Typical maximum values for the drive are defined as follows:

– **Maximum protection trip time:** not applicable

  The maximum protection trip time is the maximum allowed breaking time (open and arcing) of the breaking device after the open command has been initiated to prevent further damage to the drive, eg, diode failures.

– **Maximum safety trip time:** 500 ms

  The maximum safety trip time is the maximum allowed time to ensure safe disconnection of the main power supply to prevent any hazard to personnel.



Key

1. Short-circuit occurs
2. Open and or trip command is set at the drive control output
3. No further damage to the drive
4. No hazard to personnel
5. Maximum protection trip time
6. Maximum safety trip time

Figure 3 – ICB opening timing diagram

In order to meet the stipulated safety requirements, ABB recommends one of the following:

– ICB with 2 independent opening coils

– ICB with 1 opening coil and 1 undervoltage coil for monitoring of the control voltage

– Upstream protection coordination scheme: Uses the “breaker failure” (ANSI 50BF) signal to automatically trip the upstream circuit breaker if the ICB does not open.

  IMPORTANT! The upstream breaker must open within the maximum safety trip time after a failure has occurred.

2.5. Maintenance recommendation

The ICB trip circuits should be checked annually.

3. Hardware and features of the drive

3.1. Overview

The MEGADRIVE-LCI is a variable speed drive for continuous operation (LCI.DR), soft starting (LCI.SO) of synchronous machines and for starting gas turbines (LCI.ST).

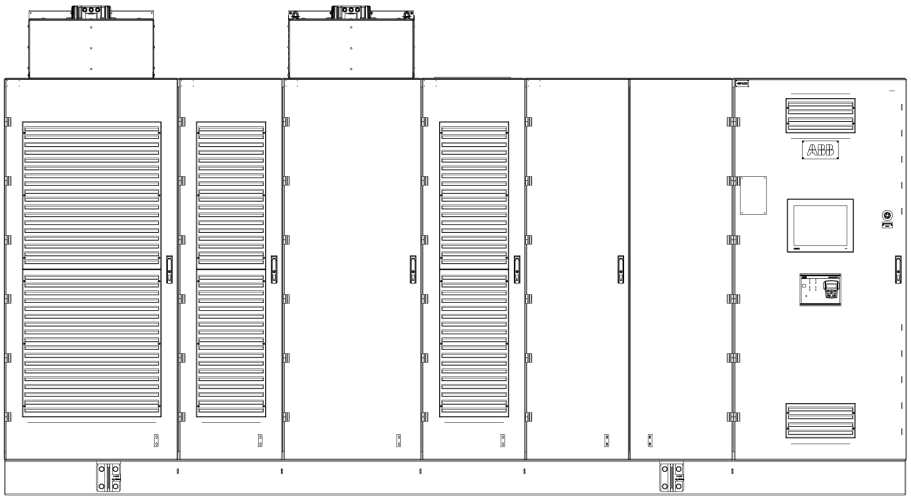


Figure 4 – MEGADRIVE-LCI air-cooled example

For more information on the drive and applicable power and voltage, see:

– Appendix A - Technical data
– Appendix B - Mechanical drawings
– Appendix C - Electrical drawings including parts list
– Rating plate on the drive

Drive configuration

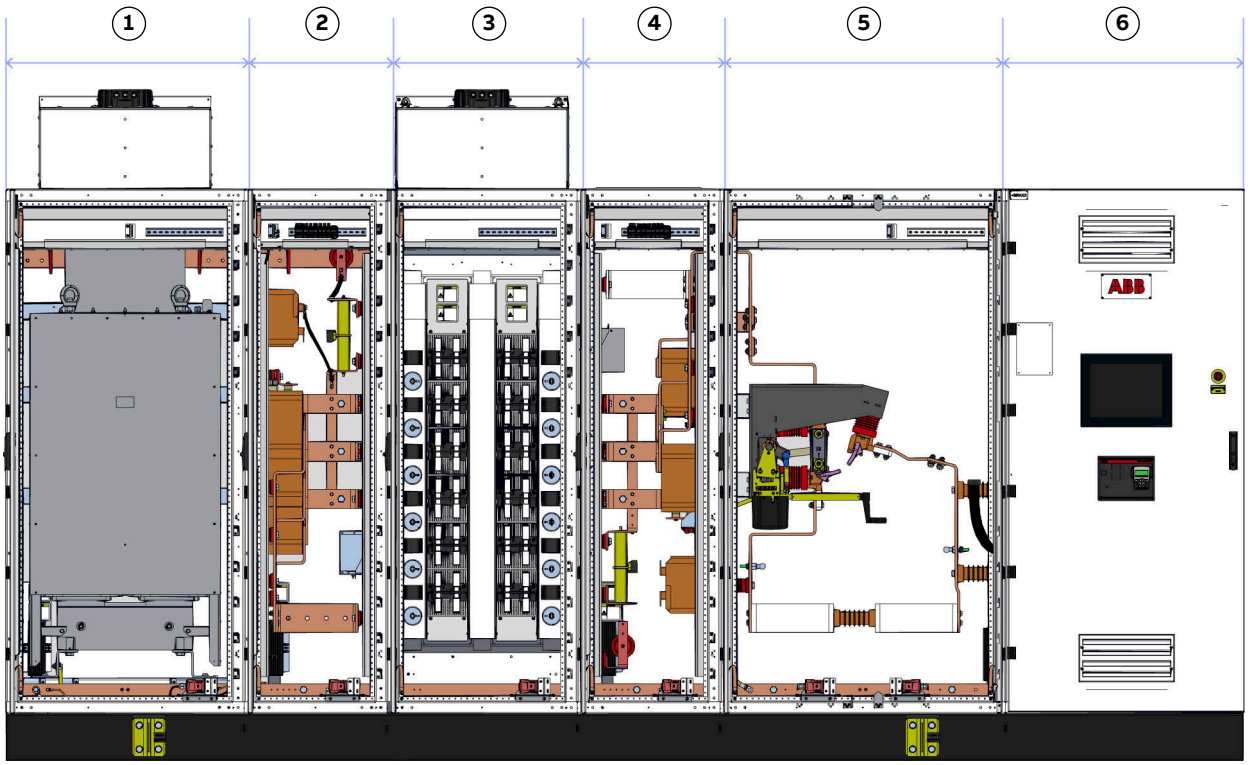
The drive configuration and size depends on the application. The following sections provide an overview of:

– General units
  • Converter unit
  • Line-side and motor-side terminal unit
  • DC-link unit
  • Control unit
  • Cooling system
– Application-specific units
  • Excitation unit
  • Synchronization unit
  • Bypass disconnector for output transformer
– Other features
  • Door locking
  • Optional heating

3.2. General units

Each drive includes at least one of the following units shown in Figure 5, regardless of the application or configuration:

- Converter unit (rectifier and inverter)
- Line-side and motor-side terminal unit
- DC-link unit
- Control unit
- Cooling system



Key

1. DC-link unit
2. Line-side terminal unit
3. Converter unit
4. Motor-side terminal unit
5. Bypass disconnector unit
6. Control unit

Figure 5 – Drive overview

3.2.1. Converter unit

A converter unit consists of a rectifier and an inverter. Both use thyristor stacks of identical design and also contain heat sinks, snubber circuits and gate firing circuits.

The rectifier converts the supply current to direct current. The inverter then converts the direct current into a three-phase alternating current that modulates into variable frequency and voltage depending on the process requirements.

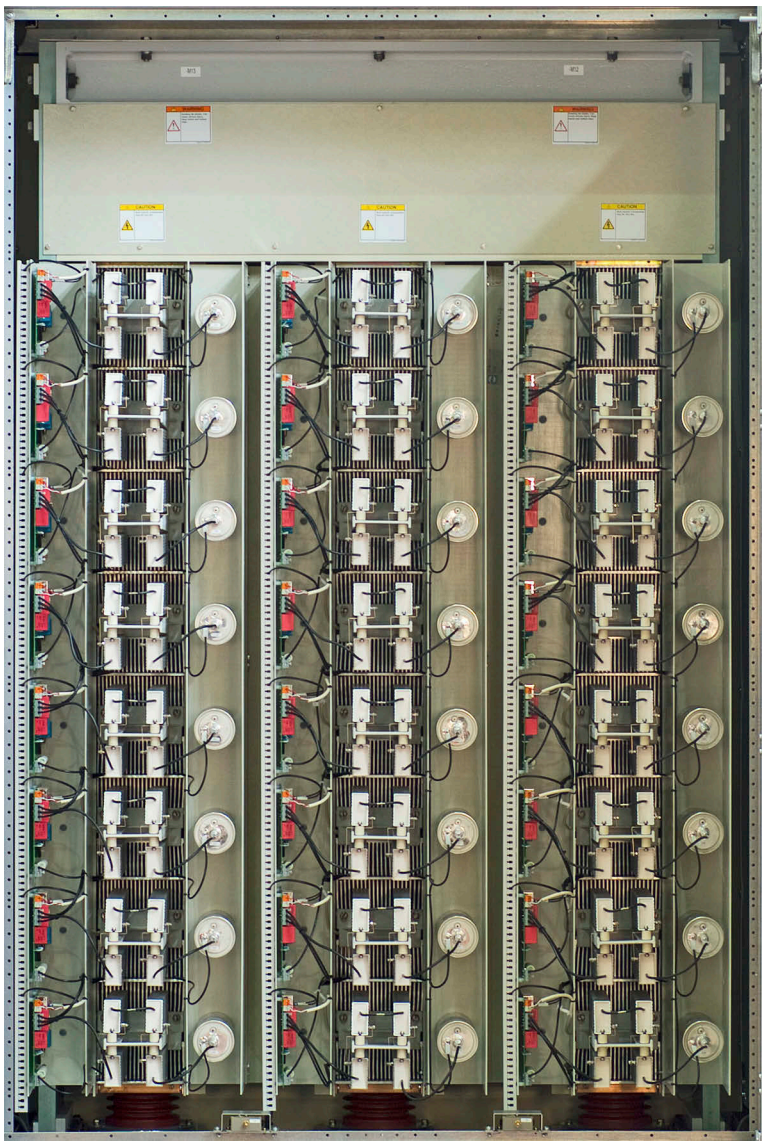


Figure 6 – Air-cooled thyristor stacks example

3.2.2. Line-side and motor-side terminal unit

The standard terminal unit (one installed for each 3-phase system) consists of the following main components:

- Busbars for the connection of the power cables from the transformer or to the motor
- Cable entry plates
- Required measuring and protection equipment (current and voltage transformers, surge arrestors)
- Control interface (LIN)

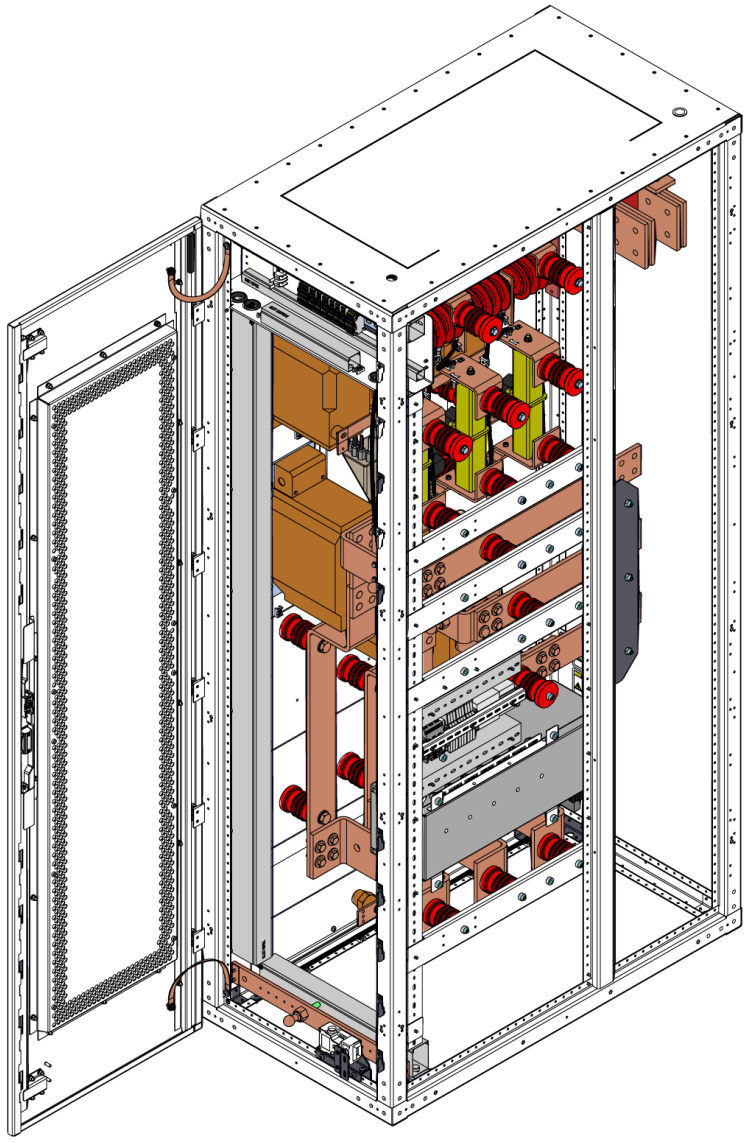


Figure 7 – Terminal unit example

3.2.3. DC-link unit

The DC-link unit has an iron core inductor and is usually part of the drive cabinet, whereas some specialized drive systems use an external air or iron core inductor instead.

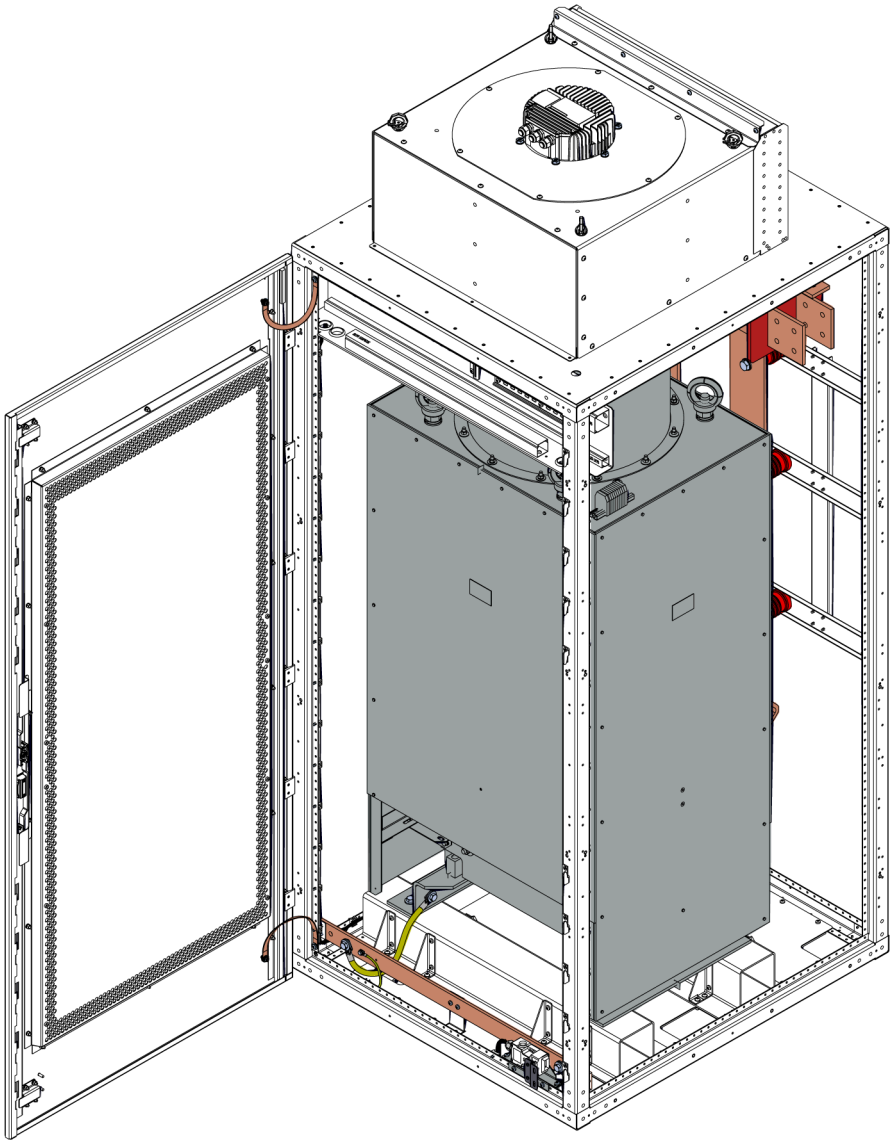
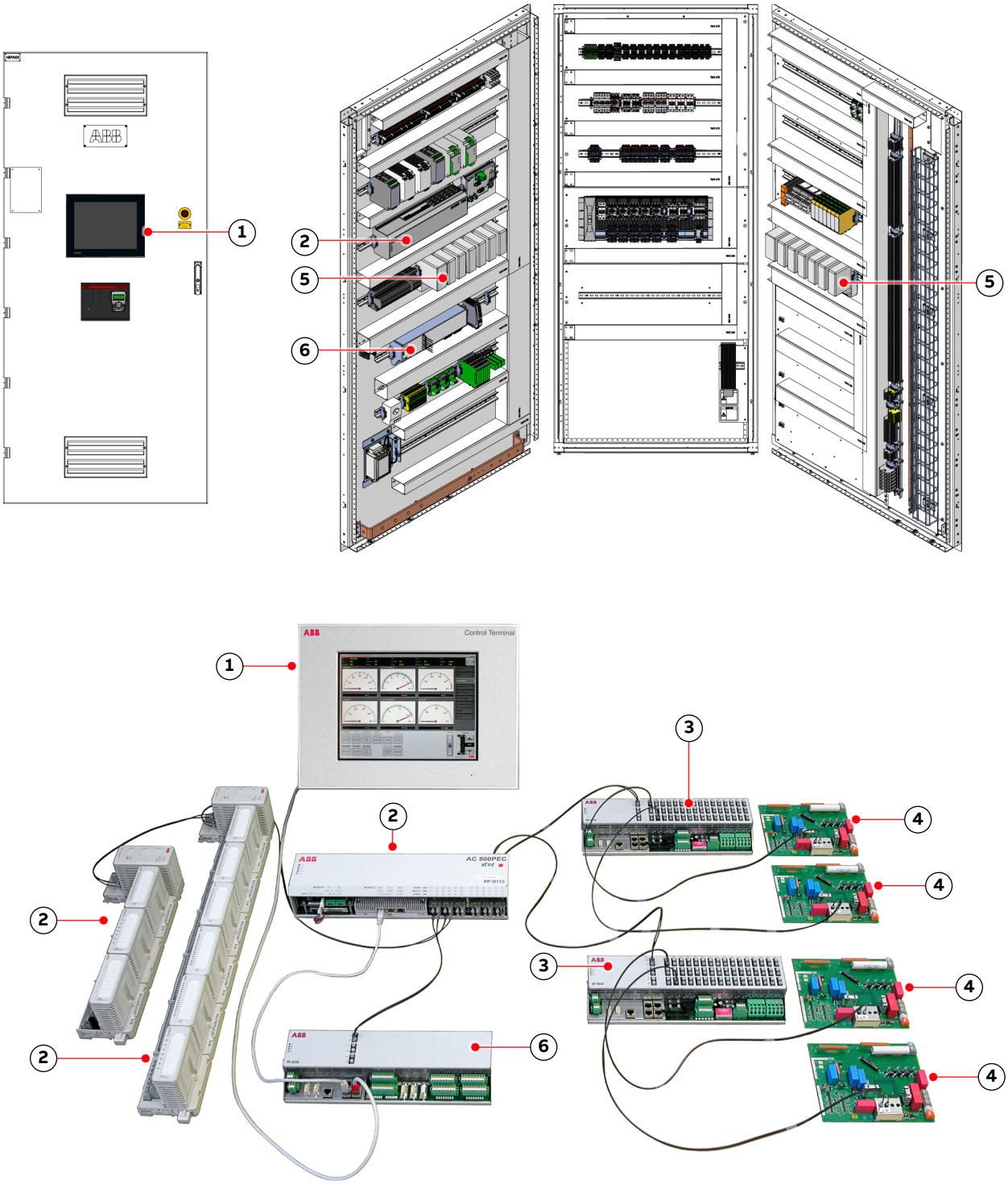


Figure 8 – Air-cooled DC-link unit example with iron core

3.2.4. Control unit

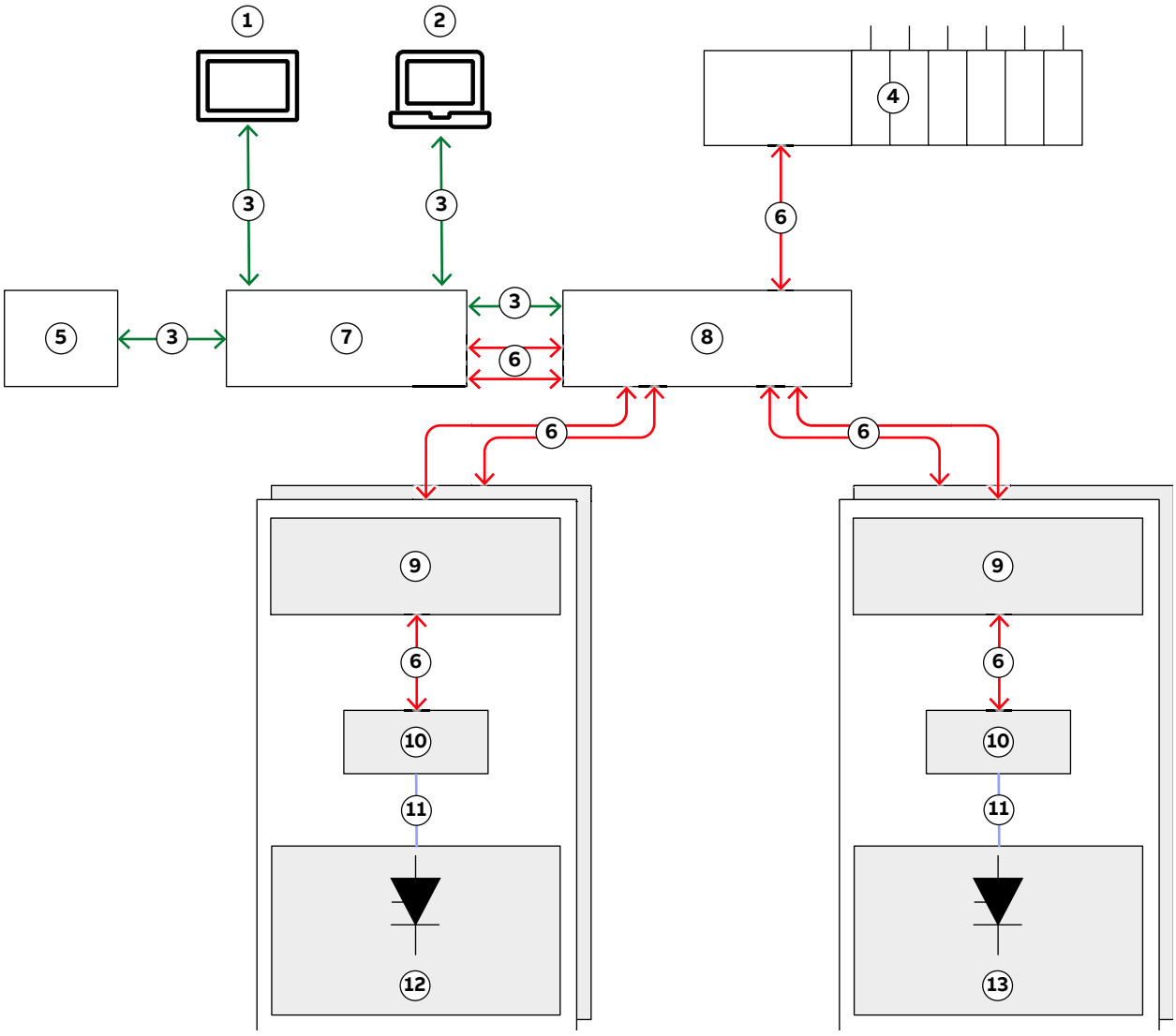


Key

1. Control terminal (LCT)
2. AC 800PEC
3. LCI converter Interface board (LIN)
4. Gate firing circuits (MV-GDR or GDI)
5. S800 I/O system
6. Combined Input/Output (CIO)

Figure 9 – Control unit

3.2.4.1. Main components



Key

1. LCT
2. PC
3. Ethernet
4. S800 - slow I/O
5. NETA-21
6. Optical fiber cable
7. CIO - Fast I/O
8. AC 800PEC
9. LIN
10. Gate driver
11. Analog signals
12. Converter line side (rectifier)
13. Converter Machine side (Inverter)

Figure 10 – Control system

AC 800PEC

The control part of the MEGADRIVE-LCI uses the AC 800PEC controller. The controller is the major component of the drive control system and performs general drive, motor control, and closed loop functions. The main internal control devices and the peripheral input and output interfaces to the customer communicate with the controller via optical fibers. It is a high-speed control system, with modules arranged according to the process and the required I/O configuration.

Figure 11 – AC 800PEC controller

Peripheral I/O devices

The peripheral input and output devices connected to the AC 800PEC include:

- Control terminal (LCT)
- Local interfaces (LIN)
- Gate firing circuits (MV-GDR or GDI) connected via LIN
- S800 I/O system
- Combined input/output unit (CIO)

LCT control terminal

The Microsoft Windows-based control terminal is used to:

- Display current values, status messages and fault messages
- Reset fault messages
- Display and set parameters
- Operate the drive locally
- Test the drive

For more information on local operation and the control terminal (LCT), see 8 Operation on page 74 and 9 Local control terminal on page 84.

LIN

Each LIN controls a 6-pulse thyristor bridge and fires the thyristors according to the magnetic or indirect light firing principle. It connects to the AC 800PEC via fast fiber optics and provides analog inputs for converter voltages and currents as well as digital contact inputs.

Gate firing circuits

Depending on the numbers of thyristors per branch, different firing principles apply.

– If the drive has one thyristor per branch (ns=1), it follows the magnetic firing principle and uses a gate driver interface (GDI) and pulse transformers for gate firing.

– If the drive has more than one thyristor per branch, it follows the indirect light firing principle and uses an MV gate driver (MV-GDR) for gate firing.

S800

The S800 provides an interface for processing slow analog and digital signals.

CIO

The CIO provides an interface for processing fast analog and digital signals.

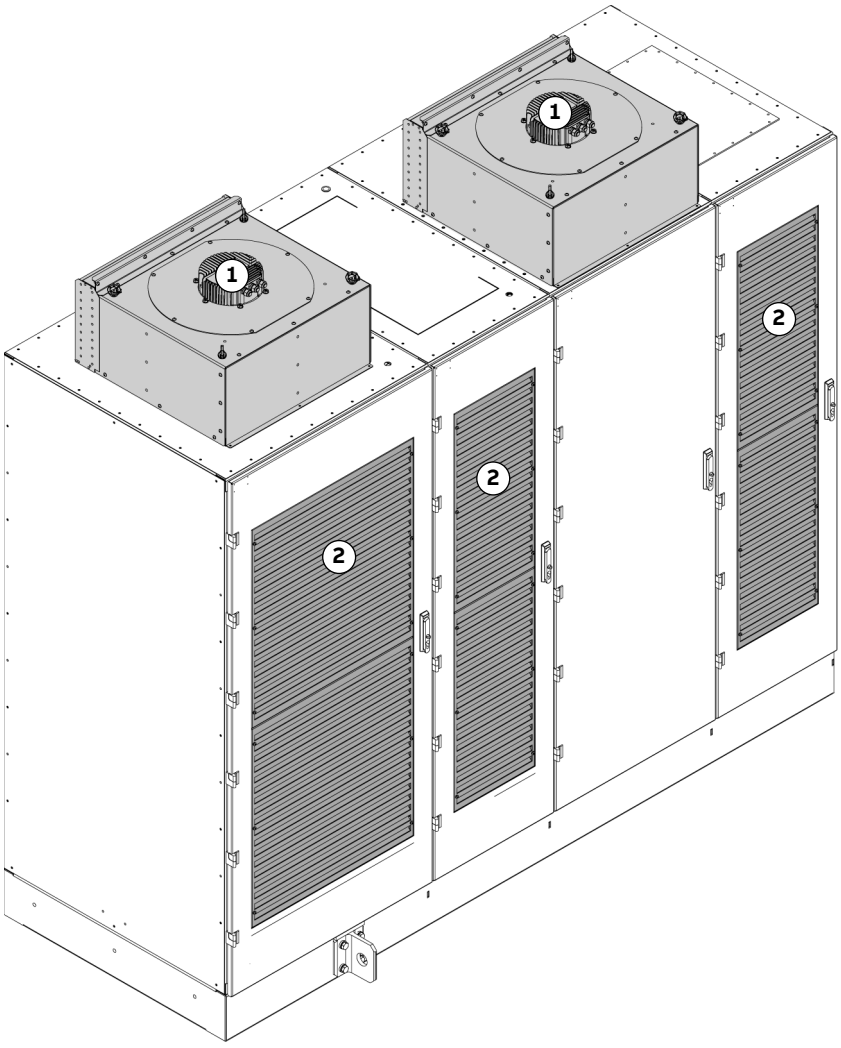
3.2.5. Cooling system

The cooling system consists of the following components:

– Fans

– Air inlets in the doors

– Filter mats (option) in the air inlets



Key

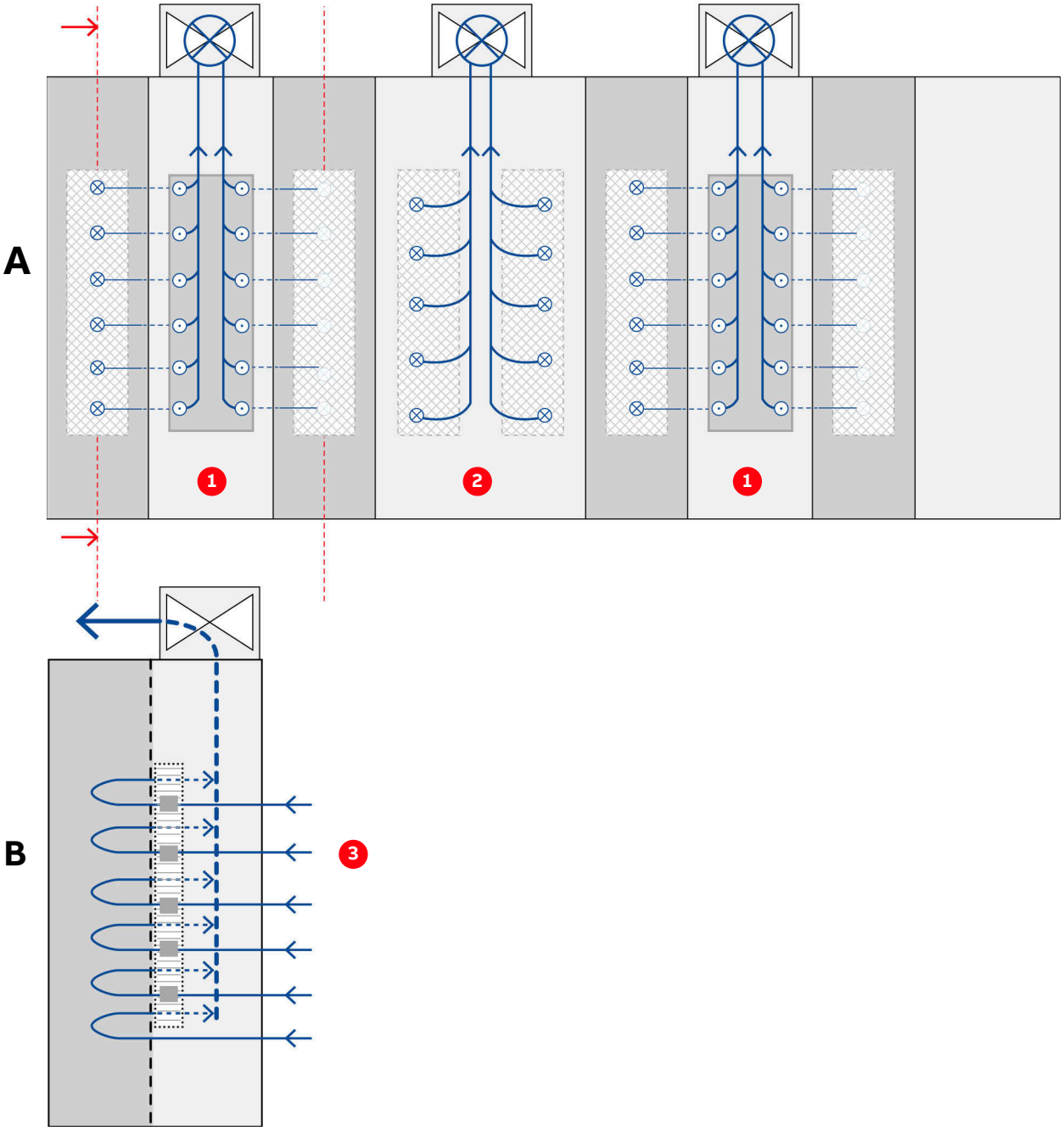
1. Fans
2. Air inlets (optional filter mats inside)

Figure 12 – Air cooling system example

3.2.5.1. Cooling circuit

The fans are installed on the roof of the converter units (1, 3, Figure 13) and inside the DC-link unit (2, Figure 13). The fans draw in the cooling air through the louvered door panels, feed the air to the power electronics components (thyristor stacks, DC-link unit), and transfer the heat to the outside of the

cabinet.



Key

1. Converter unit
2. DC-link unit
3. Front

Figure 13 – Air flow

3.3. Application-specific units

If the drive is used for speed / torque control (LCI.DR) or soft starting (LCI.SO), it may also include the following units:

– Excitation unit (standard in LCI.DR)

– Bypass disconnector for the output transformer (used in LCI.SO only)

– Synchronization unit (used in LCI.SO only)

For more information on the drive, see Appendix B - Mechanical drawings and Appendix C - Electrical drawings including parts list.

3.3.1. Excitation unit

Excitation systems provide rotor current supply and are required for synchronous machines.

– LCI.DR converter: has an excitation unit in a dedicated cabinet compartment.

– LCI.ST and LCI.SO applications usually interface with external excitation systems (outside the converter scope of delivery). If a dedicated start-up excitation is required, the converters also include excitation compartments.

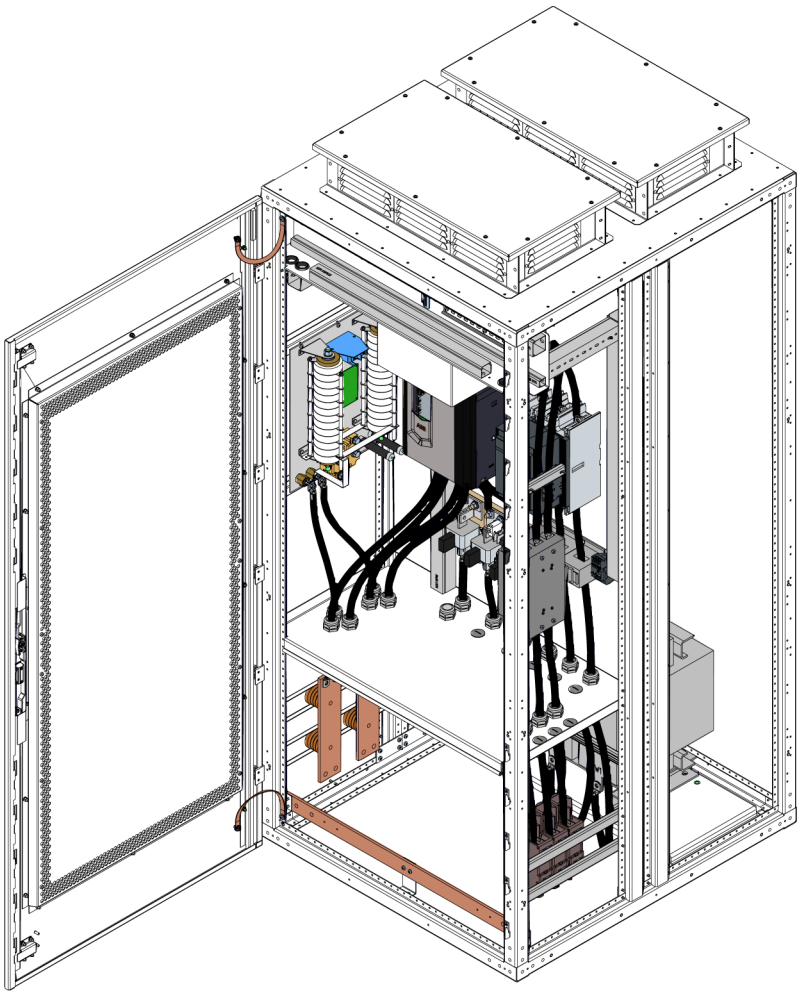


Figure 14 – AC excitation unit example with a redundant fan box – other configurations are also available

Two types of excitation units are available:

– AC excitation unit (ac-EXU) with an AC controller for synchronous machines with brushless exciter

– DC excitation unit (dc-EXU) with a DC controller for synchronous machines with slip rings

Table 8 – Excitation unit by drive type

Type	Standard	Option
LCI.DR	ac-EXU	dc-EXU, with crowbar
LCI.SO	N/A	dc-EXU
LCI.ST	N/A	dc-EXU

3.3.2. Synchronization unit (SYNCHROTACT 6)

The synchronization unit, which is used in soft starting applications (LCI.SO), controls the automatic transfer of motor operation from the drive to fixed frequency line (direct online).

When present, the synchronizing unit is on the control cabinet door of the drive.

All parameters are stored in parameter sets that define the synchronizing conditions and the voltage and frequency matching characteristics.

For more information, see the SYNCHROTACT 6 manual Appendix G - Additional manuals / options.

Figure 15 – Synchronization unit (SYNCHROTACT 6)

3.3.3. Bypass disconnector for output transformer

The bypass disconnector (BPU) is only required for a soft starting application (LCI.SO) that uses an output transformer.

A BPU allows for the bypassing the output transformer to run up the motor in the lower speed range (approximately 10% to 15% of nominal speed). Once the motor reaches a predefined speed, the disconnector switches to transformer position and the drive accelerates the motor to the nominal speed.

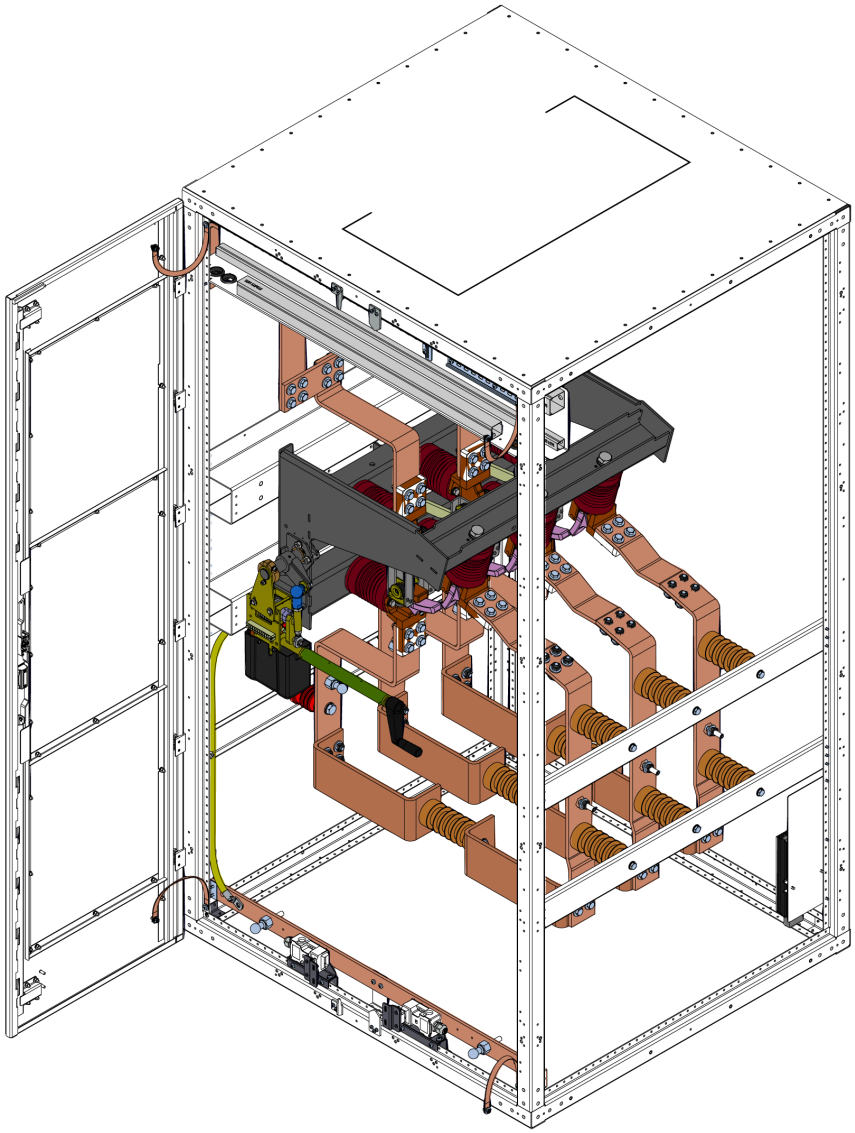


Figure 16 – Bypass disconnector example

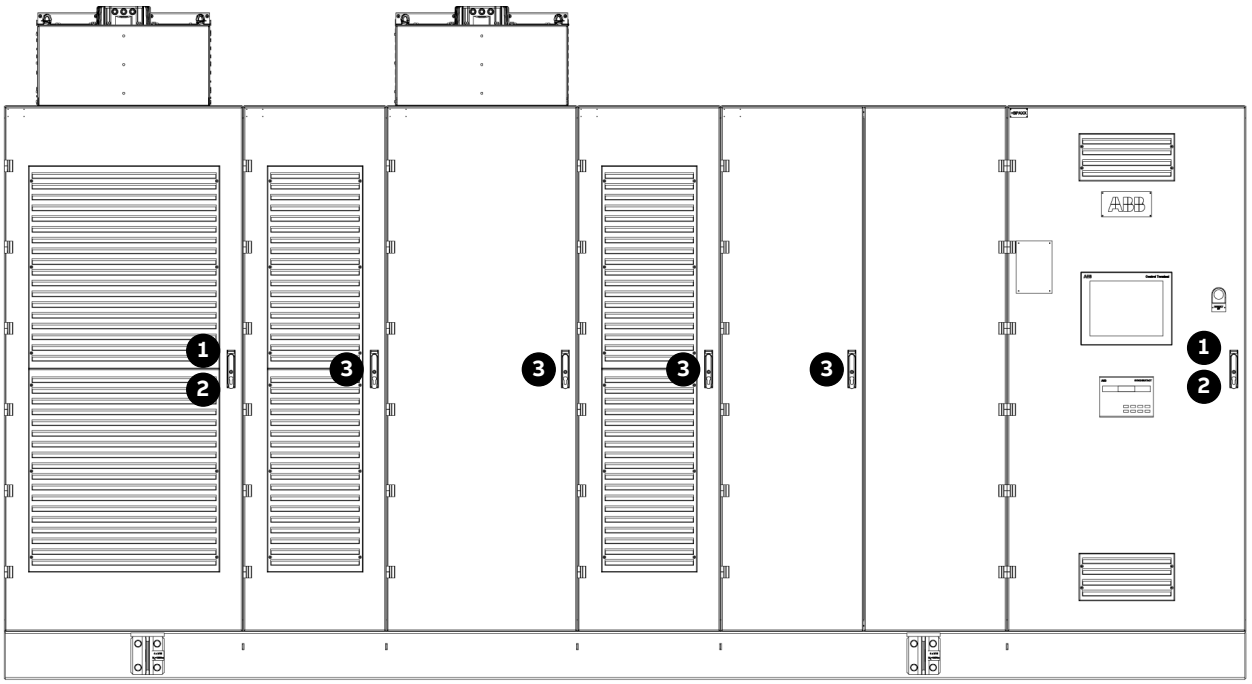
3.4. Other features

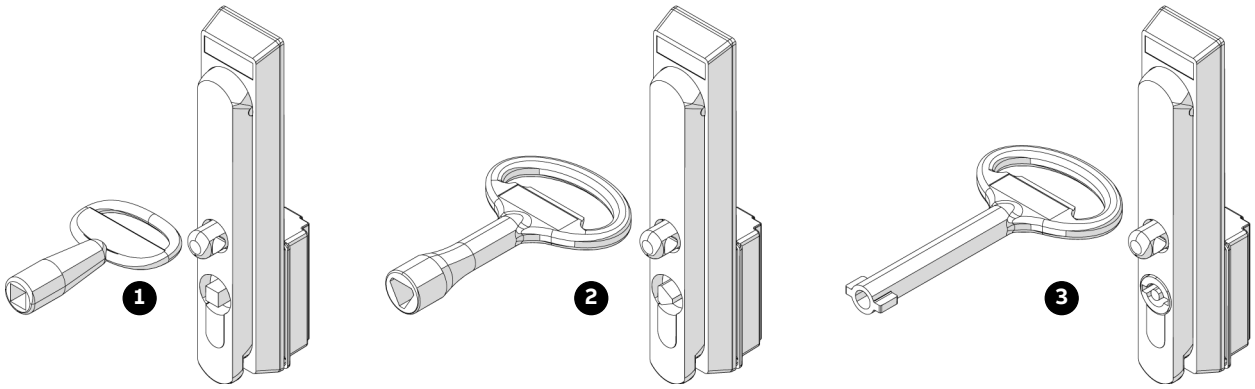
3.4.1. Door locking

To ensure safety and prevent the doors from opening unintentionally, all doors are lockable.

3.4.1.1. Locks and key types

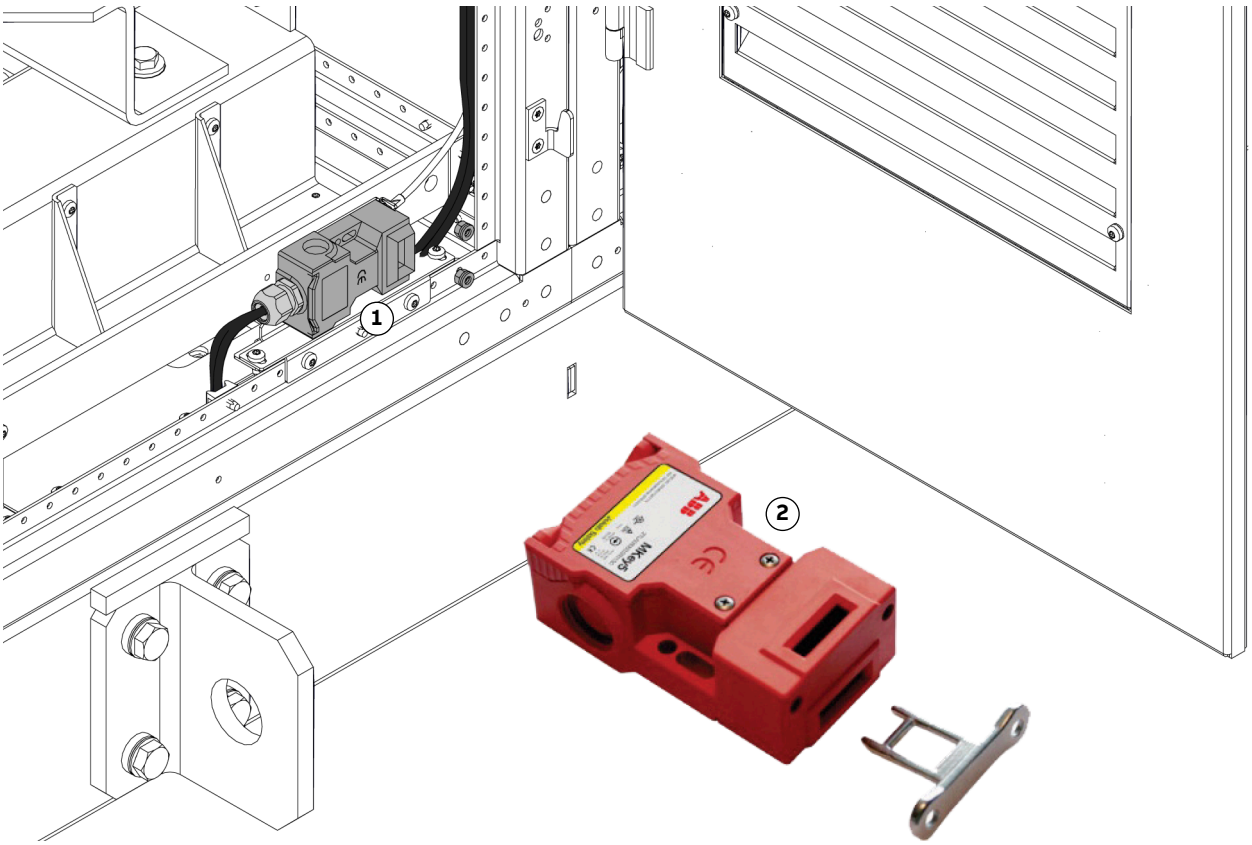
To ensure that only authorized personnel are able to open medium voltage compartments, their locks use different inserts than the locks of the control and excitation unit.





Key	Explanation
1. Square bit key	Control unit and other low voltage units, eg, excitation unit and cooling unit
2. Triangular bit key	Control unit and other low voltage units, eg, excitation unit and cooling unit
3. Double bit key	Converter unit, (if applicable) DC-link unit, line-side terminal unit and motor-side terminal unit

3.4.2. Door safety switches



Key

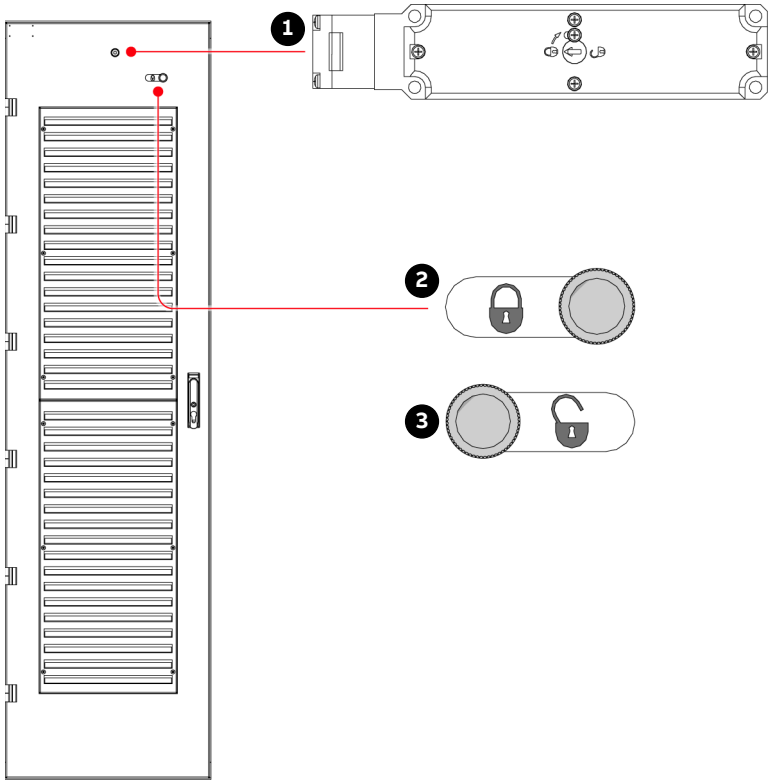
1. Safety switch location
2. Safety switch

Figure 17 – Door safety switch examples

In addition to the locks, door safety switches monitor the doors of medium voltage compartments. When the door is opened, the drive trips. For details on the trip sequence, see the flow chart in Appendix C - Electrical drawings including parts list.

3.4.3. Door safety switches with interlock (option)

Some drives are fitted with optional combined door mounting and interlock safety switches. A safety switch contains an electro-magnetic lock that keeps the door closed until a safe drive state is achieved.



Key

1. Safety switch
2. Locking bar in locked position
3. Locking bar in unlocked position

Figure 18 – Optional door safety switch and interlock

In addition to the following information, see also 8.6 Operation of doors with interlock switches (option) on page 80:

- Only the doors of the medium voltage cabinets are equipped with safety switches
- If one or more doors are open (or not properly closed) a drive trip is triggered. For details on the trip sequence, see the flow chart in Appendix C - Electrical drawings including parts list.
- Interlock mechanism requires control power for operation
- A 'safe state' in general consists of de-energizing and grounding the power part of the drive. For details on the project-specific implementation, see the project documentation for the drive.

3.4.4. Heating system (option)

The optional heating system protects electrical components of the drive from condensation. The heating system consists of heating elements with humidistats and thermostats.

The humidistats and thermostats monitor the humidity and the temperature inside the cabinet. The heating system activates as soon as the temperature falls below and the humidity climbs above their predefined thresholds.

Figure 19 – Heating element

The heating elements are typically installed above the floor plates of control unit, terminal units, DC-link unit and excitation unit.

For more information on the location of heating elements in the drive, see Appendix C - Electrical drawings including parts list.

3.5. Arc resistant design (option)

The optional “Arc Resistant Design” provides the drive with arc fault protection in accordance with IEC 62477-2.

The ABB arc resistant classes in Table 9 indicate the type of arc proofing that a drive uses. Depending on the drive configuration, classes I and II are available for an LCI.W drive.

For information on the arc resistant design class of your drive, see the project-specific “Converter Data Sheet” (Appendix B - Mechanical drawings of the MEGADRIVE-LCI user manual).

Table 9 – ABB arc resistant classes

ABB class	Description
Class I	Protection based on arc prevention (NOT certified according to IEC 62477-2)
Class II	Protection based on arc resistant cabinet structure, IAC certified by 3rd body according to IEC 62477-2
Class III	Protection based on external arc fault limitation and elimination. HV fuses are applied externally to limit the arc fault current, IAC certified by 3rd body according to IEC 62477-2
Class IV	Fast arc detection and elimination, IAC certified by 3rd body according to IEC 62477-2

3.5.1. Internal arc classification (IAC)

The arc fault rating, which is based on arc fault tests, is on the label underneath the drive rating plate of the drive.

Internal Arc Classification (IAC)
ABB Class II

IAC	F	L	R	T	B	I_A	t_A	APR	SC
IEC 62477-2	2b	2b	2b	1	1	23 kA	0.5 s	Yes	No
Distance [m]	0.3	0.3	0.3	-	-				

Certification only in conjunction with a minimum room height of 3.5 meters 3BHB049908R8223

Figure 20 – IAC label example

3.5.2. Limitations and requirements

Arc resistant cabinet design is available for drives that have power cable bottom entry.

A minimum clearance of 900 mm above the pressure relief flaps is required. Pressure relief is triggered at > 10 kPa overpressure within the cabinet.

4. Transportation, storage and disposal

4.1. Safety

The drive must only be handled by personnel who are skilled and experienced in unpacking and transporting heavy equipment.

4.2. Transport conditions

The transport conditions for the drive are based on IEC 60721-3-2.

– **Classification:** 2K12 / 2B1 / 2C2 / 2S5 / 2M4

4.3. Unpacking and inspection

1. Remove all packaging material carefully.
2. Check the drive and accompanying equipment for damage.
3. Compare the complete delivery with the purchase order and the packing list.
4. If parts are missing or damaged, immediately inform the shipping company and the ABB service organization.

It is recommended to photograph the damages and send the photographs to ABB.

4.4. Lifting and transportation

⚠WARNING

Risk of serious injury! Incorrect securing and lifting of loads can cause serious injury and damage the equipment.

→ Lift operations MUST be performed by qualified personnel in accordance with local lifting laws!

→ DO NOT use a forklift

→ Use suitable lifting gear for the load weight, eg, web slings, chain slings, round slings, safety hooks, and shackles; for information on the sling strength and weight, see the transportation drawing in Appendix B - Mechanical drawings

→ Use a lift frame or spreader frame with a crane for the drive

→ Only use the original lifting attachments with the original mounting bolts (and washers where applicable) to transport the equipment

→ Before use, always check the lifting attachments for damage, eg, corrosion and cracks. DO NOT attempt to lift equipment with a damaged lifting attachment; contact ABB for a replacement before you proceed

→ Always transport the load in an upright position

→ Always observe the center of gravity

→ DO NOT lift more than one drive at once

Refer to Appendix B - Mechanical drawings for the relevant dimensions and weight of the equipment as well as the maximum slope angle of the slings.

NOTICE

Risk of component damage. Dirt and metallic dust can cause failure when the drive is energized.

→ Keep cabinet doors closed during lift operations

4.4.1. Lifting attachment types

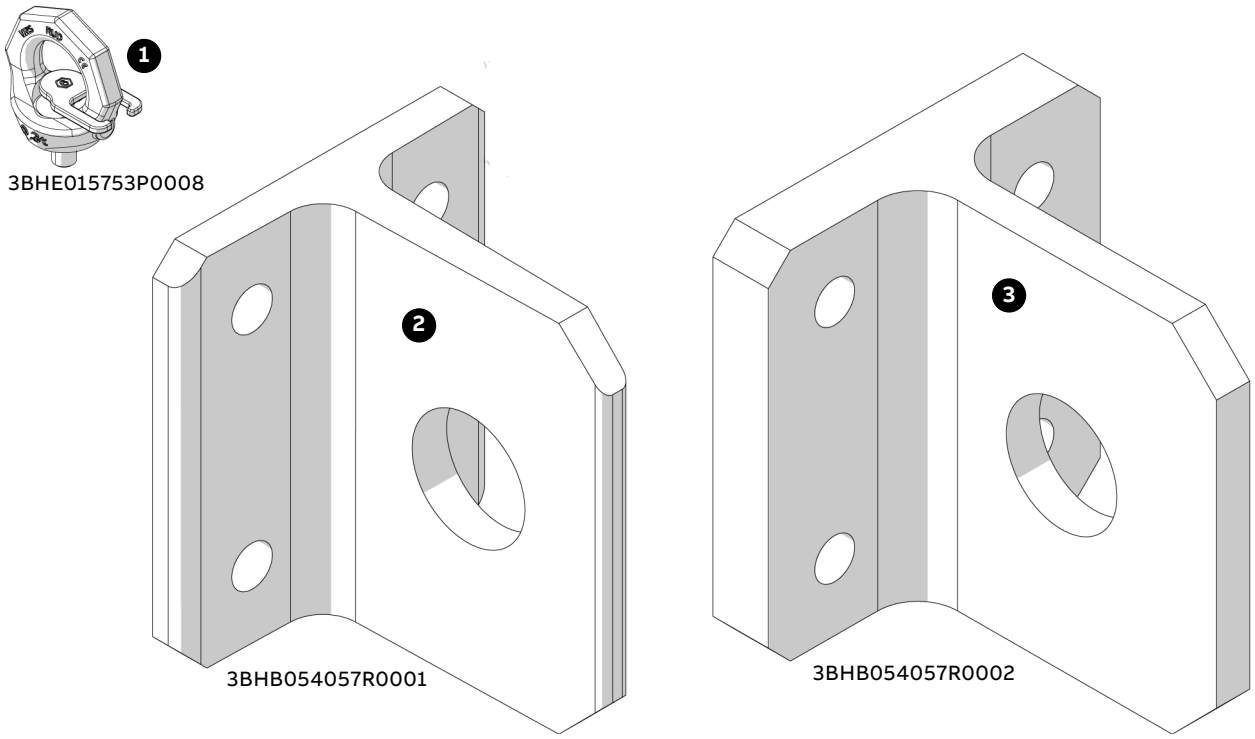
⚠WARNING

Crushing hazard Non-approved lifting attachments can fail. The load can shift, tip, or fall, causing serious injury, DEATH or equipment damage.

→ Only use the lifting attachments that are approved for MEGADRIVE-LCI equipment (Figure 21).

→ Do NOT use third party lifting attachments.

→ Do NOT use the MEGADRIVE-LCI lifting attachments for other equipment.



Key	Material No.
1. M8 rotating eyebolt for top-lifting (roof-mounted cooling units)	3BHE015753R0008
2. Type 1 lifting plate for base frame	3BHB054057R0001
3. Type 2 lifting plate for base frame	3BHB054057R0002

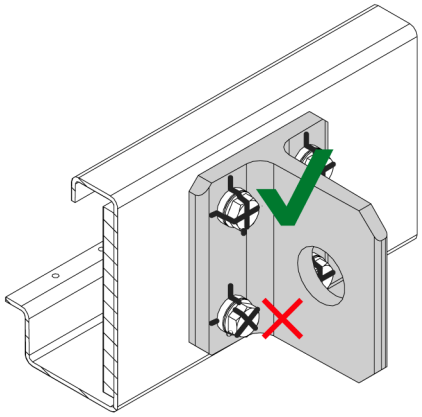
Figure 21 – Approved lifting attachments for MEGADRIVE-LCI equipment

4.4.2. Drive lifting guide

Lifting plates are factory-installed on the base frame of the drive. If you need to reinstall the plates, see 4.4.4 Installing or reinstalling lifting attachments on page 52 before you begin.

1. Verify that the factory torque marks on the mounting bolts and washers of the lifting plates are aligned.

   NOTE – If the marks are not aligned or are not visible, tighten the mounting bolt to the torque that is specified in Table 10.



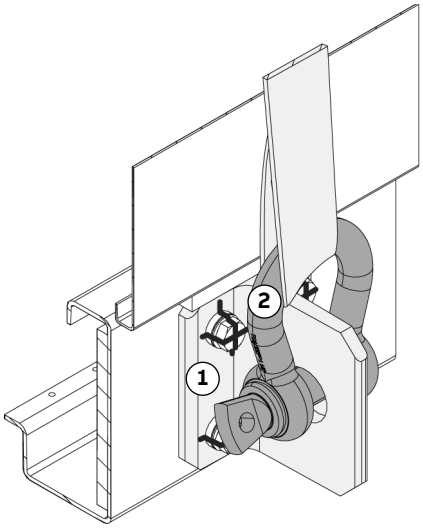
2. Attach slings to the lifting plates (1) with load-appropriate shackles (2).

   CAUTION! DO NOT run a sling through the hole of a lifting plate!

3. Protect the edges and other protrusions on the load from direct contact with the lifting gear, eg slings.

4. Lift the drive slowly and steadily, with no abrupt stops, in an upright position to the required clearance height.

   CAUTION! Keep an eye on the horizontal position of the load and reposition the slings when necessary.



4.4.2.1. (Optional) Removing the lifting plates

You can remove the lifting plates from the base frame after the drive has been permanently installed, eg, to reduce the tripping risk for personnel.

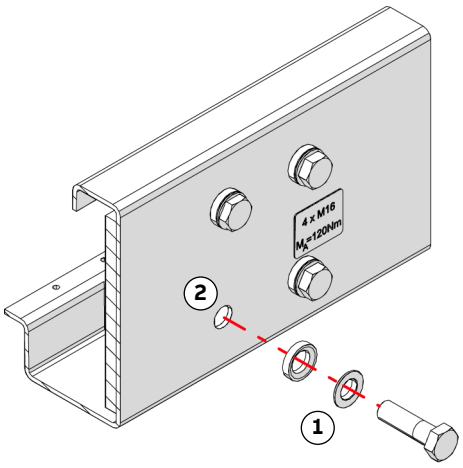
1. Unbolt and remove the lifting plates from the base frame.

   NOTE – Keep the mounting bolts and washers for the next step.

2. Reinstall the mounting bolts and washers (1) in the base frame (2) of the drive.

3. Store the lifting plates for when you need to move the drive again, eg, when the drive is at end of life.

   For more information, see 4.5 Storage on page 53.



4.4.3. Lifting with rotating eyebolts

Rotating eyebolts are required for lifting fan units (delivered separately) onto the roof of the drive. The eyebolts are delivered with the loose parts for the drive.

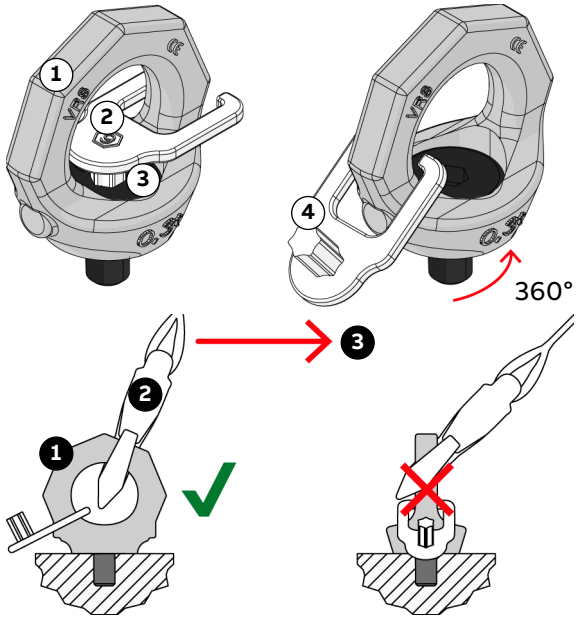
These instructions describe how to correctly use rotating eyebolts in lift operations. For installation instructions that use rotating eyebolts, see 5 Mechanical installation on page 55.

1. For rotating eyebolts (1) from the loose parts box, use the attached star key (2) to hand-tighten and properly seat the mounting bolt (3).

   CAUTION! DO NOT use an extension with the star key tool. Remove the key (4) before you attach the lifting gear. The eyebolt must be able to rotate 360° when mounted.

2. Rotate the eyebolts (1) in the pull direction (3), ie, sling direction, and then attach slings to the eyebolts with safety hooks or shackles (2).

   CAUTION! DO NOT run slings through the eyebolts!



3. Lift the load slowly and steadily, with no abrupt stops, in an upright position to the required clearance height.

   CAUTION! Keep an eye on the horizontal position of the load and reposition the slings when necessary.

4. At the end of the lifting operation, remove the hand-tightened eyebolts that you installed in step **1**.

   NOTE – Store the eyebolts for maintenance or disassembly activities throughout the lifetime of the drive. For more information, see 4.5 Storage on page 53.

4.4.4. Installing or reinstalling lifting attachments

⚠WARNING

Crushing hazard! Non-approved lifting attachments can fail. The load can shift, tip, or fall, causing serious injury, DEATH or equipment damage.

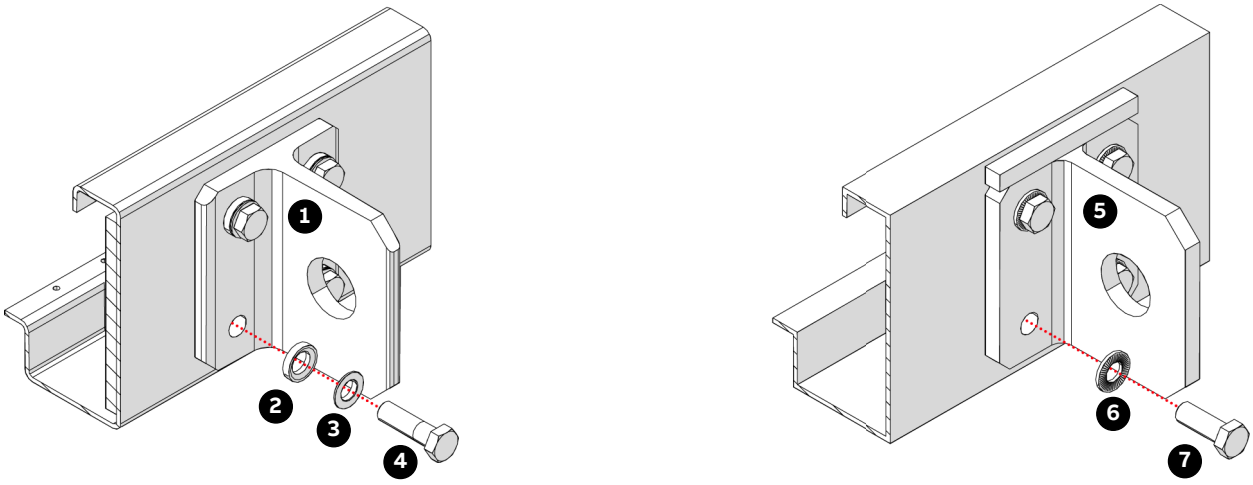
→ Only use the original lifting attachments and fasteners.

→ Before each use, inspect the lifting attachments for damage (corrosion, cracks, deformation). If you find damage, do NOT lift the equipment. Contact ABB for replacement parts before you continue.

If you need to install or reinstall factory-mounted lifting attachments, eg, when the drive is at end of life, tighten the mounting bolts to the torque that is specified in Table 10.

Table 10 – Lifting attachment specifications

Material No.	Type	Mounting bolt	Torque (Nm)
3BHB054057R0001	Lifting plate, type 1	4 × M16x60 8.8 4 × M16 conical seats (DIN6319C) 4 × M16 spherical washers (DIN6319D	120
3BHB054057R0002	Lifting plate, type 2	4 × M16x70 8.8 4 × RIPP LOCK® washer 16.4	204
3BHE015753P0008	Rotating eyebolt M8	M8	10



Key

1. Lifting plate, type 1
2. M16 conical seat
3. M16 spherical washer
4. M16 bolt
5. Lifting plate, type 2
6. M16 RIPP LOCK® washer
7. M16 bolt

Figure 22 – Lifting plate fasteners

IMPORTANT! Apply grease to bolt and between the conical seat and the spherical washer prior to assembly.

4.5. Storage

4.5.1. Storage conditions

The minimum requirements for storage are based on IEC 60721-3-1.

– **Classification:** 1K22 / 1B1 / 1C2 / 1S11 / 1M11

The drive can be stored for up to one year in the original packaging as long as it is not damaged or opened.

For information on longer storage periods, contact the ABB service organization.

4.5.2. Storing the drive

If the drive is taken out of service for a longer time, proceed as follows:

1. Cover all cable inlets and ventilation slots with an impermeable plastic or aluminum foil and a wooden panel.
2. Add the desiccant of the appropriate quality:
   - 1 unit desiccant (30 g) absorbs 6 g water vapor.

   The following quantity is needed when using a polyethylene foil:
   - 10 units/m^2 foil
3. Close and lock the doors of the drive.
4. Use polyethylene or equivalent for packaging:
   - 0.3 g/m^2/24 h water vapor diffusion
5. Attach humidity indicators to the packaging.

IMPORTANT! The storage conditions and the packaging should be checked regularly. Any damages which occur during the storage period should be repaired immediately.

4.5.3. Storage and handling of spare parts

NOTICE

Risk of component damage! Electrostatic discharge (ESD) can damage electronic components (circuit boards, semiconductors).

→ Use ESD protection when you handle electronic components

4.5.3.1. Warranty information

IMPORTANT! Check the spare parts immediately after receipt for damages. Report any damage to the shipping company and the ABB service organization.

Observe the following to maintain spare parts in good condition and to keep the warranty valid during the warranty period:

- Keep spare parts in their original packaging.
- Store printed circuit boards in antistatic bags or boxes.
- Storage temperature range: -5 °C to +55 °C
- Storage place requirements:
  - Free of vibration and shock.
  - Protected against dust, sand, vermin and insects.
  - Free of corrosive gases, salt or other impurities that could damage electronic equipment.
  - Dry with no condensation: relative air humidity: 5 to 85%

    NOTE – If in doubt whether the maximum allowed humidity has been exceeded, protect the spare parts with an external heater.
- DO NOT touch a component without wearing a wrist grounding strap.
- Put the component on a grounded working surface protected against electrostatic discharges.
- Hold the component only at the edge.

4.6. Disposal of packaging materials and components

Dispose of the packaging materials and components at the end of the life time of the drive according to local regulations.

5. Mechanical installation

5.1. Safety

Qualified personnel must do all installation work according to the site requirements, equipment requirements, and local regulations.

5.2. Overview on the installation work

Mechanical installation includes the following items:

- Preparing the floor
- (Optional, only for drives with units delivered separately) Joining transport units
- Fixing the cabinet to the floor.

5.3. General notes on installation

NOTICE

Risk of component damage. Foreign matter (metallic dust, debris) can cause failure and damage when the drive is energized.

→ Remove all foreign matter from the cabinet.

→ Close all doors and cover all openings completely.

5.3.1. Dimensions and clearances

For information on cabinet dimensions, clearances to be observed and mounting hole sizes, see Appendix B - Mechanical drawings.

5.3.2. Cabinet roof

The cabinet roof is not designed as a mounting base for, eg, foreign devices, cable ducts. Therefore, it is not permitted to install any foreign device on the roof.

5.3.3. Fire protection

To prevent fire spreading into the drive, apply suitable fire protection measures.

5.3.4. Cable duct material

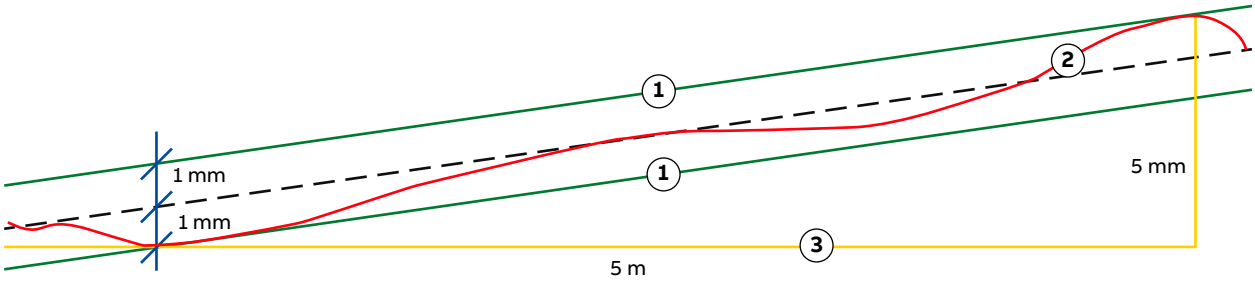
Use cable ducts of non-flammable material with non-abrasive surface.

To prevent dust, humidity and animals from entering the drive, protect all entries and exits of cable ducts.

5.3.5. Preparing the floor

To ensure proper alignment and installation of the drive, prepare the floor as follows:

- Floor must be of non-flammable material, with smooth and nonabrasive surface, protected against humidity diffusion
- Floor must be able to support the weight of the cabinets.
- Overall incline of the floor must not exceed ±0.5% of the length of the drive.



Key

1. Tolerance from mean ground ± 1 mm
2. Surface or floor
3. Tolerance for incline: 5 mm incline on 5 m length

Figure 23 – Floor inclination

- Maximum permitted overall unevenness is ≤ 1 mm.
  - Check the evenness and incline of the floor well in advance so that work for improving the surface is completed before the installation of the drive.
  - Use a spirit level or flooring rule with a vial to check the unevenness. The recommended length: 1 to 2 m.
  - If the surface cannot be improved, place shims or leveling plates under the base frame of a cabinet at appropriate distances for adjustment. Recommended size of the leveling plates: 65 mm × 50 mm

5.3.6. Fixing the drive to the floor

- You can bolt or weld a drive cabinet to the floor
- For the location of the fixing points, see Appendix B - Mechanical drawings
- Before moving the cabinets to their final location, drill the fixation holes in the floor
- For concrete floors, ABB recommends using wedge anchors (Ø 16 mm)

Figure 24 – Concrete wedge anchor example

5.4. Aligning and joining transport units

This information is for a drive shipped as several transport units. You need to assemble the units before you can use the drive.

NOTICE

Risk of equipment damage.

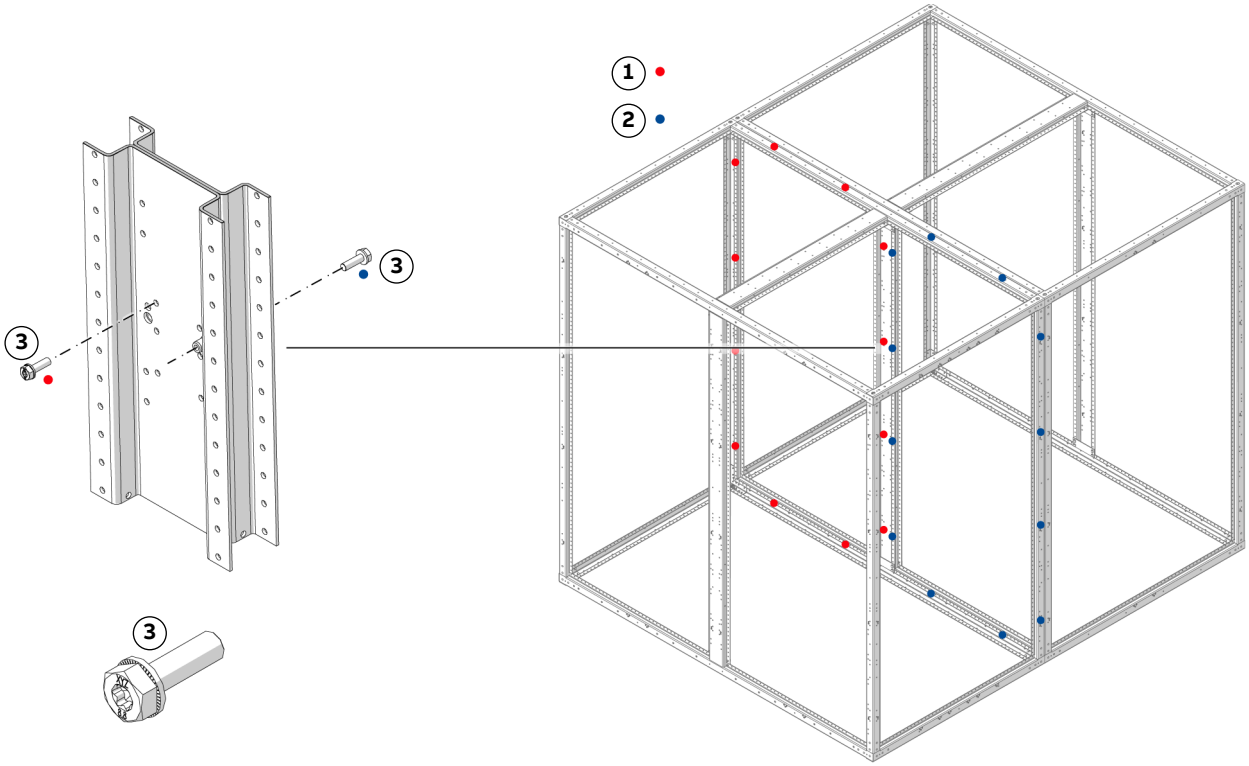
→ DO NOT move assembled transport units with a crane!

Table 11 – Required materials

Material	Location
Assembly material for base frames	– In a box or bag inside one of the cabinets – With the loose parts – Attached to one of the base frames
Busbar connection plates	– Pre-installed at one of the busbar ends in a rotated position – Delivered separately with the loose partst

•

1. Align the transport units as shown in Appendix B - Mechanical drawings and verify that the bolt holes are aligned where transport units are joined (see Figure 25).

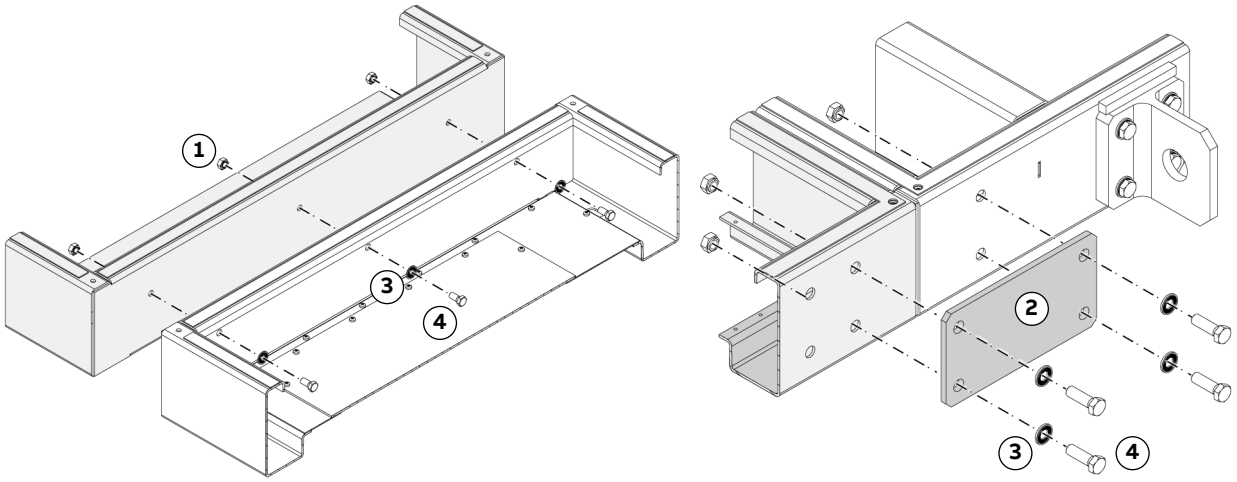


Key

1. Connection point location (bolt hole – this side)
2. Connection point location (bolt hole – other side)
3. M6 × 20 (9ABA450093R0260 SCR-CBS-M6X20-8.8-FLZNNC)

Figure 25 – Connection point locations in transport unit frames

2. Join the base frames of adjacent transport units with the assembly material that was shipped with the drive (see Table 11 for their location).



a) Normal connection

b) High power LCI connection

Key

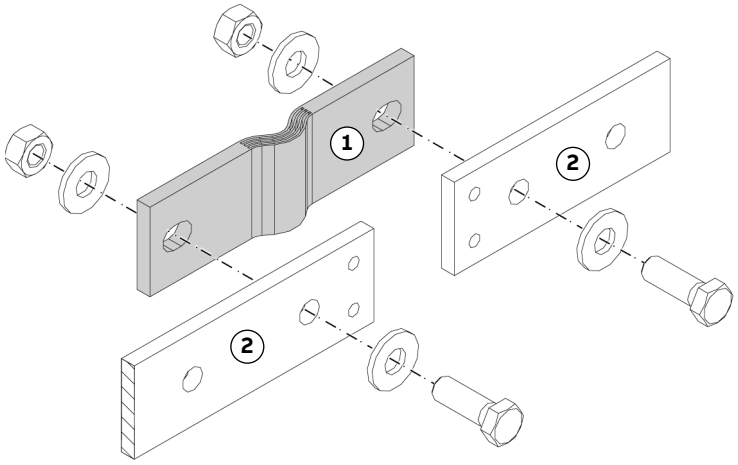
1. Nut M16
2. Washer M16
3. Bolt M16
4. Base frame connection plate

Figure 26 – Base frame connection types

3. Join the busbars with the connection plates (1, Figure 27) that were shipped with the drive (see Table 11 for their location).

   IMPORTANT! Ensure you also connect the PE busbar.

No. of busbars	Torque
2	40 Nm
3 or more	60 Nm



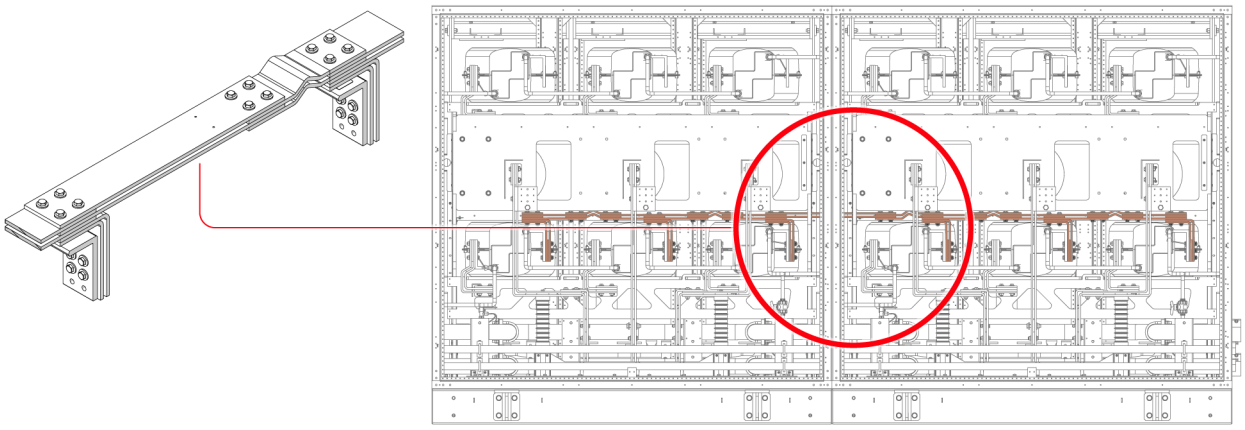
Key

1. Connection plate
2. Busbar

Figure 27 – Busbar connection plate

4. For high-power converters (> 8 kV supply voltage), you also need to add a busbar connection between adjacent power modules.

5.5.



Fixing the cabinet to the floor

The base frame is provided with holes for fixing the drive to the floor. Floor fixings are not supplied. Screws and nuts of size M16 are recommended.

For information on the location and the size of the fixing holes in the base frame, see the outline drawing in Appendix B - Mechanical drawings.

5.6. Installing the roof-mounted cooling fans

The roof-mounted cooling fans for the power part of the drive are usually shipped separately and must be installed at the drive site. The number of cooling fans is project-specific.

Table 12 – Installation material per fan unit

Material No.	Item	Quantity	Comment
9ABA450082P0310	M6×20	3 × per fan	Flat countersunk head screw, self-tapping for mounting fan to converter
HAQN401050P0259	M6×16	3 × per fan	Pan head screw, self-tapping for mounting fan to converter
9ABA450093R0311	M8×25 8.8	4 × per fan	Bolt, including washer for closing off the hoisting points

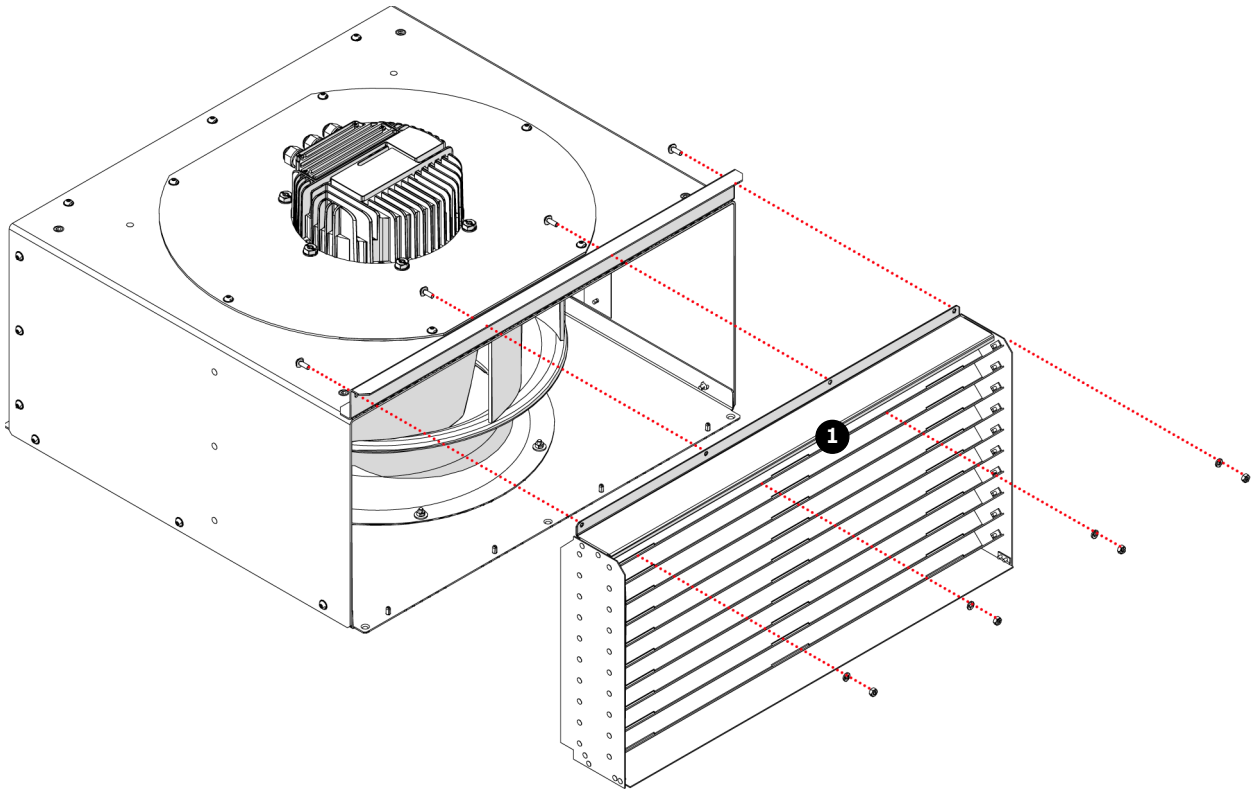
The fan unit locations and orientations (ie, direction of exhaust) are indicated on the drive layout drawing in "Appendix B - Mechanical drawings".

⚠CAUTION

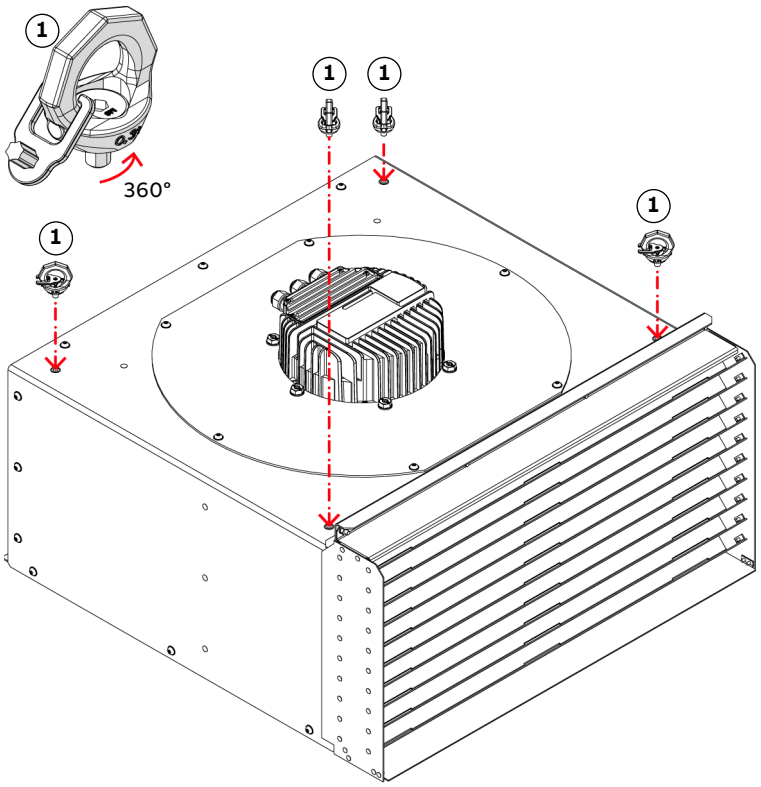
Heavy object! A cooling fan unit weighs up to **80 kg**.

- → Lift operations MUST be performed by qualified personnel in accordance with local lifting laws!
- → Use a crane to lift a fan unit onto the roof of the drive
- → Only use the rotating eyebolts (Material No.: 3BHE015753P0008) that were delivered with the loose part of the drive
- → Use appropriate slings and shackles with the eyebolts
- → Before you begin, verify that the fan cutouts on the drive are free of obstructions (eg, cables and packaging material) and read 4.4.3 Lifting with rotating eyebolts on page 51.

1. Remove the air outlet grill (1) from the fan unit and set aside the grill, mounting bolts, and washers for step **7**.

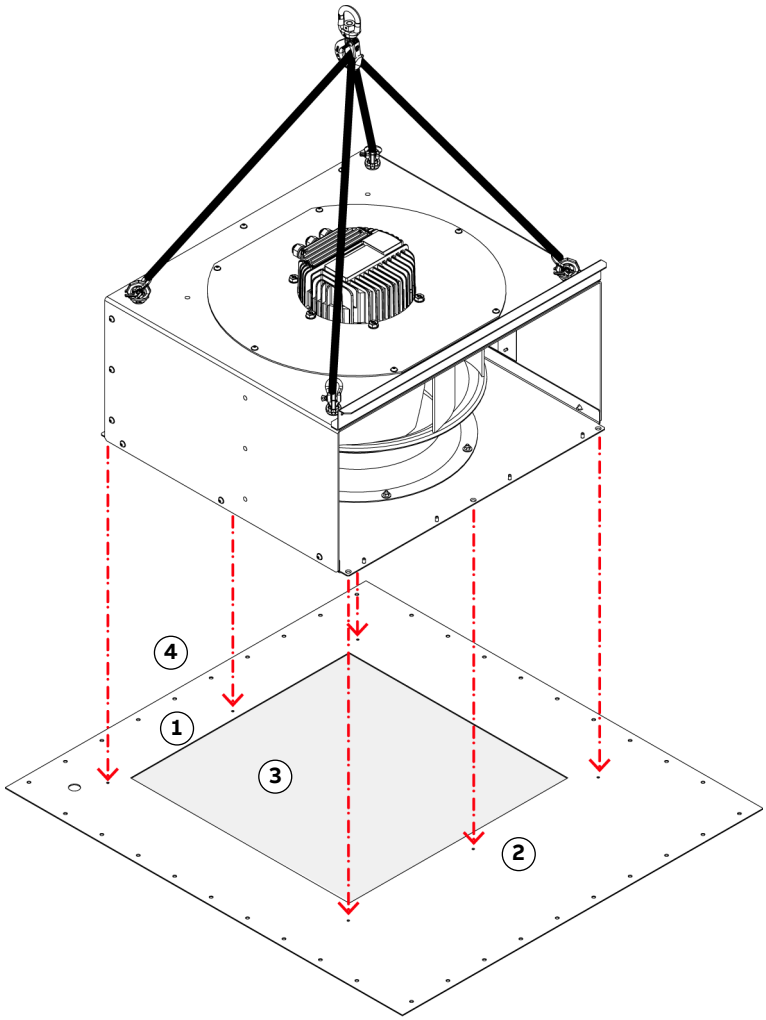


2. Following the instructions in 4.4.3 Lifting with rotating eyebolts on page 51, mount 4 rotating eyebolts (1) to the hoisting points on top of the fan unit, and then attach the lifting gear.



3. Lift and suspend the fan unit over the roof cutout (3) on the drive with the enclosed side facing the front (4) of the drive.
4. Align the mounting holes on the base of the fan unit with the corresponding holes around the cutout, and then slowly lower the fan unit onto the drive roof.
5. Mount the fan unit to the roof with the self-tapping screws from the loose parts for the drive.

   IMPORTANT! Use the flat countersunk head screws on the air outlet side (2) and the pan head screws on the closed side (1) of the fan casing (see Table 12 for the relevant ID numbers).



6. Disconnect the lifting gear from the fan unit.
7. Re-attach the air outlet grill to the fan unit with the bolts, washers, and nuts that you set aside in step **1**.
8. Remove the rotating eyebolts from the fan unit and seal the hoisting points with the blind bolts (see Table 12).

   NOTE – Store the eyebolts for maintenance or disassembly activities throughout the lifetime of the drive. For more information, see 4.5 Storage on page 53.

9. Connect the fan supply and control cables according to the converter hardware diagram in "Appendix C - Electrical drawings including parts list".

   CAUTION! Hazardous voltages. Electrical connections must only be performed by electrically qualified personnel. Prior to performing electric installation work, lock-out, tag-out procedures must be followed according to 2.3 Electrical safety on page 23.

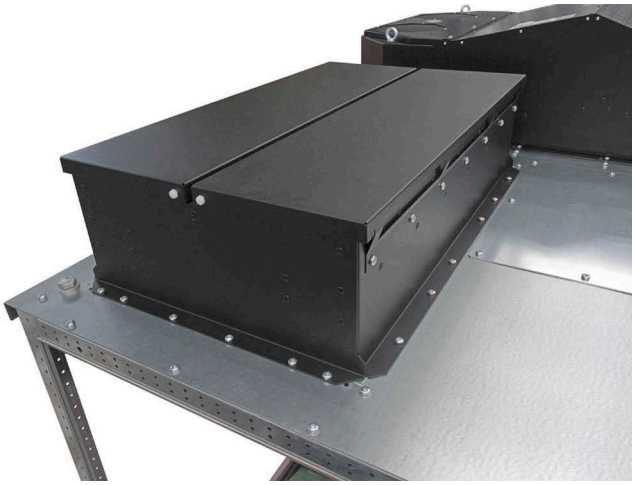
10. Repeat steps **1** to **8** for each fan unit that you need to install.

5.7. Installing the pressure relief vents (arc-rated cabinets)

Pressure relief vents are required on drives with arc-rated cabinets.

Weight	~26 kg
L × W × H	840 × 520 × 210 mm

Figure 28 – Pressure relief vents



Key

1. Cordless drill
2. Torx bit
3. 24 × M6×20 Self-tapping (HAQN401050P0260)

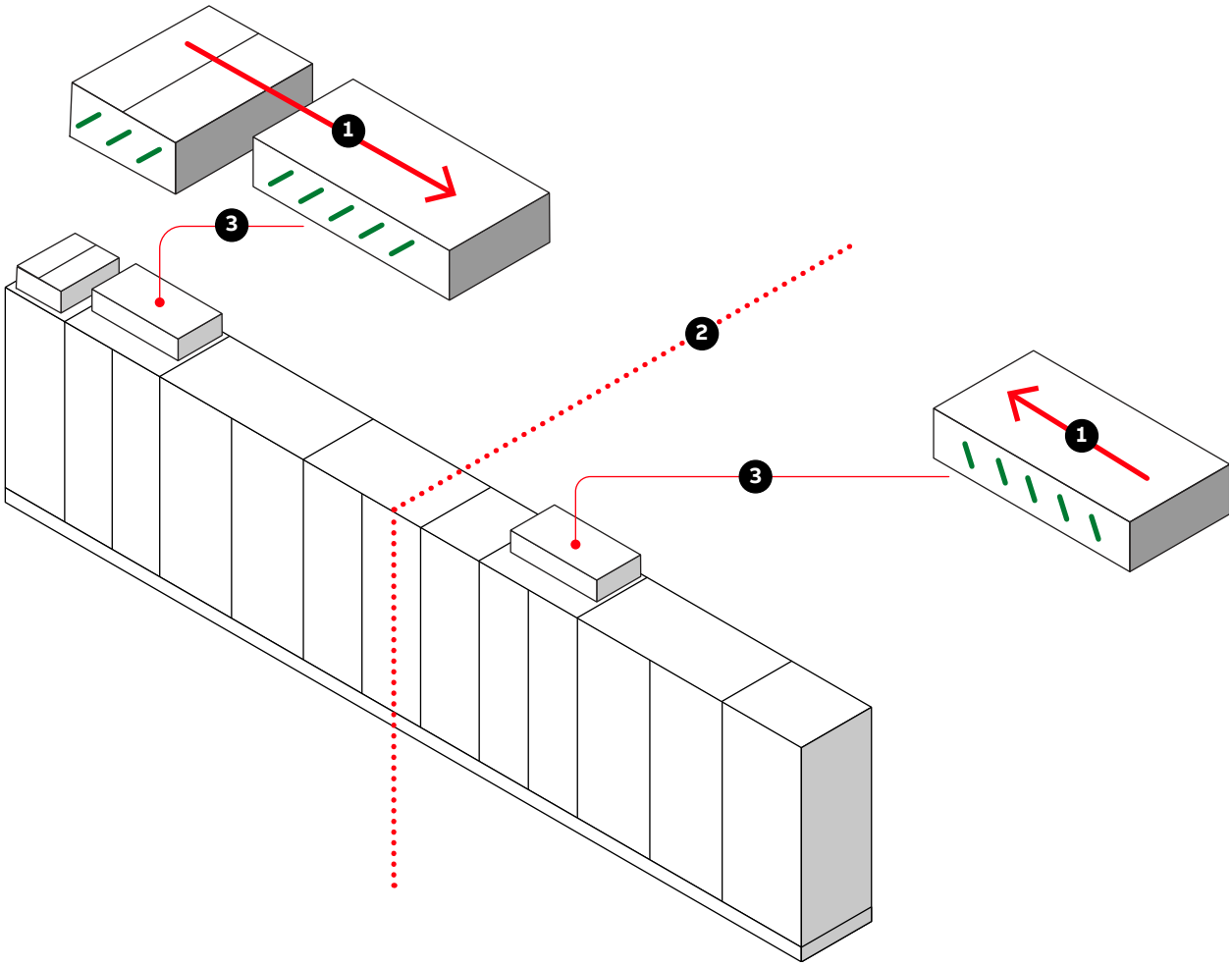
Figure 29 – Required tools

Referring to Figure 30:

1. Orientate the pressure relief vents with the baffle blades (arrows) pointing to the center of the drive.

   NOTE – You can see the orientation of the baffle blades through the grill on the underside.

2. Fasten the pressure relief vent to the roof with the supplied screws.



Key

1. Orientation of baffle blades
2. Center of drive
3. Pressure relief vents

Figure 30 – Pressure relief vent installation example

5.8. Installing the excitation air hoods

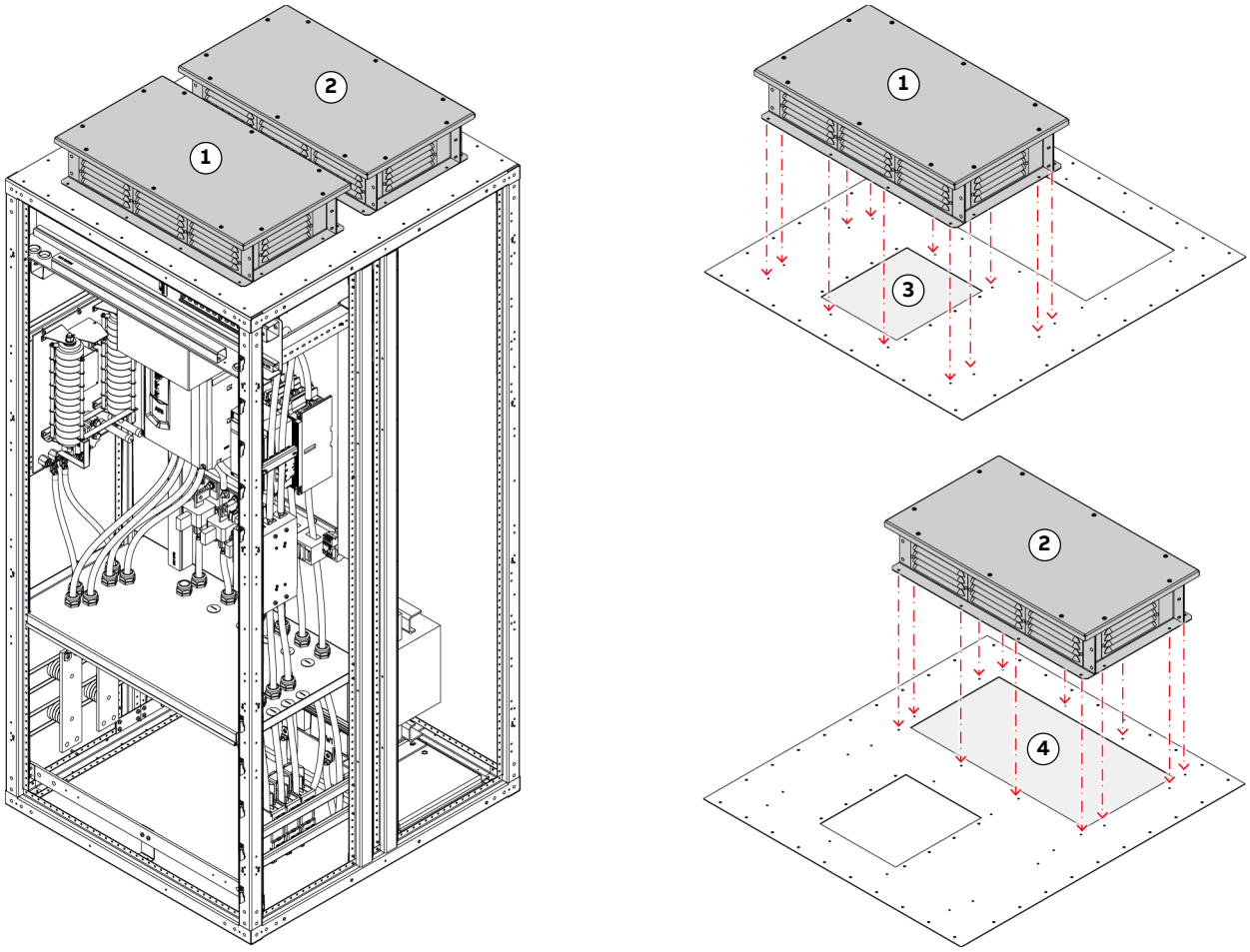
If your drive came with an excitation unit (EXU), you need to install the 2 roof-mounted air hoods.

Weight	~15 kg
L × W × H	770 × 440 × 160 mm

Key

1. Cordless drill
2. Torx bit
3. 12 × M6×16 self-tapping (HAQN401050P0259)

Figure 31 – EXU air hood tools and fasteners



Key

1. Front air hood
2. Rear air hood
3. Front cutout
4. Rear cutout

Figure 32 – EXU air hood locations

1. Verify that the fan cutouts (3, 4, Figure 32) on the EXU roof are free of obstructions (eg, cables and packaging material.
2. Manually lift the hood onto the cabinet roof.
3. Align the mounting holes on the base of the air hood with the corresponding holes around the cutout.
4. Mount the air hood on the EXU roof with the screws from the loose parts from the drive (see Figure 31 for the ID number).

6. Electrical installation

6.1. Safety

⚠WARNING

Hazardous voltage! Improper work could lead to life-threatening injury or DEATH!

→ The electrical installation must be carried out by qualified personnel according to the site and equipment requirements, and the relevant electrical codes.

→ When the electrical installation is completed, the main and auxiliary power supply to the drive must not be switched on without the consent of the ABB commissioning personnel.

→ Take appropriate measures to prevent main and auxiliary power supply being switched on during installation.

6.2. Overview on the installation work

Electrical installation includes the following connections:

– (Optional, only for drives with units delivered separately) Optical fiber cabling

– (Optional, only for drives with units delivered separately) Internal electrical wiring

– Power cables, ground cables, equipotential bonding conductor

– Auxiliary power and control cables

6.3. Cable requirements

For information on the requirements for power cables, ground cable and equipotential bonding conductor, see the following documents:

– Power cable specification

– Power cables engineering guideline

For information on the requirements for the auxiliary power cable and the control cables, see the "Auxiliary power and control cables guideline" (3BHS813742 E01).

6.4. Optical fiber cabling

This section only applies to drives delivered into separate transport units that must be joined at the installation site.

NOTICE

Risk of equipment failure! Incorrect installation or damage to an optical fiber can degrade data transmission and cause the equipment to fail.

→ Handle optical fibers with care.

→ DO NOT touch the ends of the fibers, which are sensitive to dirt.

→ When unplugging, hold the connector and NOT the fiber.

The drive includes optical fiber cables that span across the entire length of the drive and need to be reconnected in case of units delivered separately.

Such cables are rolled back in the inside of the transport unit's cabinet.

For easier identification, they are marked with appropriate labels at the two connecting terminals.

Connect the optical fiber cables, making sure that the labels on the two terminals correspond.

6.5. Internal electrical wiring

This section only applies to drives delivered into separate transport units that must be joined at the installation site.

Internal electrical wiring is equipped with plugs or connectors, which have to be reconnected.

For easier identification, plugs and sockets are marked with appropriate labels. When connecting, make sure that the labels on the two terminals correspond.

In the case there are no plugs available, the electrical wires are rolled back in the inside of the transport unit's cabinet, similarly to the optical fiber cabling.

6.6. Power cables, ground cables, equipotential bonding conductor

For information on:

→ Block diagram, see Appendix C - Electrical drawings including parts list.

→ Designation, cross-reference and device identification conventions, see Converter hardware diagram in Appendix C - Electrical drawings including parts list.

→ Cable screens and cable screen connection, see the Block diagram and Terminal list in Appendix C - Electrical drawings including parts list.

→ Terminal hole sizes, location of terminal compartments and distances between point of cable entry and busbars, see Connection plan in Appendix C - Electrical drawings including parts list.

6.6.1. Preparing the cable entry and the cables

NOTICE

Risk of damage or malfunction! Waste inside the cabinet can cause damage or malfunction.

→ If possible, DO NOT cut cables inside the terminal compartment.

→ Retrieve any waste which accidentally dropped into the cabinet.

Procedure

1. Determine the required length of a cable between the point of entry and the connection point inside the cabinet.
2. Cut the cable to the required length before connection.

6.6.2. Connecting the cables

⚠CAUTION

Risk of flashover! High voltages in terminal compartments can cause flashover between conductors with different electric potential and between a conductor and earth.

→ Maintain a minimum clearance of 55 mm between the following components:

- Conductor and the terminals of any other conductor
- Conductor and earth.

6.6.2.1. Checking cable insulation

1. Check the insulation of each cable before connection and verify that the results are within the specification of the cable manufacturer.
2. Leave the cable conductors unconnected at both ends until the commissioning engineer has given permission.

6.6.2.2. Bolted busbar connections

Material requirements

Use stainless steel bolts and nuts with the appropriate steel grade and property class for the connection (recommended: A2-70; designation according to ISO 3506).

Nuts with bonded coating can be used as an alternative to uncoated stainless steel nuts.

Connection type

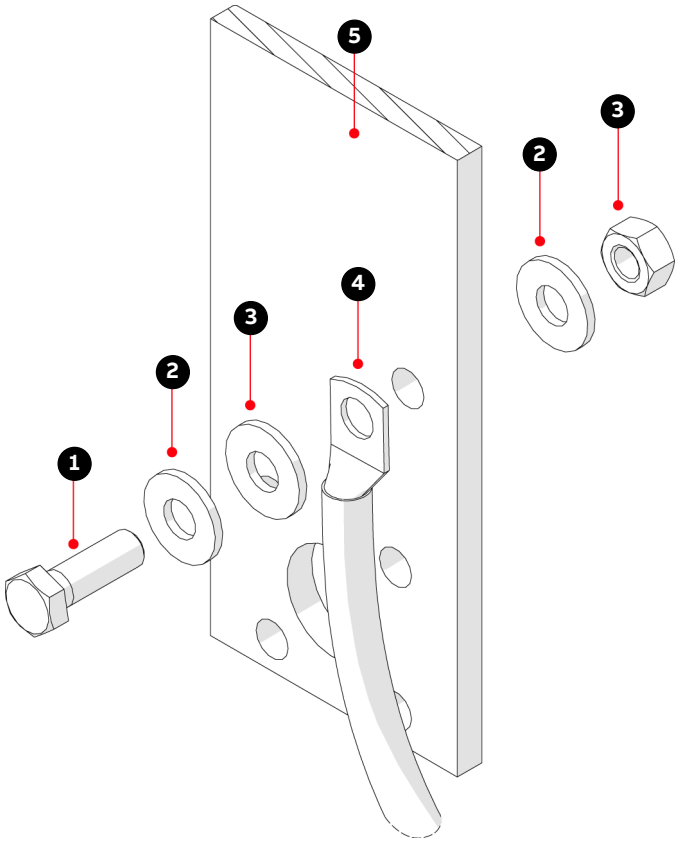
Referring to Figure 33:

→ Use two spring washers (2) and two flat washers (2) when you connect a cable lug (5) to a busbar (4).

NOTE – You can use other types of washers, provided they maintain the required contact pressure; The cable lug size is determined by the busbar hole diameter.

Table 13 – Cable lug sizes

Busbar type	Busbar hole diameter	Connection bolt size	Cable lug size
ANSI	14 mm	M12	12 mm
DIN	18 mm	M16	16 mm



Key

1. Bolt
2. Spring washer
3. Flat washer
4. Busbar
5. Cable lug

Figure 33 – Bolted busbar connection

Lubrication

- If stainless steel bolts and nuts are used, lubricate the thread and head contact surface of the bolt using recommended pasts, eg, Molykote D paste.
- If a coated nut (eg, with bonded molybdenum-disulfide [MoS_2] coating) is used, the connection does not have to be lubricated.

Tightening torque

Tighten bolted connections with bolts of sizes M10 and greater with the recommended nominal torque for the bolt size used.

6.7. Final checks

→ Check that the entry plates are properly fastened.

7. Commissioning

7.1. Overview

The following sections provide an overview of the commissioning process for your drive.

7.1.1. Required qualification

Commissioning, parameter adjustments and functional tests must be carried out only by qualified commissioning personnel that have been certified by ABB.

7.1.2. Commissioning procedure

Information on the commissioning procedure and the start conditions for commissioning can be obtained from ABB.

7.1.3. Commissioning checklist

In order to ensure uncomplicated and speedy commissioning, it is important that drive and associated equipment are ready for commissioning. Reviewing and completing the items in the commissioning check list before the commissioning personnel arrive on site will help to achieve this.

7.1.4. Customer assistance

During the commissioning period, the customer is requested to provide qualified personnel for assistance, who are:

- Experienced with medium and low voltage equipment and with the local safety regulations,
- Familiar with the driven process
- Authorized to operate associated medium and low voltage equipment (eg, input circuit breaker, other low and medium voltage switchgear)
- Authorized to operate the driven process for functional tests

7.1.5. Customer acceptance

When commissioning has been completed, the commissioning report is signed by the responsible commissioning personnel and by the customer as a sign of acceptance. A copy of the report and a copy of the actual parameter settings are handed out to the customer.

7.2. Commissioning checklists

This checklist is designed to help you prepare the drive and associated equipment for commissioning.

7.2.1. Mechanical installation checklist

☐ Drive installed according to the instructions in the user manual

☐ Drive securely fastened to the floor (if applicable)

☐ All outside covers fastened

☐ All cooling fans have been mounted on the roof (if applicable)

☐ Fan hoisting points (4 × per fan) are sealed with blind bolts

☐ Pressure relief vents have been mounted on the roof (if applicable)

☐ Excitation ventilation hood has been mounted (if applicable)

☐ Visual inspection:

- No badly affixed or damaged components
- No foreign objects inside cabinet
- No dirt, dust and humidity inside cabinet

7.2.2. Electrical installation checklist

☐ Types and cross sections of control cables suitable for the signal type and signal level

☐ Types and cross sections of power cables selected according to the power cable specification

☐ Cable entries completed

☐ All control cable screens and conductors connected, appropriately labeled, and the customer-side connections completed.

☐ Ground cable(s) securely connected at both ends

☐ Input transformer and motor cables not connected at both ends (cables and drive must be meggered before connection)

7.2.3. Input circuit breaker (ICB) checklist

☐ High-voltage connections completed

☐ ICB ready to be tested with drive

☐ ICB protection relay settings tested

☐ Safety devices (eg, door locking mechanism) tested and in operation

7.2.4. Motor checklist

☐ Motor installed, aligned and alignment protocol available

☐ Motor not coupled to driven load (if possible)

☐ Ground connection completed

☐ Motor auxiliaries (eg, bearing lubrication, heater cooling) ready

7.2.5. Insulation tests checklist

☐ All power cables to input transformer, between input transformer and drive, and from drive to motor measured, measured values within the required limits.

☐ Test report of the Megger test available

If the test is carried out by the commissioning engineer of the drive, an additional day per drive motor combination needs to be reserved. After the test, the feeder cables can be connected, except at the drive end. The test must comply with the specification.

7.2.6. Power supply checklist

☐ Medium voltage available for start-up of drive

☐ Low voltage auxiliary power available for start-up of drive

7.2.7. Miscellaneous checklist

☐ Sufficient number and correct type of spare parts available

☐ Air conditioning of drive room ready for load run of drive

☐ Optional equipment ready

☐ Information boards, safety signs, protection covers attached

8. Operation

The chapter outlines the local operation using the control terminal on the door of the control unit.

Control of the drive via a PLC or higher-level control systems is not described in this chapter.

If the drive is controlled from remote, see the appropriate manuals for information.

8.1. Safety

Only qualified and authorized personnel who are familiar with the drive system operation and hazards can operate the equipment.

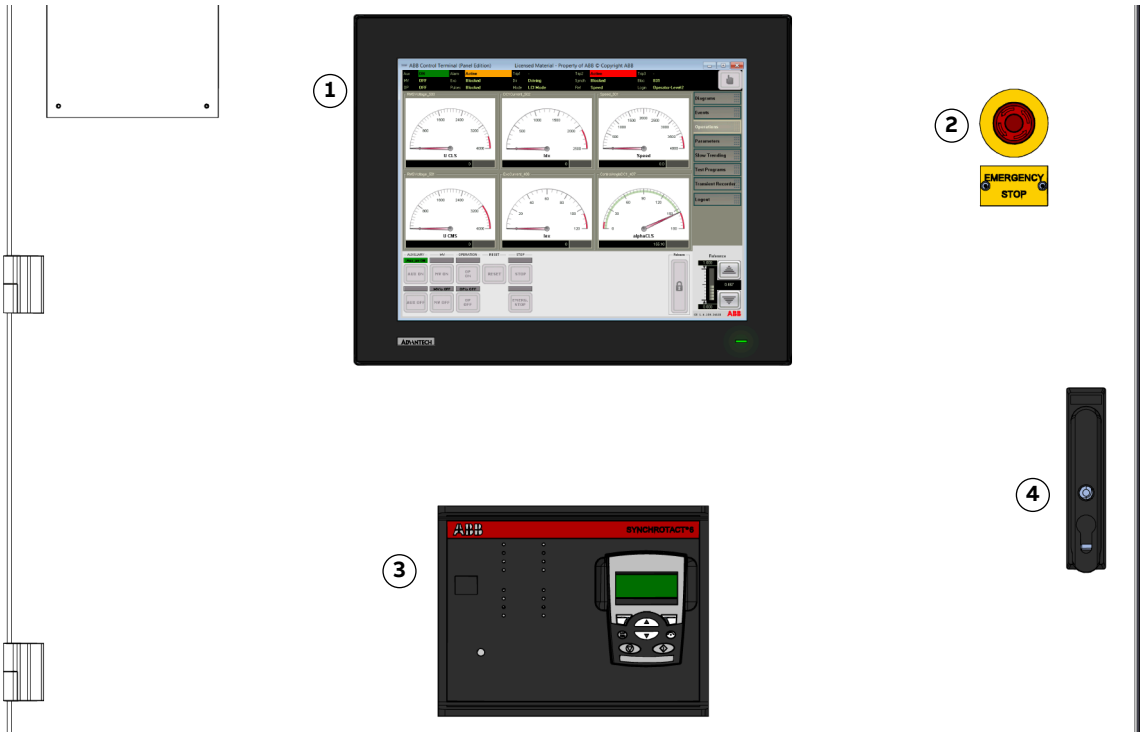
8.2. Operating conditions

The operating conditions for the drive are according to IEC 60721-3-3.

– **Classification:** 3K22 / 3B1 / 3S6 / 3M11

8.3. Local operator controls

Local operator controls are on the door of the control unit (Figure 34). All drives have a control terminal and an emergency stop push button on this door. Depending on your drive configuration, the controls might also include a SYNCHROTACT 6 device, additional lamps, or push buttons.



Key

1. Local control terminal (LCT)
2. Emergency stop push button
3. SYNCHROTACT 6 (optional)
4. Swing handle

Figure 34 – Local operator controls (example)

8.3.1. Local control terminal functions

The LCT lets you control the drive when normal operation requirements are met.

The LCT provides the following function:

- Switch the auxiliaries on or off
- Connect or disconnect the main power supply (optional – to confirm that you have this option, see the interface diagram in Appendix C - Electrical drawings including parts list.
- Set the reference value
- Start or stop the drive
- Display actual values, status messages, alarms, and fault messages
- View and change parameters
- Reset alarms and faults

For starting and stopping operating sequences, see the flow chart in Appendix C - Electrical drawings including parts list.

8.4. Starting the drive locally

It is recommended to have the following documents at hand when starting the drive locally for the first time after commissioning or after it has been taken out of service for a longer period:

– Converter hardware diagram / Interface diagram in Appendix C - Electrical drawings including parts list to identify the circuit breakers to be switched on

– Flow chart in Appendix C - Electrical drawings including parts list for information on the main operating states the drive passes through when it is put into operation, stopped or a fault condition occurs

See 9 Local control terminal on page 84 for information on functions and features of the control terminal

8.4.1. Checks before starting the drive

When the drive is put into service after it has been commissioned or after it has been taken out of service for a longer period, check the drive according to the following list:

– Check that no tools and foreign objects are left inside the drive.

– Check that:
  - All internal circuit breakers of the drive are closed.
  - All auxiliary power supplies from external sources are switched on.

– Check that all covers are mounted and the doors are closed and locked.

  DANGER! Hazardous voltage! All covers must be screwed in place to prevent unintentional contact with energized components.

– Check that the drive is ready for operation.

– Check that no alarm or fault messages are displayed on the status bar of the control terminal.

  IMPORTANT! When a fault message is displayed, reset the fault. If a fault cannot be reset, it must be rectified by the responsible personnel.

8.4.2. Start sequence of the drive

All drive-related messages mentioned in this section are displayed on the status bar of the control terminal. The buttons illustrated below are shown on the operation bar of the local control terminal.

For more information on the status bar, see 9.1.2 Status bar on page 86. For more information on the buttons, see 9.4 Operation bar and reference value input feature on page 128.

The following message is shown on the status bar when the drive is ready for operation: **AUX READY** (auxiliaries are ready)

The auxiliaries of the drive can now be switched on.

Procedure

1. Touch the **AUX ON** button (auxiliaries on) to switch on the auxiliaries.

↳ After the auxiliaries have been switched on, the following message appears on the status bar of the control panel: **MV READY (Medium voltage is ready)**. The input circuit breaker of the drive can now be closed.

2. Touch the **MV ON** button (medium voltage on) to close the input circuit breaker.

NOTE – To check if the drive has this optional feature, see the Interface diagram in Appendix C - Electrical drawings including parts list.

↳ After the input circuit breaker has been switched on, the following message appears on the status bar of the control panel: **OPERATION READY**. The drive can now be started.

3. Touch the **OP ON** button (operation on) to start the drive.

↳ After the drive has been started, the following message appears on the status bar of the control panel: **OPERATION ON**. The firing pulses for the line-side and motor-side converter and the excitation unit (if present) are released, and the motor accelerates to the preset reference value.

8.5. Stop sequences

All drive-related messages mentioned in this section are displayed on the status bar of the control terminal. The buttons illustrated below are shown on the operation bar of the local control terminal.

For more information on the status bar and the buttons, see 9.1.2 Status bar on page 86 and 9.4 Operation bar and reference value input feature on page 128, respectively.

The drive can be stopped in two ways:

– Coast stop

– Controlled stop

8.5.1. Coast stop

A coast stop immediately stops the converter modulation, allowing the machine to coast down.

1. Touch the **OP OFF** button (operation off) to coast down the motor.

↳ The firing pulses of the line-side and motor-side converter and the excitation unit (if present) are switched off. The following message appears on the status bar of the control panel: **OPERATION OFF**. The input circuit breaker of the drive can now be opened.

2. Touch the **MV OFF** button (medium voltage off) to open the input circuit breaker.

   NOTE – To check if the drive has this optional feature, see the interface diagram in Appendix C - Electrical drawings including parts list.

↳ After the input circuit breaker has opened, the following message appears on the status bar of the control panel: **MV READY** (medium voltage ready). The auxiliaries of the drive can now be switched off.

3. Touch the **AUX OFF** button (auxiliaries off) to switch off the auxiliaries.

↳ After the auxiliaries have been switched on, the following message appears on the status bar of the control panel: **AUX OFF** (Auxiliaries off).

8.5.2. Controlled stop (optional)

A controlled stop ramps down the machinery speed and then activates a coast stop (see 8.5.1 Coast stop on page 78).

The stop sequence follows these steps:

1. Speed reference decreases linearly.
2. Converter uses electric braking to decelerate the machinery. During this phase, the energy flow in the system is reversed.
3. When the speed drops below a threshold (typically 1 - 10% of nominal speed), a coast stop is activated.

To start a controlled stop in local control mode, press the **STOP** button on the LCT.

8.5.3. Emergency stop (E-stop)

The **EMERGENCY STOP** push button is on the control unit door. When you activate the button, the E-stop function puts the drive system into a safe, electrically de-energized state and keeps it there.

NOTE – The auxiliary power for the LCT remains on.

The following happens when you press the **EMERGENCY STOP** push button:

1. The coast stop sequence is immediately triggered and the converter switches OFF (see 8.5.1 Coast stop on page 78).
2. Trip commands are sent to the input circuit breaker (ICB) and other medium-voltage breakers, if present.
3. Trip signal is triggered to show that the **EMERGENCY STOP** push button was pressed.

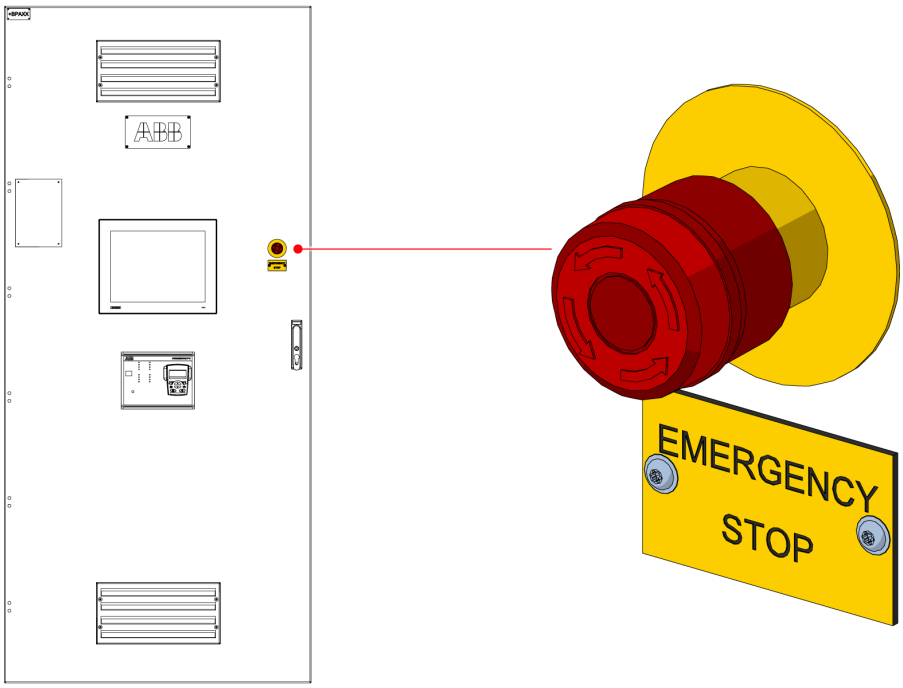


Figure 35 – EMERGENCY STOP push button

8.5.3.1. Restarting the drive after an emergency stop

1. Verify that the reason for the emergency stop has been resolved.
2. Turn the **EMERGENCY STOP** push button in the direction of the arrows until the button unlatches and returns to the up position.
3. On the LCT, press the **RESET** button to acknowledge and clear any pending faults on the converter or other equipment.

   NOTE – The **Events** and **Operations** menus have **RESET** buttons.

a) Events menu b) Operations menu

Figure 36 – LCT reset buttons

4. After you clear the faults, start the drive according to 8.4.2 Start sequence of the drive on page 76.

8.6. Operation of doors with interlock switches (option)

Door interlock operation control requires (auxiliary) voltage. If you need to open the door when the converter is completely de-energized, see 8.6.3 Emergency release of a door safety switch on page 82

8.6.1. Unlocking and opening the doors

✓ Make sure that control voltage is available.

✓ Make sure that the power part is de-energized and grounded (see the project documentation).

1. Slide the locking bar to the unlocked position.
   → Doors hinged on the left: Slide the locking bar to the left from position 1 (locked) to position 2 (unlocked).

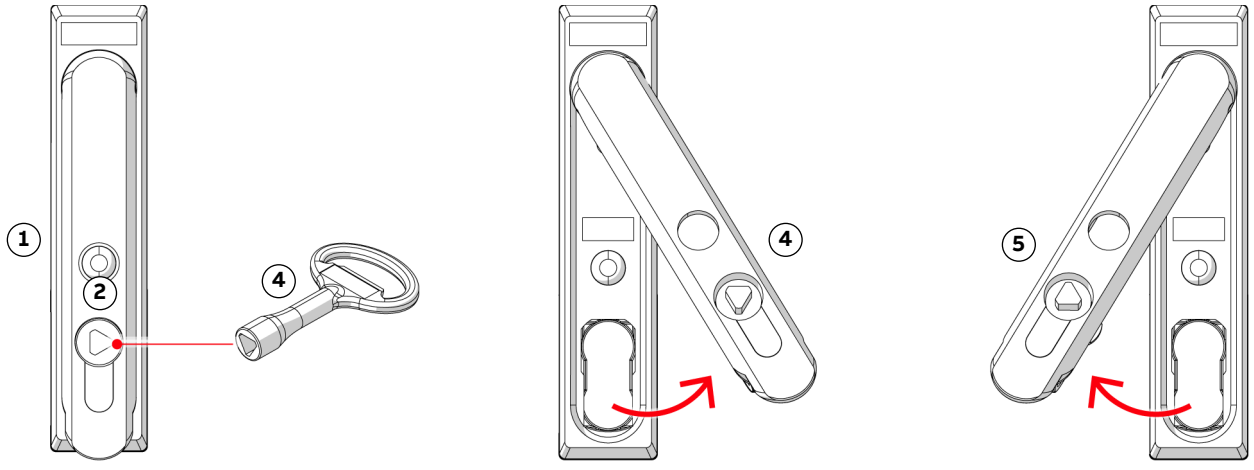
   → Doors hinged on the right: Slide the locking bar to the right from position 1 (locked) to position 2 (unlocked).

2. Insert the key (4, Figure 37) into the lock and turn it to the right.

↳ The swing handle (1, Figure 37) pops out.

3. Open the door.
   → Doors hinged on the right: Turn the swing handle to the right (4, Figure 37).
   → Doors hinged on the left: Turn the swing handle to the left (5, Figure 37).

   NOTE – If you cannot open the door, see 8.6.3 Emergency release of a door safety switch on page 82.



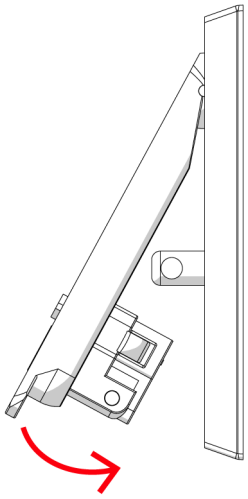
Key

1. Swing handle (locked)
2. Lock
3. Key
4. Turn right (door hinge on the right)
5. Turn left (Door hinge on the left)

Figure 37 – Door handle positions

8.6.2. Closing and locking the doors

1. Close the door.
   → Doors hinged on the left: Turn the swing handle to the right.
   → Doors hinged on the right: Turn the swing handle to the left.
2. Align the swing handle with the door plate and press the handle down until it clicks into place.



3.
4. Insert the key into the lock and turn it to the left.
5. Slide the locking bar to the locked position.
   → Doors hinged on the left: Slide the locking bar to the right from position 2 (unlocked) to position 1 (locked).

   → Doors hinged on the right: Slide the locking bar to the left from position 2 (unlocked) to position 1 (locked).

IMPORTANT! A limit switch monitors the locked position. If a door is not locked correctly, you cannot start the drive.

8.6.3. Emergency release of a door safety switch

DANGER

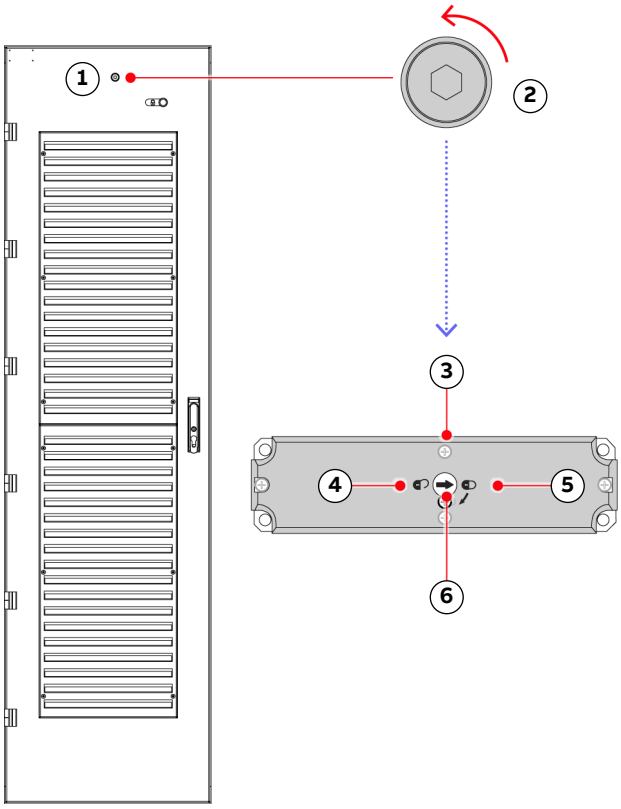
Hazardous voltages! Touching energized components can be FATAL.

→ Before you unlock a safety switch, verify that the drive is de-energized.

→ DO NOT unlock the safety switches permanently.

8.6.3.1. Location of safety switches

The doors of medium voltage units are equipped with safety switches.

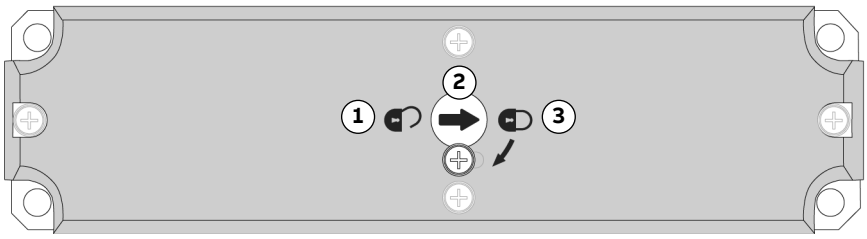


Key

1. Screw cap on door
2. Safety switch location (behind door)
3. Safety switch
4. Unlocked position
5. Locked position
6. Release dial

Figure 38 – Safety switch example (TEU door)

8.6.3.2. Safety-switch settings

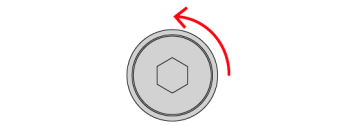


Key		Explanation
1.	Unlocked	Enables opening the door of a medium voltage unit whether the auxiliary voltage is switched on or off.
2.	Release dial	Direction of arrow indicates safety switch status, ie, locked or unlocked
3.	Locked	Normal operating setting. To open the door of a medium voltage unit, the DC-link must be discharged and the auxiliary voltage must be switched on.

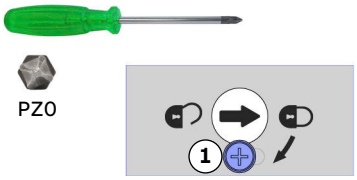
Figure 39 – Safety switch settings

8.6.3.3. Unlocking a safety switch

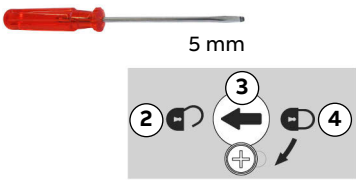
1. Remove the screw cap on the door to access the release dial.



2. Loosen the locking screw (1) with a Phillips screwdriver until you can turn the release dial.



3. Use a flat screwdriver to turn the release dial (3) to the unlocked position (2).



4. Slide the locking bar to the unlocked position (see 8.6.1 Unlocking and opening the doors on page 80).

↳ You can now open the door.

5. Turn the release dial to the locked position with a flat screwdriver when the door is open.
6. Tighten the locking screw and seal it.
7. Replace the screw cap.

9. Local control terminal

9.1. LCT touch panel

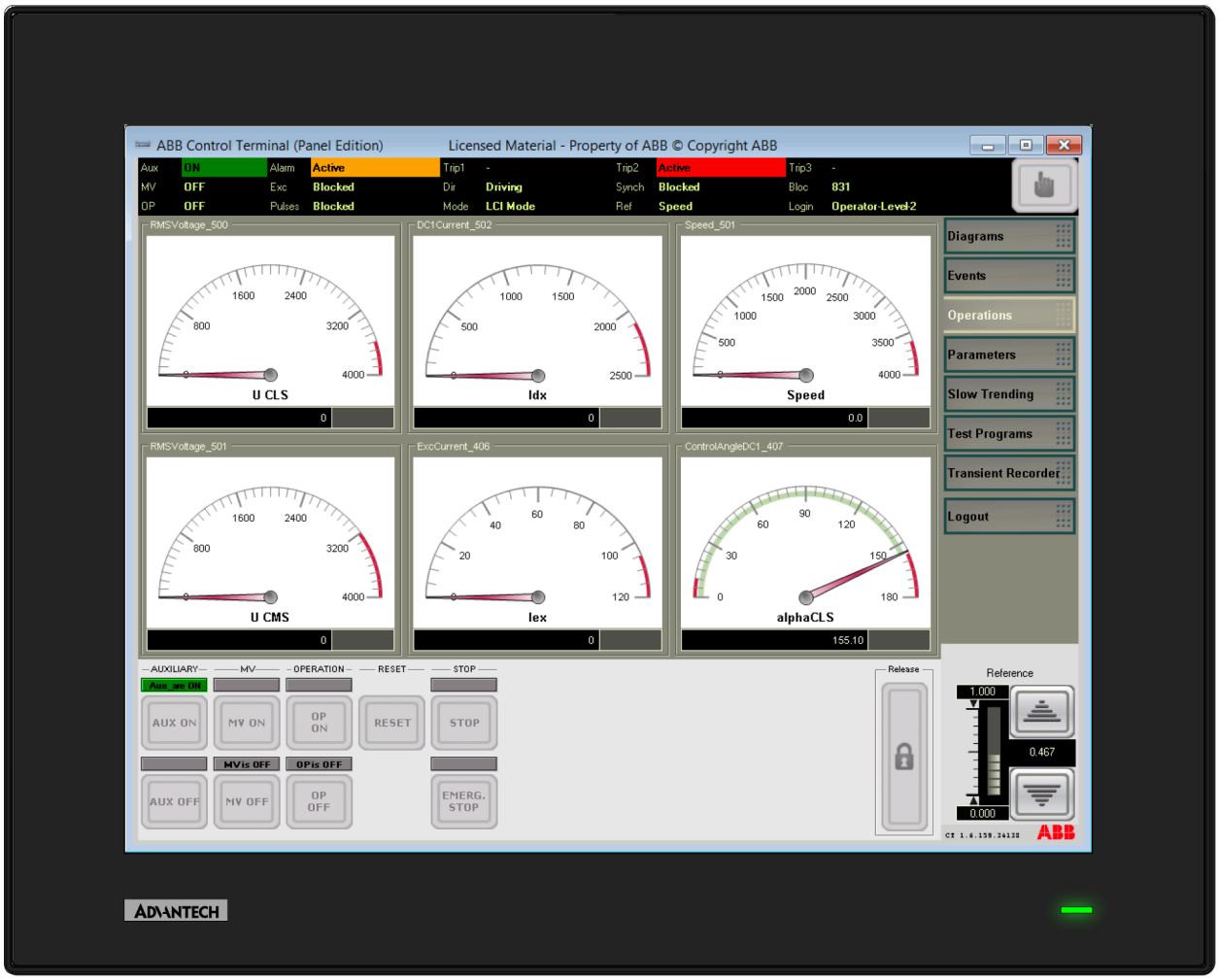


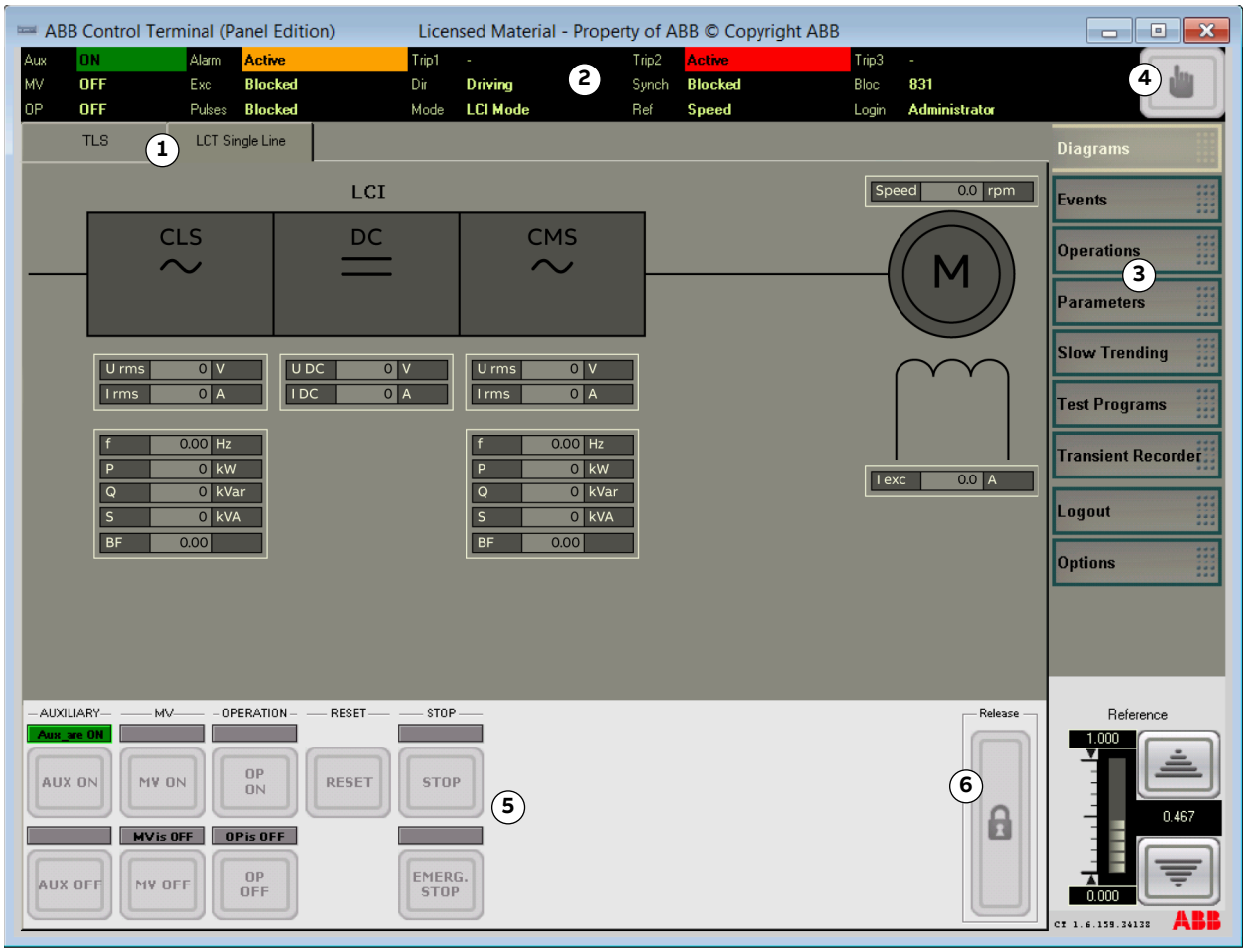
Figure 40 – Control terminal with touch panel PC

The MEGADRIVE-LCI local control terminal (LCT) incorporates a touch panel PC with a Microsoft Windows operating system and programs specific to the MEGADRIVE-LCI.

The menus described in this chapter are typical examples to illustrate the related instructions and functions. Depending on the software version, the illustrations might differ.

9.1.1. User interface overview

The default start menu in the LCT touch panel is the **Diagrams** menu, which opens when the auxiliary supply voltage of the drive is switched on.



Key

1. Optional LCT tabs (if applicable, see “Appendix G” for details)
2. Status bar
3. Menu bar
4. Panel control key
5. Operation bar
6. Release button for operation bar
7. Reference value input feature

Figure 41 – LCT start menu

9.1.2. Status bar

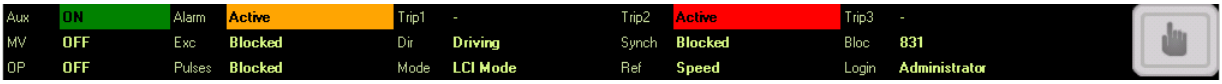


Figure 42 – Status bar

The status bar at the top of the **Diagrams** menu provides the following information:

Table 14 – Signals on the status bar

Signal	Status/value	Description
Aux	OFF / ON	Status of auxiliary units (eg, cooling)
MV	OFF / ON	Status of medium voltage supply
OP	OFF / ON	Status of drive operation
Alarm	- / Active	Displays if there is an active alarm
Exc	Blocked / Starting Current / Motor Voltage Control / Hold	Status of excitation pulses
Pulses	Blocked / Released	Status of firing pulses
Trip 1	- / Active	Displays an active fault of level 1
Dir	Driving / Braking	Status of drive mode
Mode	Pulse Mode / LCI Mode	Status of load-commutated mode
Trip 2	- / Active	Displays an active fault of level 2
Synch	Blocked / Released	Status of the synchronization device
Ref	Torque / Speed / Excitation Current / DC Current	Control parameter
Trip 3	- / Active	Displays an active fault of level 3
Bloc	_ _ _	Displays the serial number of the drive
Login	- Operator-Level-1 / Operator-Level-2 / Operator-Level-3 / Administrator	Displays the active user status

9.1.2.1. Panel Control button

The **Panel Control** button is part of the status bar. To use the **Panel Control** button, you must be logged in with one of the following user authorizations:

- Operator-Level-2
- Operator-Level-3
- Administrator

The hand symbol on the Panel Control button changes its color depending on the control status:

Table 15 – Panel control button statuses

Color	Description
	Drive is in remote (or service) control and control cannot be requested due to one of the following reasons: – A user has not logged into the control terminal – Current user does not have access rights to request control, eg, Operator-Level-1
	Control via the panel is active. The user can start or stop the drive and change parameters and has full control of the reference value input. → To transfer control to a user with lower priority, touch the **Panel Control** button. ↳ The hand turns red.
	A user with lower priority is in control of the drive (eg, remote control, fieldbus). → To take over control, touch the **Panel Control** button. ↳ The hand turns green.

9.1.3. Menu bar

The menu bar takes you to different menus with various functions. They are described in:

– 9.2 Login and logout procedures on page 89

– 9.3 LCT menus on page 92

– 9.4 Operation bar and reference value input feature on page 129

9.1.4. Standard buttons

The following buttons have the same function in all of the LCT menus where they appear:

Table 16 – Standard buttons on LCT menu

Button	Description
Confirm 	Confirms a selection or a change carried out in the system.
Cancel 	Leaves a window or dialog without saving changes.
Edit 	Edits the selected data.
Delete 	Deletes the selected data.
Info 	Displays information about the selected data

9.2. Login and logout procedures

To perform operational commands, enter settings and use functions, you must be logged in as a user. Without logging in, you only have limited rights to perform changes, and you can only view process values and recorded data.

There are four user authorizations with different user rights:

– Operator-Level-1

– Operator-Level-2

– Operator-Level-3

– Administrator

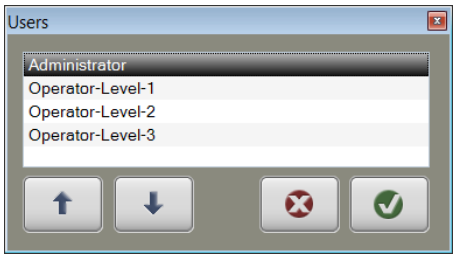
9.2.1. Logging in to the LCT

1. To log in, touch the **Login** button in the menu bar.

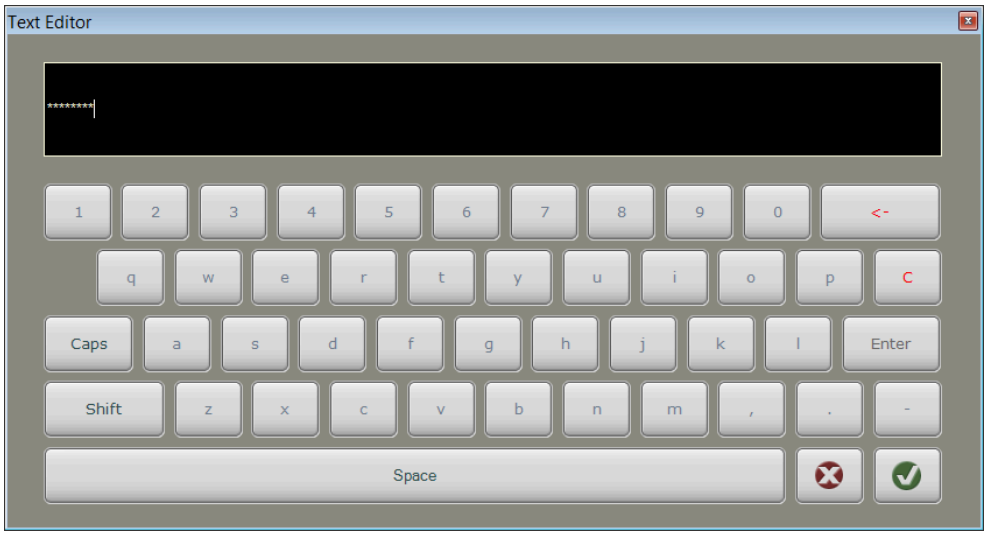
2. Enter your **User ID** (1) and ***PASSWORD*** (2).

Figure 43 – Login window

- To open the Users window where you can select your **User ID**, touch the browse button (…) beside the **User ID** box and touch your **ID** in the list. See Table 17 for an overview of the user authorizations.



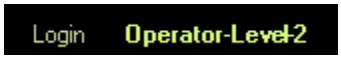
- To open the **Text Editor** window for password entry, touch the browse button (…) beside the **Password** box (Figure 43). See Table 18 for the default passwords.



↳ After entering the password, you are logged in and authorized to use the menu functions.

- If no users are logged in, the login status in the status bar is a hyphen (-).

- If a user is logged in, the login status in the status bar displays the name of the user.



NOTE – When logged in, the **Login** button changes to the **Logout** button.

9.2.2. Automatic logout function

NOTICE

Risk of component damage! Automatic logout can cause an abrupt change of speed and torque in the motor.

The automatic logout function is a safety feature that triggers after a certain time of inactivity. This function resets the reference value input for speed and torque to the constant operating point specified for auto-controlled operation.

→ To set the automatic logout time or to disable the function, go to the **Options** menu (see 9.3.9 Options menu on page 124)

9.2.3. User authorizations

Table 17 describes the types of user authorizations that are available for the LCT.

Table 17 – Overview of user authorizations

Item	Function	User authorizations			
		Oper. level-1	Oper. level-2	Oper. level-3	Admin.
Program	Minimize, close	-	-	X	X
Panel Control button	Usage	-	X	X	X
Events	Reset	X	X	X	X
Events	Save, print, freeze	-	X	X	X
Events	Delete events list	-	-	X	X
Operations	Configure measuring instruments	-	X	X	X
Options	Open dialog [a]	-	X	X	X
Parameters	Create snapshot	X	X	X	X
Parameters	Open, save snapshot	-	-	X	X
Parameters	Create, configure groups	-	X	X	X
Slow Trending	Configure, start	-	X	X	X
Slow Trending	Format graphics, display	X	X	X	X
Slow Trending	Create, save recordings	-	X	X	X
Test Programs	Operate command buttons	-	-	X	X
Transient Recorder	Configure auto-read	-	X	X	X
Transient Recorder	Configure recorder	-	-	X	X
Transient Recorder	Select recorder	X	X	X	X
Transient Recorder	Trigger	X	X	X	X

[a] Use of the “Options” menu is subject to additional restrictions (see Figure 28)

9.2.4. User passwords

The LCT uses the following default passwords.

Table 18 – Default passwords for different user authorizations

User	Default password	Modified password
Administrator	Not released	- - - -
Operator-Level-3	ABB3	
Operator-Level-2	ABB2	
Operator-Level-1	ABB1	

9.3. LCT menus

The following sections provide an overview of the LCT menus:

9.3.1. Diagrams menu

The **Diagrams** menu shows a simplified block diagram with analog views of the current, voltage and power data of the drive. These views are not customizable.

The configurable operation bar is at the bottom of the **Diagrams** menu. For more information, see 9.4.1 Releasing the operation buttons on page 129 and 9.4.2 Reference value input feature on page 131.

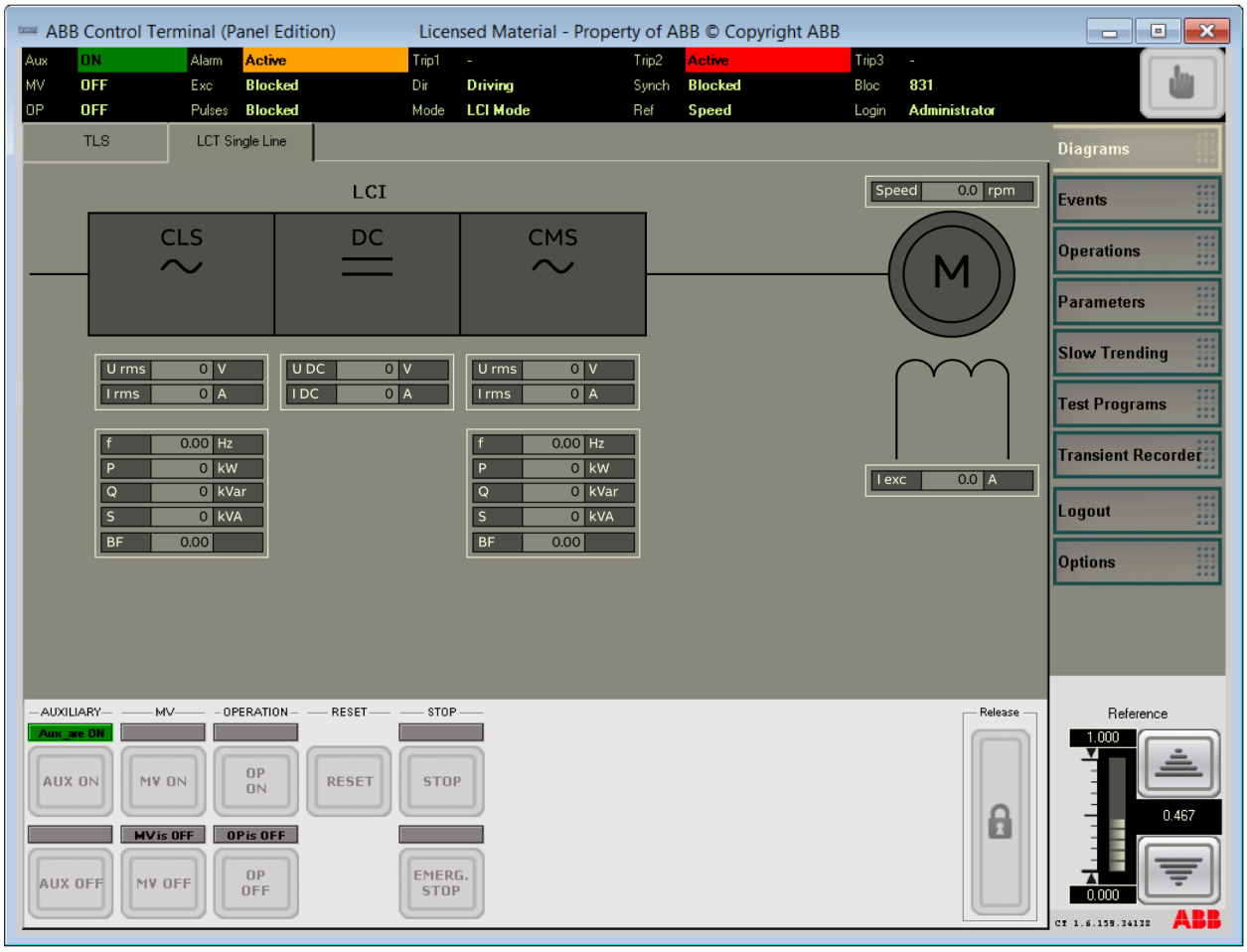


Figure 44 – Diagrams menu

Table 19 – Description of the Diagrams menu

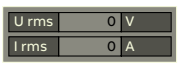
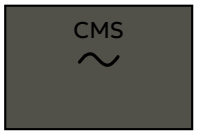
Term	Symbol	Description
CLS	 	Converter line side CLS is the line-side converter of the drive. The following CLS values are monitored: – U_{rms}: r.m.s. value of the input voltage – I_{rms}: r.m.s. value of the input current

Table 19 – Description of the Diagrams menu (continued)

Term	Symbol	Description
		– f: frequency of the input voltage – P: active input power – Q: reactive input power – S: apparent input power $S = \sqrt{P^2 + Q^2}$ (1) – PF: power factor PF= cos ϕ (ϕ: phase shift between U and I on the line side)
DC	 	Direct current DC is the DC circuit between the CLS and CMS. The following DC- link unit values are monitored: – U_{DC}: DC voltage across the DC- link unit – I_{DC}: DC current through the DC- link unit
CMS	  	Converter motor-side CMS is the motor-side converter of the drive. The following values of the CMS are monitored: – U_{rms}: r.m.s. value of the output voltage – I_{rms}: r.m.s. value of the output current – f: frequency of the motor-side voltage – P: active output power – Q: reactive output power – S: apparent output power $S = U \times I = \sqrt{P^2 + Q^2}$ (2) – PF: power factor PF= cos ϕ (ϕ: phase shift between U and I on the line side)
M	  	Synchronous motor The following values are monitored: – I_{exc}: actual value of the excitation current – Speed: actual value of the motor speed in rpm

9.3.2. Events menu

Key	Explanation
1. Alarm fault window	Displays any pending alarm and fault.
2. Operation buttons	
3. Reset button	For alarms and faults

Figure 45 – Events menu

The **Events** menu provides an overview of the last 1000 events of the drive.

The following attributes are available for each event:

- Type of event (information, alarm, error)
- Affected device (eg, AC 800PEC controller)
- Date of event
- Time of event
- Source of event (eg, M/S: Matlab Simulink)
- ID of the event
- Event name in an abbreviated form

By default, the events are sorted by time. To sort them by another attribute, touch the corresponding column header.

9.3.2.1. Operation buttons in the Events menu

The following operation buttons are available on the **Events** menu.

Table 20 – Operation buttons in the Events menu

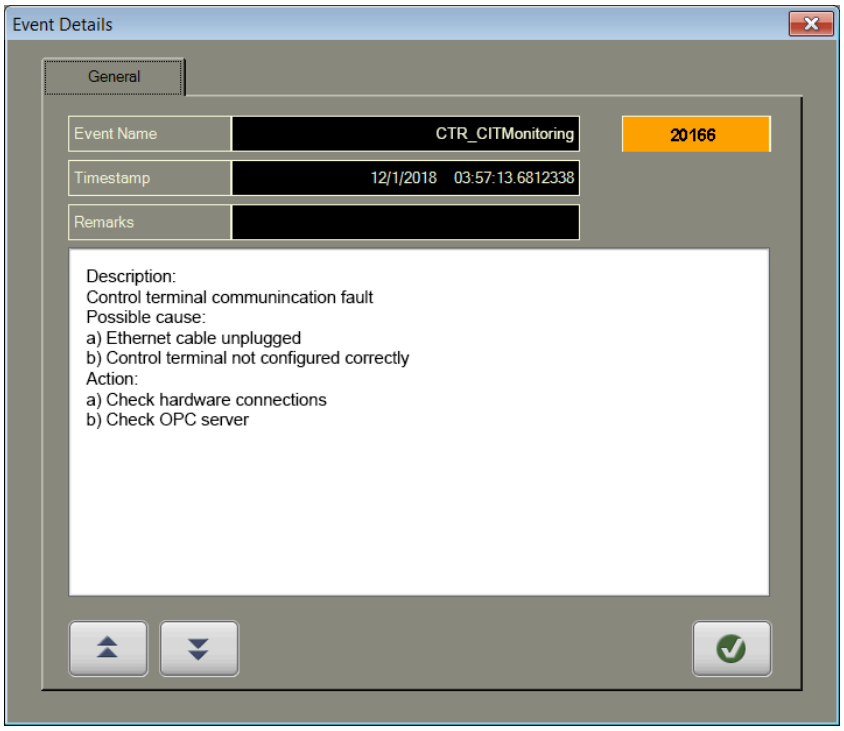
Button	Description
Up/Down 	Scroll up or down selected events.
Info 	Displays description, possible cause and recommended actions for the selected alarm and fault messages. Opens the **Event Details** window: 
Double arrow 	Jumps between the descriptions of distinct events.
Snowflake 	Freezes / unfreezes the current view without stopping the recording of events. – The black snowflake button freezes the view. – The blue snowflake button unfreezes the view.

Table 20 – Operation buttons in the Events menu (continued)

Button	Description
Save 	Automatically saves the current events list in the Alarms and Events folder that has been specified in the application settings (**Options** > **Application** > **Data Folder**).  All 1000 events currently displayed in the list are saved in a `*.csv` file that allows further processing, eg, with Microsoft Excel®. To save an events list, you must be logged in with one of the following User authorizations: – Operator-Level-2 – Operator-Level-3 – Administrator
Print 	Prints the complete events list without any further prompt. Data is printed through the printer defined in Windows® in the portrait orientation. 1000 events generate a document of about 27 - 30 pages of size A4. The printer is not supplied with the MEGADRIVE-LCI. You can connect one via the USB port of the control terminal, or install a PDF printer. To print an events list, you must be logged in with one of the following User authorizations: – Operator-Level -2 – Operator-Level-3 – Administrator
Delete 	Deletes the entire events list. To delete the events list, you must be logged in with one of the following User authorizations: – Operator-Level-3 – Administrator
Select tag filter 	Applies one of the predefined tag filters.
Reset 	Resets all pending events To reset pending events, you must be logged in with one of the following User authorizations: – Operator-Level-2 – Operator-Level-3 – Administrator

9.3.3. Operations menu

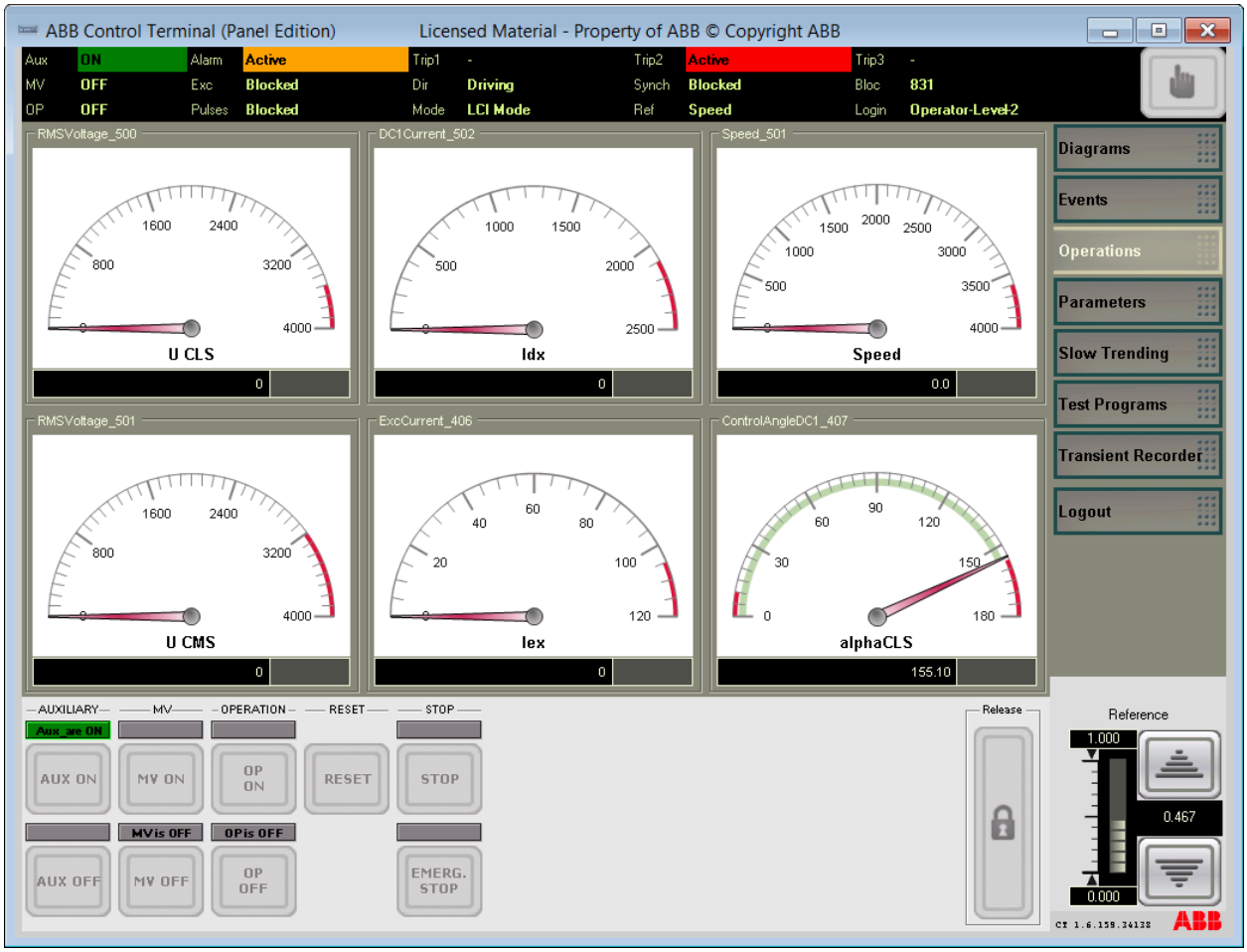


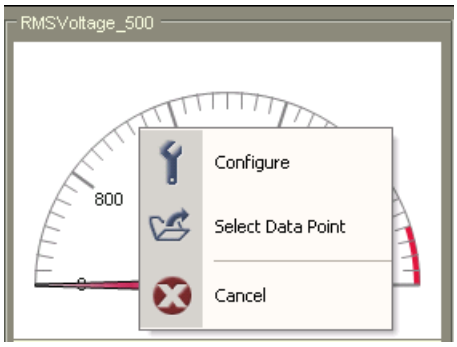
Figure 46 – Operations menu

To configure the analog meter, you must be logged in with one of the following User authorizations

- Operator-Level-2
- Operator-Level-3
- Administrator

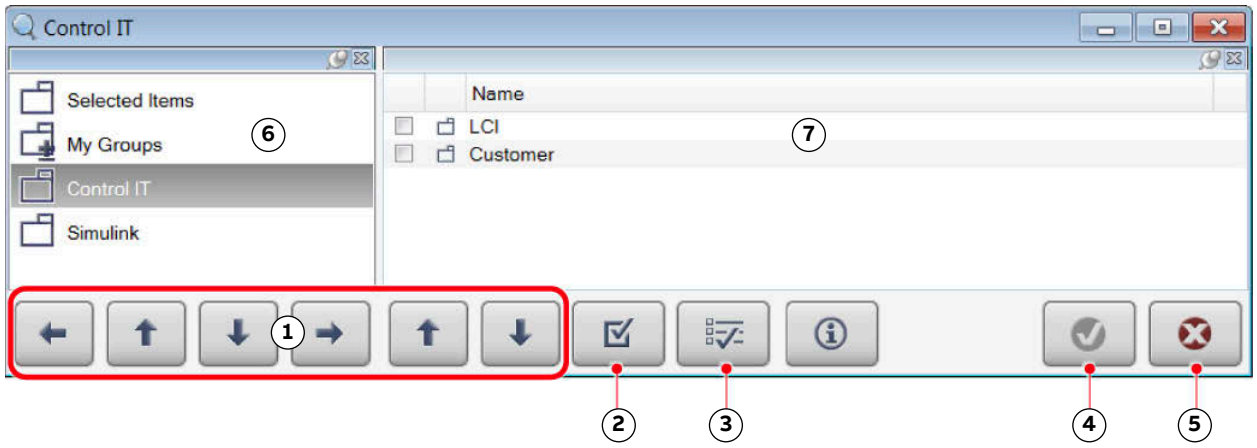
9.3.3.1. Selecting a data point

1. To select a data point, touch the analog meter to be configured.
2. Touch **Select Data Point**.



3. Touch **Simulink** or **Control IT**.
   - **Selected Items** contains the selected data points
   - **My Groups** contains the user-defined groups if there are any.
   - **Simulink** contains the Simulink data points
   - **Control IT** contains the data points of the “Control Builder”.

   NOTE – The names of the data points are not self-explanatory. If you need assistance finding the desired data points, contact ABB.



Key

1. Browse buttons
2. Select/Clear button
3. Info button
4. Confirm button
5. Cancel button
6. Main directory
7. Subdirectory

Figure 47 – Control IT window

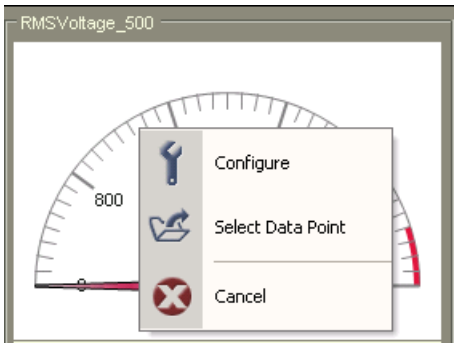
4. Select a data point.
   → To search the subfolders for a data point, use the browse buttons (1, Figure 47).
   → To select a data point, touch the **Select/Clear** button (2, Figure 47).

   NOTE – To view information about the selected data point, touch the **Info** button (3, Figure 47). The selected data point is also indicated in the **Selected Items** folder.

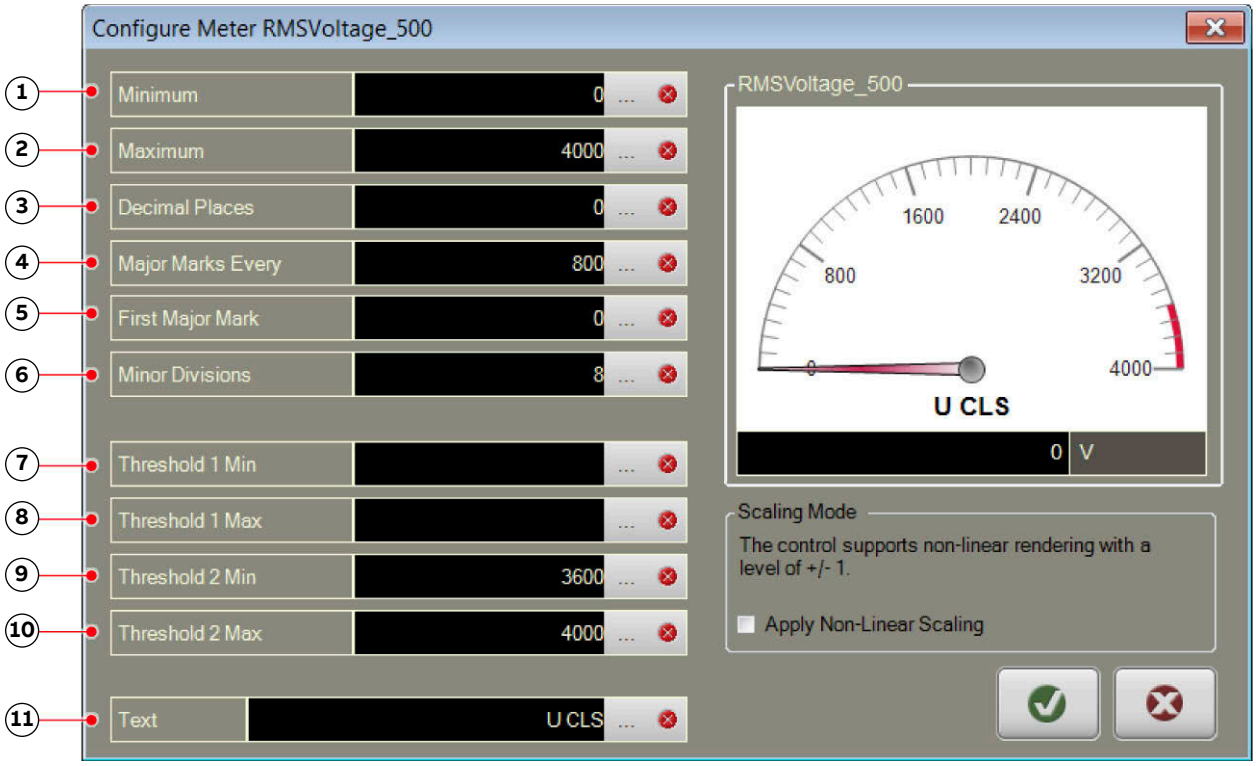
5. To link the selected data point with the analog meter, touch the **Confirm** button (4, Figure 47).
   NOTE – To leave the **Operations** menu without selecting a data point, touch the **Cancel** button (5, Figure 47).

9.3.3.2. Configuring an analog meter for a selected data point

1. Select a data point according to 9.3.3.1 Selecting a data point on page 99).
2. Touch the analog meter that you want to configure.
3. Touch **Configure**.



4. Enter the values for the meter.



Key

1. Lower limit value of scale
2. Upper limit value of scale
3. Number of decimal points
4. Major scale divisions
5. First major scale divisions
6. Minor scale divisions
7. Minimum value of the specified threshold region (1)
8. Maximum value of the specified threshold region (1)
9. Minimum value of the specified threshold region (2)
10. Maximum value of the specified threshold region (2)
11. Freely configurable text designating the applicable signal

Figure 48 – Configure meter window

The meter refreshes after each user input.

5. To configure the analog meter, touch the **Confirm** button (4, Figure 47).

   NOTE – To leave the **Operations** menu without selecting a data point, touch the **Cancel** button (5, Figure 47).

9.3.4. Parameters menu

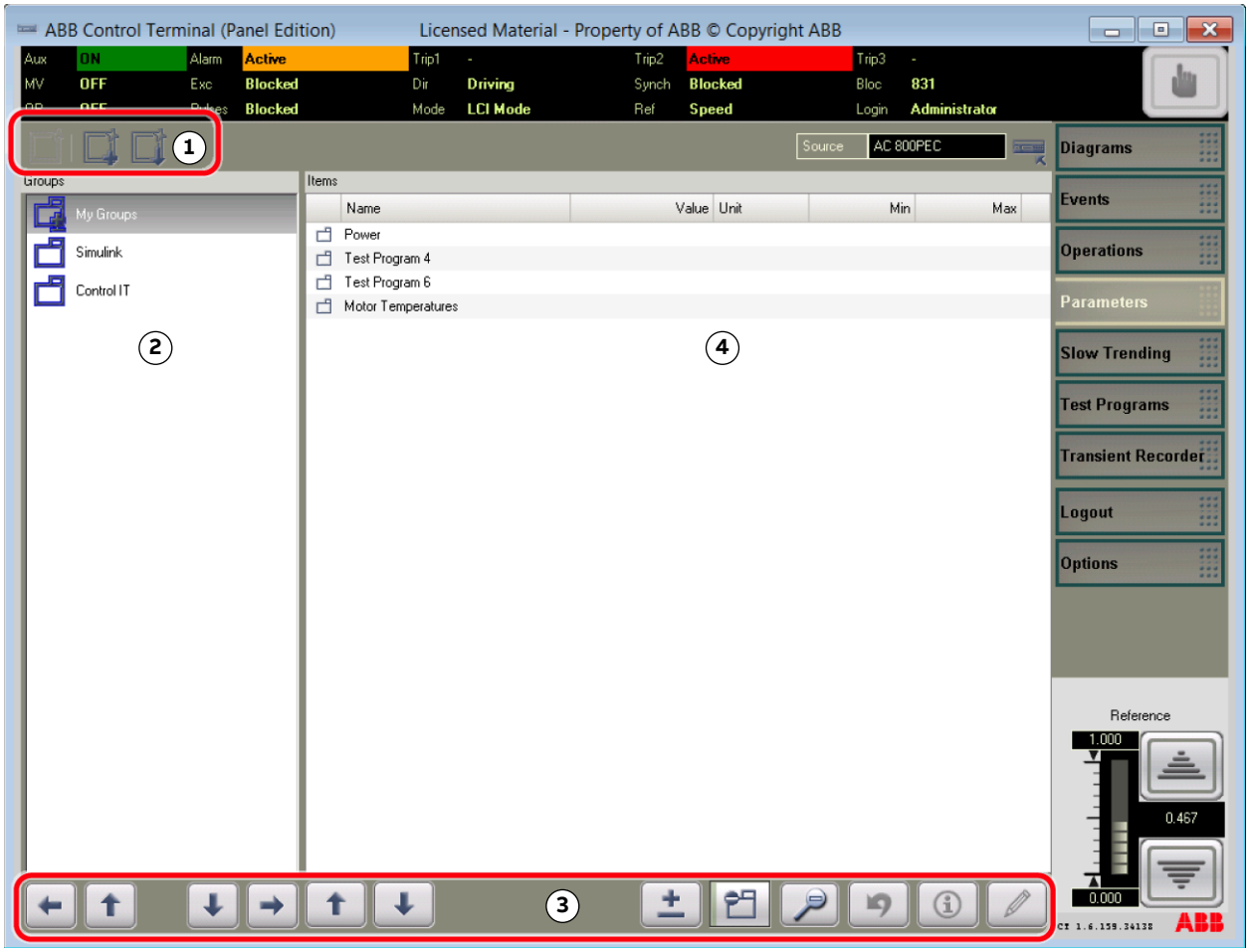
NOTICE

Risk of component damage. Running the drive system with incorrect data can result in improper operation, reduction of control accuracy and damage of equipment.

→ Parameters must only be set by qualified personnel.

→ DO NOT change a parameter if the effects of the change are unclear.

The **Parameters** menu provides detailed information about all available settings, parameters and status variables for the AC 800PEC controller. The **Groups** window (2, Figure 49) shows the parameter folders in a tree structure. Detailed knowledge of the software structure is required to be able to work with it efficiently. The **Items** window (4, Figure 49) shows the parameters and variables of a particular folder along with the actual values.



Key

1. Snapshot buttons for creating and saving parameter settings.
2. Groups window
3. Operation buttons
4. Items window

Figure 49 – Parameters menu

NOTE – Group and item names are not self-explanatory. If you require assistance to find an item, contact ABB.

9.3.4.1. Operation buttons in the Parameters menu

The following operation buttons (3, Figure 49) allow you to search the **Groups** window (2, Figure 49) for desired parameters and to adjust the settings of the groups and **Items** window (4, Figure 49).

Table 21 – Operation buttons in the Parameters menu

Button	Description
Arrows 	Navigate in the window.
Items/Groups 	Switches from **Items** to **Groups**.
Groups/Items 	Switches from **Groups** to **Items**.
Select tag filter 	Applies one of the predefined tag filters.
Undo 	Undoes any changes to parameters.
Groups 	Adds the selected parameter to an existing group or creates a new group with the selected parameter. To create parameter groups, you must be logged in with one of the following User authorizations: – Operator-Level-2 – Operator-Level-3 – Administrator

9.3.4.2. Parameter types

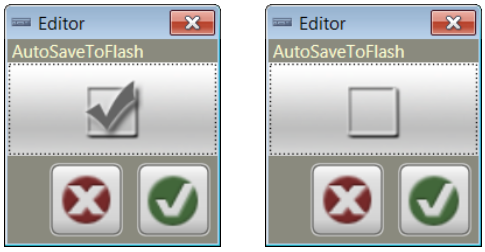
There are two parameter types for editing:

– Binary

– Real

Binary parameters

Editor windows of parameter type binary look like this:



To invert the parameter value, touch the relevant button

1. Invert the parameter value from **0** to **1**.
2. Invert the parameter value from **1** to **0**.

Real parameters

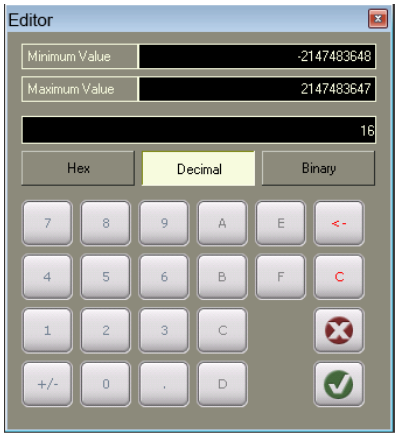


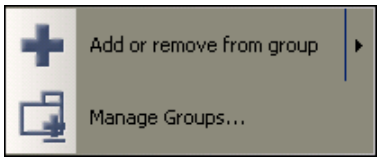
Figure 50 – Editor window for real parameters

This window allows you to enter a new parameter value in hexadecimal, decimal or binary format.

9.3.4.3. Managing parameter groups

1. Touch the **Groups** button.

2. Do one of the following:



- To add or remove the selected parameter to / from an existing group, touch **Add or remove from groups.**
- To create a new group with the selected parameter, touch **Manage Groups**.

↳ The **Manage Groups** command opens the following window:

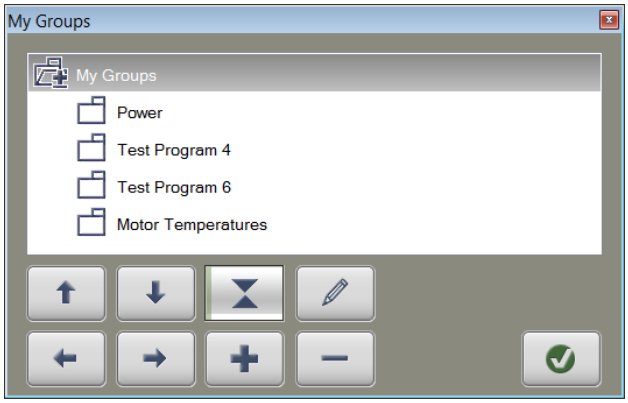


Figure 51 – My Groups window

The **My Groups** window provides the following operation buttons:

Table 22 – Buttons in My Groups window

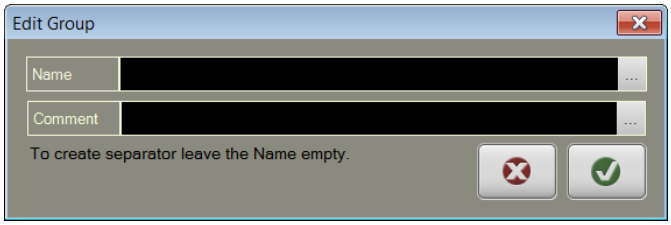
Button	Description
Arrows 	Navigate across the groups.
Add 	Create a new group. The **Add** button opens the following window:  To open the touch keypad and name the new group, touch the upper (...) button.

Table 22 – Buttons in My Groups window (continued)

Button	Description
Delete 	Deletes the selected group
Edit 	Opens a a window to change the group name and to move or delete the group.

9.3.4.4. Creating and saving parameter settings

The snapshot features create, save and load a snapshot of the parameter settings. It is useful to save a specific setting of the parameters (eg, after startup) or to report the current settings to ABB if there is a fault.

A snapshot is not the same as a print screen. A snapshot captures and exports only the parameter values.

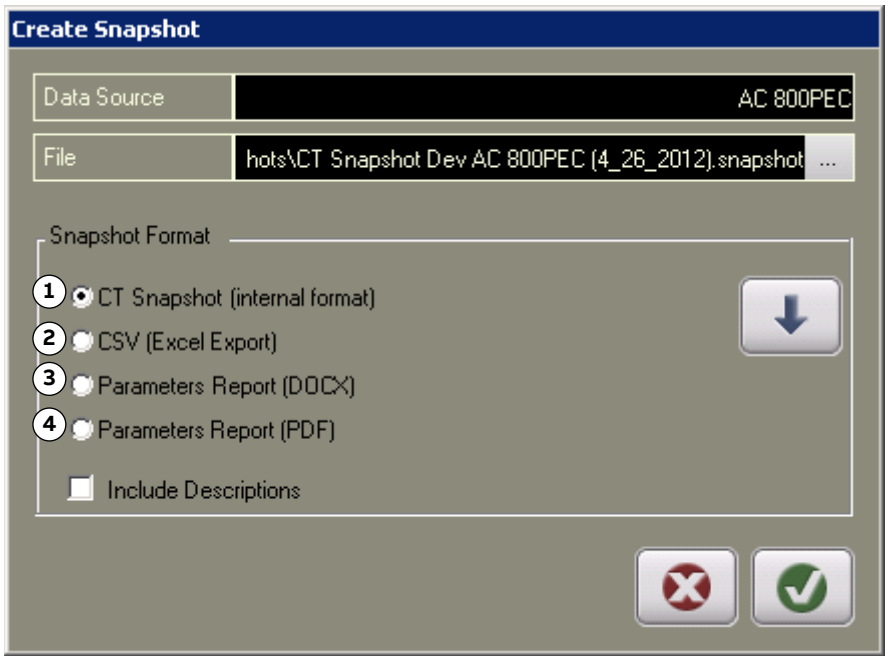
Table 23 – Snapshot buttons

Button	Description
Create a snapshot 	Creates and saves a snapshot. To create a snapshot, you must be logged in with one of the following User authorizations: – Operator-Level-1 – Operator-Level-2 – Operator-Level-3 – Administrator
Open snapshot 	Opens a snapshot (note: only internal format) To open a snapshot, you must be logged in with one of the following User authorizations: – Operator-Level-3 – Administrator
Change view 	Switches from the snapshot parameters view (green / white pattern) to the active AC 800PEC parameters view.
Snapshot info 	Displays additional information about the loaded snapshot.
Save snapshot 	Saves an opened snapshot in a different folder than the default folder or any changes made to the opened snapshot.
Apply snapshot 	Apply the snapshot parameters to the main control device. **IMPORTANT!** This function is only for ABB personnel!

9.3.4.4.1. Saving the AC 800PEC controller parameter settings in a snapshot file

1. Touch the **Create snapshot** button.

↳ The following window opens:



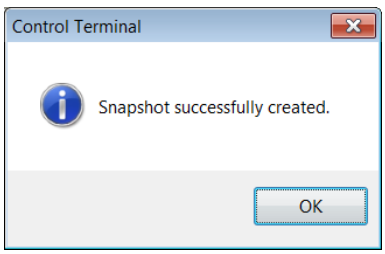
Key	Explanation
1. CT Snapshot (internal format)	Creates a file that can only be read by this software.
2. CSV (Excel Export)	Creates a comma separated values text file that can be opened in Excel or other spreadsheets
3. Parameter Report (DOCX)	Creates a Word (.docx) file
4. Parameter Report (PDF)	Creates a portable document file (PDF) that can be viewed with a PDF reader such as Acrobat Reader.

Figure 52 – Create Snapshot window

2. Use the arrow button to select the file format for the snapshot.

3. To specify a different storage location or name for the file, touch the browse button (**...**).
4. Touch the **Confirm** button to start the export.

The export includes more than 5000 parameters and takes several minutes. The following message opens when the export is complete:



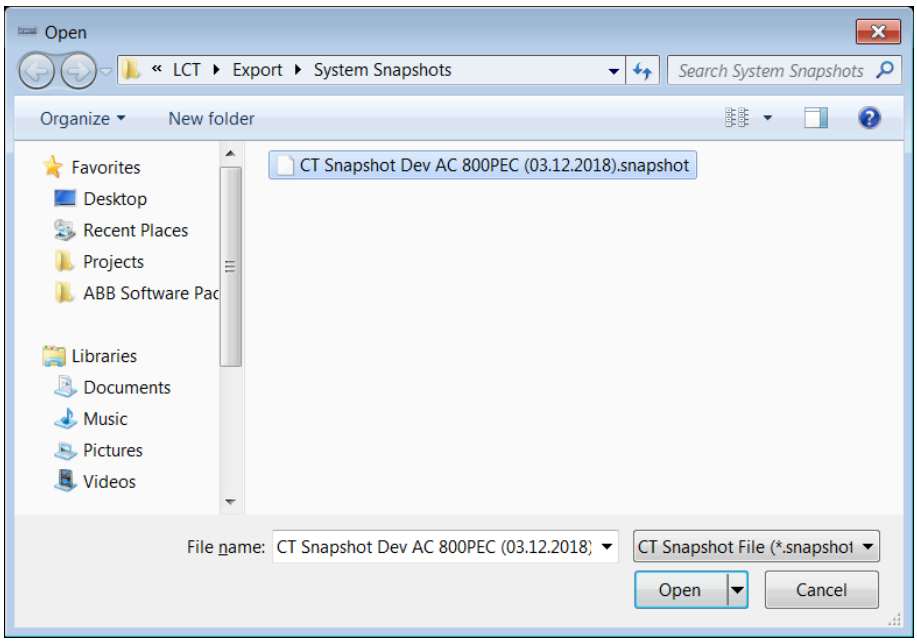
9.3.4.4.2. Opening and editing snapshot files

You can load, edit and save snapshot files on the LCT hard disk.

IMPORTANT! Opening a snapshot file does not replace any of the data in the main control device. For information on the types of parameters that you can configure, see 9.3.5 Slow trending menu on page 109

1. Touch the **Open snapshot** button:

2. Go to the folder with the snapshot file, select the file and then touch **Open**.



NOTE – A snapshot file includes more than 5000 parameters and takes several minutes to load. The loaded snapshot appears as a green and white parameter list in the **Items** window (Figure 53). The green and white pattern indicates that the displayed parameters represent a snapshot and not the actual data of the main control device, ie, AC 800PEC controller.

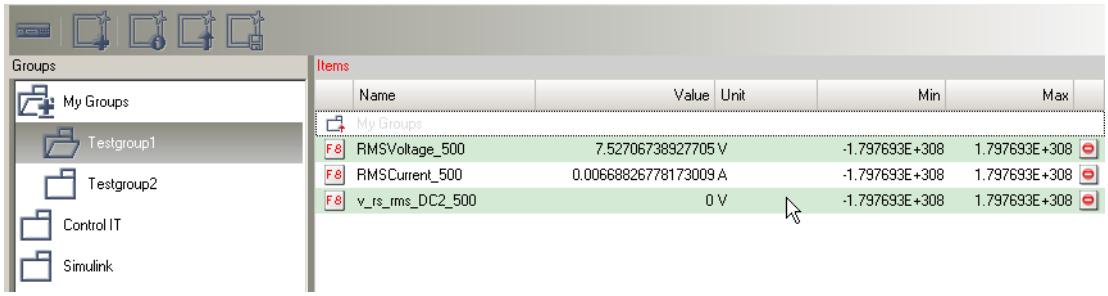
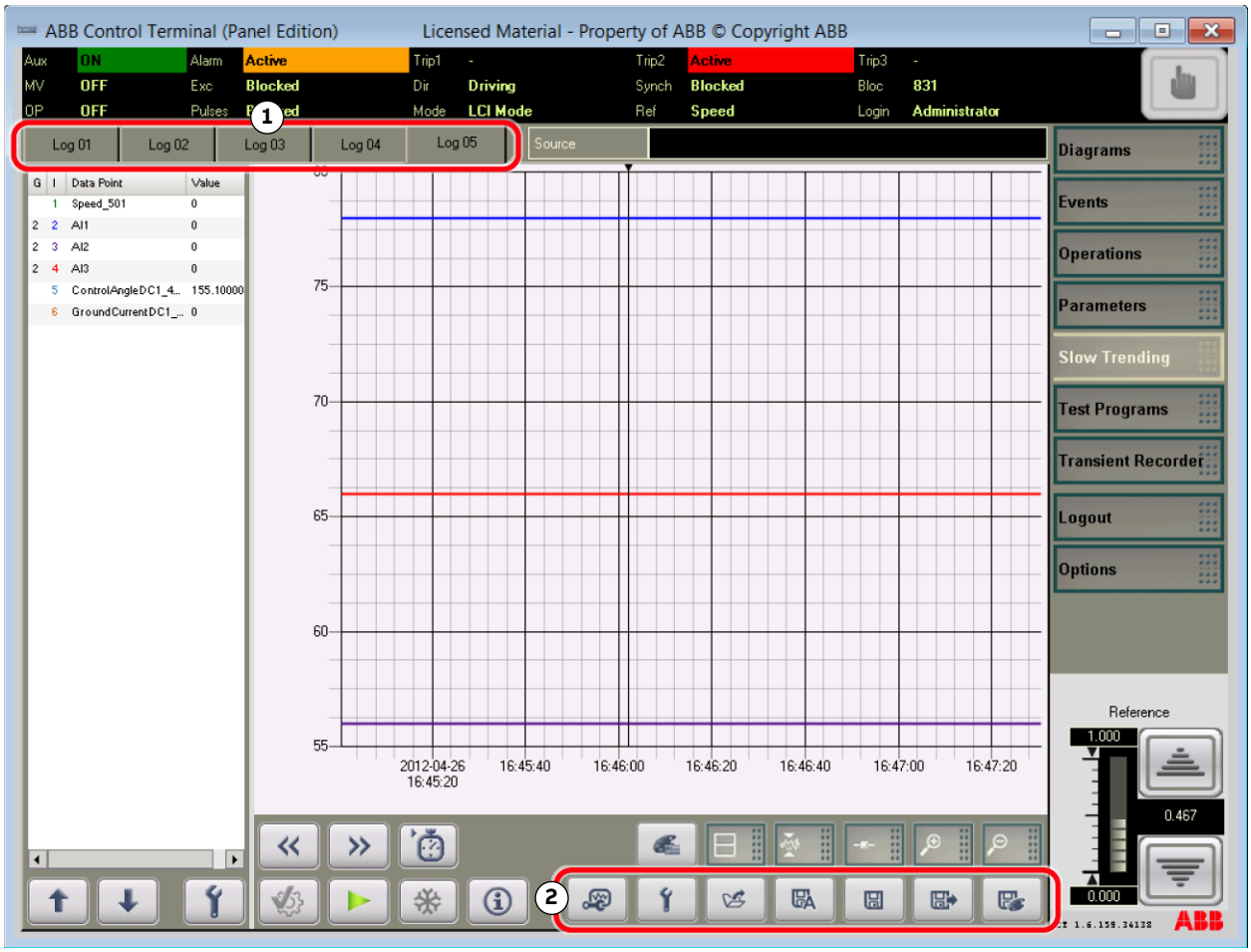


Figure 53 – Parameters list

9.3.5. Slow trending menu

The **Slow Trending** menu is fully customizable and can display up to five trend views (1, Figure 54) with a fixed sample rate of 500 ms.



Key

1. Trend view button
2. Operation button

Figure 54 – Slow Trending menu

To configure and start a trending, you must be logged in with one of the following User authorizations:

– Operator-Level-2

– Operator-Level-3

– Administrator

9.3.5.1. Operation buttons in the Slow Trending menu

The following operation buttons are in the **Slow Trending** menu.

Table 24 – Operation buttons in the Slow Trending menu

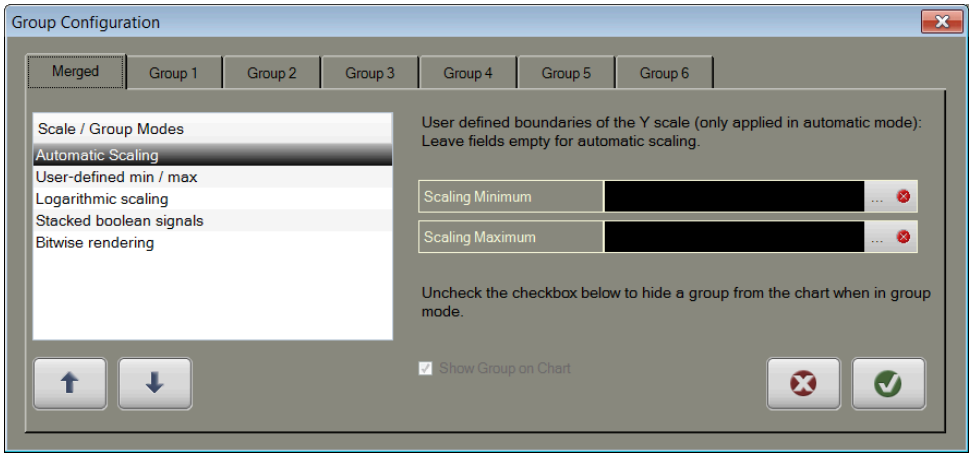
Button	Description
Configure 	Configures a trending To configure the graphs and views, you must be logged in with one of the following User authorizations: – Operator-Level-1 – Operator-Level-2 – Operator-Level-3 – Administrator
Configure group 	Defines the display settings for the merged view or individual ones for each group. The **Configure Group** button opens the following window: 
Snowflake 	Touch this button to freeze or unfreeze the current view without stopping the recording. – The black snowflake button freezes the view. – The blue snowflake button unfreezes the view.
Stop 	Stops the recording
Start 	Starts a new recording with the previously selected signals.
Save internal 	Save a recording in the internal format.

Table 24 – Operation buttons in the Slow Trending menu (continued)

Button	Description
Save as CSV 	Saves a recording as `*.CSV` file.
Auto-Save view 	Saves the current view settings. It is recommended to save recordings for later analysis using one of the save buttons above. All of them open a window for entering the file name and location of the savings.
Load 	Loads and analyzes recordings, ie, their logs.

9.3.5.2. Configuring a trending

1. Touch the **Configure** button.

2. In the window that opens, select the connected AC 800PEC controller (the drive only has one), and touch the **Confirm** button.

3. In the **Browse** Items window, select an empty row.

   By default, the first row is selected. You can add up to 12 signals to one recording.

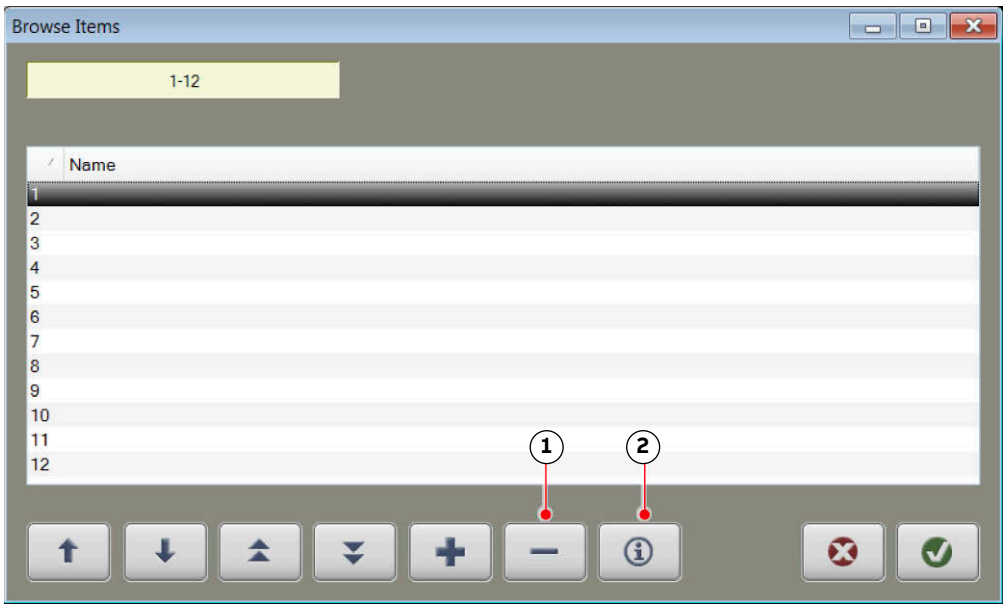
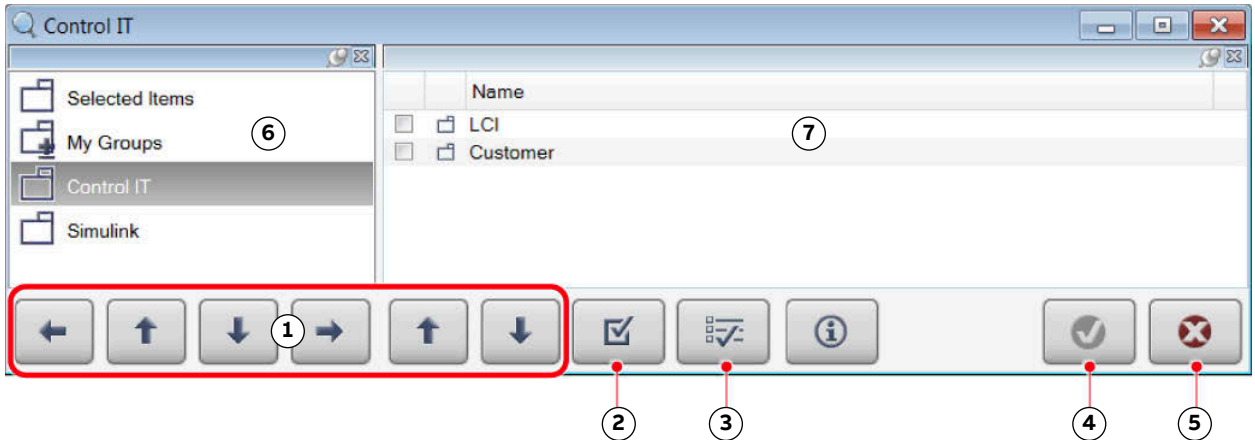


Figure 55 – Browse items window

4. Touch the **Add** button.

5. In the **Control IT** window, use the arrow buttons (1, Figure 56) to select a signal in the list.



Key

1. Browse buttons
2. Select/Clear button
3. Info button
4. Confirm button
5. Cancel button
6. Main directory
7. Subdirectory

Figure 56 – Signal list in Control IT window

6. Touch the **Select** button (2, Figure 56) to select a signal.

   NOTE – If there are predefined user groups and you want to select all signals of a user group at once, touch the **Select All** button (3, Figure 56).

7. Touch the **Confirm** button (4, Figure 56).

↳ The **Browse Items** window (Figure 55) opens, displaying the selected signals.

8. If required, add or remove signals.
   - → To add additional signals, repeat steps 4 - 8.
   - → To remove a signal, select the corresponding row and touch the **Remove** button (2, Figure 55).

9. Touch the **Confirm** button.

↳ Trending starts immediately after the signals have been selected and loaded.

9.3.5.3. Opening a log/recording file

1. Touch the **Load** button.

2. To load recordings that are not located in the default folder or a USB memory stick, touch the **Load** button in the **Log Browser** window.

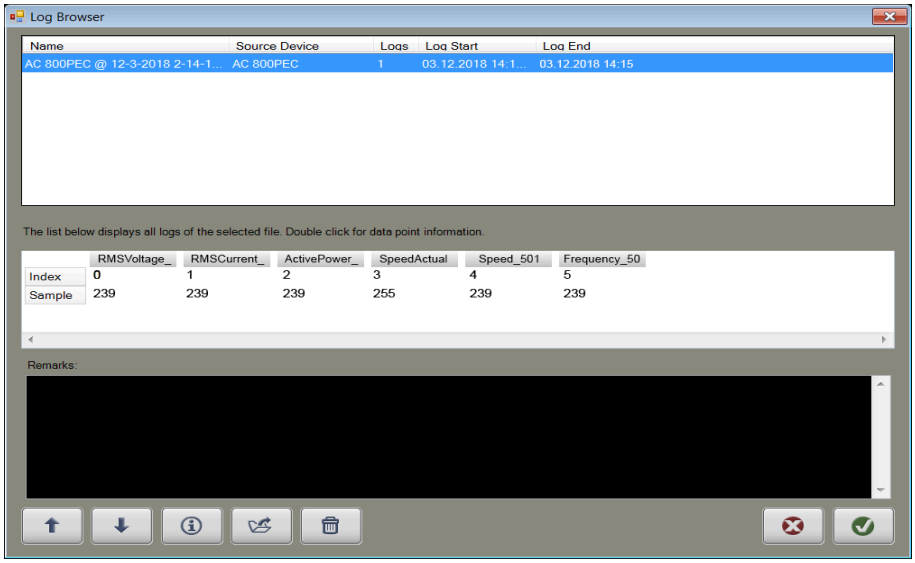


Figure 57 – Log Browser window

↳ If you saved the recordings in the default directory, they are automatically listed in the **Log Browser** window together with information about their contents and date.

3. Go to the location of the recording, select the corresponding file and touch the **Confirm** button.

↳ The recording is displayed in the **Log Browser** window.

4. Touch the **Confirm** button in the **Log Browser** window.

↳ The recording is displayed in the **Slow Trending** menu and can be configured using the operation buttons.

9.3.5.3.1. Operation buttons for controlling a recording

You can use the following buttons after you load a recording file.

Table 25 – Operation buttons for controlling a recording

Button	Description
Restart 	Restarts a loaded recording if the same configuration is reused. It is recommended to define separate groups that are better suited for fast configuration.
Timer 	Sets time markers (displayed as vertical lines) for specifying a measuring range (indicated as dark background between two markers). The **Timer** button is always active regardless of whether a recording is being carried out, a file is open or the recording is stopped.
Legend 	Adjusts the display format and location of the diagram legend. The diagram legend states the name of the data points that are displayed in the menu. By default, it appears above the diagram, however, its size and location can be changed.
Display mode 	Adjusts the display format of different parameters in the diagram.
Measuring points 	Displays / hides the measuring points of the recorded parameters in the diagrams.
Zoom 	Touch these buttons to zoom in / out of a diagram.

9.3.5.4. Adding markers to the recording

1. To set the first marker in the diagram, touch the appropriate spot on the screen.
2. Touch the **Timer** button.

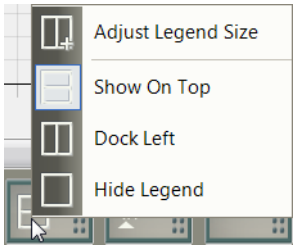
3. Add the markers.
4. To set the second marker, repeat steps 1 and 2.
5. To change a specified measuring range, drag and drop the markers.

↳ The times and the duration of the current measuring range appear in the box next to the **Timer** button.

9.3.5.5. Configuring the legend

1. Touch the **Legend** button.

2. Touch an adjustment option:

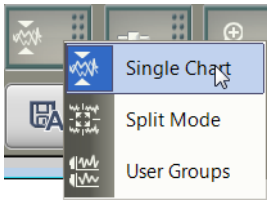


- **Adjust Legend Size**: auto-adjusts the legend to the optimal size.
- **Show On Top**: displays the legend above the diagram.
- **Dock Left**: displays the legend on the left-hand side of the diagram.
- **Hide Legend**: hides the legend.

9.3.5.6. Adjusting the display mode

1. Touch the **Display Mode** button.

2. Touch an adjustment option:



- **Single Chart**: displays all recorded parameters in a single diagram.
- **Split Mode**: displays each parameter of the recording separately in a small diagram.
- **User Groups**: displays the parameters of the user-defined group in a single diagram.

9.3.6. Test programs menu

The **Test Programs** menu is used to commission and troubleshoot the drive. This menu can only be used by authorized personnel.

Available test programs:

– **Test program 1 - 2**: Firing pulses test

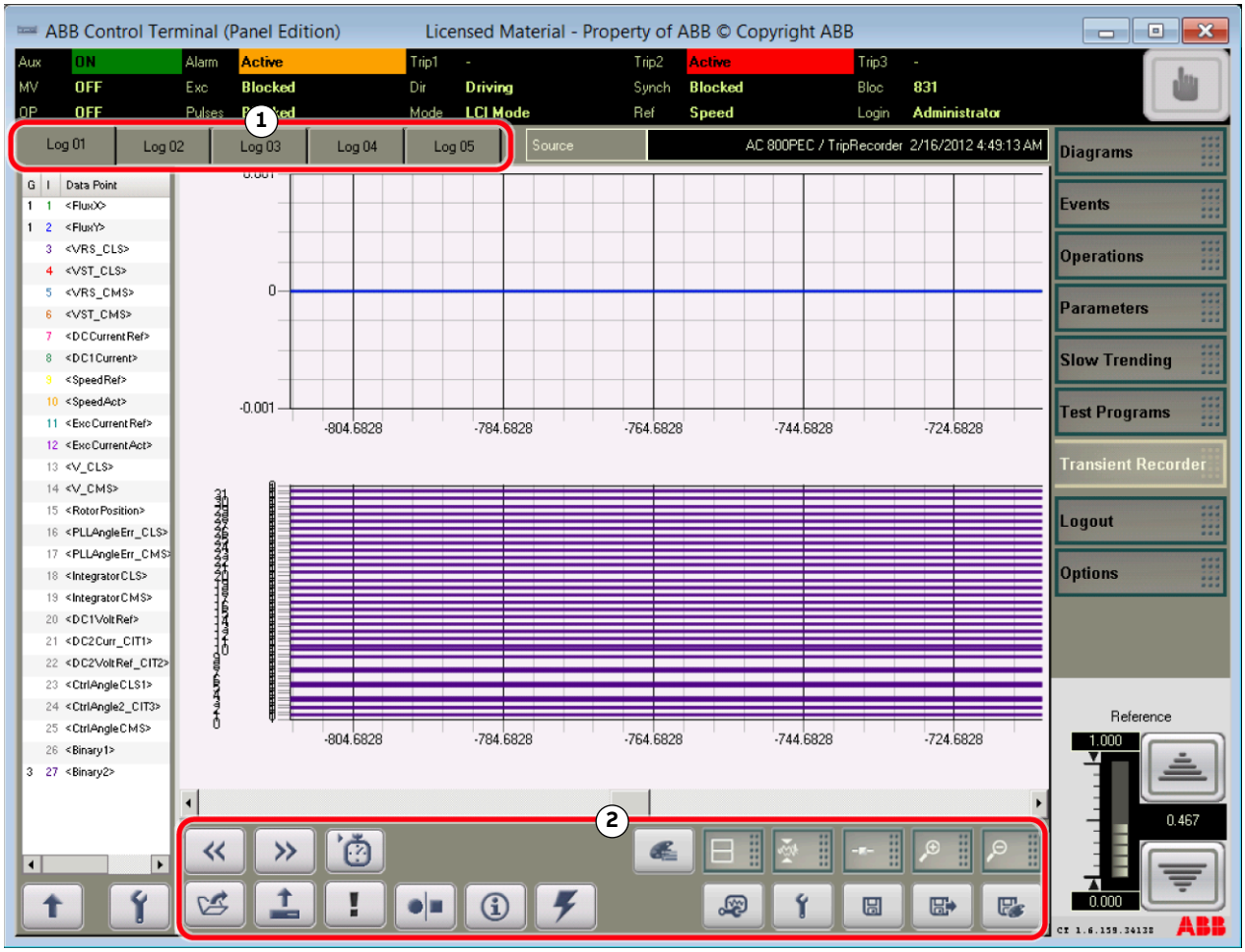
– **Test program 4**: Excitation test

– **Test program 5 - 6**: Short-circuit test

9.3.7. Transient recorder menu

The **Transient Recorder** menu provides an important tool for testing, startup and troubleshooting. Actual signals recorded with the transient recorder have a higher sample rate than slow trending signals. Recorded data is therefore not saved on the hard drive of the control terminal but in the AC 800PEC controller. You can, however, save, process, archive or email the data later.

As with slow trending, the **Transient Recorder** menu can display five views / tabs (1, Figure 58). Each view can hold up to six diagrams of different recordings.



Key

1. Diagram buttons
2. Operation buttons

Figure 58 – Transient recorder menu

9.3.7.1. Operation buttons in the Transient recorder menu

The operation buttons of the **Transient Recorder** menu that are not described in the following section are identical to those in the **Slow Trending** menu. For more information, see 9.3.5 Slow trending menu on page 109.

Table 26 – Operation buttons in the Transient recorder menu

Button	Description
Load 	Loads a recording from the AC 800PEC controller. To load recordings in this menu, you must be logged in with one of the following User authorizations: – Operator-Level-1 – Operator-Level-2 – Operator-Level-3 – Administrator
Read latest 	Loads the latest recorder file from the AC 800PEC controller.
Trigger 	Triggers a recorder manually.
Auto-Read 	Automatically saves the recorder to the local hard disk of the LCT (download from PEC) every time you trigger a new recorder.
Configure 	Configures a recorder file. To configure a recorder file in the **Transient Recorder** menu, you must be logged in with one of the following User authorizations: – Operator-Level-3 – Administrator
Save as Logs 	Saves data as `*.logs` file with all measuring points.
Save as CSV or PNG 	Saves data as `*.CSV` or `*.PNG` file. It is recommended to save recordings for later analysis using one of the save buttons. All of them open a window to enter the saving properties: – File location – File name – Export file format – Chart export settings

Table 26 – Operation buttons in the Transient recorder menu (continued)

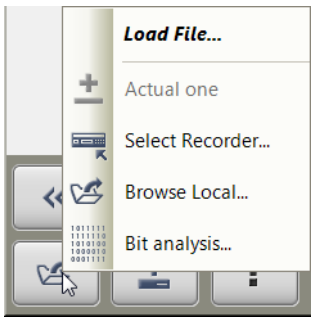
Button	Description
Chart export	Defines the export settings for the chart.
	

9.3.7.2. Loading a log/recording file

1. Touch the **Load** button.

2. Touch one of the following commands:
   - **Load file**: loads the currently selected recorder file.
   - **Current**: displays the name of a previously loaded file.

     NOTE – If you are using the recorder for the first time, this option is grayed out.
   - **Select Recorder**: opens a window where you can select which recorder to use. For more information, see 9.3.7.6 Selecting a recorder file on page 121.
   - **Browse Local**: opens the **Log Browser** window in which to select a local storage medium other than the main control device. For more information, see 9.3.7.4 Selecting a different location to save the recording on page 120.



9.3.7.3. Selecting a recorder

1. Touch the **Load** button.

2. Touch **Select Recorder** and in the **Transient Recorder Browser** window, select a recorder.

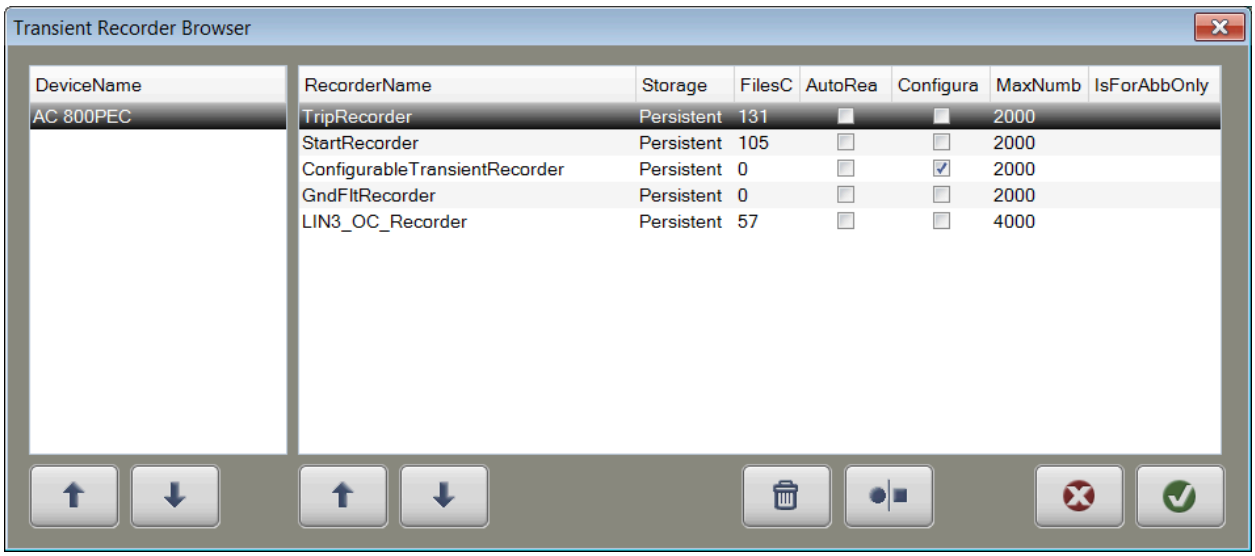
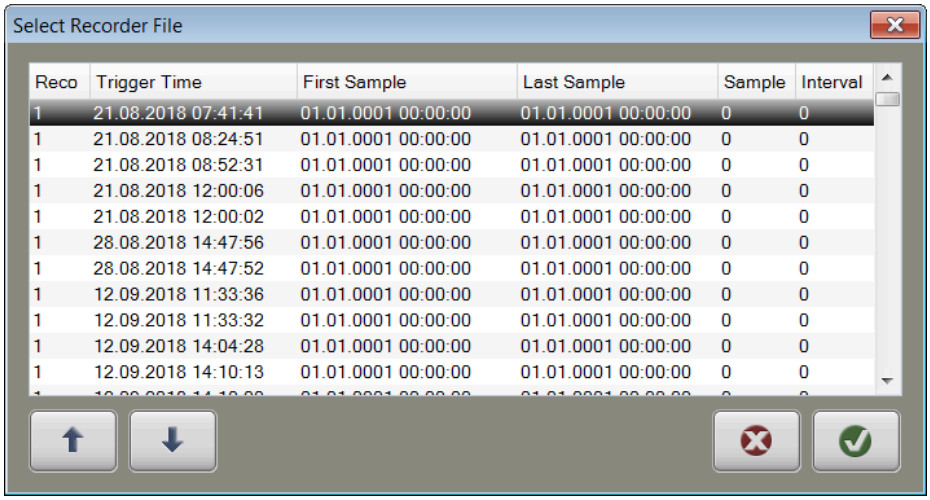


Figure 59 – Transient recorder browser window

3. Touch the **Confirm** button.

4. In the **Select a Recorder File** window, select a recorder file.



5. Touch the **Confirm** button.

9.3.7.4. Selecting a different location to save the recording

The default location for saving a recording is the main control device.

1. Touch the **Load** button.

2. Touch **Browse Local**.

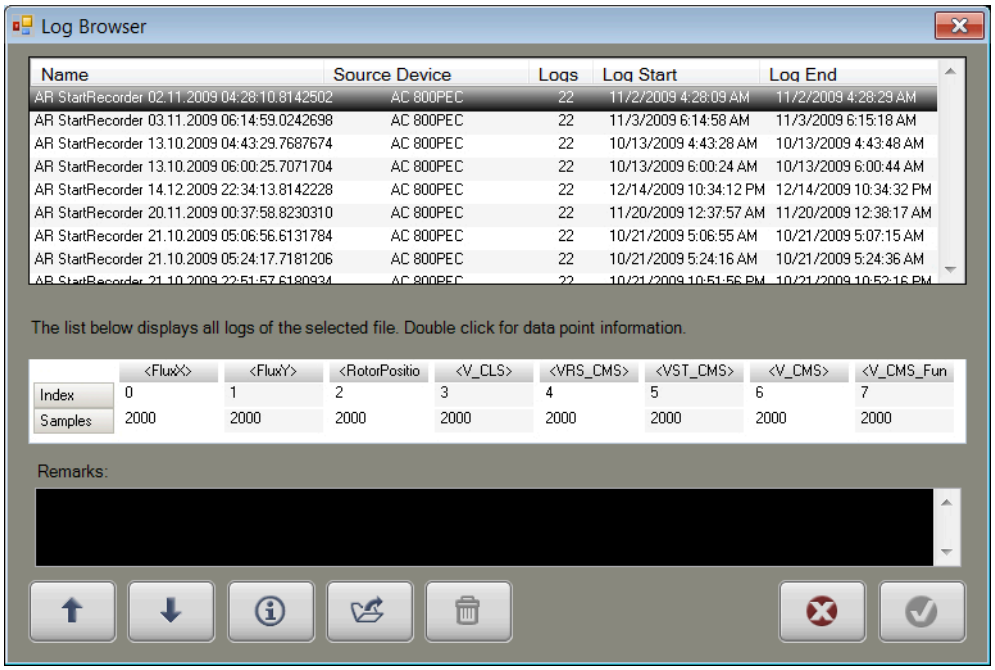


Figure 60 – Log Browser window

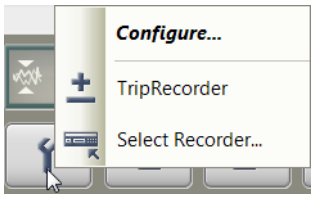
3. Do one of the following:
   → Select a recorder file in the list
   → Touch the **Load button** to select a file form a local folder.

4. Touch the **Confirm** button.

9.3.7.5. Configuring a recording

1. Touch the **Configure** button.

2. Touch one of the following commands:
   - **Configure**: opens the configuration window for the currently selected recorder file.
   - **Start Recorder**: displays the name of a previously loaded file
   - If you are using the recorder for the first time, this option is called **Current**.
   - **Select Recorder**: opens a window in which to select a recorder other than the last one used. For more information, see 9.3.7.6 Selecting a recorder file on page 121.



9.3.7.6. Selecting a recorder file

1. Touch the **Configure** button.

2. Do one of the following:
   - Select a file in the AC 800PEC list (Table 27)
   - Touch the name of the most recently used file

Table 27 – Installed recorders

Recorder	ConfigTransRec	TripRecorder	StartRecorder
Characteristics	Fast response for test / service	Records data in the event of a shutdown	Records the start-up of the motor
Number of samples	0 - 1000	0 - 2000	0 - 2000
Sampling interval	200 µs (0.2ms)	1000 µs (1ms)	10000 µs (10ms)
Pretrigger (as number of samples)	(0 - 2000) × sampling interval	(0 - 2000) × sampling interval	(0 - 2000) × sampling interval

3. Specify the recorder parameters.
   - Configurable parameters:
     - **Number of Samples** (data points) per signal
     - **Sampling Interval**: The sampling interval must always be an integer multiple of the value thats is stated in Table 27. Otherwise, the operation is aborted with a fault message.
   - **Pretrigger**: non-configurable parameters (except for in the configurable transient recorder):
     - Trigger Signal
     - Cancel Signal

↳ Depending on your settings, the recording is of long or short duration and of exact or rough shape.

4. Touch the **Confirm** button.

9.3.7.7. Exporting a chart

1. Touch the **Chart Export Settings** button.

2. In the **Chart Export Settings** window, touch the **Confirm** button.

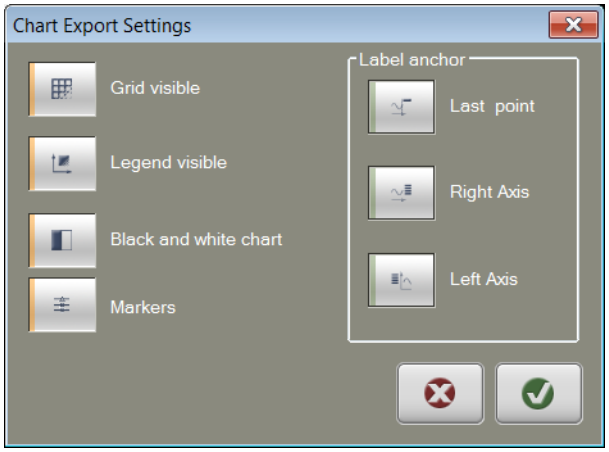


Figure 61 – Chart Export Settings windows

9.3.8. Options menu

The **Options** menu defines basic operation settings as well as general import and export configurations.

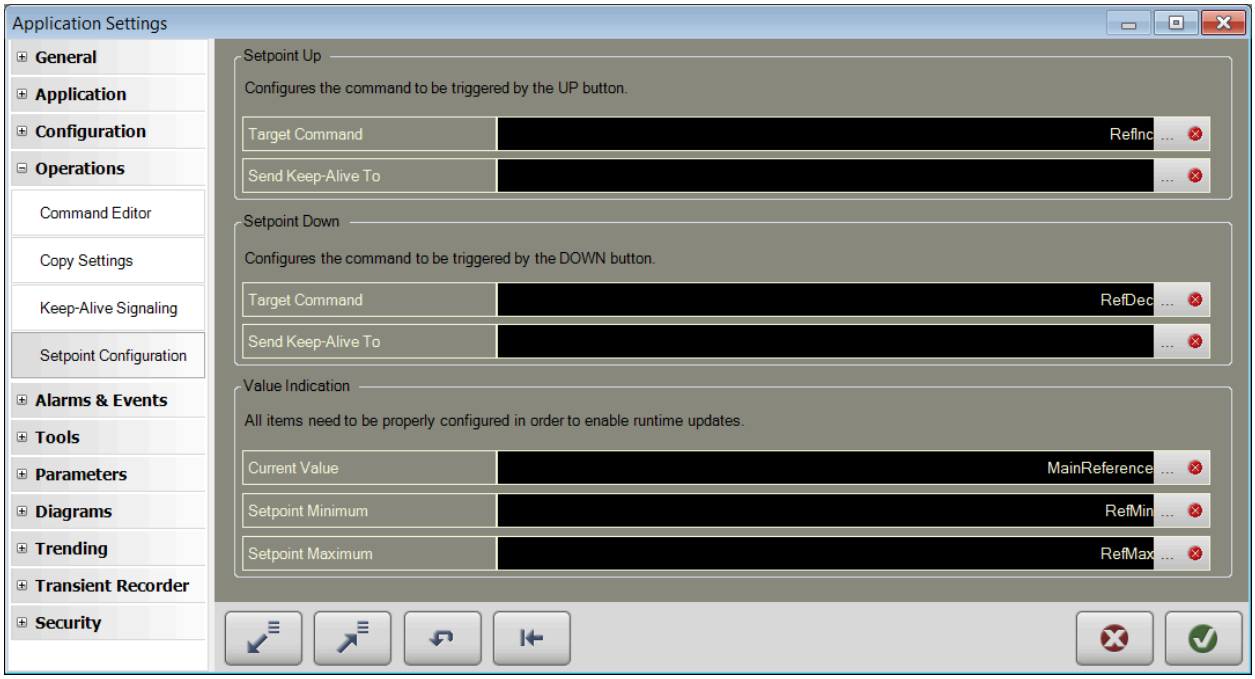


Figure 62 – Options menu

The user rights for the **Options** menu are listed in Table 28.

Table 28 – User authorizations in the Options menu

Application	Operator level 1	Operator level 2	Operator level 3	Administrator
Import settings	-	-	X	X
Standard settings	-	-	-	X
Alarms & events	-	-	-	X
Tools	-	X	X	X
Trending	-	-	X	X
Security	X	X	X	X
Change the user rights	-	-	-	X

9.3.8.1. Operations buttons in the Options menu

The following sections describe the operation buttons in the **Options** menu.

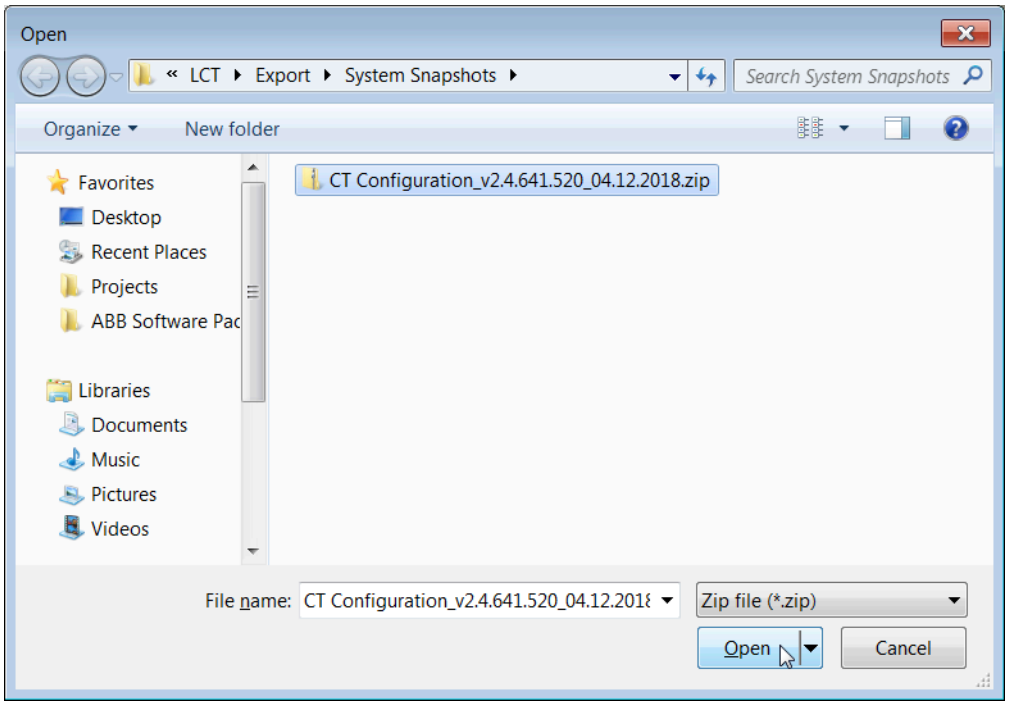
Table 29 – Operations buttons in the Options menu

Button	Description
Import 	Imports LCT settings from a local storage location. The following data types can be loaded: – Alarms – Events – Slow trend recordings – Snapshots – Imported LCT settings overwrite any existing ones.
Export 	Exports the LCT settings to a local storage location.
Reset 	Resets all changes made since saving for the last time and re-establishes the values saved last.
Default settings 	Resets all operation settings and re-establishes the factory settings.

9.3.8.2. Loading a configuration file

1. Touch the **Import** button.

2. Go to the folder that contains the configuration file.



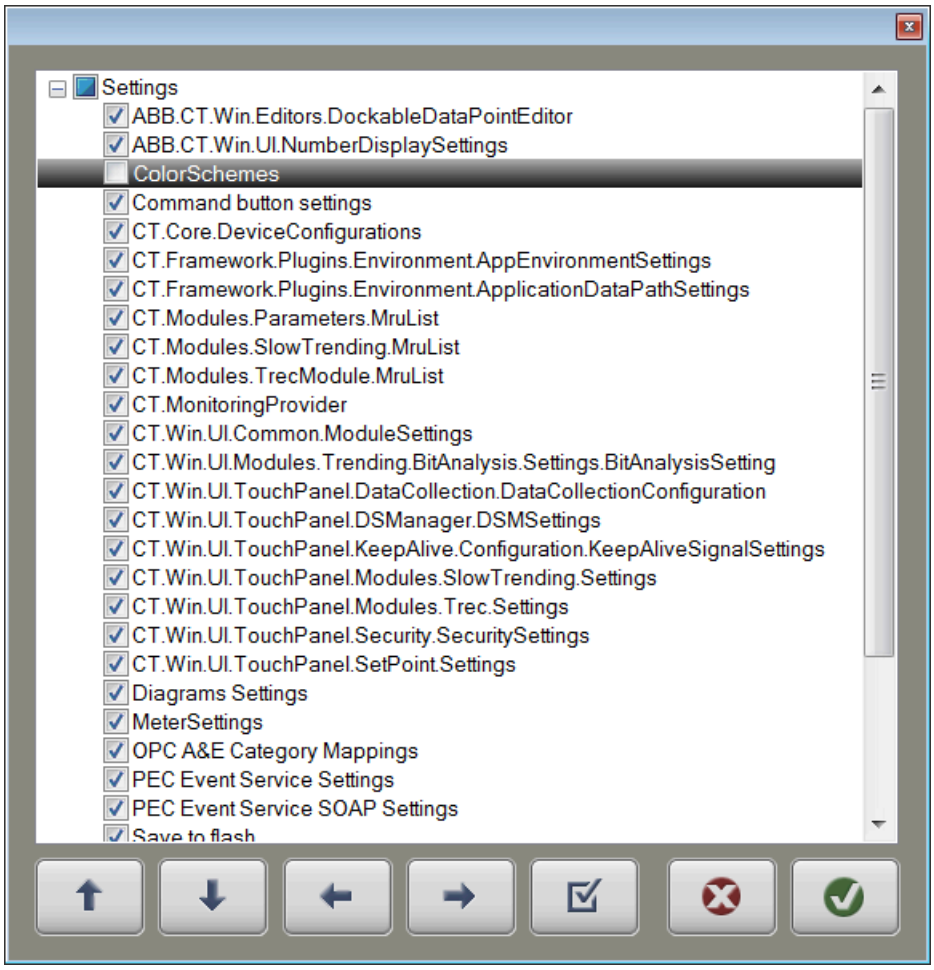
3. Select the file and touch **Open**.

↳ The LCT settings are imported and used as default.

9.3.8.3. Exporting a configuration file

1. Touch the **Export** button.

2. In the list of settings, select the settings that you want to export.



NOTE – Depending on your user rights, selection of export settings can be restricted. Nevertheless, it is recommended to select all settings.

3. To export the file, touch the **Confirm** button.

9.3.8.4. Applications

NOTICE

Risk of component damage! Incorrect settings can damage to the drive.

→ Certain settings in the **General, Configuration**, **Operations, Alarms & Events** and **Trending** applications MUST only be changed by specially-trained personnel.

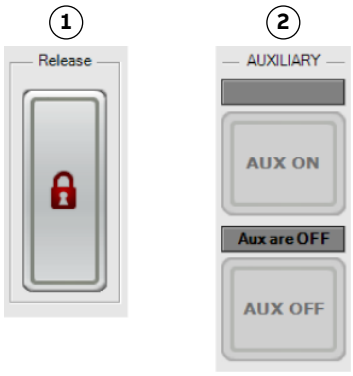
Application	Description
General	Configures the AC 800PEC controller, displayed / hidden menu items and the language settings.
Application	Configures the folder for saving files and the disk space settings.
Configuration	Configures individual modules.
Operations	Configures the operation bar (described in 8.4 Operation bar and reference value input feature)
Alarms & Events	Customizes system messages.
Tools	Monitors ongoing processes and the processor load.
Diagrams	Selects diagrams that are to be displayed in specific menus.
Trending	Makes basic configurations for slow data recording.
Transient Recorder	Makes basic configurations for fast data recording.
Security	Depending on your user rights: – Changes your password, – Determines the automatic logout time, – Defines new user authorizations, – Edits or deletes existing user authorizations.

9.4. Operation bar and reference value input feature

To use the features of the operation bar, you must have the corresponding user rights and control over the panel (see Table 28 and 9.1.2.1 Panel Control button on page 87). To prevent accidental manipulation, the operation bar is blocked (grayed out) by default.

9.4.1. Releasing the operation buttons

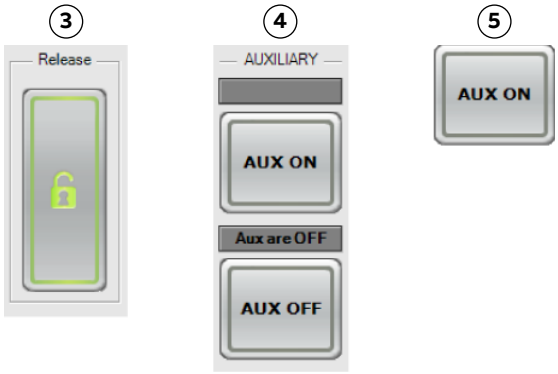
The red lock symbol on the Release button (1) means that the operation buttons are blocked and you cannot access them. The operation buttons are grayed out (2).



→ To release the operation buttons, touch the **Release** button.

↳ The lock symbol on the **Release** button turns green (3) and the operation buttons are not grayed out (4). They can be accessed now for 6 seconds. After 6 seconds, the operation buttons are blocked again.

NOTE – Once you touch an operation key, it turns green for a short time (5). The green color indicates that the operation key is activated.



NOTE – If the Release button is grayed out (6), a user with a higher-level user right has control over the panel and you cannot take over control (7), see 9.1.2.1 Panel Control button on page 87).

9.4.1.1. Standard buttons on the Operation bar

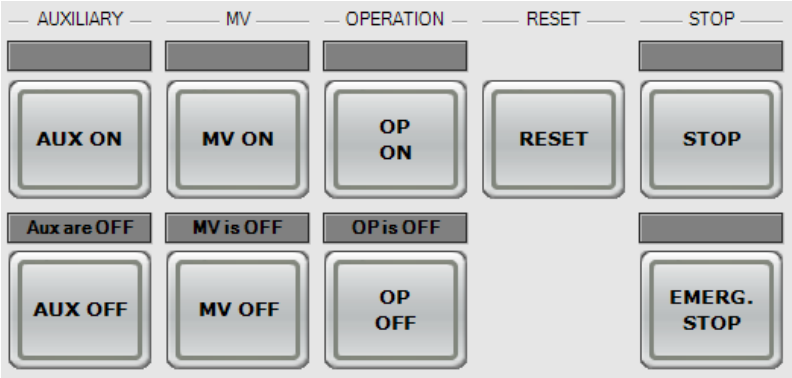
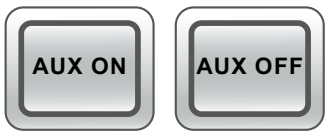
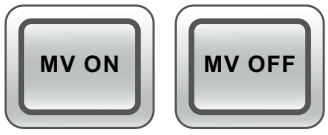
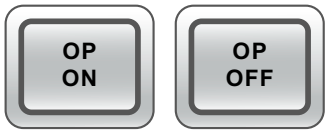


Figure 63 – Standard buttons on the Operation bar.

Table 30 – Standard buttons on the Operation bar

Button	Description
AUX ON/AUX OFF 	Switches the auxiliaries on / off.
MV ON/MV OFF 	Switches the medium voltage power supply on/off.
OP ON/OP OFF 	Switches the drive on (operation starts) / off (operation stops).
RESET 	Resets the fault messages.
STOP 	Slowly ramps down the motor speed and switches off the drive. The medium voltage power supply and the auxiliary systems remain switched on.
EMERGENCY STOP 	Ramps down the drive as fast as possible and switches off the drive. The medium voltage power supply and the auxiliary systems switch off as well.

9.4.2. Reference value input feature

The reference value input feature is located below the menu bar.

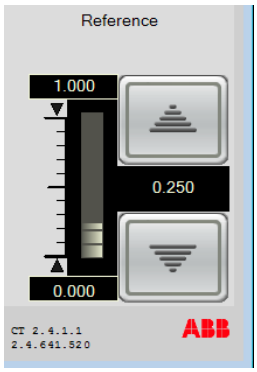


Figure 64 – Reference value input

The feature allows you to enter a reference value for the operation of the drive. The reference value defines the constant operating point for auto-controlled operation.

– For motor speed or torque, the nominal value is entered as reference value.

– For test purposes, a reference value for the excitation or DC current can be entered.

9.5. PecUp tool

PecUp is a software tool installed in the LCT, allowing to perform the following activities:

– Automatic of the AC 800PEC software

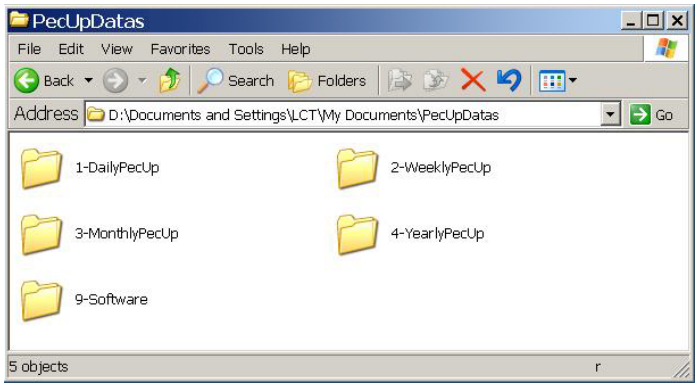
– Monthly reboot of the LCT

– Delayed start of the LCT software

9.5.1. Logging

All PecUp activities (backup, rebooting, delayed starting) are logged in:

`My Documents\PecUpDatas\9-Software\debug.txt`



If a task fails, a detailed report is generated directly in the corresponding `My Documents\PecUpDatas\...` subfolder.

9.5.2. Software backup

The PecUp software tool automatically creates and archives the following types of backups of the AC 800PEC software:

- Daily backups for the last 7 days
- Weekly backups for the last 4 weeks
- Monthly backups for the last 12 months
- Annual backups

The backup files are stored in the corresponding subfolder of:

`My Documents\PecUpDatas`

9.5.3. Monthly reboot

In order to replace ECR reboot scripts of earlier installations and prevent LCT crashes, PecUp also includes a reboot task of the LCT. By default, rebooting starts one hour after the monthly automatic backup on the day specified in the backup settings.

9.5.4. Delayed start

The delayed start task enforces the LCT software to start 60 seconds after Microsoft Windows starts (unless the user aborts the task). Delaying the start of the LCT software ensures the necessary startup communication with the AC 800PEC, before exchanging any data.

9.5.5. Transferring the LCT software package

Use the procedure below every time you need to transfer a software package from the LCT, ie, PecUp file, into a new hardware device. For example, for loading a software backup performed with the PecUp tool into a new AC 800PEC controller.

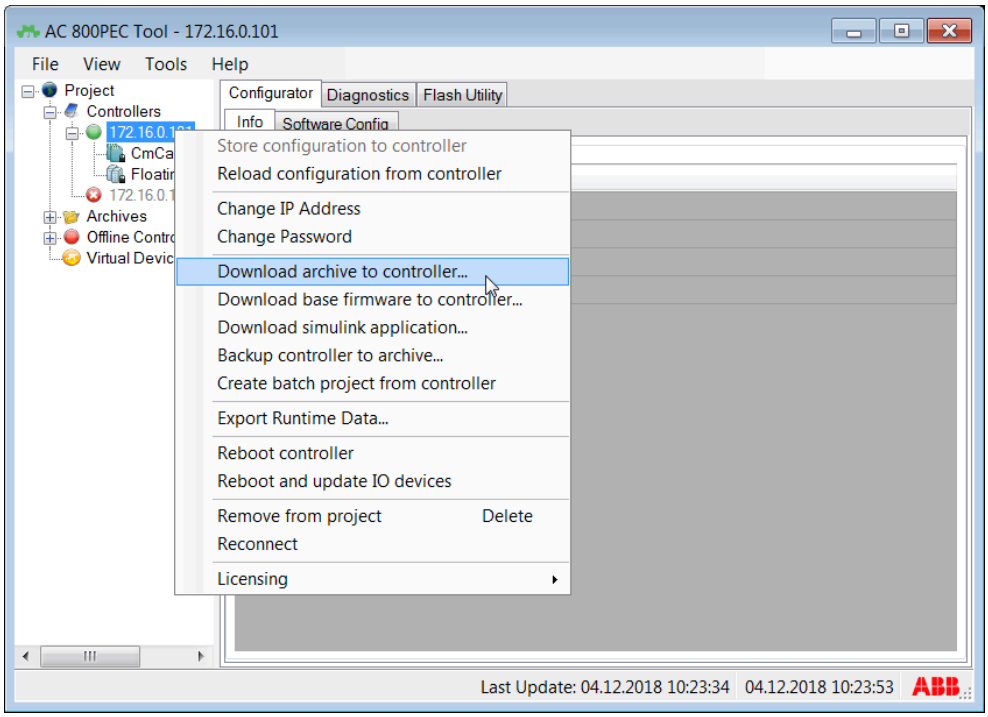
Prerequisites/ Precautions

- Drive must not be in operation.
- PEC IP address must be `172.16.0.101` (for spare parts, check with a ping signal).
- Download must not be interrupted at any time.

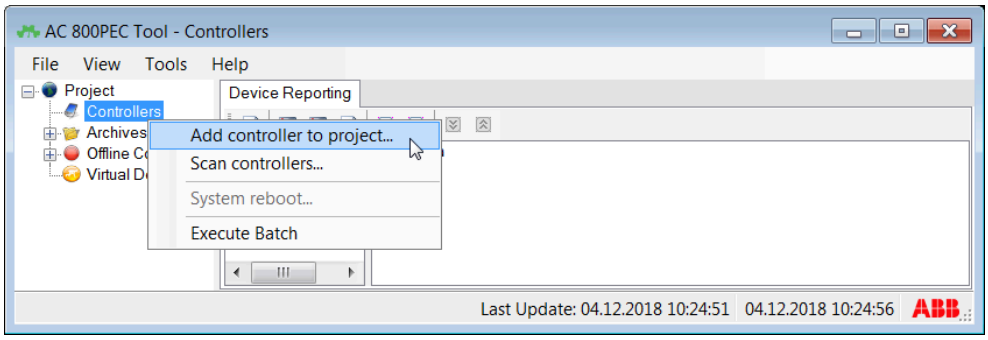
9.5.5.1. Loading a PecUp file into a new AC 800PEC controller

1. Open the AC 800PEC Tool.
   - Via the Desktop shortcut
   - On the Start Menu, click **Programs** > **ABB AC 800PEC Tool**

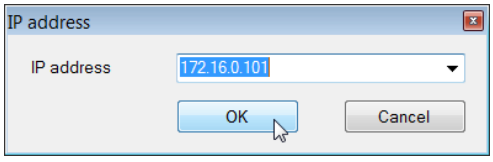
2. If the `172.16.0.101` controller is in the **Controllers** tree, right-click the `172.16.0.101` controller, click **Download archive** to controller and continue with step 6.



3. If the `172.16.0.101` controller is not in the Controllers tree, right-click **Controller** and click **Add controller to project**.



4. Type `172.16.0.101` in the IP address box and click **OK**.



5. Right-click the `172.16.0.101` controller and click **Download archive to controller**.

6. Select the PecUp file to download and click **Open**.

   The default path of the PecUp backup files is:

   `My Documents/PecUpDatas/ 1- DailyPecUp (2-WeeklyPecUp; 3-MonthlyPecUp; 4-YearlyPecUp)`

7. Click **Download Archive.**

   NOTE – The names of the backup files are unique to each converter.

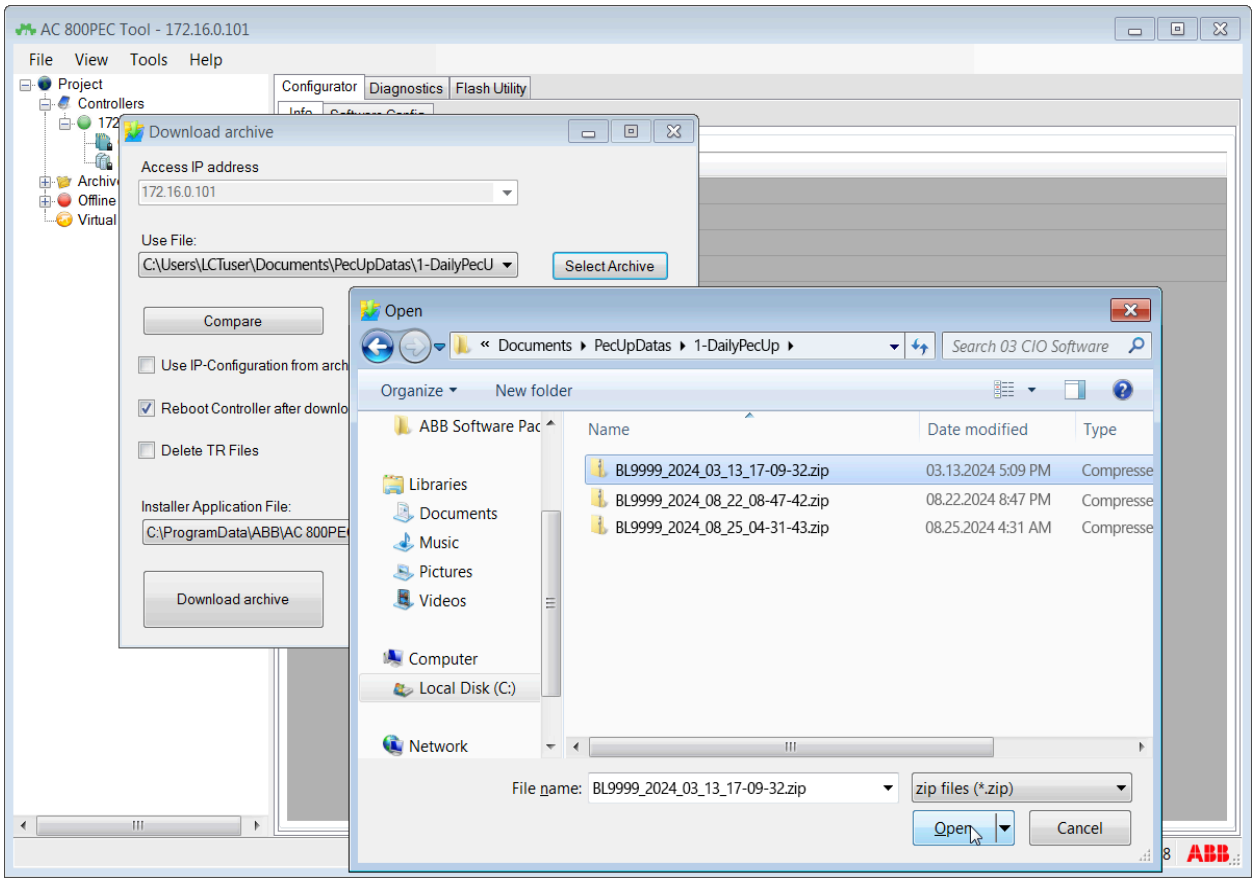
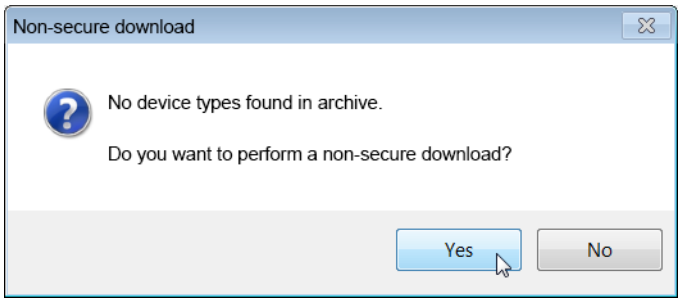


Figure 65 – PECup file example – file names are unique to each converter

8. In the **Non-secure download** dialog box, click **No**.

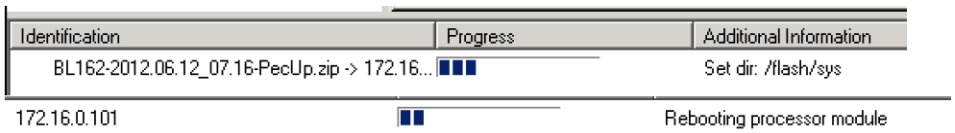


For complex projects involving several different devices/controllers, the archives (`*.zip` files) and the corresponding ABB device to download can be defined as secure downloads.

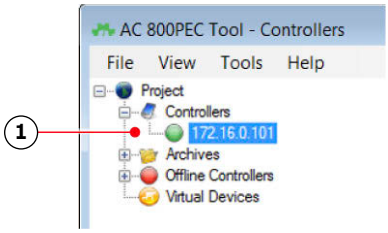
As the AC 800PEC is the only possible device in the LCI application, the device type does not have to be defined in the archive, which results in a non-secure download.

The download progress is displayed on the bottom of the **PEC Tool** window.

IMPORTANT! DO NOT interrupt the download at any time!



↳ The process is complete after the processor module reboots. The PEC is ready when the icon next to the controller turns green.



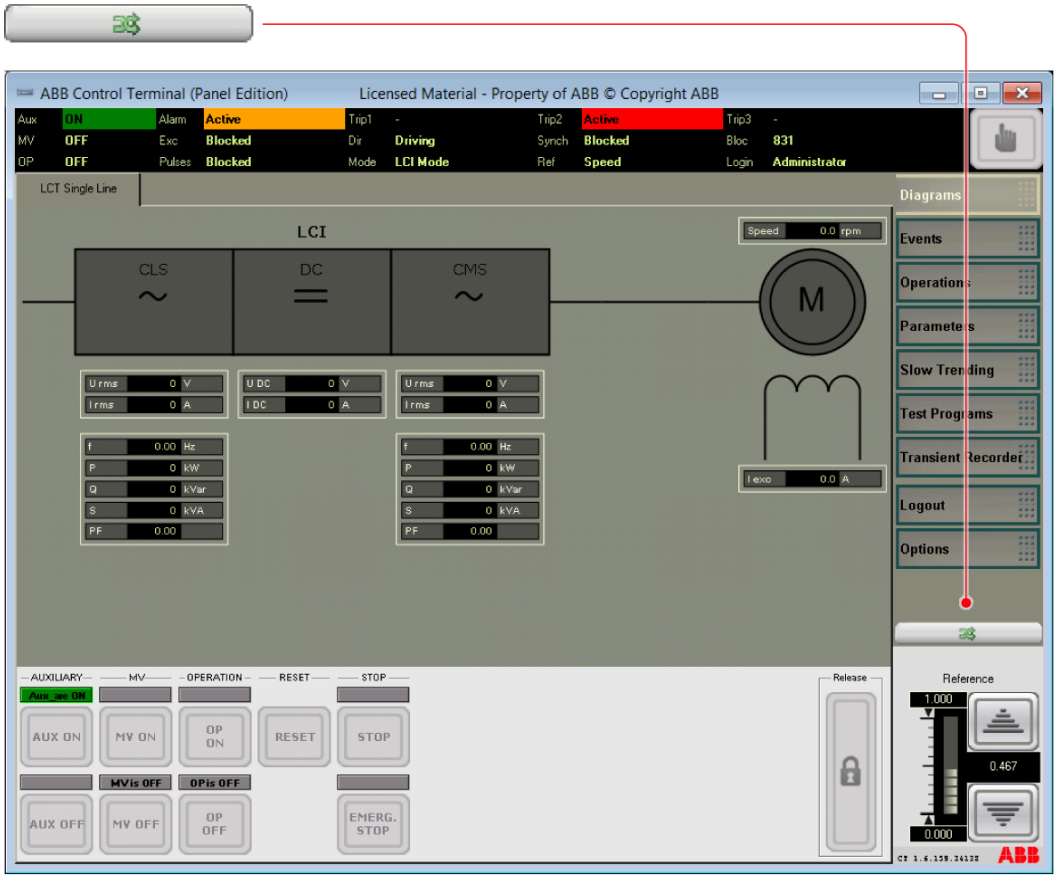
9. Restart the LCT to ensure correct communication with the AC 800PEC controller.

9.6. Print screen function

You can use the print screen function to create and save a screen shot of the current LCT display in PDF and JPG formats.

9.6.1. Creating and printing print screens without project-specific information

1. Touch the **Process Selector** icon, which is below the menu bar.



↳ The **Process Selection** window opens.

2. Touch the **Print Screen** button.

↳ Touching the Print Screen button opens a PDF reader and saves the print screen as `*.jpg` and `*.pdf` file (named with date / time / extension) in the following location:

`My Documents\LCT Screenshots`

10. Preventive and corrective maintenance

10.1. General information

During the warranty period of the drive, any maintenance must be carried out exclusively by ABB service personnel. After the warranty period, repair work may only be carried out by certified personnel.

10.1.1. Required qualification

To maintain safe and reliable operation of the drive, ABB recommends taking out a service contract with the ABB service organization.

10.1.2. Maintenance schedule

Carry out all maintenance tasks according to the maintenance schedule, on time and at the stated intervals in the “MEGADRIVE-LCI preventive maintenance schedule”, 3BHS855047 E01.

10.1.3. Logbook

It is recommended to record all troubleshooting and maintenance work in a logbook including:

- Date and time
- Detailed description

10.1.4. NETA-21 remote monitoring tool

The NETA-21 remote monitoring tool is used for browser-based remote monitoring of ABB drives via Ethernet. Multiple drives can be connected to the network by using a panel bus or through the fiber optic channel of the NETA-21 extension unit.

Through the NETA-21, you can:

- Monitor drives
- Read and adjust drive parameter values
- Read status information and actual values from drives
- Set up and monitor the data logger and save its content to a file
- Read the contents of the fault log from monitored devices and save it to the memory
- Send email messages on events
- Use email for continuous monitoring of drives
- Reset a fault on drives
- Use an SD card for continuous monitoring of drives
- Use an SD card to store all events
- Use the FTP server for storing drive parameters and events
- Create custom events
- Create custom reports: email reports, SD card reports and FTP report.

10.1.5. Spare parts

To ensure safe and reliable operation, use only spare parts recommended and approved by ABB. For information on types and identification codes, see the parts list that is attached to “Appendix C - Electrical drawings including parts list”.

Spare parts can be purchased from:

– Your local ABB office

– ABB Switzerland Ltd
Service MV Drives
CH-5300 Turgi, Switzerland
mvdrives.supportline@ch.abb.com

10.2. Standard troubleshooting procedure

Recommended procedure if a malfunction shuts down the drive:

1. DO NOT switch off the auxiliary voltage or try to reset a fault message before all information at the time of the occurrence of the fault condition has been saved.

   IMPORTANT! DO NOT clear the fault buffer of the drive!

2. Identify the fault in the event list according to 9.3.2 Events menu on page 95 and make a log book entry.

3. Save the content of the appropriate Trip Recorder and/or Start Recorder, using the Save as logs key.
   - To identify the appropriate recorder, refer to the time stamp.

4. If a fault cannot be rectified, contact ABB service.

   When calling ABB service, it is recommended to have the following data available for the time the fault occurred:
   - Operating, ambient and load conditions
   - Unusual events

5. After the fault has been rectified, start the drive again.

10.3. Maintenance tasks

10.3.1. Safety

DANGER

Hazardous voltage!

→ Before working on the drive, ensure that:
  → Main and auxiliary power supply to the drive is switched off, locked out, and tagged out
  → Drive is de-energized, grounded and secured
  → See 10.3.2 De-energizing the drive on page 137.
  → Safety ground connections are in place
  → Personal protective equipment is provided and used when required
  → Everyone involved is informed
→ Before energizing the drive again, make sure that:
  → All foreign objects are removed from the drive
  → All internal and external covers are securely fastened and all doors are closed, locked and / or bolted.

NOTICE

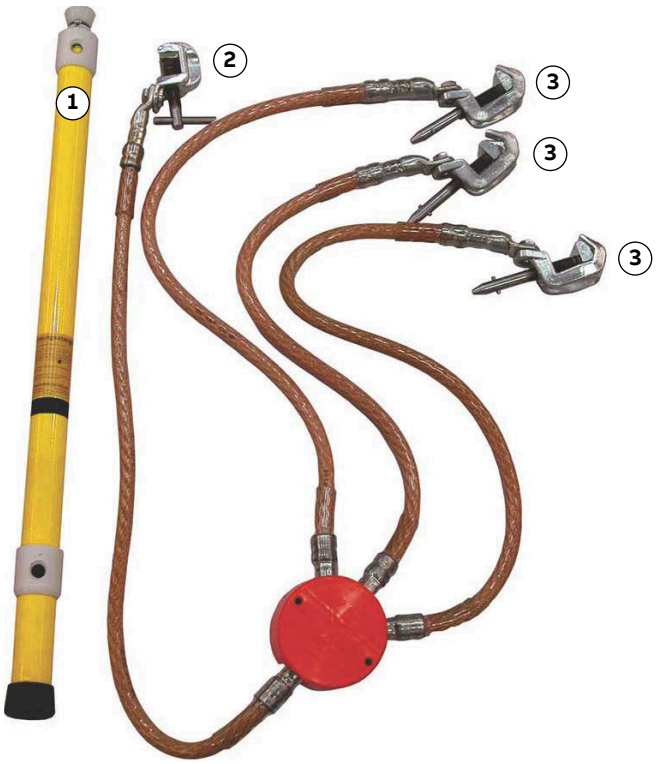
Risk of component damage. Foreign matter and particularly metallic dust can cause failure and damage when the drive is energized.

→ Close the doors and cover openings completely when work is discontinued.
→ Retrieve any foreign matter which accidentally dropped into the cabinet.

10.3.2. De-energizing the drive

1. Stop the motor.
2. Open the main power feeder.
3. Rack-out, lock-out, ground and tag-out the main power feeder.
4. Switch off and lockout all auxiliary voltages from external sources.
5. Verify that the drive system is de-energized.
6. To connect a grounding set, continue with “10.3.3 Connecting a grounding set on page 138”.

10.3.3. Connecting a grounding set



Key

1. Telescopic insulating pole
2. Enclosure grounding clamp
3. Busbar grounding clamps

Figure 66 – Four-way grounding set

1. Connect the enclosure grounding clamp (2, Figure 66) to the ground ball stud (1, Figure 67 or Figure 68) and tighten the clamp.

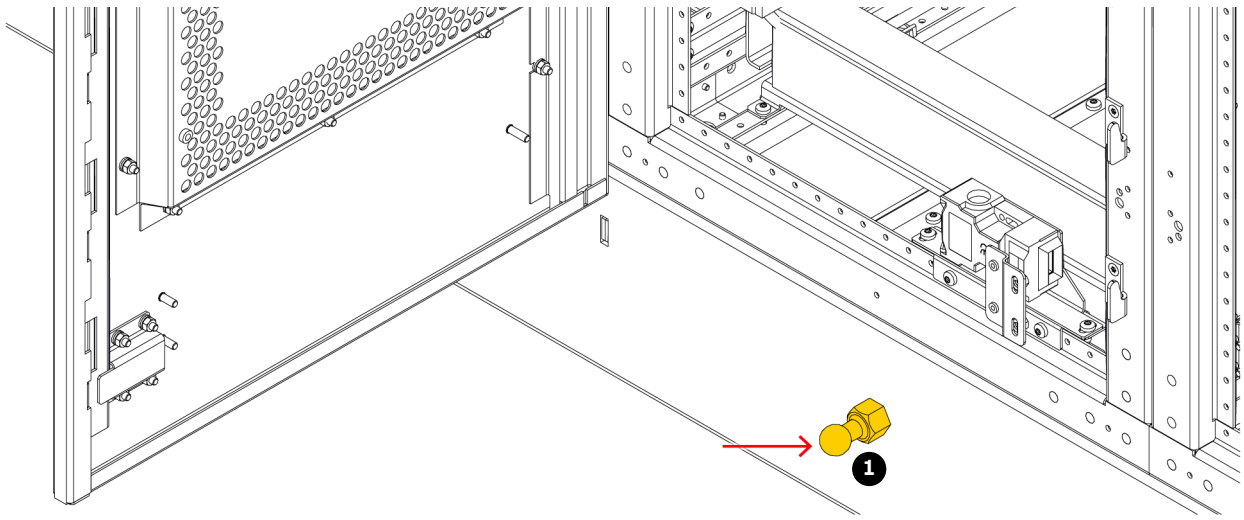


Figure 67 – Ground ball stud on block built drive base frame

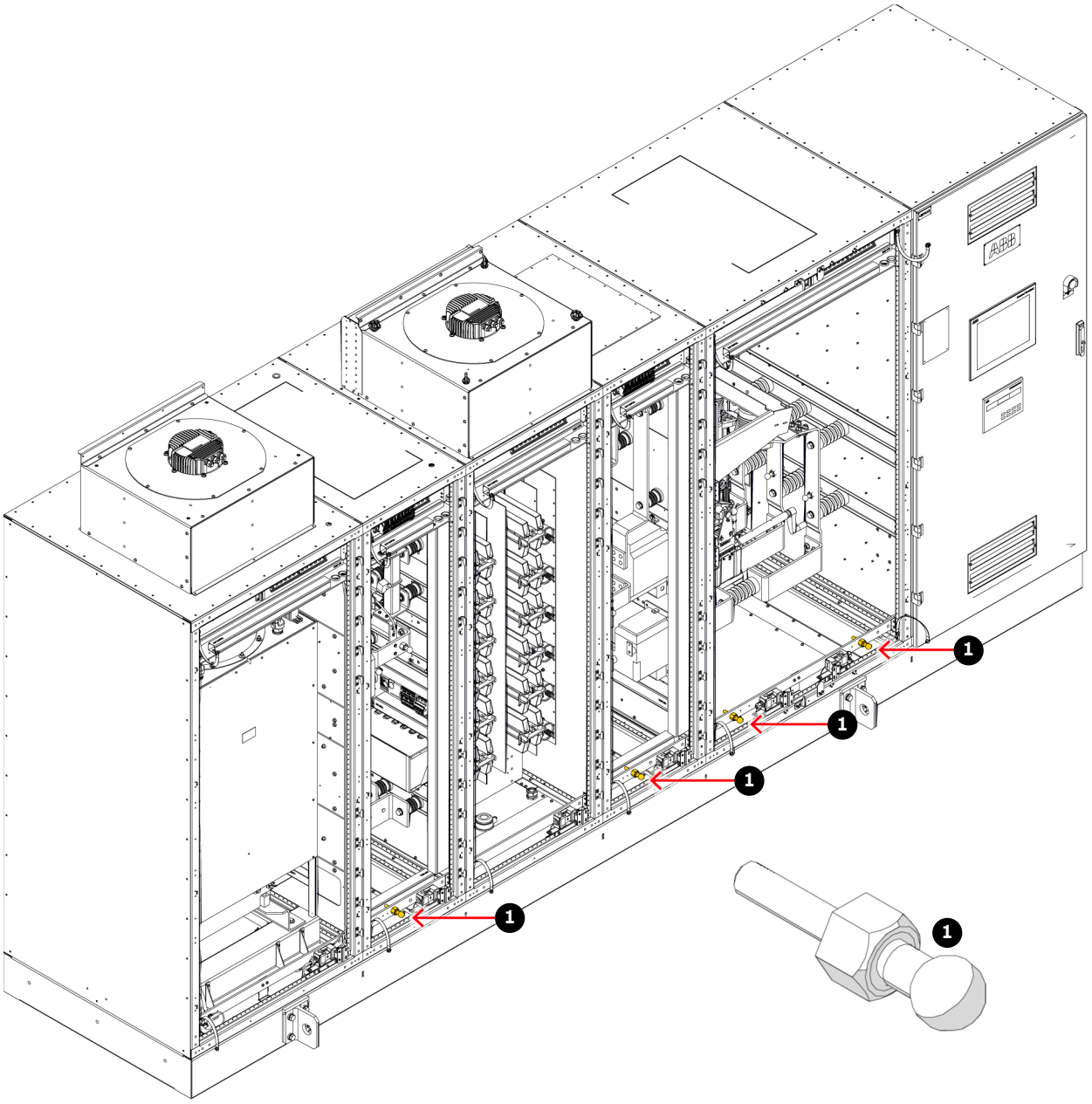
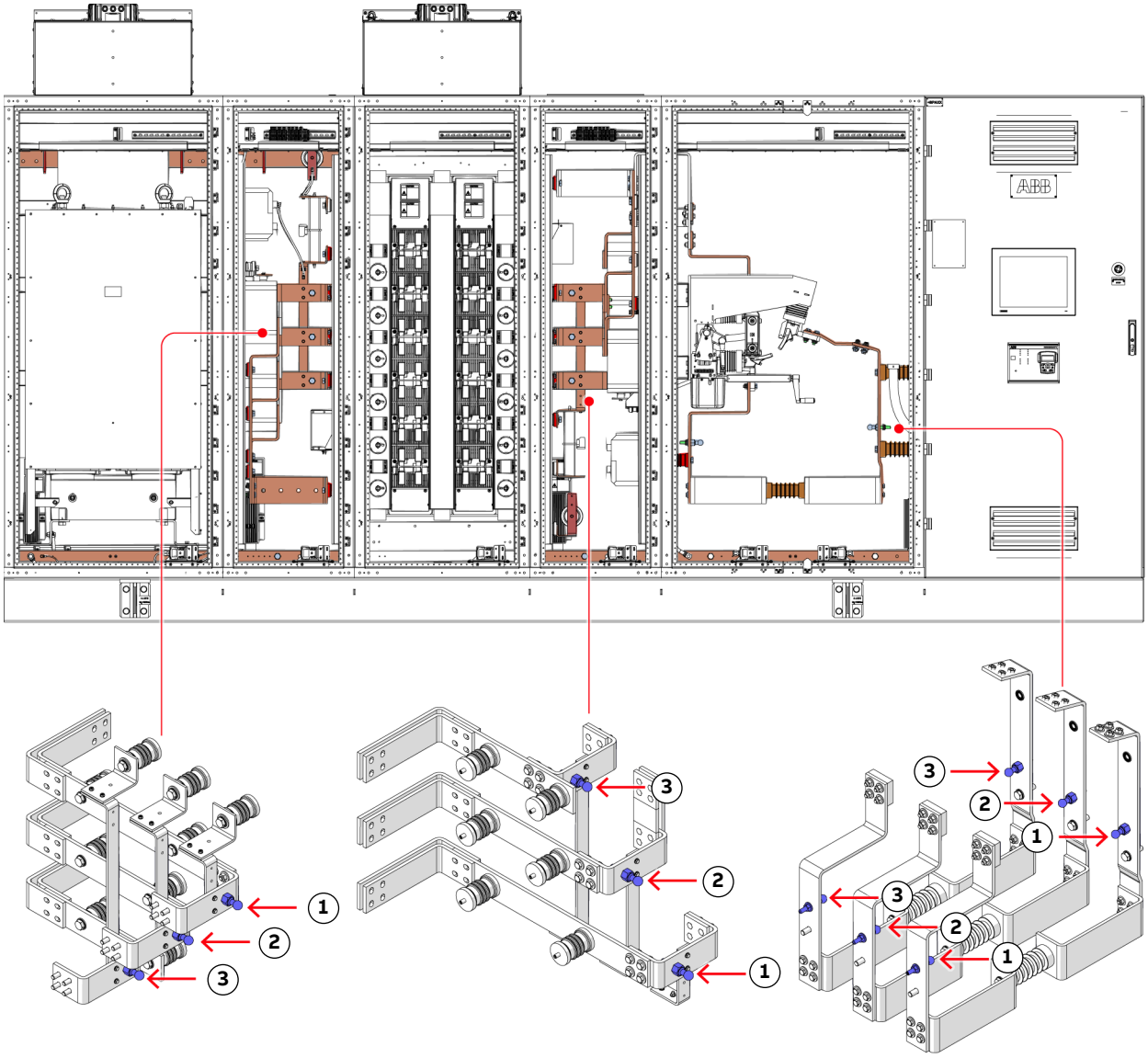


Figure 68 – Ground ball stud locations in LCI.A modularized drive

2. Use the telescopic insulating pole (2, Figure 66) to connect the busbar grounding clamps (3, Figure 66) to the ground ball studs inside the terminal compartment, and to tighten each connection.
3. Connect the outer busbar first (3, Figure 69), followed by the middle busbar (4, Figure 69) and then the inner busbar (5, Figure 69).

↳ The drive is now de-energized, grounded and secured, and safe access is possible.



Key

1. Ground ball stud
2. Telescopic insulating pole
3. Outer busbar
4. Middle busbar
5. Inner busbar

Figure 69 – Connecting a grounding set to the ground ball studs on the busbars (LCI air-cooled example)

10.3.4. Visual checks on the drive

Check the drive and its immediate vicinity visually at the intervals stated in the maintenance schedule and pay attention to the following items:

- Humidity inside the drive
- Permitted range of ambient air temperature and humidity of the drive
- Dust built-up inside the drive room and inside the drive
- Signs for overheated components, wires, cables or busbars
- Corrosion on circuit boards, connectors or busbars
- Appropriate fastening of cables and wires and connections of cable shields and screens (see 6 Electrical installation on page 67).
- Integrity of cable insulation
- The outer cable sheath must not be damaged.
- Correct type of signal and power cables (see the applicable cable specifications).

10.3.5. Cleaning

NOTICE

Risk of component damage! Check the cabinet regularly for signs of dust and humidity and clean if necessary.

→ Alcohol and solvents can damage the components.

→ Use appropriate and recommended cleansing agents.

→ To prevent dirt falling into equipment, cover the equipment. The drive contains components which are sensitive to electrostatic discharge.

→ Take electrostatic-sensitive precautions and use suitable tools.

→ Clean circuit boards with special care.

→ To prevent the components being damaged, use antistatic brushes and a vacuum cleaner with a soft nozzle.

→ Remove dust on assemblies and busbars inside the cabinet with a vacuum cleaner and lint-free cleaning cloths.

→ Remove water, oily or greasy deposits on assemblies, components and busbars with water- and oil-absorbing microfibers such as “3M Scotch Brite”.

→ Use a nylon brush or a vacuum cleaner for removing dust or deposits from recesses.

→ Clean the outside of the cabinet with a vacuum cleaner and cleaning cloths.

10.3.6. Checking wire and cable connections

Vibration can loosen electrical connections and cause occasional malfunction or equipment failure.

→ Check all power and control cable connections and tighten them if necessary.

→ Check that all plugs and connectors are tight.

10.3.7. Maintaining the disconnector

This section only applies to drives equipped with disconnector (see 3.3.3 Bypass disconnector for output transformer on page 42).

The disconnector is a mechanical component subject to wear.

Perform the maintenance tasks below according to the recommended schedule.

Table 31 – Disconnector maintenance

Maintenance task	Recommended schedule
Inspect bolt fixations and connections.	Annually or every 1000 operating cycles
Inspect the contacts for possible dust and dirt. If necessary, clean them with a clean cloth.	Annually or every 1000 operating cycles
Lubricate the active parts (upper and lower contacts) and all other mechanical parts with oil or grease containing graphite.	Annually or every 1000 operating cycles

Disconnectors which have been in use for 10 to 15 years, or have passed approximately 25000 operating cycles, require extended maintenance carried out by ABB Service personnel.

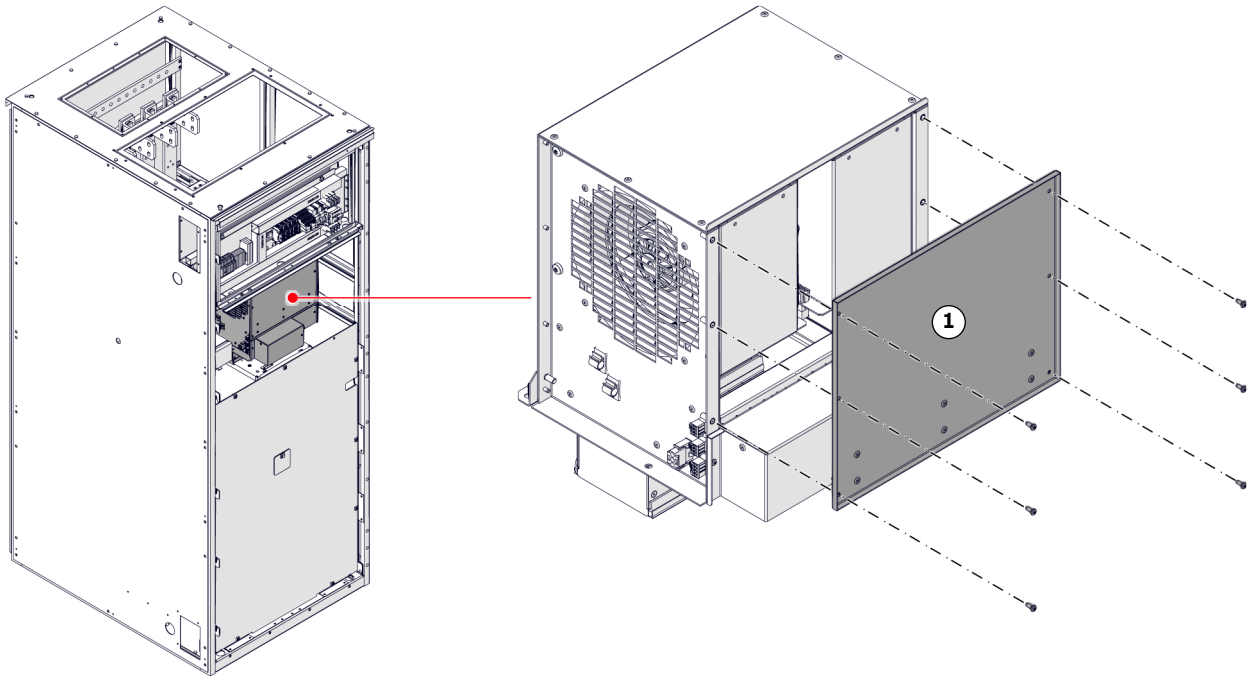
10.3.8. Excitation unit, replacing the fan of a redundant cooling box DCS880 H4/DCT880 T4

Figure 72 – DCS880 controller - size H4

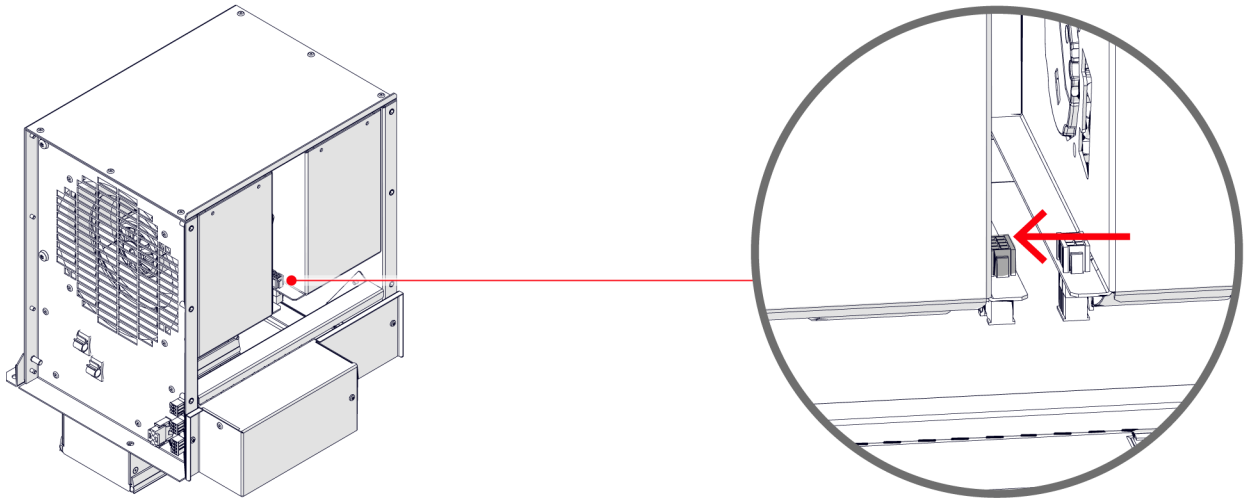
1. Switch off the miniature circuit breaker of the fan unit.

   NOTE – To identify the miniature circuit breaker, see “Appendix C - Electrical drawings including parts list”.

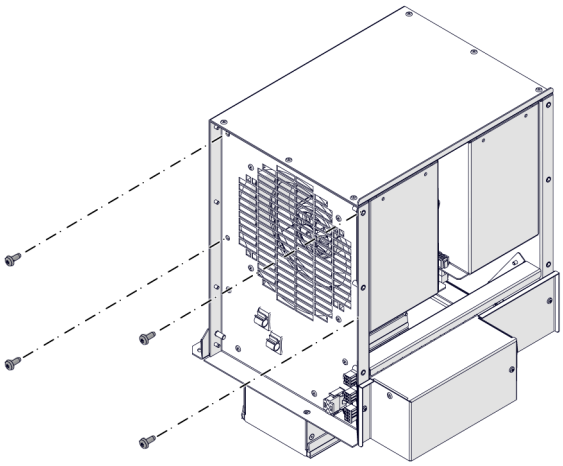
2. Remove the 6 screws from the fan cover (1) and then remove the fan cover.



3. Unplug the fan cables.

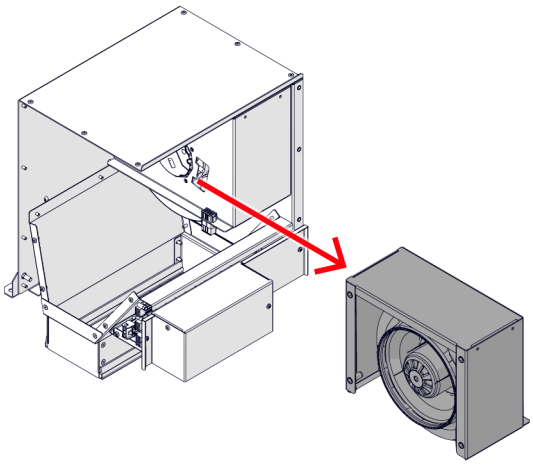


4. Remove the 4 fastening screws from the outside panel of the fan unit.



5. Pull the fan out of fan unit in the cabinet.

   CAUTION! To prevent the fan from falling onto you, place a support (ie, a box) underneath.



6. Install the new fan in reverse order of removal.

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