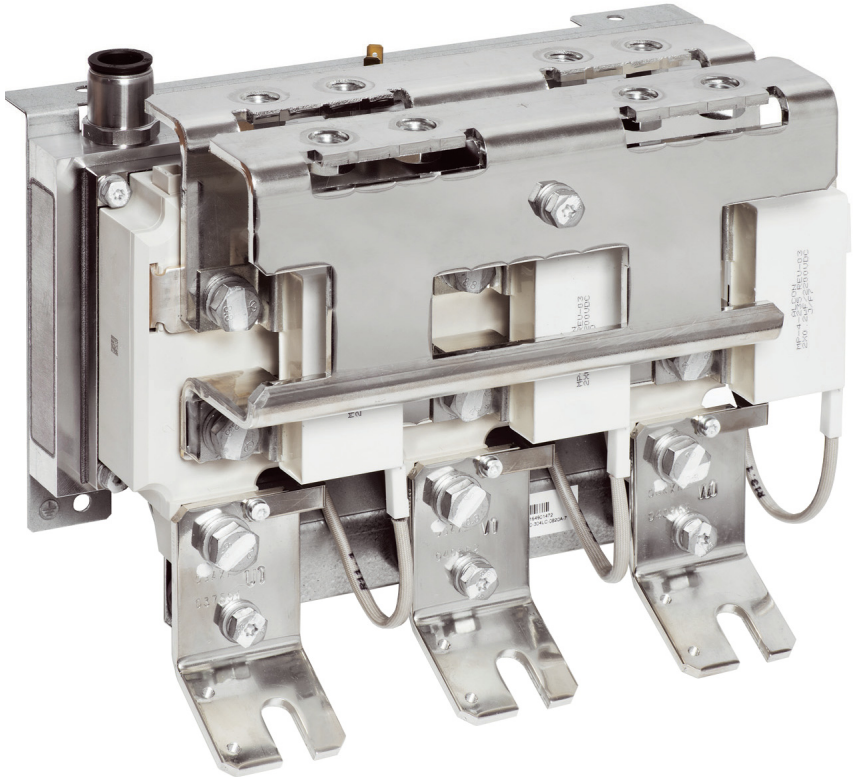
ABB INDUSTRIAL DRIVES

ACS880-304LC...+A019 diode supply modules

Hardware manual



ACS880-304LC…+A019 diode supply modules

Hardware manual

3AXD50000045157 Rev C
EN
Original instructions
EFFECTIVE: 2022-09-12

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1

Introduction to the manual

Contents of this chapter

This chapter describes the manual. It gives information on the markings and component designations, and also the terms and abbreviations that are used in the manual. This chapter also includes a list of related manuals.

Applicability

The manual is applicable to liquid-cooled ACS880-304LC…+A019 diode supply modules for user-defined cabinet installations.

Safety instructions

Obey all safety instructions delivered with the drive.

- Read the **complete safety instructions** before you install, commission, use or service the drive. The complete safety instructions are given in ACS880 liquid-cooled multidrive cabinets and modules safety instructions (3AXD50000048633 [English]).
- Read the **software-function-specific warnings and notes** before changing the default settings of a function. For each function, the warnings and notes are given in the section describing the related user-adjustable parameters.
- Read the **task-specific safety instructions** before starting the task. See the section describing the task.

Target audience

This manual is intended for people who plan the installation, install, commission and do maintenance work on the drive, or create instructions for the end user of the drive concerning the installation and maintenance of the drive.

Read the manual before you work on the drive. You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

Categorization by frame size and option code

Some descriptions, instructions, technical data and dimensional drawings which concern only a certain group of units are marked with the symbol of the frame size (such as “D8D”, “2×D8D” etc.). The marking derives from the quantity and basic construction of the modules that form a supply unit. For example, frame size “2×D8D” indicates that the supply unit consists of two frame size D8D modules connected in parallel.

The frame size is marked on the type designation labels. The frame size of each module is also shown in the rating tables of chapter Technical data.

The instructions and technical data which concern only certain optional selections are marked with option codes (such as +A019). The options included in the drive can be identified from the option codes visible on the type designation label.

Use of component designations

Some device names in the manual include the component designation in brackets (for example, [Q20]). This will help you to identify the components in the circuit diagrams of the drive.

Terms and abbreviations

Term/ Abbreviation	Description
CIO	I/O module for controlling cooling fans
Control unit	The part in which the control program runs.
Cubicle	One section of a cabinet-installed drive. A cubicle is typically behind a door of its own.
DC link	DC circuit between rectifier and inverter
DDCS	Distributed drives communication system protocol
DI	Digital input
Diode supply module	Diode rectifier and related components enclosed in a metal frame or enclosure. Intended for cabinet installation.
Diode supply unit	Diode supply modules under control of one control board, and related components.
Drive	Frequency converter for controlling AC motors
DSU	Diode supply unit
EMC	Electromagnetic compatibility
External charging	In this manual, external charging stands for drive charging circuit outside the supply unit cubicle.
FDCO	Optical DDCS communication module
FDPI	Diagnostics and panel interface board
Flat-PLS	Rittal Flat-PLS, a busbar system for standard, commercially available flat busbars
Frame, frame size	Physical size of the drive or power module
Intermediate circuit	DC circuit between rectifier and inverter
Internal charging	In this manual, internal charging stands for an ABB charging kit installed inside the supply unit cubicle.

Term/ Abbreviation	Description
INU	Inverter unit
Inverter	Converts direct current and voltage to alternating current and voltage.
Inverter unit	Inverter module(s) under control of one control unit, and related components. One inverter unit typically controls one motor.
Multidrive	Drive for controlling several motors which are typically coupled to the same machinery. Includes one supply unit, and one or several inverter units.
Parameter	In the drive control program, user-adjustable operation instruction to the drive, or signal measured or calculated by the drive. In some (for example fieldbus) contexts, a value that can be accessed as an object. For example, variable, constant, or signal.
Rectifier	Converts alternating current and voltage to direct current and voltage
Single drive	Drive for controlling one motor
Supply unit	Supply module(s) under control of one control unit, and related components.
THD	Total harmonic distortion
ZCU	Type of control unit

Related documents

Multidrive module manuals

Manual	Code
General manuals	
ACS880 liquid-cooled multidrive cabinets and modules safety instructions	3AXD50000048633
ACS880 liquid-cooled multidrive cabinets and modules electrical planning instructions	3AXD50000048634
Drive modules cabinet design and construction instructions	3AUA0000107668
BCU-02/12/22 control units hardware manual	3AUA0000113605
CIO-01 I/O module for distributed I/O bus control user's manual	3AXD50000126880
Supply module manuals	
ACS880-204LC IGBT supply modules hardware manual	3AXD50000284436
ACS880 IGBT supply control program firmware manual	3AUA0000131562
ACS880-304LC…+A018 diode supply modules hardware manual	3AXD50000568963
ACS880-304LC…+A019 diode supply modules hardware manual	3AXD50000045157
ACS880 diode supply control program firmware manual	3AUA0000103295
Inverter module manuals and guides	
ACS880-104LC inverter modules hardware manual	3AXD50000045610
ACS880 primary control program firmware manual	3AUA0000085967
ACS880 primary control program quick start-up guide	3AUA0000098062
Brake module and DC/DC converter module manuals	
ACS880-604LC 1-phase brake chopper modules hardware manual	3AXD50000184378
ACS880-604LC 3-phase dynamic brake modules as units hardware manual	3AXD50000581641
ACS880 (3-phase) brake control program firmware manual	3AXD50000020967
ACS880-1604LC DC/DC converter modules hardware manual	3AXD50000371631
ACS880 DC/DC converter control program firmware manual	3AXD50000024671
Option manuals	

Manual	Code
ACS880-1007LC liquid cooling unit user's manual	3AXD50000129607
ACS-AP-I, -S, -W and ACH-AP-H, -W Assistant control panels user's manual	3AUA0000085685
BAMU-12C auxiliary measurement unit hardware manual	3AXD50000117840
Drive Composer start-up and maintenance PC tool user's manual	3AUA0000094606
Drive application programming (IEC 61131-3) manual	3AUA0000127808
Converter module lifting device for drive cabinets hardware manual	3AXD50000210268
Manuals and quick guides for I/O extension modules, fieldbus adapters, safety functions modules, etc.	

See www.abb.com/drives/documents for all manuals on the Internet.

You can find all documentation related to the multidrive modules on the Internet at https://sites-apps.abb.com/sites/lvacdrivesengineeringsupport/content.

2

Operation principle and hardware description

Contents of this chapter

This chapter describes how the diode supply unit works and the hardware of the diode supply module.

Operation principle

The heart of the diode supply unit is a diode bridge. It rectifies three-phase AC current to direct current for the intermediate DC link of the drive. The intermediate DC link supplies the inverters that run the motors. There can be one inverter unit only (single drives) or several inverter units (multidrives) connected to the intermediate circuit.

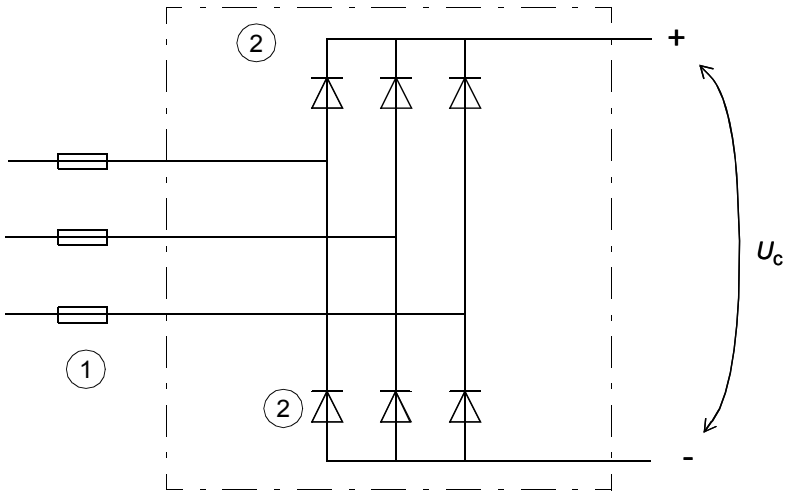
The rectifier bridge in the supply module is uncontrolled: it cannot control the DC link voltage or limit the charging current of the DC link capacitors at the power up. Thus you can only use the bridge with inverters that have charging circuits, or you must equip the supply unit with a separate charging circuit.

Note:

- The supply module does not have means to control, limit or cut off the load current.
- The customer must arrange the overload and short-circuit protection of each supply cable (typically with fuses).
- The supply unit does not have AC or DC chokes. Thus, the customer must arrange a sufficient inductance at the AC side of each supply module with suitable cabling. The minimum length of the supply cable per each supply module is 5 meters (16.4 feet). The inductances between the parallel-connected supply modules must be identical, ie, the cabling to each module must be identical in regard to cable type and length. For selecting the supply transformer, see Selecting the supply transformer.

Main circuit diagram

The figure shows a simplified main circuit diagram of the rectifier bridge.



1	AC fuses
2	Diodes

Implementing DC voltage measurement

The control program needs a measured voltage value:

- for the control of the charging circuit at the power up
- for overvoltage and undervoltage monitoring and protection.

The supply unit does not have DC voltage measurement as standard. The cabinet installer must implement it separately. The cabinet installer can, for example:

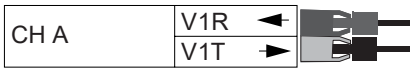
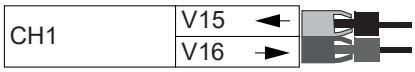
1. connect the DC voltage measurement of the inverter unit to the supply unit via a fiber optic link between DDCS communication modules. For more information, see Start-up (page 75), Example circuit diagrams (page 153) and the relevant firmware manuals.
2. connect the DC voltage measurement of the inverter unit to the supply unit via the analog output of the inverter unit and analogue input AI2 or AI1 of the supply unit. For more information, see Start-up (page 75), Example circuit diagrams (page 153) and the relevant firmware manuals.
3. use a separate voltage measurement device (transducer), and connect it between the drive DC link and analogue input AI2 or AI1 of the supply unit.

You can use alternatives 1, 2, or 3 for a single drive, in other words, for a drive that consist of one supply unit and one inverter unit. For multidrives (one supply unit feeds several inverters), use alternative 3.

Charging

A charging circuit powers up the DC link capacitors of the drive system smoothly. Discharged capacitors cannot be directly connected to the full supply voltage. The charging current must be limited until the capacitors are charged and ready for normal use.

If the diode supply unit is equipped with a charging circuit, the DC voltage level must be signaled to the control unit either through analog input AI2 (AI1) or fiber optic connection between the supply unit and inverter unit (requires FDCO-01 DDCS communication module). The charging function and DC voltage measurement source must be defined by parameters. For more information, see the firmware manual.

Supply unit	Inverter unit
FDCO-01 in ZCU control unit	RDCO-04 in BCU control unit
	

DC overvoltage and undervoltage protection

The supply unit control program monitors the measured DC voltage value. If it detects an overvoltage or undervoltage, it trips the main contactor and generates a fault. For more information, see the firmware manual.

Note: There is no DC voltage measurement in the supply unit as standard. See section Implementing DC voltage measurement (page 16).

Short-circuit protection

AC fuses protect the supply unit against short circuit. The cabinet installer must acquire and install the fuses. Fuses are available from ABB.

Note that the supply unit designs presented in this manual do not contain DC fuses. The cabinet installer must arrange for appropriate short circuit protection on the DC side.

DC fuses limit the DC short-circuit energy and are necessary when D8D modules are used as a part of a multidrive configuration or when the total capacitance of the line-up exceeds 36 mF or 4 × R8i modules.

Module temperature supervision

Thermal switch [F6.1] supervises the temperature inside the supply module. Wire the switch to a digital input (DI1) of the supply control unit (1 = OK, 0 = overtemperature). In case of overtemperature, the switch opens and the control program generates first a warning, and then, if the overtemperature indication remains over a predefined delay, trips the supply unit on a fault. You can adjust the delay time by parameters.

For the example wirings, see Example circuit diagrams (page 153).

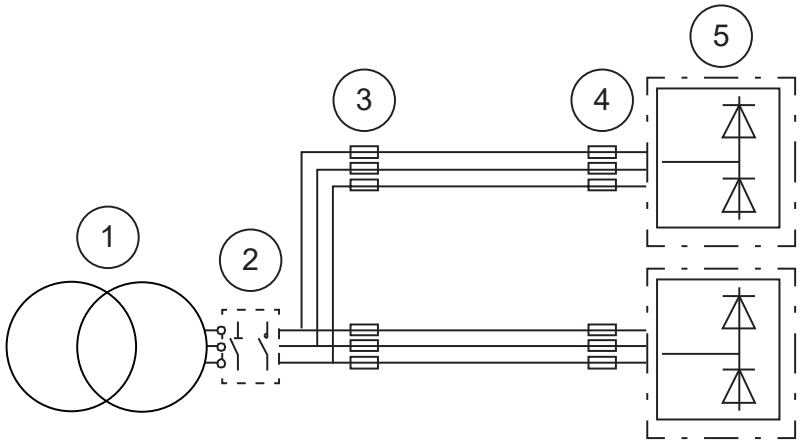
For cabinet temperature supervision, see Cabinet temperature supervision (page 39).

6-, 12- and 24-pulse supply units

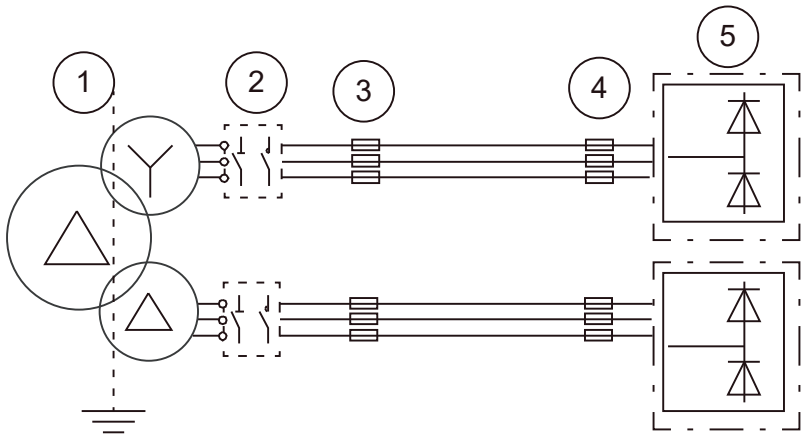
The supply units can be connected either to 6-pulse, 12-pulse or 24-pulse connection. If 12-pulse or 24-pulse supply transformer is used, there can be a maximum of 4 diode supply modules in one drive system. The figure illustrates the difference between 6-pulse and 12-pulse AC supply connections. The 6-pulse connection is standard.

The 12-pulse supply connection eliminates the fifth and seventh harmonics, which remarkably reduces the harmonic distortion of the line current and the conducted emissions. The 12-pulse connection requires a three-winding transformer, or two separate transformers. There is a 30-degree phase shift between the two 6-pulse supply lines.

6-pulse connection



12-pulse connection



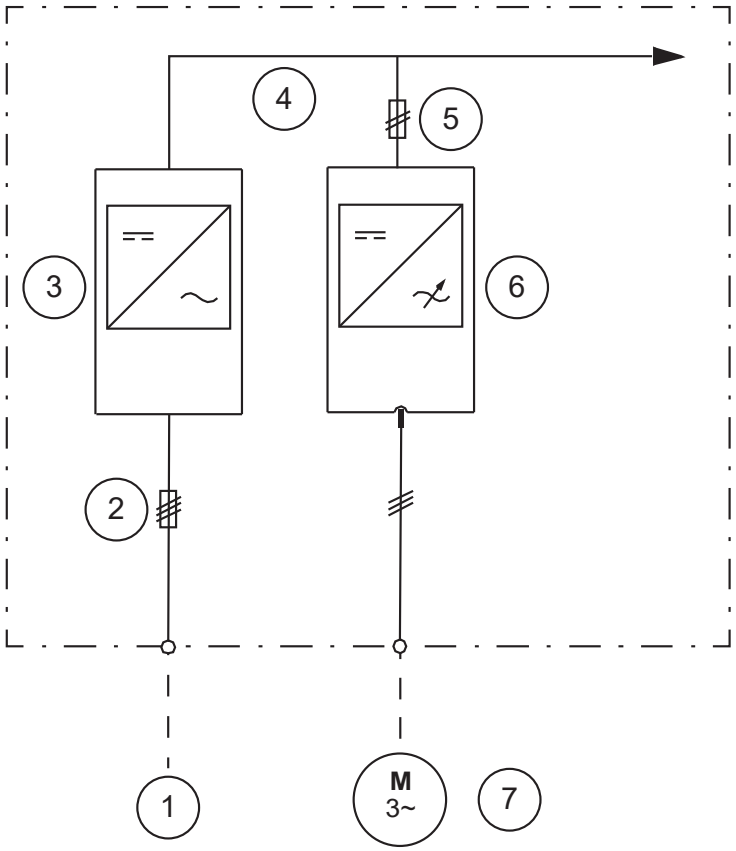
1	Supply transformer
2	Switching equipment and fuses
3	Fuses for protecting input cabling
4	AC fuses for protecting supply unit against short circuit
5	Diode supply modules

Overview diagrams

This section contains examples of main circuit overview diagrams. The diagrams show the power line connection, and the connections between the components. The supply unit overview diagrams also show examples of division of components in cubicles, and indicate which components you can order from ABB and which you need to acquire separately.

Overview diagram of a drive

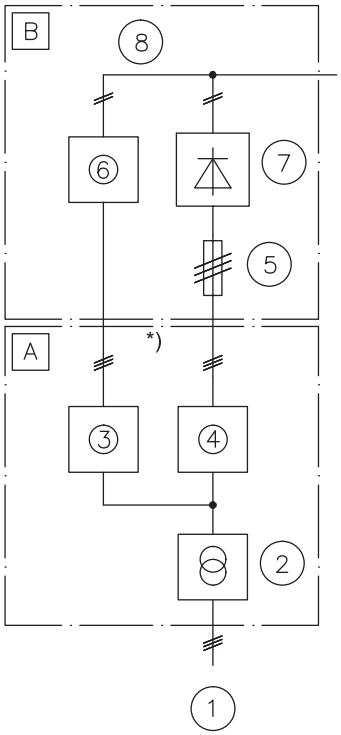
This diagram shows a a simplified diagram of a drive with one diode supply unit and one inverter unit.



1	AC supply
2	Input (AC) fuses
3	Supply module
4	DC bus (-, +)
5	Inverter DC fuses
6	Inverter module
7	Motor

Overview diagram – 1×D8D, 6-pulse, internal charging

The diagram shows a supply unit with one D8D module and internal charging in a 6-pulse connection. In this manual, internal charging stands for ABB charging kit inside the supply unit cubicle.



Note: *) Minimum length of the cables is 5 meters.

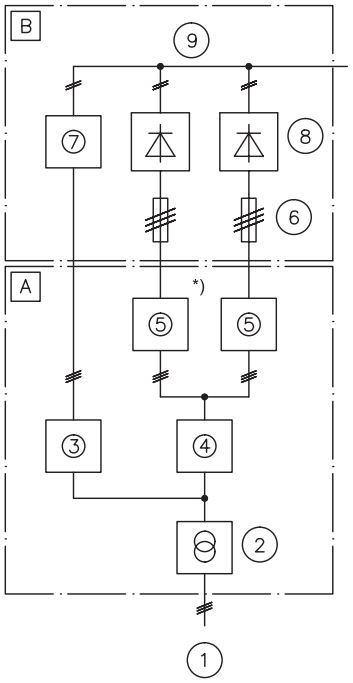
A	External installation (outside supply module cubicle)
B	Supply module cubicle
1	Medium voltage/low voltage switchboard
2	Supply transformer
3	Charging switchgear including disconnecting device
4	Dedicated supply unit switchgear including: • Disconnecting device • Breaker/contactor • Overcurrent and short-circuit protection of input cabling
5	AC fuses for protecting supply unit against short circuit [1)]
6	Internal charging kit [2)]
7	Diode supply module [2)]
8	DC link

[1)] Available through ABB or third party

[2)] Available through ABB

Overview diagram – 2×D8D, 6-pulse, internal charging

The diagram shows a supply unit with two D8D modules and internal charging in a 6-pulse connection.



Note: *) Each module must have its own input AC cable with the minimum length of 5 meters. Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges.

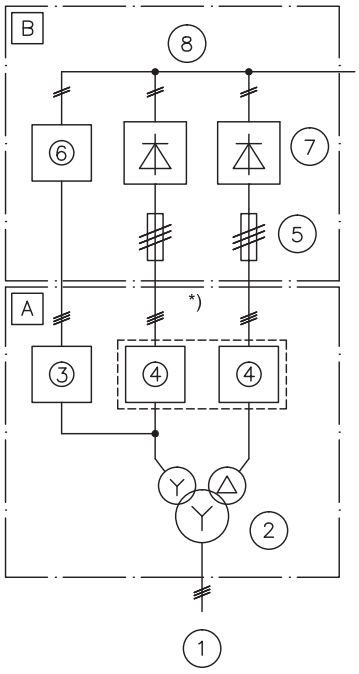
A	External installation (outside supply module cubicle)
B	Supply module cubicle
1	Medium voltage/low voltage switchboard
2	Supply transformer
3	Charging switchgear including disconnecting device
4	Dedicated supply unit switchgear including: • Disconnecting device • Breaker/contactor
5	Overcurrent and short-circuit protection of input cabling
6	AC fuses for protecting supply unit against short circuit [1)]
7	Internal charging kit [2)]
8	Diode supply modules [2)]
9	DC link

[1)] Available through ABB or third party

[2)] Available through ABB

Overview diagram – 2×D8D, 12-pulse, internal charging

The diagram shows a supply unit with two D8D modules and internal charging in a 12-pulse connection.



Note: *) Each module must have its own input AC cable with the minimum length of 5 meters. Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges.

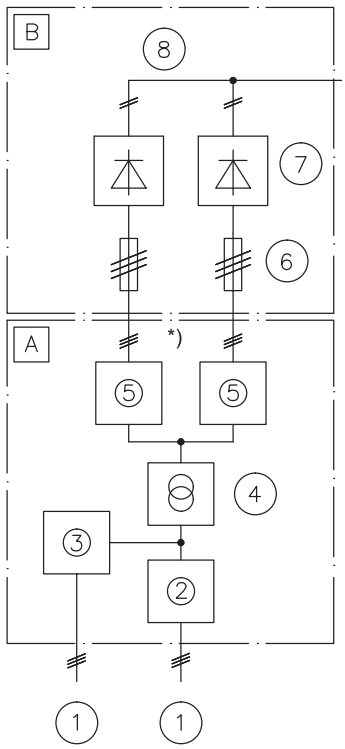
A	External installation (outside supply module cubicle)
B	Supply module cubicle
1	Medium voltage/low voltage switchboard
2	Supply transformer
3	Charging switchgear including disconnecting device
4	Interlocked dedicated supply unit switchgear including: • Disconnecting device • Breaker/contactor • Overcurrent and short-circuit protection of input cabling
5	AC fuses for protecting supply unit against short circuit [1)]
6	Internal charging kit [2)]
7	Diode supply modules [2)]
8	DC link

[1)] Available through ABB or third party

[2)] Available through ABB

Overview diagram – 2×D8D, 6-pulse, external charging and pre-magnetizing

The diagram shows a supply unit with two D8D modules in a 6-pulse connection. The system has an external charging circuit combined with a transformer pre-magnetization circuit. For more information, contact ABB.



Note: *) Each module must have its own input AC cable with the minimum length of 5 meters. Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges.

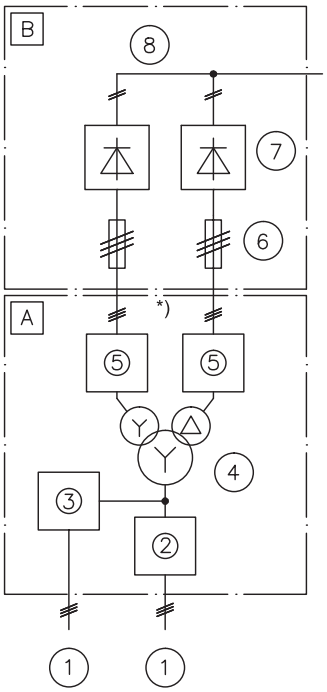
A	External installation (outside supply module cubicle)
B	Supply module cubicle
1	Medium voltage/low voltage switchboard
2	Switchgear including: • Disconnecting device • Breaker/contactor
3	Combined transformer pre-magnetizing circuit and drive charging circuit
4	Supply transformer
5	Overcurrent and short-circuit protection of input cabling
6	AC fuses for protecting supply unit against short circuit [1)]
7	Diode supply modules [2)]
8	DC link

[1)] Available through ABB or third party

[2)] Available through ABB

Overview diagram – 2×D8D, 12-pulse, external charging and pre-magnetizing

The diagram shows a supply unit with two D8D modules in a 12-pulse connection. The system has an external charging circuit combined with a transformer pre-magnetization circuit. For more information, contact ABB.



Note: *) Each module must have its own input AC cable with the minimum length of 5 meters.

A	External installation (outside supply module cubicle)
B	Supply module cubicle
1	Medium voltage/low voltage switchboard
2	Switchgear including: • Disconnecting device • Breaker/contactor
3	Combined transformer pre-magnetizing circuit and drive charging circuit
4	Supply transformer
5	Overcurrent and short-circuit protection of input cabling
6	AC fuses for protecting supply unit against short circuit [1)]
7	Diode supply modules [2)]
8	DC link

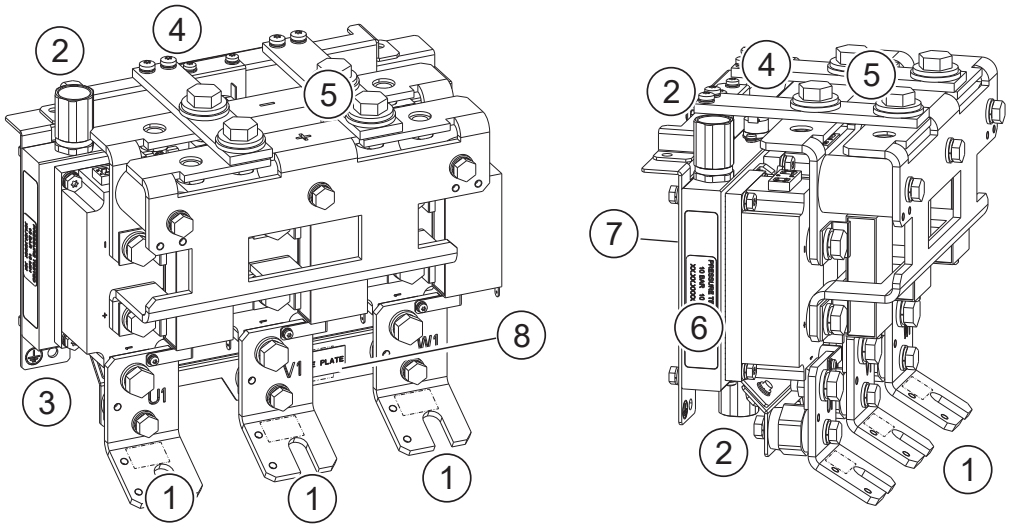
[1)] Available through ABB or third party

[2)] Available through ABB

Hardware of the supply modules

Layout drawing of the D8D module

This figure shows the layout of the D8D module.



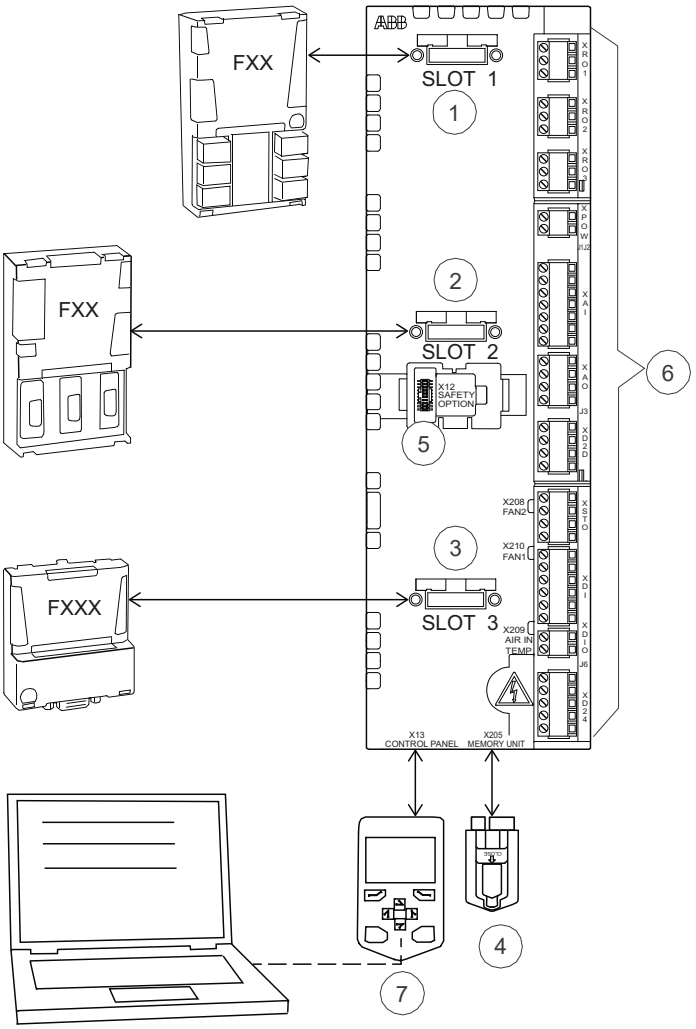
1	External main supply connections U1, V1 and W1
2	Coolant connectors
3	Unpainted grounding point (PE)
4	Thermal switch [F6.1]
5	DC+ and DC- connections
6	Heatsink
7	Type designation label is on the back of the module (on the mounting plate of the module)
8	Label with the serial number of the supply module

Overview of control connections of ZCU-14 control unit

It is possible to:

- control the unit through the control panel and fieldbus
- read the status information of the supply unit through the control panel, fieldbus and relay output.

The diagram shows the control connections and interfaces of the ZCU control unit.



1 2 3	Analog and digital I/O extension modules and fieldbus communication modules can be inserted into slots 1, 2 and 3.
4	Memory unit
5	Not in use in supply modules
6	Terminal blocks
7	Control panel

Supply unit control devices

Run enable is the main control signal of the supply unit. The control program reads it from digital input DI2. You can control the signal, for example, with an operating switch

installed on the supply module cubicle door, and wired to DI2. When the digital input DI2 is on, it is also possible to control the Run enable signal from a control panel, through fieldbus interface, or from the inverter unit.

For other control signals, see the firmware manual and the default I/O connection diagram.

Auxiliary voltage switch

You can equip the unit with an auxiliary voltage switch [Q20, Q22]. Using the switch, you can disconnect the auxiliary circuit from the power line.

We recommend to equip the auxiliary voltage supply with disconnecting device(s), to be able to disconnect also auxiliary voltages from the supply module cubicles for maintenance work.

Operating switch

You can equip the cabinet with an operating switch [S21].

By default, the operating switch controls the unit as follows:

- The ENABLE/RUN position: If the supply unit has an internal or external charging circuit, the control program charges first the DC link. Then the main contactor closes and the supply module starts to rectify. If the supply unit has no charging circuit, the switch closes the main contactor.
- The OFF position: The control program opens the main contactor [Q2] and the module stops rectifying.

The control unit

The diode supply unit is controlled by a ZCU control unit.

Control panel [A59]

With the control panel, the user can:

- start and stop the unit
- view and reset the fault and warning messages, and view the fault history
- view actual signals
- change parameter settings
- change between local (control panel) and remote (external device) control.

To be able to start and stop the unit by the control panel, the Run enable signal and Start enable signal must be on (1) on the supply control unit. Normally, this is the case when the operating switch [S21] on the cabinet door is in ENABLE/RUN (1) position. The control mode selection on the control panel must also be Local. The Loc/Rem key of the panel selects between the local and remote control modes.

PC connection

There is a USB connector on the front of the control panel that can be used to connect a PC to the drive. When a PC is connected to the control panel, the control panel keypad is disabled.

Fieldbus control

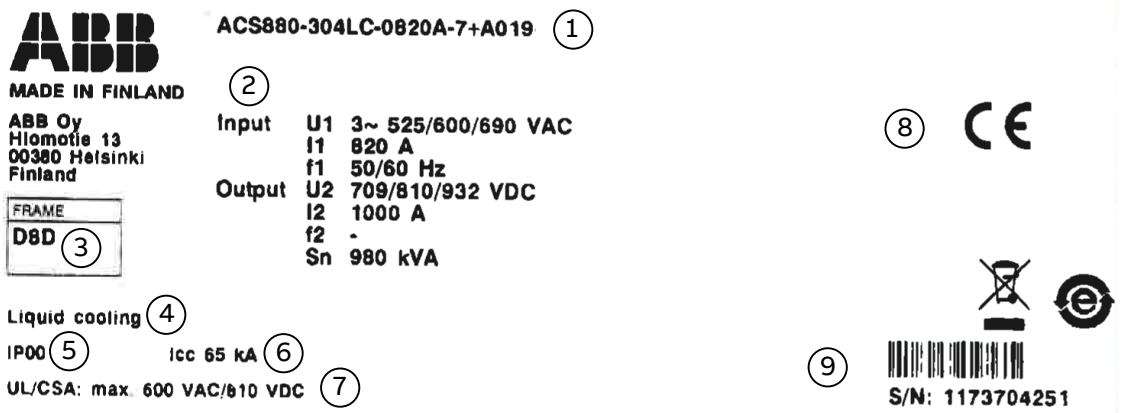
You can control the unit through a fieldbus interface if the unit is equipped with an optional fieldbus adapter and when you have configured the control program for the fieldbus control with the parameters. For information on the parameters, see the firmware manual.

Note: To be able to switch the main contactor [Q2] or main circuit breaker [Q1] and the supply unit on and off (Run enable signal) through the fieldbus, the Run enable command at digital input DI2 must be on (1).

Type designation label

Each supply module has type designation labels attached to it. The type designation stated on the labels contains information on the specifications and configuration of the unit.

Quote the complete type designation and serial number when contacting technical support on the subject of individual supply modules.



1	Type designation. See section Type designation key (page 29).
2	Ratings. See the technical data.
3	Frame size
4	Cooling system and additional information
5	Degree of protection
6	Short-circuit withstand strength, see section Electrical power network specification (page 126).
7	UL/CSA data. See section Electrical power network specification (page 126).
8	Valid markings. See *ACS880 liquid-cooled multidrive cabinets and modules electrical planning instructions* [3AXD50000048634 (English)].
9	Serial number. The first digit of the serial number refers to the manufacturing plant. The next four digits refer to the unit's manufacturing year and week, respectively. The remaining digits complete the serial number so that there are no two units with the same number.

Type designation key

The type designation describes the composition of the module in short. The complete designation code is divided in subcodes:

- The first 1…18 digits form the basic code. It describes the basic construction of the unit. The fields in the basic code are separated by hyphens.
- The option codes follow the basic code. Each option code starts with an identifying letter (common for the whole product series), followed by descriptive digits. The option codes are separated by plus signs.

Code	Description
Basic codes	
ACS880	Product series
304LC	Construction: Diode supply module, liquid-cooled.
Size	
0820A	Refer to the Ratings (page 119).
Voltage range	
7	525…690 V (525…600 V AC for UL/CSA) 3-phase ± 10%. This is indicated in the type designation label as typical input voltage levels 3~525/600/690 V AC (600 V AC for UL/CSA).
Plus codes	
A019	Direct uncontrolled diode-diode bridge (as standard)

3

Moving and unpacking the module

Contents of this chapter

This chapter gives basic information on unpacking and moving the module.

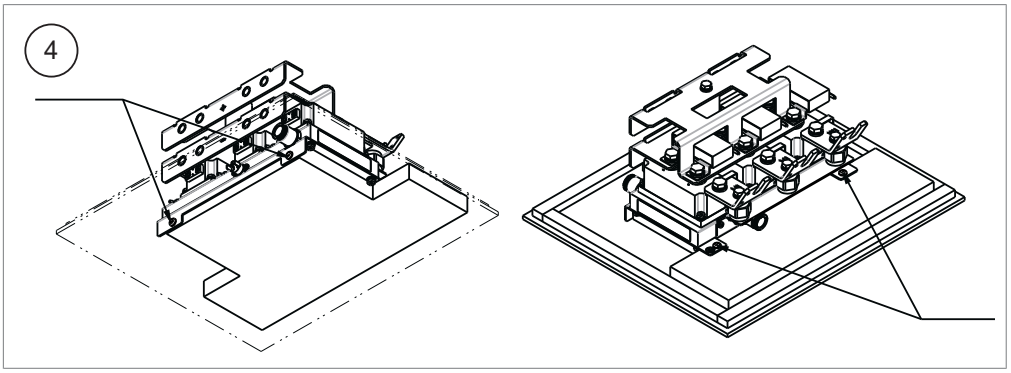
Moving the module

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

Move the transport package by pallet truck to the installation site.

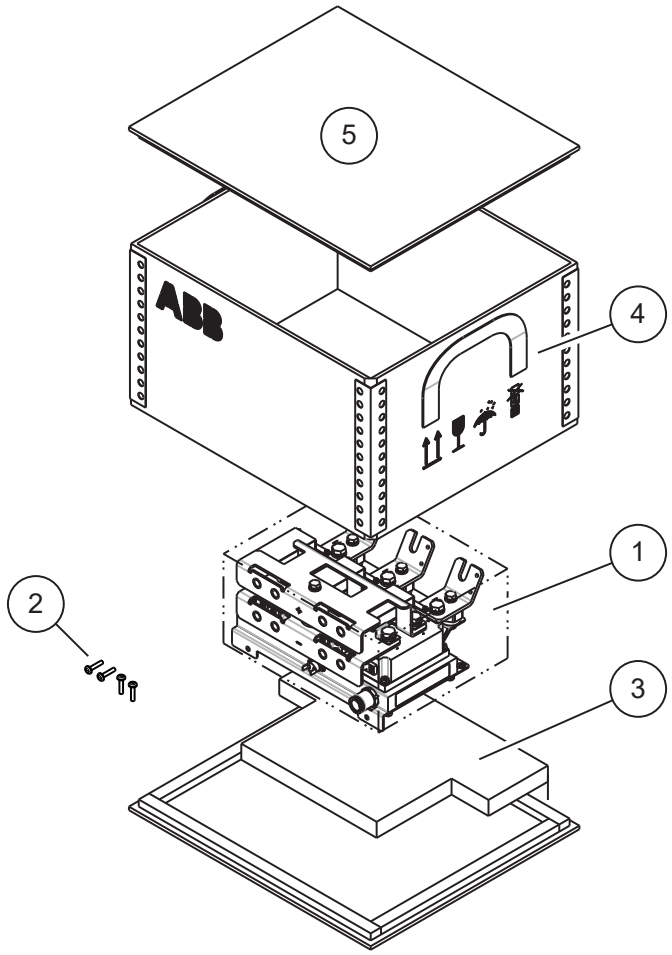
Unpacking and examining the delivery

1. Cut off the plastic straps or undo the screws of the box.
2. Lift off the box cover and sides.
3. Cut open the plastic wrapping of the module.
4. Undo the four screws with which the module is attached to the plywood support.



5. Lift off the module.
6. Check that there are no signs of damage.
7. Dispose of or recycle the packaging according to the local regulations.

This illustration shows the layout of the transport package. Examine that all items are present and there are no signs of damage. Read the data on the type designation label of the module to make sure that the module is of the correct type.



1	VCI sheet
2	Screws
3	Plywood support
4	Plywood box
5	Plywood cover

4

Cabinet construction

Contents of this chapter

This chapter gives instructions on how to install the modules and additional equipment into a cabinet.

For general instructions, see Drive modules cabinet design and construction instructions (3AUA0000107668 [English]).

Limitation of liability

The installation must always be designed and made according to applicable local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches the local laws and/or other regulations. Furthermore, if the recommendations given by ABB are not followed, the drive may experience problems that the warranty does not cover.

Switching, disconnecting and protecting solution

To arrange the switching, disconnection and protection of the supply module, you can use the following solution:

1. Equip the main circuit with a disconnecting device which meets the local safety regulations.
2. The disconnecting device must separate the whole drive cabinet from the AC power line, including the AC fuses which are placed inside the drive cabinet.
3. Equip the drive with AC fuses to protect the unit against short circuit. Protect each input terminal of the supply module with a fuse of its own.
4. Protect the input cable with fuses or circuit breaker which meet the local safety regulations.

For more information, see Connecting the power cables and busbars (page 61). See also Electrical safety precautions (page 56) and the example circuit diagrams.

Cabinet configuration overview

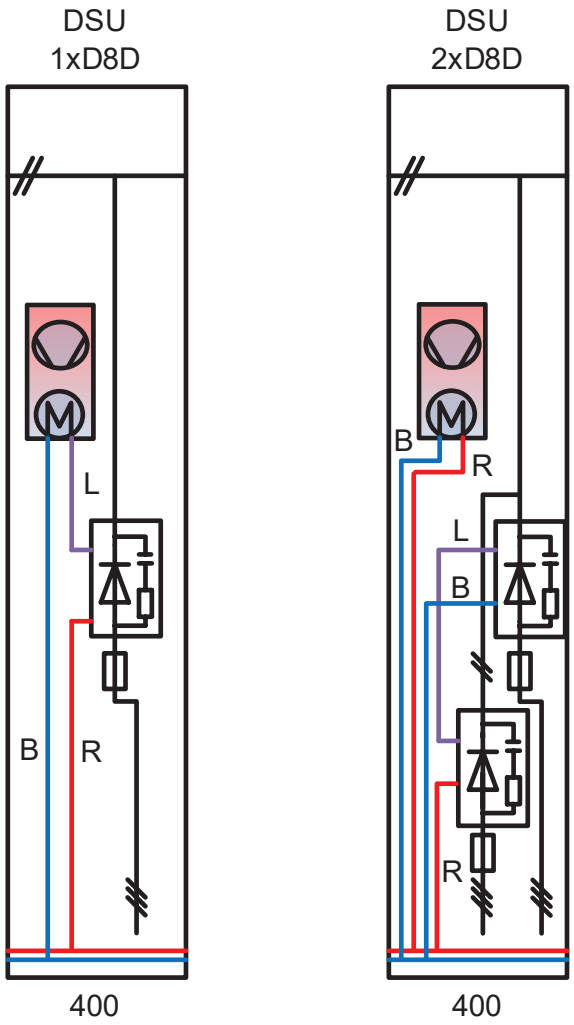
This section shows configuration examples of the supply module cubicles. The 6-pulse and 12-pulse connections use the same mechanics. The cubicles have direct AC cabling to the supply module through the bottom plate of the cubicle.

The 400 mm wide design:

- uses Rittal VX25 enclosure or generic enclosures
- can have 1×D8D or 2×D8D modules
- does not have space reserved for internal charging circuit components
- has a swing-out frame for installing the control unit and other electrical equipment.

400 mm wide Rittal VX25 and generic enclosures

These figures show 1×D8D and 2×D8D modules in 400 mm wide Rittal VX25 and generic enclosures. The figures show also pipe routing overviews.



Blue lines	B	Incoming pipes
Red lines	R	Outgoing pipes
Lilac lines	L	Intermediate pipes
Black lines	Electrical connections	

In diode supply unit cabinets, flow restrictors are used in both manifolds.

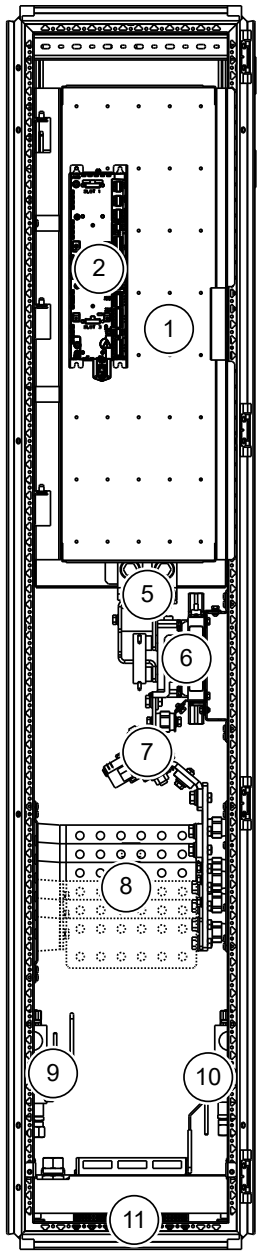
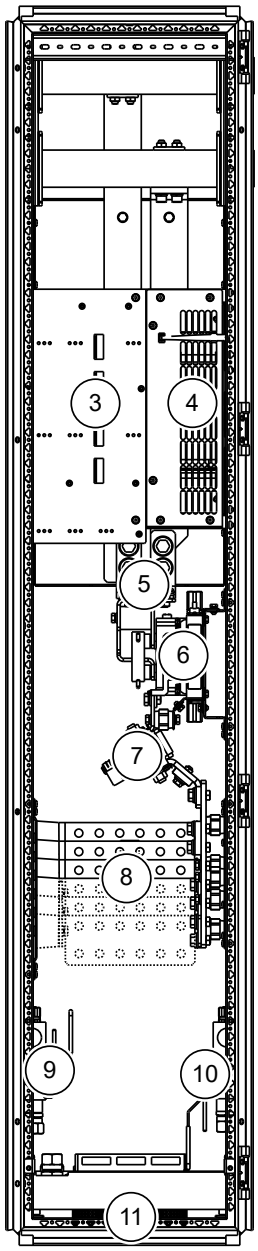
1 supply module: 1×D8D module and the heat exchanger are connected in series in the cooling circuit. The pipe size is 16/13 mm. See Pipe routing example of 1×D8D unit in 400 mm wide Rittal VX25 enclosure (page 41).

2 supply modules: 2×D8D modules are connected in series, and the heat exchanger is connected parallel to the modules in the cooling circuit. The pipe size is 16/13 mm between the modules and the manifolds. The pipe size for parallel connected heat exchanger is 8/6 mm. See Pipe routing example of 2×D8D unit in 400 mm wide Rittal VX25 enclosure (page 42).

Cabinet layout drawings

The cabinet layout drawings show examples of the supply units in the Rittal VX25 enclosure with external charging. The unit includes a D8D supply module/supply modules and bottom entries for cabling. The figures show also the cooling circuit inlet, outlet and the cooling circuit valves.The swing-out frame has space for installing the control unit and other electrical equipment.

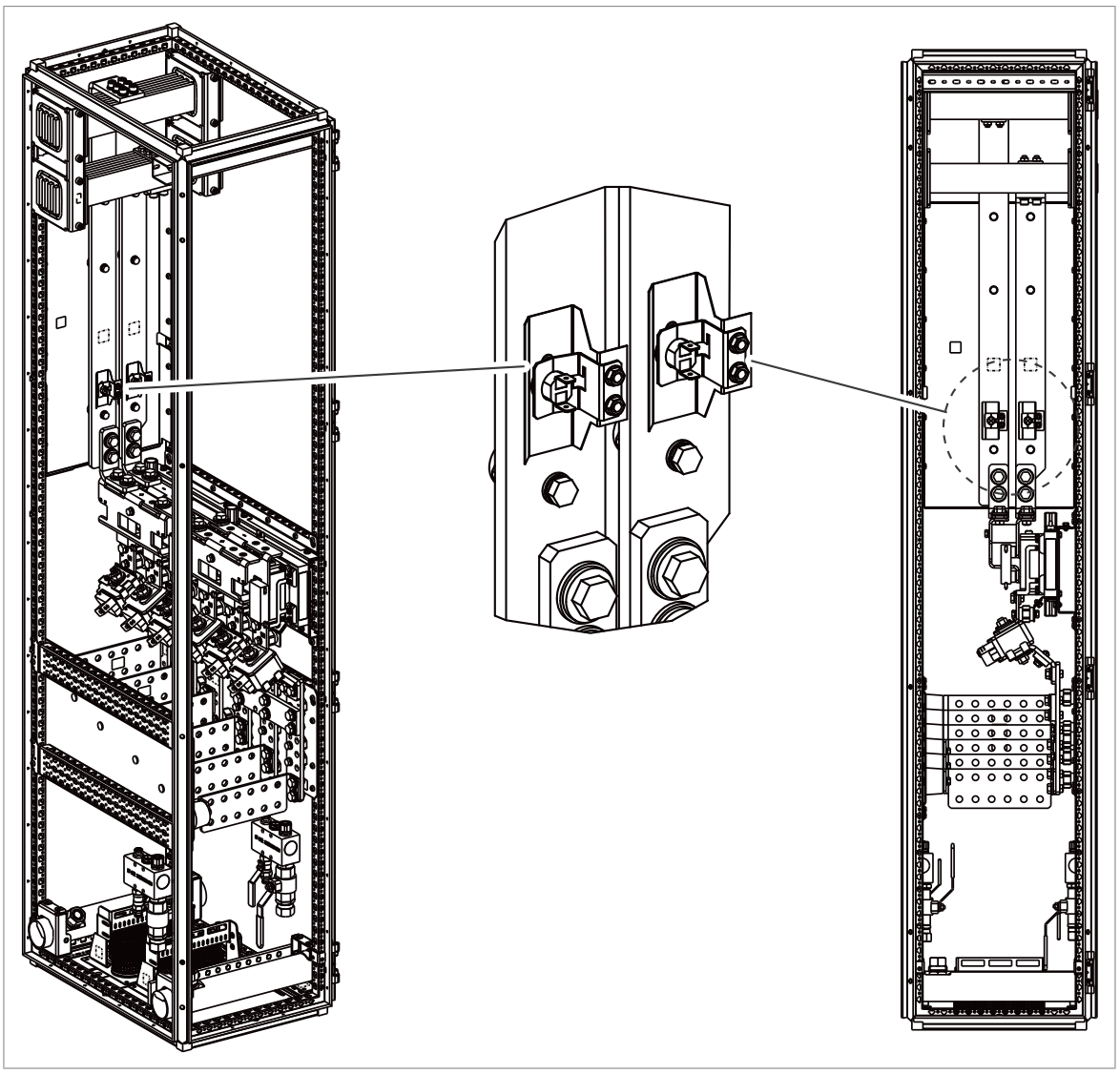
Layout drawing of 1×D8D or 2×D8D unit in 400 mm wide Rittal VX25 enclosure

Swing-out frame closed	Swing-out frame open		
		1	Swing-out frame
		2	Control unit
		3	Heat exchanger behind the mounting plate
		4	Cabinet fan behind the louver plate
		5	Common DC busbars
		6	1×D8D: One supply module 2×D8D: Two supply modules (one module is behind the other)
		7	AC fuses
		8	AC input cable terminals
		9	Inlet stop valve and drain valve behind the inlet valve
		10	Outlet stop valve and drain valve behind the outlet valve
		11	Cable entries

Cabinet temperature supervision

In liquid-cooled drive systems, the cabinet can be totally sealed from the ambient air. The air inside the cabinet must be able to circulate freely. You can install a fan inside the cabinet to push air through a heat exchanger.

You can use thermal switches [F6.11, F6.12] to supervise the temperature inside the cabinet. Install the thermal switches on the hottest element of the cabinet. In this example, the thermal switches are on the DC busbar above the supply module (two thermal switches for 1×D8D and 2×D8D modules on the DC+ and DC- busbars). ABB recommends to use thermal switches with 100 °C temperature limit.



Wire the switch to a digital input (DI) of the supply control unit (1 = OK, 0 = overtemperature). In case of overtemperature, the switch opens and the control program generates first a warning, and then, if the overtemperature indication remains over a predefined delay, trips the supply unit on a fault. You can adjust the delay time by parameters. For the example wirings, see the example circuit diagrams.

Note: If you install the switches on the busbars, make sure there is proper insulation between the busbars and thermal switches.

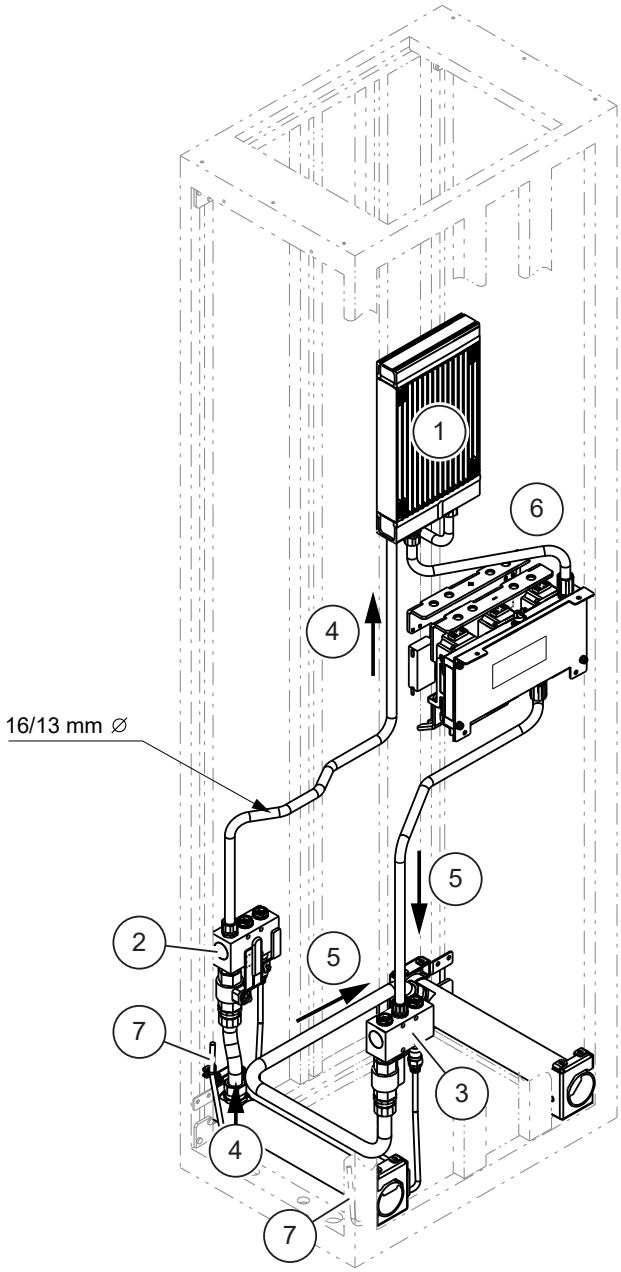
A temperature sensor integrated into the control unit supervises the board operating temperature. In case of overtemperature, the control program generates a warning or trips the supply unit on a fault.

The module has its own thermal switch for temperature supervision. See Module temperature supervision (page 17).

Pipe routing

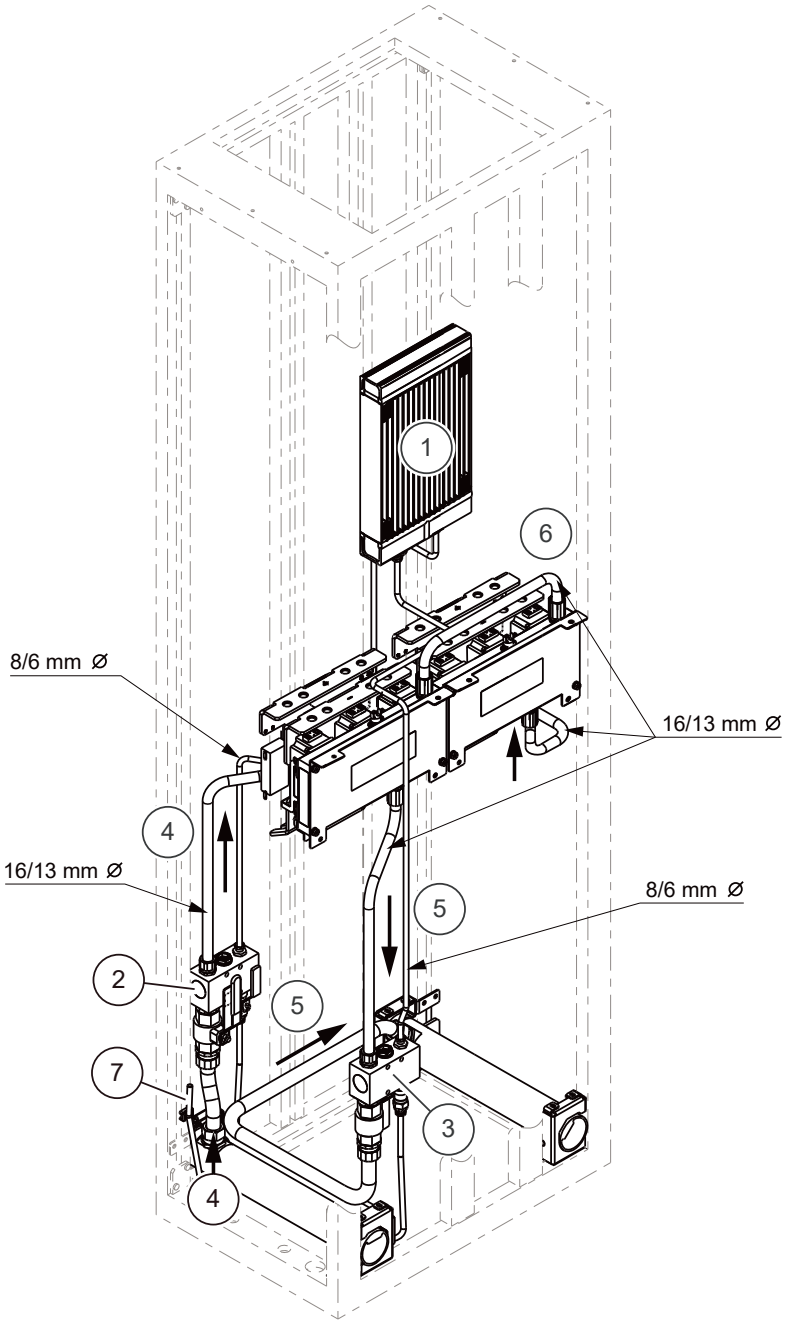
This section includes pipe routing examples for the supply unit cabinets. See also section Internal cooling circuit (page 109). It describes cooling-systems for cabinet-built ACS880 liquid-cooled multidrives. Pipe routing example drawings show also the drain pipes. For the liquid-cooling component offering for D8D supply unit cabinets, see the ordering information.

Pipe routing example of 1×D8D unit in 400 mm wide Rittal VX25 enclosure



1	Heat exchanger
2	Inlet manifold with stop and drain valves
3	Outlet manifold with stop and drain valves
4	Incoming pipes
5	Outgoing pipes
6	Intermediate pipes
7	Drain pipes

Pipe routing example of 2×D8D unit in 400 mm wide Rittal VX25 enclosure



1	Heat exchanger
2	Inlet manifold with stop and drain valves
3	Outlet manifold with stop and drain valves
4	Incoming pipes
5	Outgoing pipes
6	Intermediate pipes
7	Drain pipes

Installation examples

This section gives examples of how to place the drive and additional equipment into a Rittal VX25 enclosure.

Each example includes a table that lists:

- installation stages of different equipment in the order in which the installation into the enclosure should be done
- instruction code of the step-by-step instructions
- equipment kit code
- kit ordering code.

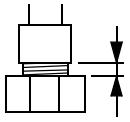
You can find the kit-specific assembly drawings, step-by-step instructions and kit information on the Internet. Go to https://sites-apps.abb.com/sites/lvacdrivesengineeringsupport/content. If needed, contact your local ABB representative.

The example includes also cabinet assembly drawings that show each stage listed in the table. More detailed steps of each stage are described in the kit-specific assembly drawings. The tightening torques are listed in the kit-specific assembly drawings. See the hardware manual for the tightening torques of drive module input and output terminals.

For general instructions, see Drive modules cabinet design and construction instructions (3AUA0000107668 [English]).

WARNING!
Remove the code labels attached to mechanical parts such as busbars, shrouds and sheet metal parts before installation. They may cause bad electrical connections, or, after peeling off and collecting dust in time, cause arcing or block the cooling air flow.

WARNING!
To avoid breaking the coolant pipes, do not overtighten the nuts of the unions. Leave 2…3 mm (0.08 … 0.12″) of thread visible.

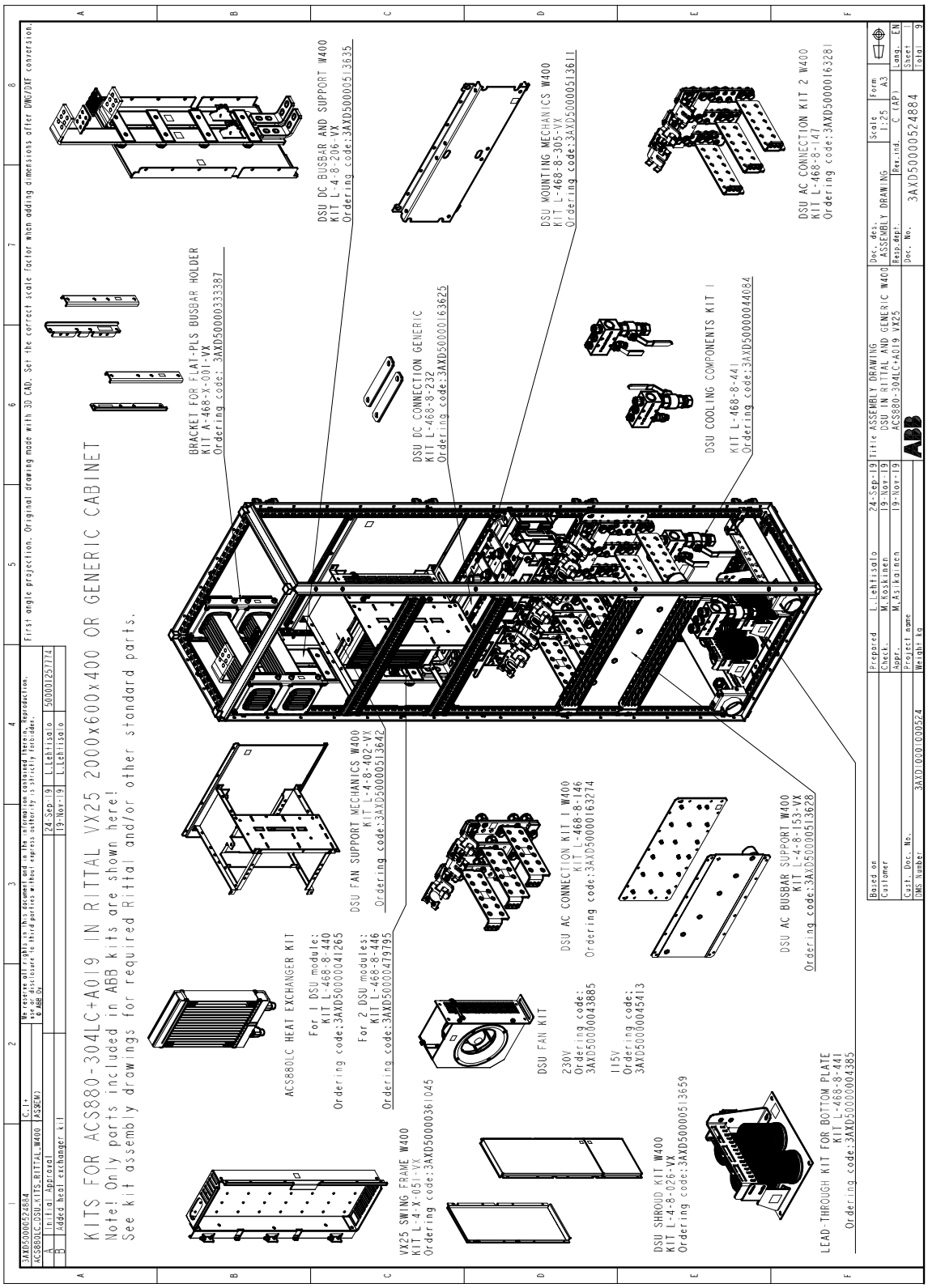


D8D modules in a 400 mm wide Rittal VX25 or generic enclosure

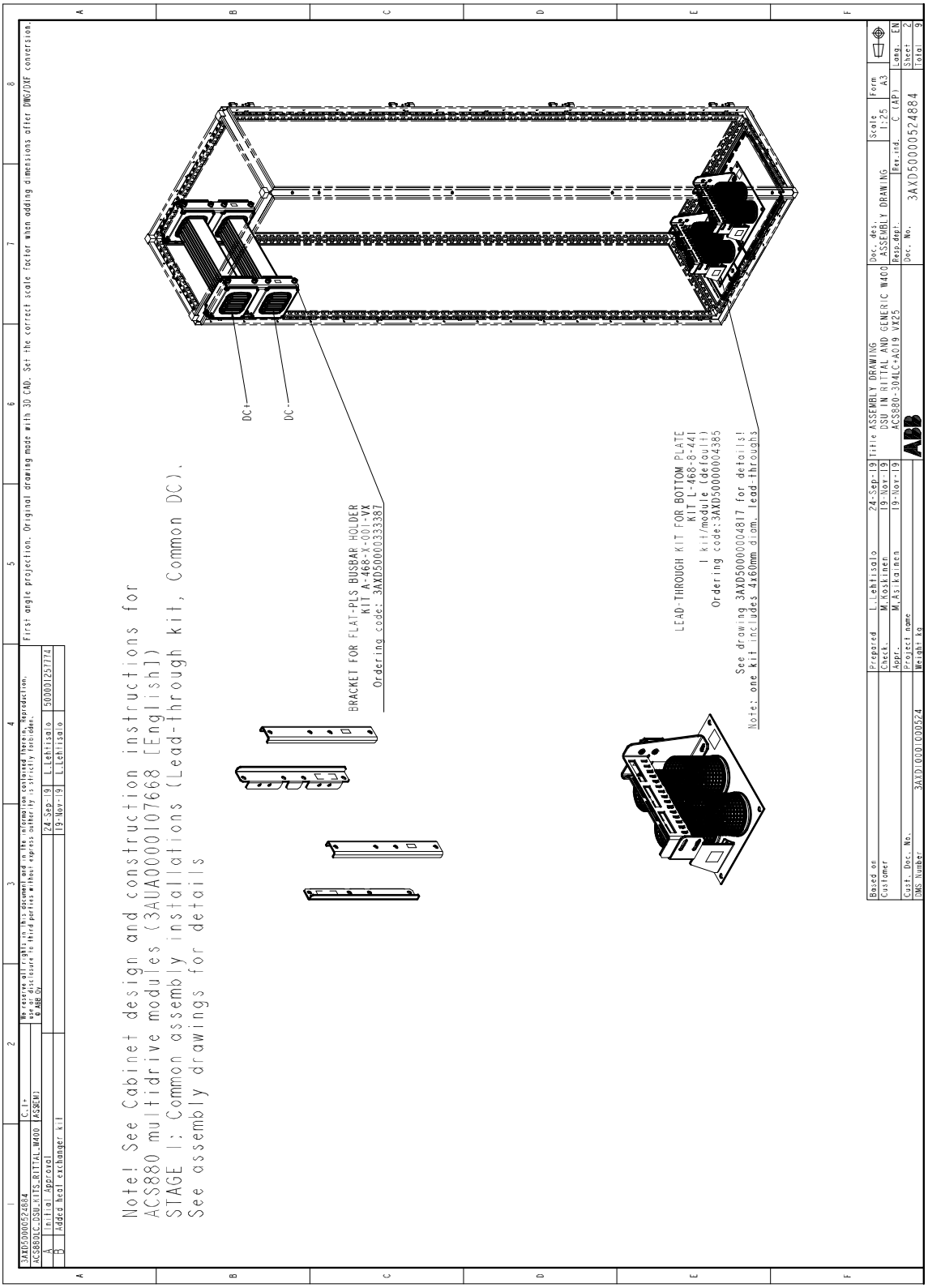
Installation stages

#	Installation stage	Instruction code	Kit code	Kit ordering code
1	Installation of common parts:			
	Cable entry kit	3AXD50000004817	A-468-8-441	3AXD50000004385
	Common DC Flat-PLS assembly (for Rittal VX25)	3AUA0000115891	A-468-X-001-VX	3AXD50000333387
2	Module installation parts:			
	Module installation mechanics	3AXD50000512430	L-468-8-305-VX	3AXD50000513611
	AC busbar support	3AXD50000511730	L-4-8-153-VX	3AXD50000513628
3	Liquid-cooling system components:			
	Cooling components kit	3AXD50000048217	L-468-8-441	3AXD50000044084
4	AC and DC busbar installation, **1 supply module:**			
	DC busbars and support (for Rittal VX25)	3AXD50000512393	L-4-8-206-VX	3AXD50000513635
	AC connection kit 1	3AXD50000164394	L-468-8-146	3AXD50000163274
5	AC and DC connection, **2 supply modules:**			
	AC connection kit 2	3AXD50000167616	L-468-8-147	3AXD50000163281
	DC connection kit	3AXD50000165070	L-468-8-232	3AXD50000163625
6	Cabinet fan and heat exchanger:			
	Cabinet fan support	3AXD50000514830	L-4-8-402-VX	3AXD50000513642
	Cabinet fan kit, 230 V	3AXD50000514830	-	3AXD50000043885
	Cabinet fan kit, 115 V	3AXD50000514830	-	3AXD50000045413
	Heat exchanger, **1 supply module**:	3AXD50000514830	L-468-8-440	3AXD50000041265
	Heat exchanger, **2 supply modules**:	3AXD50000514830	L-468-8-446	3AXD50000479795
7	Shroud and swing frame installation:			
	Swing frame	3AXD50000345106	L-4-X-051-VX	3AXD50000361045
	Shroud kit	3AXD50000516742	L-4-8-026-VX	3AXD50000513659
8	Door, covers and explosion exhaust kit	68834341	-	68797560

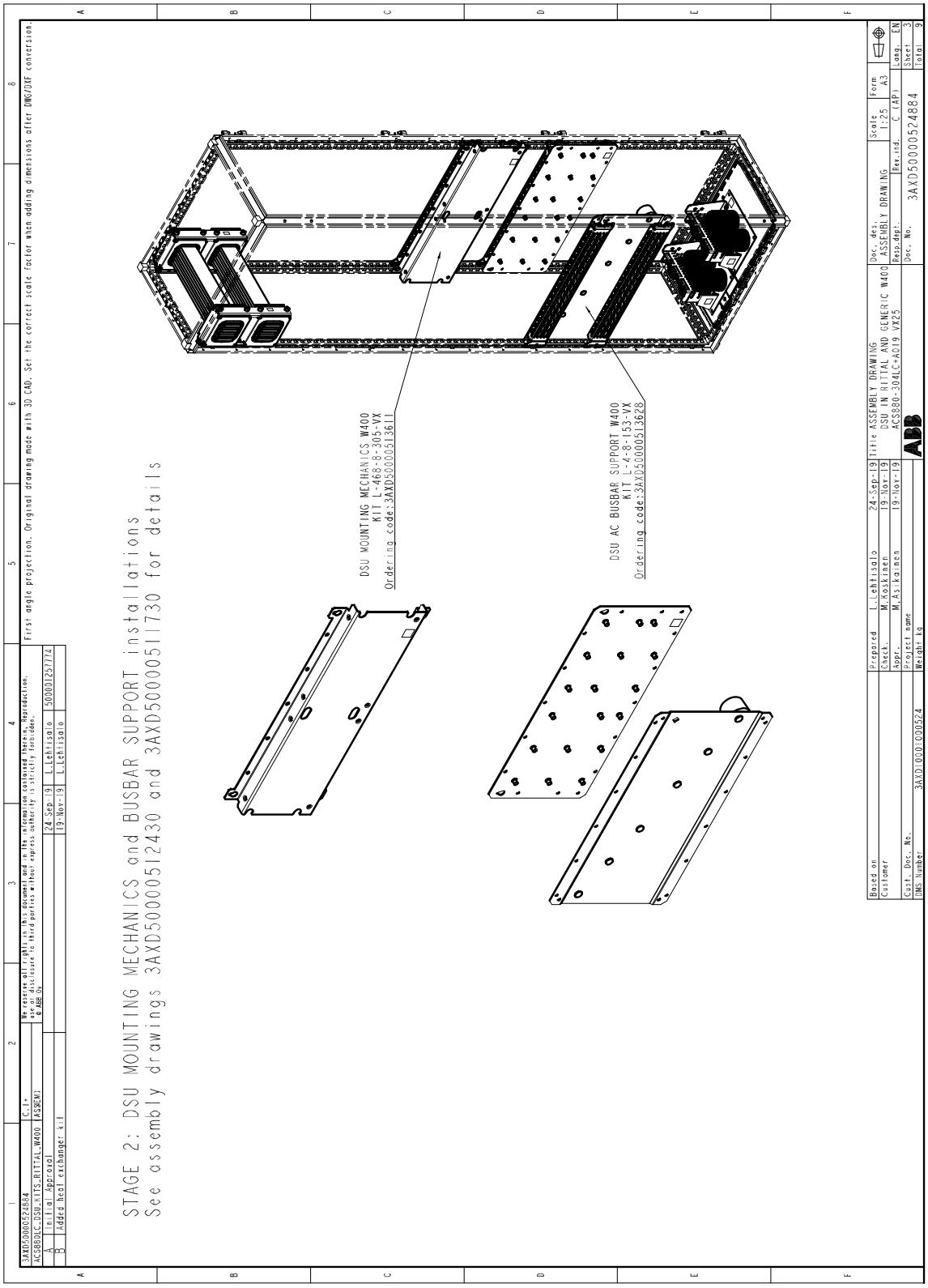
Kits for D8D supply modules in 400 mm Rittal VX25 or generic enclosure



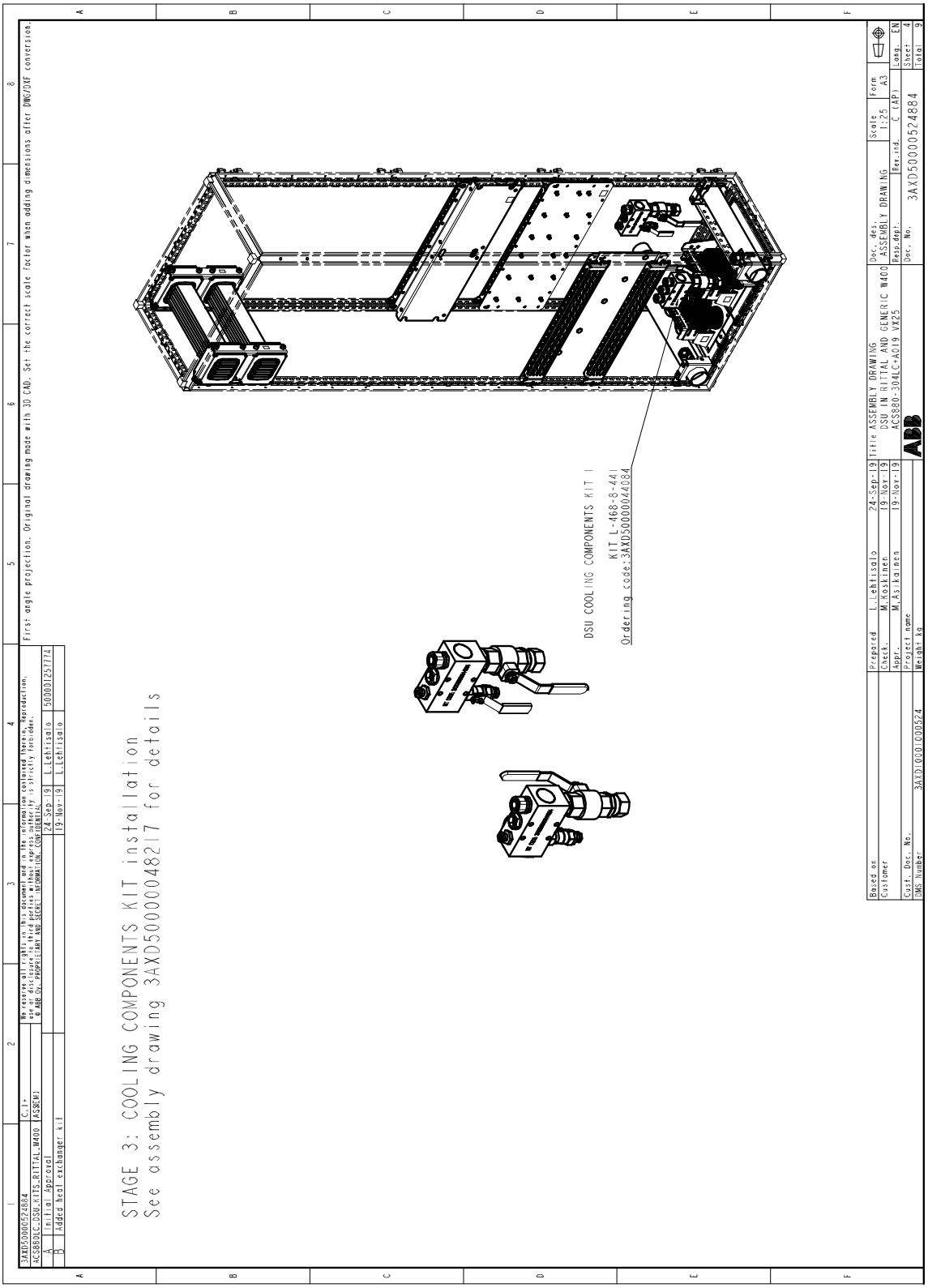
Stage 1: Installation of common parts



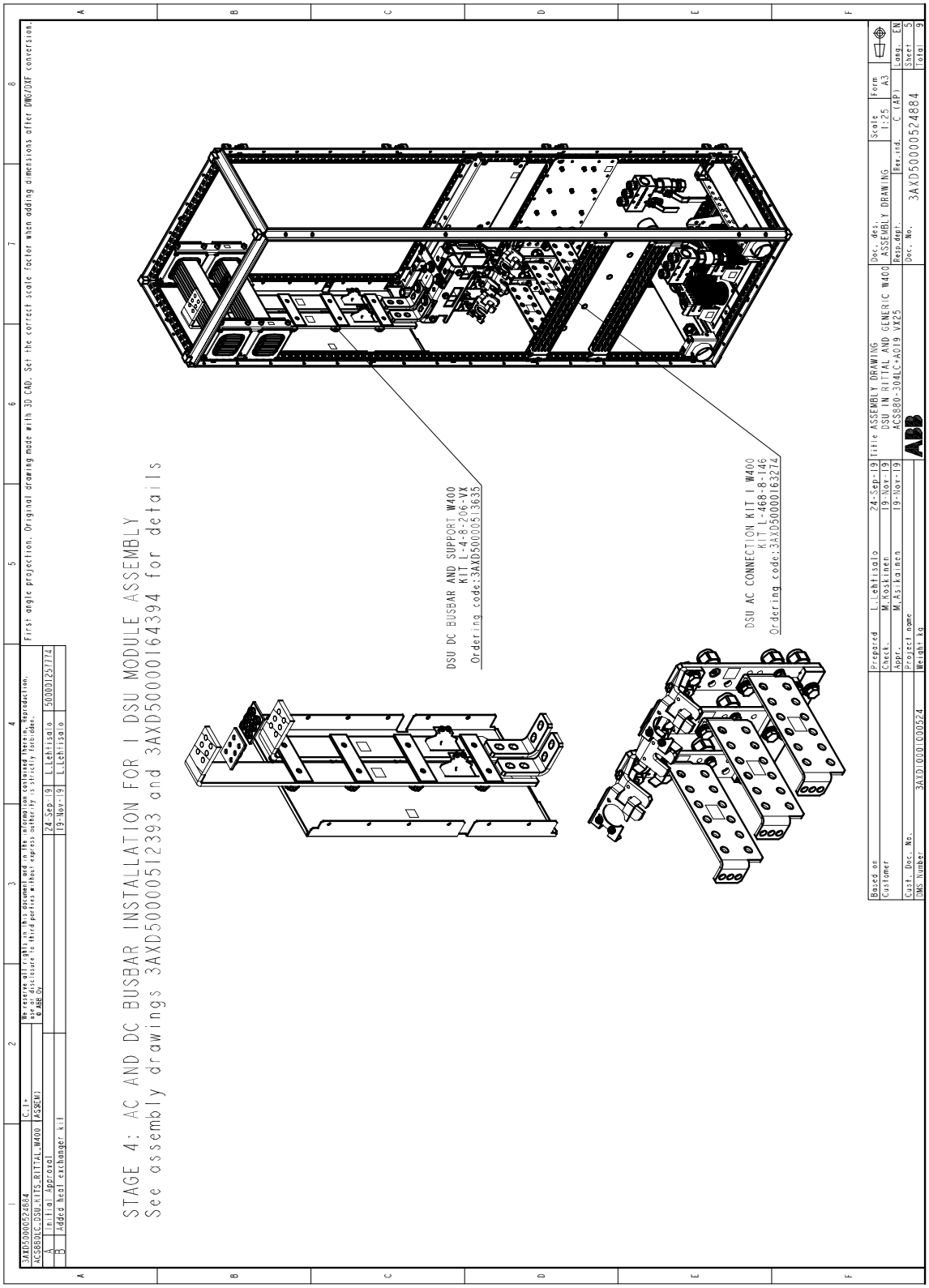
Stage 2: Module installation parts



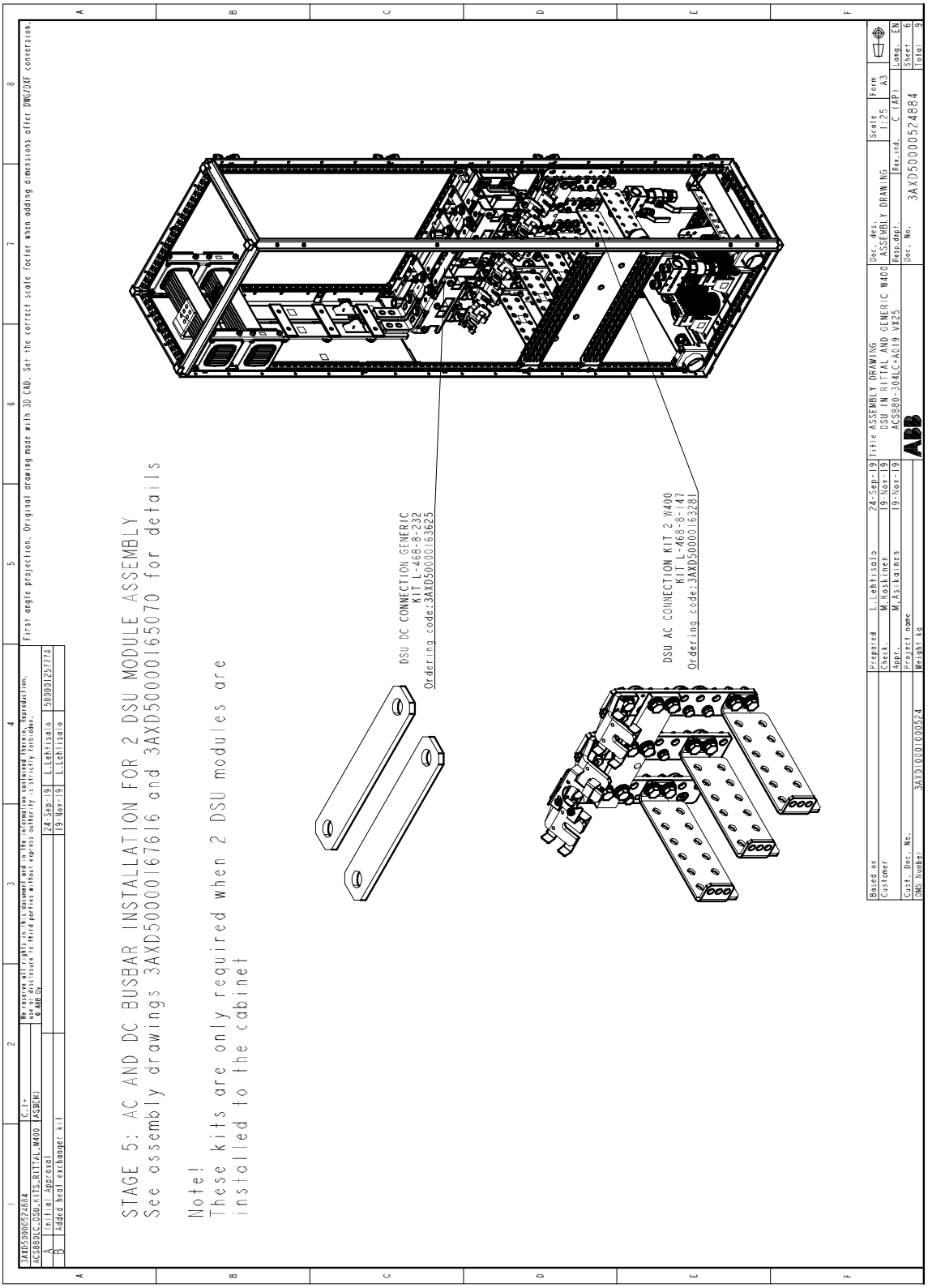
Stage 3: Liquid-cooling system components



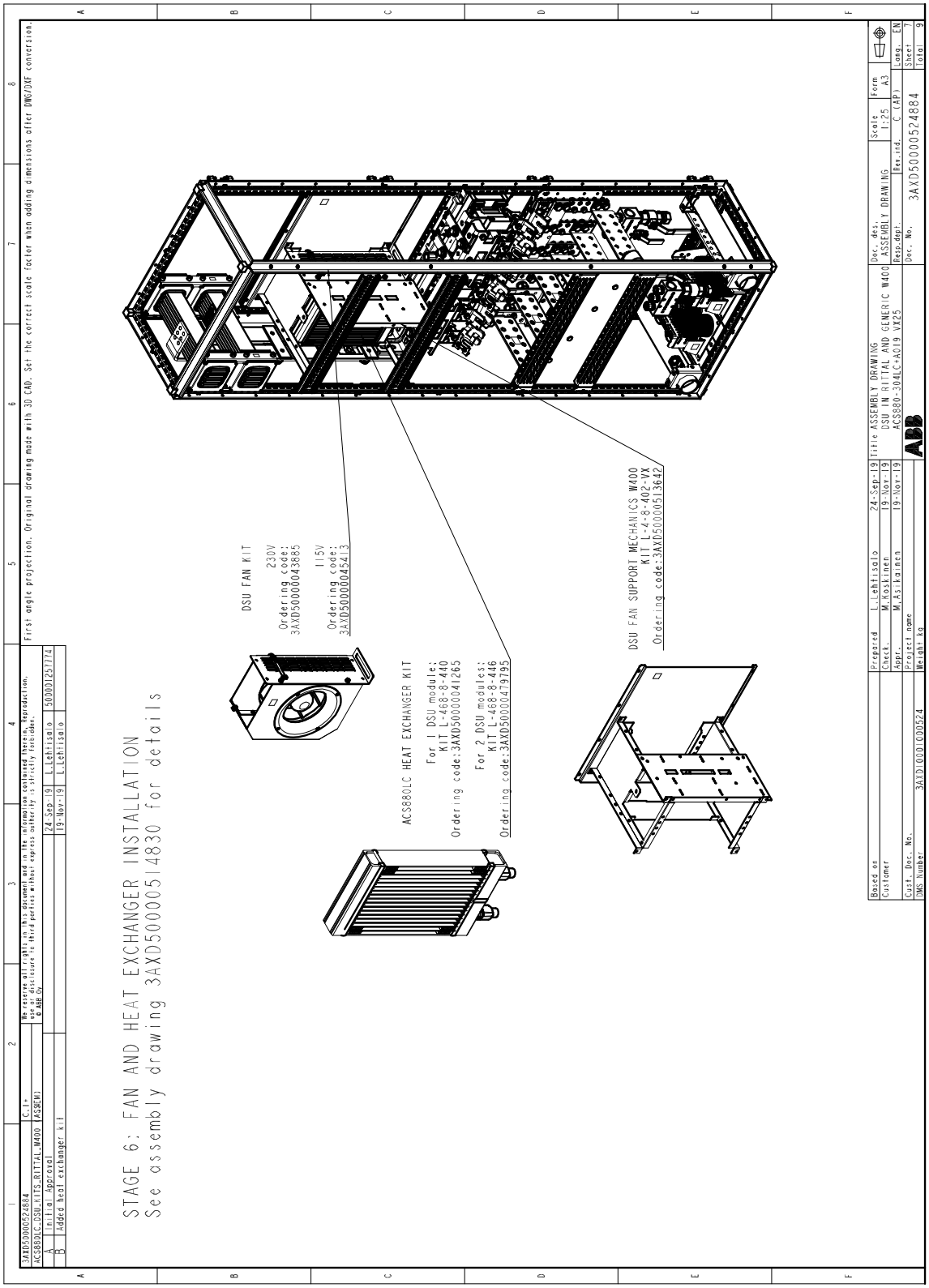
Stage 4: AC and DC busbar installation



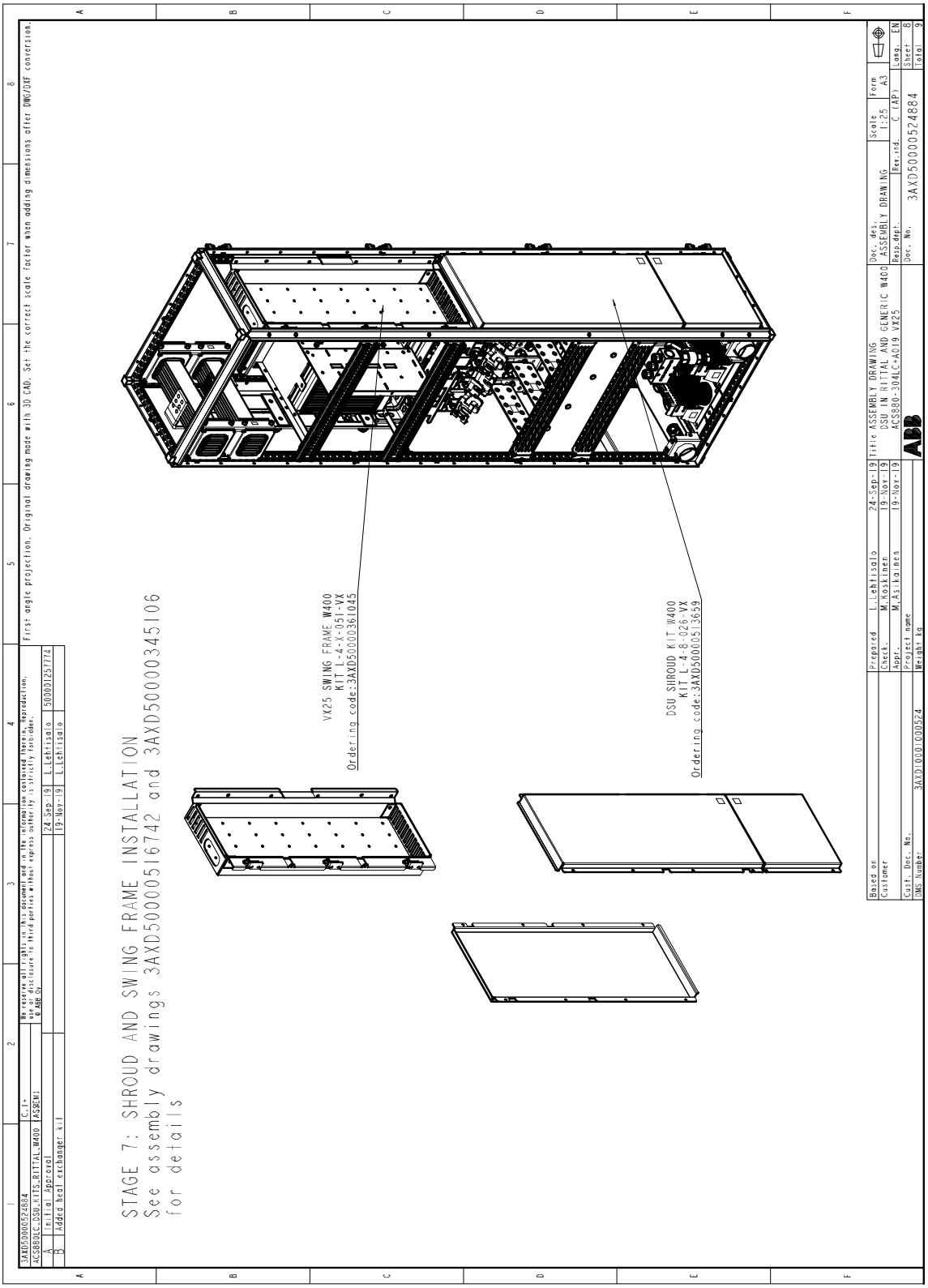
Stage 5: AC and DC connection



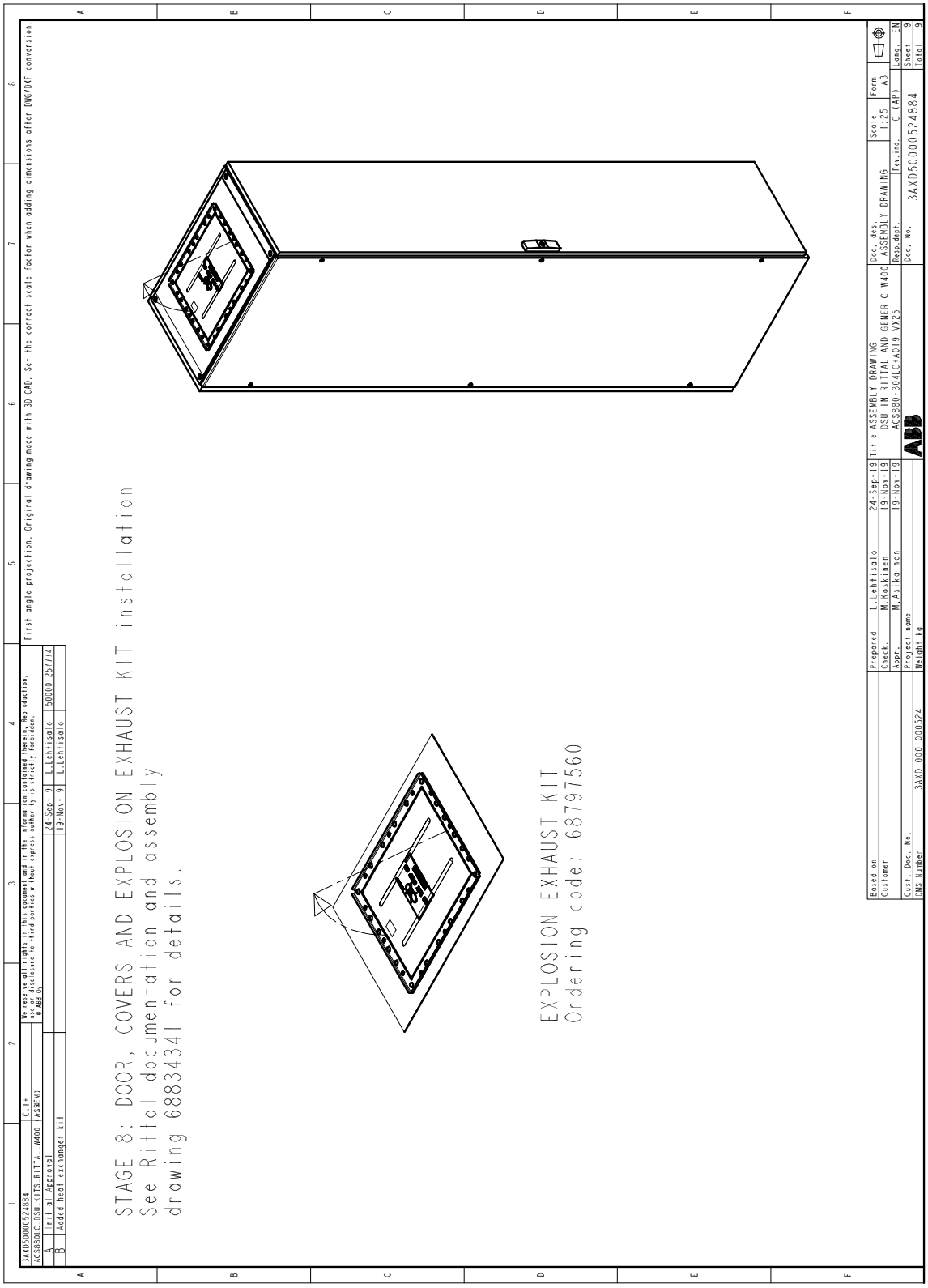
Stage 6: Cabinet fan and heat exchanger



Stage 7: Shroud installation parts



Stage 8: Door, covers and explosion exhaust kit



5

Electrical installation

Contents of this chapter

This chapter describes the electrical installation of the modules.

The wiring diagrams in this chapter are simplified presentations. For details, see the example circuit diagrams included in the manual.

Note: The instructions do not cover all possible cabinet constructions.

For more information on electrical installation, see ACS880 liquid-cooled multidrive cabinets and modules electrical planning (3AXD50000048634 [English]).

Safety and liability

WARNING!
Only qualified electrical professionals are allowed to do the work described in this chapter. Read the **complete safety instructions** before you install, commission, use or service the drive. The complete safety instructions are given in ACS880 liquid-cooled multidrive cabinets and modules safety instructions (3AXD50000048633 [English]).

Note: The installation must always be designed and made according to applicable local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches the local laws and/or other regulations. Furthermore, if the recommendations given by ABB are not followed, the drive system may experience problems that the warranty does not cover.

Electrical safety precautions

These electrical safety precautions are for all personnel who do work on the drive, motor cable or motor.

WARNING!
Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

If you are not a qualified electrical professional, do not do installation or maintenance work.

Do these steps before you begin any installation or maintenance work.

1. Clearly identify the work location and equipment.
2. Disconnect all possible voltage sources. Make sure that re-connection is not possible. Lock out and tag out.
   - Open the main disconnecting device of the drive.
   - Open the charging switch if present.

     WARNING!
     The charging switch is not necessarily located within or nearby the drive cubicle.

   - Open the disconnector of the supply transformer. (The main disconnecting device in the drive cabinet does not disconnect the voltage from the AC input power busbars of the drive cabinet.)
   - If the drive is equipped with a DC/DC converter unit (optional) or a DC feeder unit (optional): Open the DC switch-disconnector [Q11] of the unit. Open the disconnecting device of the energy storage connected to the unit (outside the drive cabinet).
   - Open the auxiliary voltage switch-disconnector (if present), and all other possible disconnecting devices that isolate the drive from dangerous voltage sources.
   - In the liquid cooling unit (if present), open the switch-disconnector of the cooling pumps.
   - If you have a permanent magnet motor connected to the drive, disconnect the motor from the drive with a safety switch or by other means.
   - Disconnect all dangerous external voltages from the control circuits.
   - After you disconnect power from the drive, always wait 5 minutes to let the intermediate circuit capacitors discharge before you continue.
3. Protect any other energized parts in the work location against contact.
4. Take special precautions when close to bare conductors.
5. Measure that the installation is de-energized. Use a quality voltage tester. If the measurement requires removal or disassembly of shrouding or other cabinet structures, obey the local laws and regulations applicable to live working (including – but not limited to – electric shock and arc protection).
   - Before and after measuring the installation, verify the operation of the voltage tester on a known voltage source.
   - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is zero.
   - Make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is zero.

Important! Repeat the measurement also with the DC voltage setting of the tester. Measure between each phase and ground. There is a risk of dangerous DC voltage charging due to leakage capacitances of the motor circuit. This voltage can remain charged for a long time after the drive power-off. The measurement discharges the voltage.

- Make sure that the voltage between the drive DC terminals (UDC+ and UDC-) and the grounding (PE) terminal is zero. In cabinet-built drives, measure between the drive DC busbars (+ and -) and the grounding (PE) busbar.

6. Install temporary grounding as required by the local regulations.
7. Ask for a permit to work from the person in control of the electrical installation work.

General notes

Printed circuit boards

WARNING!
Use a grounding wristband when you handle printed circuit boards. Do not touch the boards unnecessarily. The boards contain components sensitive to electrostatic discharge.

Optical components

WARNING!
Obey these instructions. If you ignore them, damage to the equipment can occur.

- Handle the fiber optic cables with care.
- When you unplug the fiber optic cables, always hold the connector, not the cable itself.
- Do not touch the ends of the fibers with bare hands as the ends are extremely sensitive to dirt.
- Do not bend the fiber optic cables too tightly. The minimum allowed bend radius is 35 mm (1.4 in).

Checking the insulation of the assembly

Measuring the insulation resistance of the drive

WARNING!
Do not do any voltage withstand or insulation resistance tests on any part of the drive as testing can damage the drive. Every drive has been tested for insulation between the main circuit and the chassis at the factory. Also, there are voltage-limiting circuits inside the drive which cut down the testing voltage automatically.

Measuring the insulation resistance of the input power cable

Before you connect the input power cable to the drive, measure its insulation resistance according to local regulations.

Selecting the supply transformer

The supply modules do not have input chokes. Thus, the supply transformer (or generator) must be dimensioned according to the apparent power of the supply unit (S_n) and the supply transformer impedance Z_k(trafo). The supply nominal impedance Z_k must be at least 5% calculated with nominal apparent power of the supply modules. In a 6-pulse system, the transformer's nominal short-circuit impedance must be according to the following equation. The same impedance requirement also applies to a generator when used as the supply.

$$\frac{S_n}{S_n(\text{trafo})} \times Z_k(\text{trafo}) \geq 5\%$$

Definitions

S_n ACS880-304LC +A019 nominal apparent power

S_n(trafo) Transformer or generator nominal apparent power

Z_k(trafo) Transformer or generator nominal short-circuit impedance

Example:

Diode supply unit: ACS880-304LC-1540A-7+A019 → S_n = 1840 kVA

Transformer nominal power is, for example, 2500 kVA

$$Z_k(\text{trafo}) \geq \frac{2500\ \text{kVA}}{1840\ \text{kVA}} \times 5\%$$

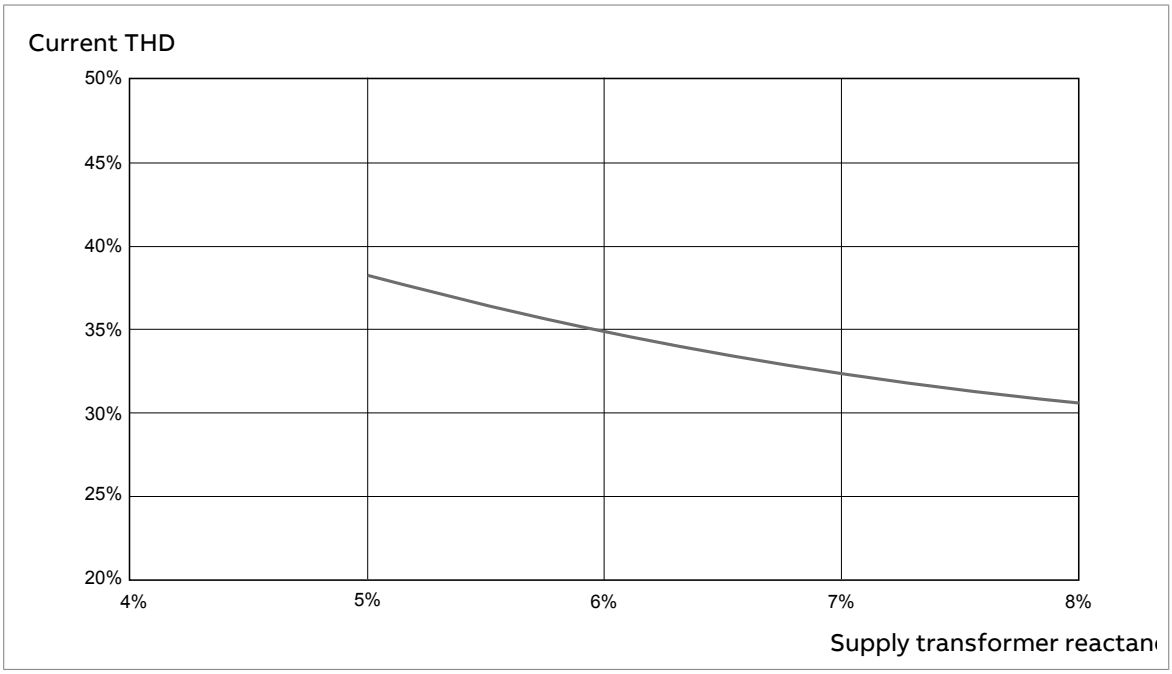
→ Z_k(trafo) ≥ 6.8%

The same rule also applies to 12-pulse transformers when the nominal values are calculated based on the total power of the 12-pulse transformer. If the nominal values are calculated per 6-pulse windings (power per winding is half of the power of the 12-pulse transformer), then half of the reactance (≥ 2.5%) is sufficient.

If the necessary transformer impedance Z_k cannot be fulfilled, it is also possible to install a separate 3-phase AC choke in addition to transformer (or generator) impedance to reach the necessary minimum impedance of 5%. Separate chokes are not available from ABB.

Note: Since the supply modules do not have input chokes, the THD currents and voltages have to be taken into account when dimensioning the system. If necessary, it is also possible to install a separate 3-phase AC choke to reach lower THD levels.

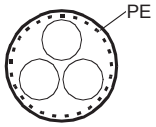
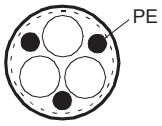
The diagram below shows the typical current THD at nominal current in relation to supply transformer impedance in a 6-pulse connection.



Selecting the power cables

Input AC cabling

The input AC cabling has to be identical (length and cross-sectional area) between all the parallel-connected supply modules. Each module must have its own shielded 3-conductor input AC cable with the minimum length of 5 m (16.4 ft). This ensures uniform loading of all the three input phases. If 1 phase cabling or shorter cables than 5 m (16.4 ft) are used to connect the supply modules to the grid, it is required to install a separate 3-phase AC choke between each ACS880-304LC +A019 module and grid to ensure current balance between the phases. Separate chokes are not available from ABB.

	Symmetrical shielded cable with three phase conductors and a concentric PE conductor as shield. The shield must agree with the requirements of IEC 61800-5-1. Check with local / state / country electrical codes for allowance.
	Symmetrical shielded cable with three phase conductors and symmetrically constructed PE conductor, and a shield. The PE conductor must agree with the requirements of IEC 61800-5-1.
	Symmetrical shielded cable with three phase conductors and a concentric PE conductor as shield. A separate PE conductor is required if the shield does not agree with the requirements of IEC 61800-5-1.

Typical power cable sizes

This table gives aluminum and copper cable types. The cable sizing is based on max. 9 cables laid on the cable trays side by side, three ladder type trays one on top of the other, ambient temperature 30 °C (EN 60204-1 and IEC 60364-5-52). A correction factor K = 0.70 is used.

Frame size	Aluminum cable		Copper cable		
	PVC insulation	XLPE insulation	PVC insulation	XLPE insulation	
	Conductor temperature T=70 °C	Conductor temperature T=90 °C	Conductor temperature T=70 °C	Conductor temperature T=90 °C	
	Size mm²	Size mm²	Size mm²	Size mm²	
U_N = 690 V					
1×D8D	4×(3×240+72 Cu)	4×(3×150+41 Cu)	4×(3×150+70)	4×(3×95+50)	or 3×(3×150+70)
2×D8D	2×4×(3×240+72 Cu)	2×4×(3×150+41 Cu)	2×4×(3×150+70)	2×4×(3×95+50)	or 2×3×(3×150+70)

Connecting the power cables and busbars

Connection diagrams

The following connection diagrams show how connection and grounding of the supply modules and their switchgear can be arranged.

The switchgear and modules are typically grounded to the frame of the cabinet via the fixing screws. If good enough electrical contact for grounding is not possible via the fastening screws and cabinet frame, the cabinet installer must use a separate grounding.

The diagrams show also a separate charging circuit and supply transformer. For more information on them, see section Selecting the supply transformer.

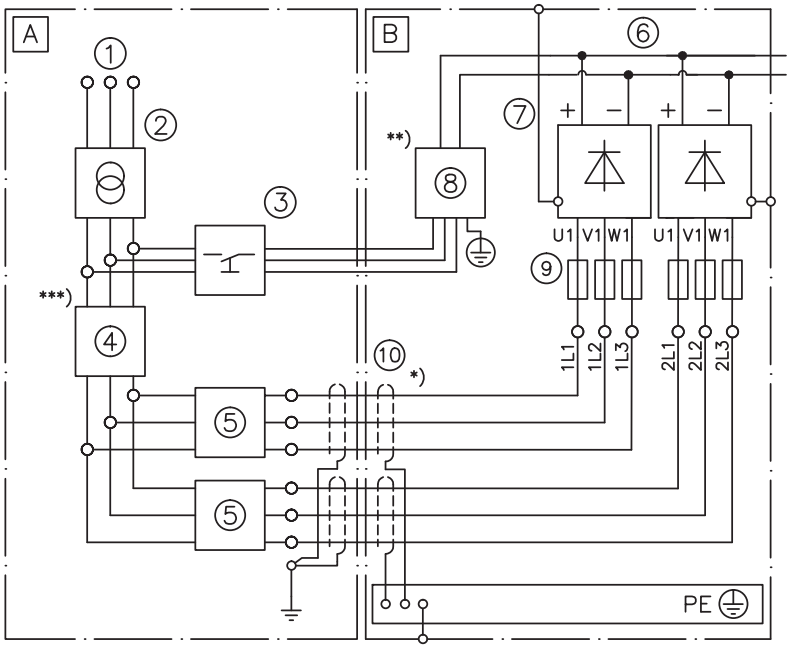
The connection diagrams in this section are simplified. They do not contain all details, such as terminal markings, and are not suitable for the installation work as such. The designer of the cabinet must:

- prepare the final circuit diagrams
- provide the final circuit diagrams to the installer(s).

The electricians that do the connections must use the final circuit diagrams.

Connection diagram – 2×D8D, 6-pulse, internal charging

The diagram shows 2×D8D modules in a 6-pulse connection with internal charging. In this manual, internal charging stands for ABB charging kit inside the supply unit cubicle.



A	External installation (outside supply module cubicle)	B	Supply unit cubicle
1	Medium voltage/low voltage switchboard	6	DC link
2	Supply transformer	7	Supply modules
3	Charging switchgear including disconnecting device	8	Internal charging kit. For the connections, see Example circuit diagrams.
4	Dedicated supply unit switchgear including: • Disconnecting device • Breaker/contactor	9	AC fuses for protecting supply unit against short circuit
5	Overcurrent and short-circuit protection of input cabling	10	360 degrees grounding

Note: *) Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges. Required minimum length of the cables is 5 meters. See section Input AC cabling (page 60).

**) Internal charging kit can be used with 525…690 V AC supply voltage only.

***) Breaker/contactor is mandatory with internal charging.

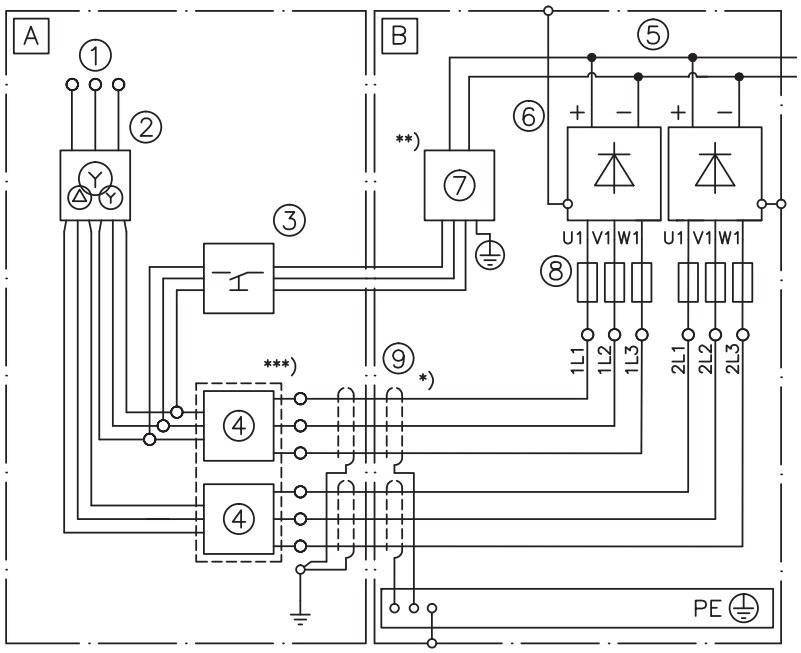
Ground the cable shield 360 degrees at the cable entry (recommendation). For grounding instructions, see section Connection procedure (page 66).

Use a separate PE conductor in addition if the conductivity of the shield does not meet the requirement for the PE conductor. See *ACS880 liquid-cooled multidrive cabinets and modules electrical planning instructions* (3AXD50000048634 [English]).

For cable selection instructions, see Selecting the power cables (page 60).

Connection diagram – 2×D8D, 12-pulse, internal charging

The diagram shows 2×D8D modules in a 12-pulse connection with internal charging. In this manual, internal charging stands for ABB charging kit inside the supply unit cubicle.



A	External installation (outside supply module cubicle)	B	Supply unit cubicle
1	Medium voltage/low voltage switchboard	5	DC link
2	Supply transformer	6	Supply modules
3	Charging switchgear including disconnecting device	7	Internal charging kit. For the connections, see Example circuit diagrams.
4	Interlocked dedicated supply unit switchgear including: • Disconnecting device • Breaker/contactor • Overcurrent and short-circuit protection of input cabling	8	AC fuses for protecting supply unit against short circuit
		9	360 degrees grounding. See section Selecting the supply transformer.

Note: *) Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges. Required minimum length of the cables is 5 meters. See section Input AC cabling (page 60).

**) Internal charging kit can be used with 525…690 V AC supply voltage only.

***) Breaker/contactor is mandatory with internal charging.

Ground the cable shield 360 degrees at the cable entry (recommendation). For grounding instructions, see section Connection procedure (page 66).

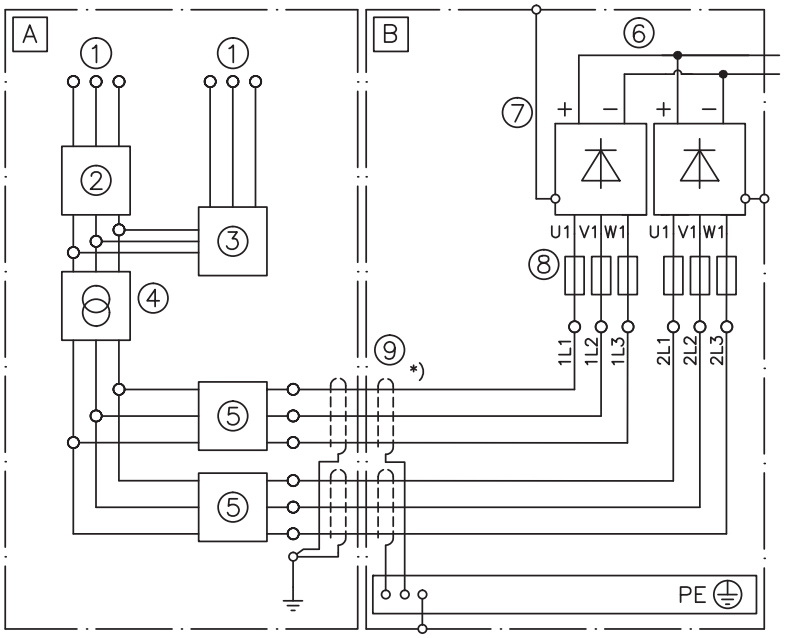
Use a separate PE conductor in addition if the conductivity of the shield does not meet the requirement for the PE conductor. See *ACS880 liquid-cooled multidrive cabinets and modules electrical planning instructions* (3AXD50000048634 [English]).

For cable selection instructions, see Selecting the power cables (page 60).

Connection diagram – 2×D8D, 6-pulse, external charging and pre-magnetizing

The diagram shows 2×D8D modules in a 6-pulse connection with external charging of the drive. The external charging circuit is combined with the transformer pre-magnetization circuit. For more information, contact ABB.

In this manual, external charging stands for drive charging circuit outside the supply unit cubicle.



A	External installation (outside supply module cubicle)	B	Supply unit cubicle
1	Medium voltage/low voltage switchboard	6	DC link
2	Switchgear including: • Disconnecting device • Breaker/contactor	7	Supply modules
3	Combined transformer pre-magnetizing circuit and drive charging circuit	8	AC fuses for protecting supply unit against short circuit
4	Supply transformer	9	360 degrees grounding. See section Selecting the supply transformer.
5	Overcurrent and short-circuit protection of input cabling		

Note: *) Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges. Required minimum length of the cables is 5 meters. See section Input AC cabling (page 60).

Ground the cable shield 360 degrees at the cable entry (recommendation). For grounding instructions, see section Connection procedure (page 66).

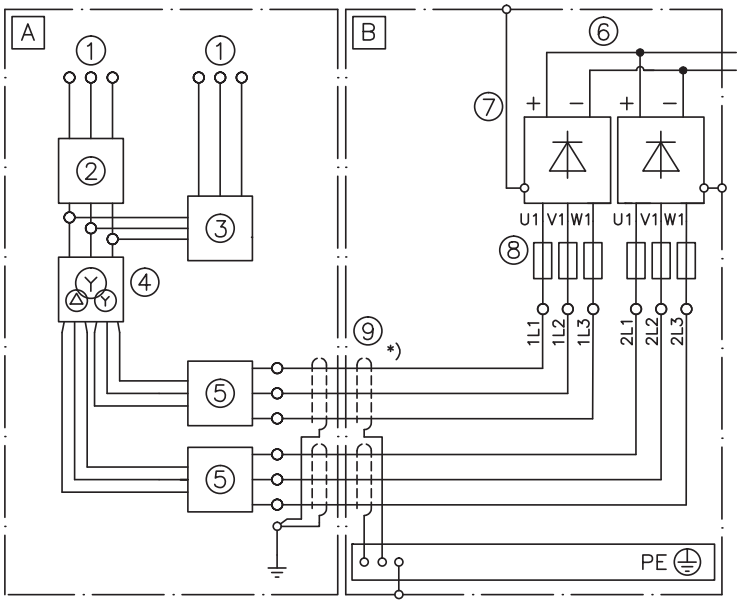
Use a separate PE conductor in addition if the conductivity of the shield does not meet the requirement for the PE conductor. See *ACS880 liquid-cooled multidrive cabinets and modules electrical planning instructions* (3AXD50000048634 [English]).

For cable selection instructions, see Selecting the power cables (page 60).

Connection diagram – 2×D8D, 12-pulse, external charging and pre-magnetizing

The diagram shows 2×D8D modules in a 12-pulse connection with external charging of the drive. The external charging circuit is combined with the transformer pre-magnetization circuit. For more information, contact ABB.

In this manual, external charging stands for drive charging circuit outside the supply unit cubicle.



A	External installation (outside supply module cubicle)	B	Supply unit cubicle
1	Medium voltage/low voltage switchboard	6	DC link
2	Switchgear including: • Disconnecting device • Breaker/contactor	7	Supply modules
3	Combined transformer pre-magnetizing circuit and drive charging circuit	8	AC fuses for protecting supply unit against short circuit
4	Supply transformer	9	360 degrees grounding. See section Selecting the supply transformer.
5	Overcurrent and short-circuit protection of input cabling		

Note: *) Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges. Required minimum length of the cables is 5 meters. See section Input AC cabling (page 60).

Ground the cable shield 360 degrees at the cable entry (recommendation). For grounding instructions, see section Connection procedure (page 66).

Use a separate PE conductor in addition if the conductivity of the shield does not meet the requirement for the PE conductor. See *ACS880 liquid-cooled multidrive cabinets and modules electrical planning instructions* (3AXD50000048634 [English]).

For cable selection instructions, see Selecting the power cables (page 60).

Connection procedure

Note: The instructions below are based on the cabinet construction where the charging circuit is in the same cabinet with the supply module/s. The instructions are not applicable to all possible solutions but only clarify the principles.

WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrive cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

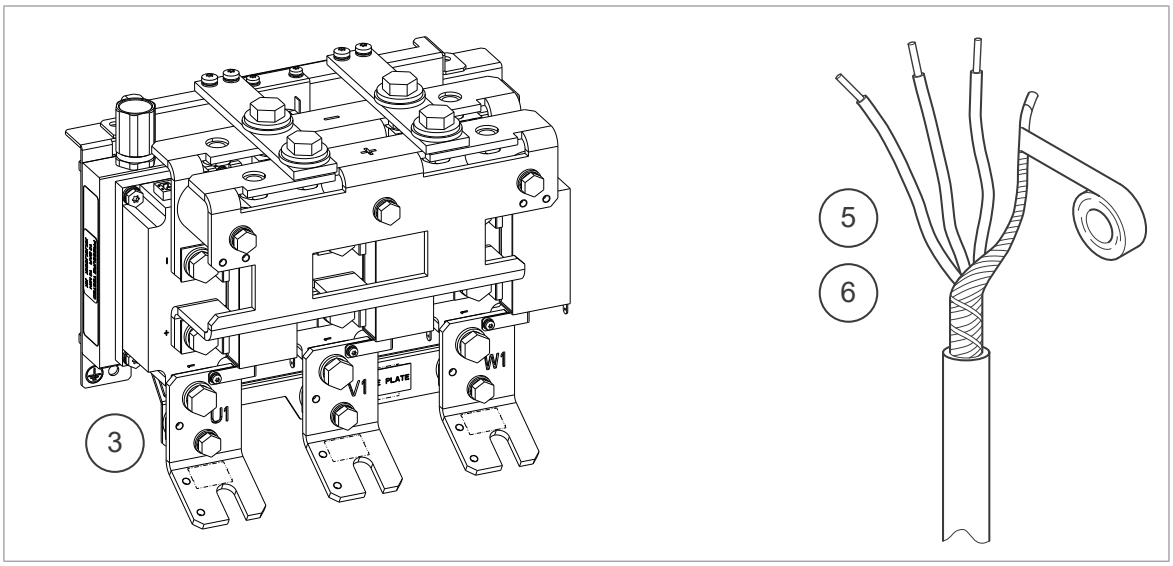
If you are not a qualified electrical professional, do not do installation or maintenance work.

1. Make sure that you have the following components installed in the cabinet:
   - AC fuses for protecting the module
   - input power cable busbars
   - DC busbars of the drive cabinet
   - supply module(s)
   - charging circuit components
   - DC fuses, if necessary.
2. Make the interconnections (if not made yet) between:
   - AC fuses for protecting the module
   - input power cable busbars
   - DC busbars of the drive cabinet
   - supply module(s)
   - charging circuit components. The connections of the ABB-defined charging circuit with the terminal markings are shown in the example circuit diagrams
   - DC fuses, if necessary.
3. Ground the module (if not made yet). If the grounding via the module fixing screws is not good enough, connect a separate cable between the module grounding point and the cabinet PE busbar. The grounding point is marked on the module.

   Note: If the cabinet frame is painted (such as with Rittal VX25 enclosures), it is important to make sure that a good galvanic connection to ground (PE busbar) is achieved. You can, for example, remove the paint from the connection points and use star washers.

   Note: The connection to ground through fixing screws and the cabinet chassis is not always good enough. To ensure the continuity of the protective bonding circuit, you can connect the modules to the cabinet PE busbar with a copper busbar or cable. The inductance and impedance of the PE conductor must be rated according to permissible touch voltage appearing under fault conditions (so that the fault point voltage will not rise excessively when a ground fault occurs).
4. Lead the input power cables into the cabinet. 360° grounding of the cable shield at the entry is recommended to suppress interference.
5. Twist the input power cable shields to bundles and connect to cabinet PE (ground) busbar. Connect the separate ground conductors/cables to cabinet PE (ground) busbar.
6. Connect the phase conductors to the input power cable busbars. For tightening torques, see the technical data.

7. Lead the charging circuit supply cable into the cabinet. 360° grounding of the cable shield at the entry is recommended to suppress interference (not shown in the figure).
8. Twist the cable shield of the charging circuit cable to a bundle and connect to the cabinet PE (ground) busbar (not shown in the figure). Connect the separate ground conductors/cables to cabinet PE (ground) busbar.
9. Connect the phase conductors of the charging circuit supply cable to the charging circuit. The connections of the ABB-defined charging circuit with the terminal markings are shown in the example circuit diagrams. For tightening torques, see the technical data.



Charging circuit wire recommendations

If the charging circuit is needed, the cabinet builder must install and connect it. For the connections, see the example circuit diagrams.

The charging components are dimensioned according to the DC link capacitances. For more information on the charging kits, see Charging kits (page 102). If the total DC link capacitance exceeds these limits, the components must be re-dimensioned. Contact your local ABB representative for more information.

DC link with...	Copper cable, PVC insulation
	Conductor temperature T=70 °C
	Size mm²
1×R8i...3×R8i	3×4+4
4×R8i	3×6+6

Connecting the external power supply cable for the auxiliary circuit

The cabinet builder must arrange 230/115 V AC auxiliary power supply for the auxiliary circuit and cabinet fan.

See also section Auxiliary circuit current consumption (page 124).

Connection diagram

See the final circuit diagrams for details. The ABB-defined installation example is shown in the example circuit diagrams.

Connecting power supply for the control unit

The cabinet builder must connect 24 V DC auxiliary power supply for the ZCU control unit.

See also section Auxiliary circuit current consumption (page 124).

Connection diagram

See the final circuit diagrams for details. The ABB-defined example installation is shown in chapter Example circuit diagrams. It also contains a 24 V power supply and a battery that further supplies the supply unit control unit. The customer must acquire the 24 V power supply and the battery.

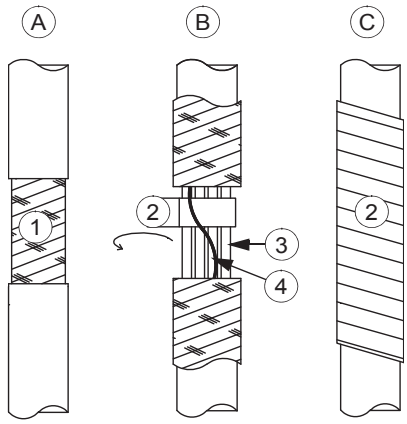
Connecting the control cables

For technical data and default I/O connections of the control unit, see The control unit (page 131).

WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrive cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

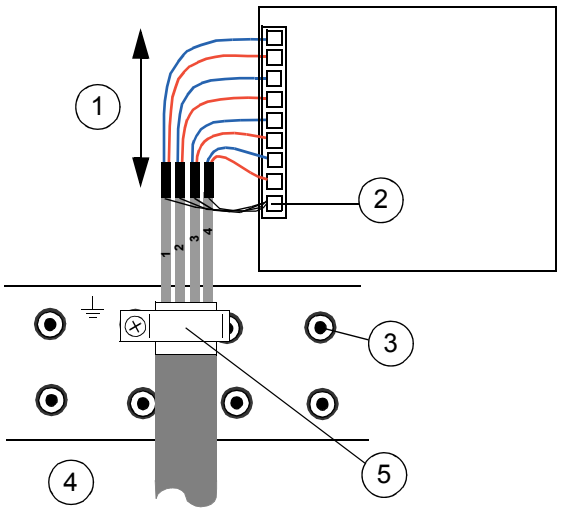
If you are not a qualified electrical professional, do not do installation or maintenance work.

1. Remove shrouding to access the cable entries and trunking inside the cubicle.
2. Run the control cables into the cubicle. If possible, arrange for a 360° grounding of the cable shield at the cable entry.
   If the outer surface of the shield is non-conductive, turn the shield inside out as shown below and wrap copper foil around the cable to keep the shielding continuous. Do not cut the grounding wire (if present).



A	Stripped cable
B	Conductive surface of the shield exposed
C	Stripped part covered with copper foil
1	Cable shield
2	Copper foil
3	Shielded twisted pair
4	Grounding wire
5	Copper cable

3. Run the cables to the control unit (or other connection point). Use the existing trunking wherever possible.
4. Cut the cables to suitable length.
5. Strip the cable ends and conductors. When connecting to the drive I/O, also remove the shield along with the outer sheathing, and use electrical tape or shrink tubing to contain the strands. Elsewhere, twist the outer shield strands into a bundle, crimp a lug onto it and connect it to the nearest chassis grounding point.



1	Keep as short as possible
2	SHIELD*
3	If no dedicated “shield” connector is provided, ground the inner cable shields to the chassis.
4	At the other end of the cable, leave the shield unconnected, or connect it to ground via a capacitor with a value of a few nanofarads.
5	Where grounding clamps are not available, twist the shield strands into a bundle, crimp a lug terminal onto it and fasten the lug to the chassis. Secure the cable into place with eg. cable ties.

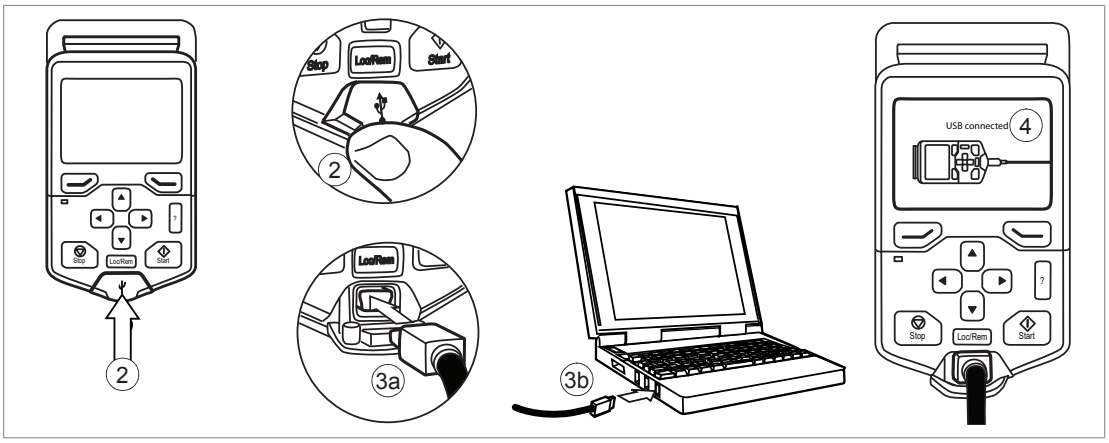
6. Connect the conductors to appropriate terminals.
7. Refit any shrouds removed earlier.

Connecting a PC

WARNING!
Do not connect the PC directly to the control panel connector of the control unit as this can cause damage.

A PC (with, for example, the Drive composer PC tool) can be connected as follows:

1. Connect a ACS-AP-… or ACH-AP-… control panel to the unit either
   - by inserting the control panel into the panel holder or platform, or
   - by using an Ethernet (eg, Cat 5e) networking cable.
2. Remove the USB connector cover on the front of the control panel.
3. Connect an USB cable (Type A to Type Mini-B) between the USB connector on the control panel (3a) and a free USB port on the PC (3b).
4. The panel will display an indication whenever the connection is active.
5. See the documentation of the PC tool for setup instructions.



6

Installation checklist

Contents of this chapter

This chapter contains a checklist for the mechanical and electrical installation of the drive.

Checklist

Examine the mechanical and electrical installation of the drive before start-up. Go through the checklist together with another person.

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

WARNING!
Stop the drive and do the steps in section Electrical safety precautions (page 56) before you start the work.

Make sure that ...	☑
The ambient operating conditions meet the drive ambient conditions specification and enclosure rating (IP code).	☐
The supply voltage matches the nominal input voltage of the drive. See the type designation label.	☐
The insulation resistance of the input power cable, motor cable and motor is measured according to local regulations and the manuals of the drive.	☐
The drive cabinet is attached to the floor, and if necessary due to vibration etc, also by its top to the wall or roof.	☐

Make sure that ...	☑
The drive module is fastened properly to the enclosure.	☐
If the drive is connected to a network other than a symmetrically grounded TN-S system: You have done all the required modifications (for example, you may need to disconnect the EMC filter or ground-to-phase varistor). See the electrical installation instructions in the supply unit manual.	☐
The enclosures of the equipment in the cabinet have proper galvanic connection to the cabinet protective earth (ground) busbar; The connection surfaces at the fastening points are bare (un-painted) and the connections are tight, or separate grounding conductors have been installed.	☐
The main circuit connections inside the drive cabinet correspond to the circuit diagrams.	☐
The control unit has been connected. See the circuit diagrams.	☐
Appropriate AC fuses and main disconnecting device are installed.	☐
Appropriate DC fuses are installed, if necessary.	☐
There is an adequately sized protective earth (ground) conductor(s) between the drive and the switchboard, the conductor is connected to correct terminal, and the terminal is tightened to the correct torque. Grounding has also been measured according to the regulations.	☐
If the drive is equipped with a DC/DC converter unit: There is an adequately sized protective earth (ground) conductor between the energy storage and the DC/DC converter, the conductor has been connected to appropriate terminal, and the terminal has been tightened to the proper torque. Proper grounding has also been measured according to the regulations.	☐
If the drive is equipped with a DC/DC converter unit: The energy storage cable has been connected to the correct terminals of the DC/DC converter and energy storage, and the terminals have been tightened to the proper torque.	☐
If the drive is equipped with a DC/DC converter unit: The energy storage has been equipped with fuses for protecting energy storage cable in a cable short-circuit situation.	☐
If the drive is equipped with a DC/DC converter unit: The energy storage has been equipped with a disconnecting device.	☐
The input power cable is connected to the correct terminals, the phase order is correct, and the terminals are tightened to the correct torque.	☐
There is an adequately sized protective earth (ground) conductor between the motor and the drive. The conductor is connected to the correct terminal, and the terminal is tightened to the correct torque. Grounding has also been measured according to the regulations.	☐
The motor cable is connected to the correct terminals, the phase order is correct, and the terminals are tightened to the correct torque.	☐
The motor cable is routed away from other cables.	☐
No power factor compensation capacitors are connected to the motor cable.	☐
If an external brake resistor is connected to the drive: There is an adequately sized protective earth (ground) conductor between the brake resistor and the drive, and the conductor is connected to the correct terminal, and the terminals are tightened to the correct torque. Proper grounding has also been measured according to the regulations.	☐
If an external brake resistor is connected to the drive: The brake resistor cable is connected to the correct terminals, and the terminals are tightened to the correct torque.	☐
If an external brake resistor is connected to the drive: The brake resistor cable is routed away from other cables.	☐
The control cables are connected to the correct terminals, and the terminals are tightened to the correct torque.	☐
If a drive bypass connection will be used: The Direct On Line contactor of the motor and the drive output contactor are either mechanically and/or electrically interlocked, that is, they cannot be closed at the same time. A thermal overload device must be used for protection when bypassing the drive. Refer to local codes and regulations.	☐

Make sure that ...	☑
There are no tools, foreign objects or dust from drilling inside the drive.	☐
The cover(s) of the motor connection box are in place. Cabinet shrouds are in place and doors are closed.	☐
The motor and the driven equipment are ready for power-up.	☐
The coolant connections between cubicles (if any) and to the cooling circuit are tight.	☐
If the drive is equipped with a cooling unit: Make sure that the mechanical and electrical installation of the cooling unit is completed. Refer to the cooling unit documentation.	☐

7

Start-up

Contents of this chapter

This chapter contains start-up instructions of the diode supply unit.

The underlined tasks are necessary only for certain cases. The symbols in brackets, for example [Q1], refer to the item designations used in the circuit diagrams. If a task is valid only for a certain option device or feature, the option code is given in brackets.

Note: The instructions do not cover all possible supply unit configurations.

Note: The start-up instructions for functional safety features are not given in this chapter. The designer of the cabinet-installed drive is responsible for the instructions of testing the functional safety systems.

WARNING!
Before you activate the automatic fault reset or automatic restart functions of the drive control program, make sure that no dangerous situations can occur. These functions reset the drive automatically and continue operation after a fault or supply break. If these functions are activated, the installation must be clearly marked as defined in IEC/EN 61800-5-1, subclause 6.5.3, for example, “THIS MACHINE STARTS AUTOMATICALLY”. If you select an external source for the start command and it is on, the drive will start immediately after fault reset. See the firmware manual.

Start-up procedure

Example description

This start-up example is valid for drive with 2×D8D ACS880-304LC…+A019 modules in a 6-pulse connection with internal charging, that is, the charging components are installed in the supply unit cubicle. The charging switchgear has a disconnecting device

that is outside the supply unit cubicle. The drive switchgear is also outside the supply unit cubicle. The switchgear includes a main disconnector and main contactor or breaker.

Safety

Action	☑
 **WARNING!** Obey the safety instructions during the start-up procedure. See ACS880 liquid-cooled multidrive cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation or maintenance work.	☐

Checks/Settings with no voltage connected

Action	☑
Disconnect the drive from the AC power line and make sure it is safe to start the work. See section Electrical safety precautions (page 56).	☐
Make sure that the charging disconnector is open.	☐
Make sure that the mechanical and electrical installation of the drive is completed. See Installation checklist (page 71).	☐
Check the settings of breakers/switches in the auxiliary circuits.	☐
Make sure that the voltage settings of the auxiliary voltage transformers are according to the actual power line voltage. See the final circuit diagrams by the designer of the cabinet-installed drive.	☐

Starting and checking the cooling system

Action	☑
Fill up and bleed the internal cooling circuit. Start the cooling unit up. See Internal cooling circuit (page 109).	☐
Check the cooling system for leaks.	☐
Make sure that cooling circuit joints at the shipping split joining cubicles are tight and that all drain valves have been closed.	☐
Make sure that the coolant can flow freely in all cubicles.	☐
Install all shrouds (if removed) and close the cabinet doors.	☐

Powering up the auxiliary circuit of the drive

Action	☑
Remove the temporary grounding system (if installed).	☐
Close the circuit breakers supplying the auxiliary circuits.	☐

Action	☑
Make sure that it is safe to connect voltage: • nobody is working on the unit or circuits that are wired from outside into the cabinets • covers of the motor terminal boxes are on • cabinet doors are closed • the disconnecting device [Q1] is open.	☐
Close the auxiliary voltage switch-disconnectors [Q20, Q22].	☐

Setting up the supply unit parameters

Action	☑
Activate communication between the inverter and supply units as follows: • Set bit 11 of **supply unit** parameter *195.20 HW options word 1* to 1. • Set bit 11 of **inverter unit** parameter *95.20 HW options word 1* to 1 and parameter *61.152 INU-LSU data set 10 data 2 sel* to *01.11 DC voltage*.	☐
Adjust the parameters for the DC voltage measurement: • Set parameter *162.52 Data set 10 data in 2 selection* to *External DC meas signal*. • Set parameter *195.40 DC voltage source* to *External measurement signal* (an inverter unit measures the value and sends it to supply unit). • Activate the DC link voltage monitoring function and define the DC overvoltage and undervoltage limits by selecting the supply voltage class by parameter *195.01 Supply voltage*. **Note:** You can alternatively set analog inputs AI1 and AI2 as the source of the DC measurement signal by parameter *195.40 DC voltage source*.	☐
For charging: • Set parameter *110.24 RO1 source* to *Charging*. • Set parameter *120.30 External charge enable* to *Yes*. **Note:** The charging function uses the DC voltage measurement signal. Set also the DC voltage measurement parameters for charging.	☐
Define the source for the fuse trip monitoring: • Set parameter *111.09 DIO2 function* to *Input*. • Set parameter *131.38 Fuse trip fault source* to *DIO2*.	☐
Make sure that the source for the auxiliary circuit breaker monitoring is set to digital input DI4 (*131.32 Aux circuit breaker fault source = DI4*).	☐

Powering up the main circuit of the drive

Action	☑
Close the disconnecting device of the supply unit. Drive with main switch-disconnector [Q1]: Unlock the main switch-disconnector, and close it.	☐
Close the charging disconnector for the line-up.	☐
Make sure that the control panel [A59] is in the remote mode (Loc/Rem key of the panel).	☐
Drive with brake chopper: Make sure that there are inverters connected to the DC bus before closing the main contactor. A rule of thumb: The sum capacitance of the inverters connected to the DC bus of the drive must be at least 50% of the sum capacitance of all inverters of the drive. If there is not enough capacitive load at start, the DC voltage can exceed the overvoltage limit, causing immediate start of the brake unit and continuous supply for it by the supply unit. Continuous braking will overload brake choppers and resistors and cause overheating.	☐

Action	☑
Switch the Run enable and Start signals at digital input DI2 on (1) to start the operation of the supply unit. Turn the operating switch [S21] on the cabinet door to ENABLE/RUN (1) position. Run enable starts the supply unit power up sequence. After the program has stepped through it (approximately 3 seconds), the drive DC link is charged, the main contactor/ is closed and the supply unit is in operation and ready to the supply inverters.	☐
Turn the operating switch [S21] to *on* (1) position to activate the Run enable signal and to close the main contactor [Q2] / main breaker [Q1].	☐

Validating the safety functions

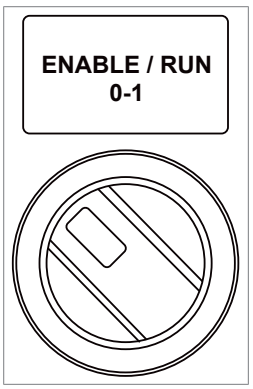
Action	☑
Validate the operation of safety functions (for example, emergency stop). **WARNING!** The safety functions are not safe before they are validated according to the instructions. See the function-specific manual for the validation tasks. Safety functions are optional. See the function-specific manual for the validation tasks.	☐

On-load checks

Action	☑
Make sure that the cooling operates properly (no overtemperature related warnings or faults).	☐

Switching the supply unit off

1. Stop the motors connected to inverter units.
2. Turn the operating switch [S21] to the OFF (0) position to deactivate the Run enable signal and to switch off the main disconnecting device ().



Disconnecting and temporary grounding the drive

See Electrical safety precautions (page 56).

8

Maintenance

Contents of this chapter

This chapter instructs how to maintain the modules and how to interpret their fault indications. The information is valid for ACS880-304LC…+A019 supply modules and example cabinet installations of the modules.

Note: The instructions do not cover all possible cabinet constructions.

WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrive cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

If you are not a qualified electrical professional, do not do installation or maintenance work.

Maintenance intervals

The tables below show the maintenance tasks which can be done by the end user. The complete maintenance schedule is available on the Internet (https://new.abb.com/drives/services/maintenance/preventive-maintenance). For more information, consult your local ABB Service representative (www.abb.com/searchchannels).

Description of symbols

Action	Description
I	Inspection (visual inspection and maintenance action if needed)
P	Performance of on/off-site work (commissioning, tests, measurements or other work)

Action	Description
R	Replacement

Recommended maintenance intervals after start-up

Maintenance task/object	Years from start-up													
	0	1	2	3	4	5	6	7	8	9	10	11	12	...
Coolant														
Coolant draining and replacement							R						P	
Checking coolant quantity			P		P		P		P		P		P	
Checking coolant antifreeze concentration		P	P	P	P	P	P	P	P	P	P	P	P	P
Cooling fan														
Main cooling fan 230 V										R				
Main cooling fan 115 V							R						R	
Batteries														
Control panel battery										R				
Control unit battery							R						R	
Connections and environment														
Quality of supply voltage		P	P	P	P	P	P	P	P	P	P	P	P	P
Spare parts														
Spare parts		I	I	I	I	I	I	I	I	I	I	I	I	I
Inspections														
Checking tightness of cable and busbar terminals. Tightening if needed.		I	I	I	I	I	I	I	I	I	I	I	I	I
Checking ambient conditions (dustiness, corrosion, temperature)		I	I	I	I	I	I	I	I	I	I	I	I	I
Checking cooling liquid pipe connections		I	I	I	I	I	I	I	I	I	I	I	I	I

Note:

- Maintenance and component replacement intervals are based on the assumption that the equipment is operated within the specified ratings and ambient conditions. ABB recommends annual drive inspections to ensure the highest reliability and optimum performance.
- Long term operation near the specified maximum ratings or ambient conditions may require shorter maintenance intervals for certain components. Consult your local ABB Service representative for additional maintenance recommendations.

Maintenance timers and counters

The control program has maintenance timers and counters that can be configured to generate a warning when a pre-defined limit is reached. Each timer/counter can be set to monitor any parameter. This feature is especially useful as a service reminder. For more information, see the firmware manual.

Internal liquid-cooling system

For instructions on coolant replacement and checking the liquid-cooling system, see chapter Internal cooling circuit.

Cabinet

Cleaning the interior of the cabinet

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur.

WARNING!
Use a vacuum cleaner with antistatic hose and nozzle, and wear a grounding wristband. Using a normal vacuum cleaner creates static discharges which can damage circuit boards.

1. Stop the drive and do the steps in section Electrical safety precautions (page 56) before you start the work.
2. Open the cabinet door.
3. Clean the interior of the cabinet. Use a vacuum cleaner and a soft brush.
4. Clean the air inlets of the fans and air outlets of the modules (top).
5. Clean the air inlet gratings (if any) on the door.
6. Close the door.

Cleaning the heat exchanger

For cleaning the heat exchanger, remove the fan. See Replacing the cabinet fan (page 83).

Fuses

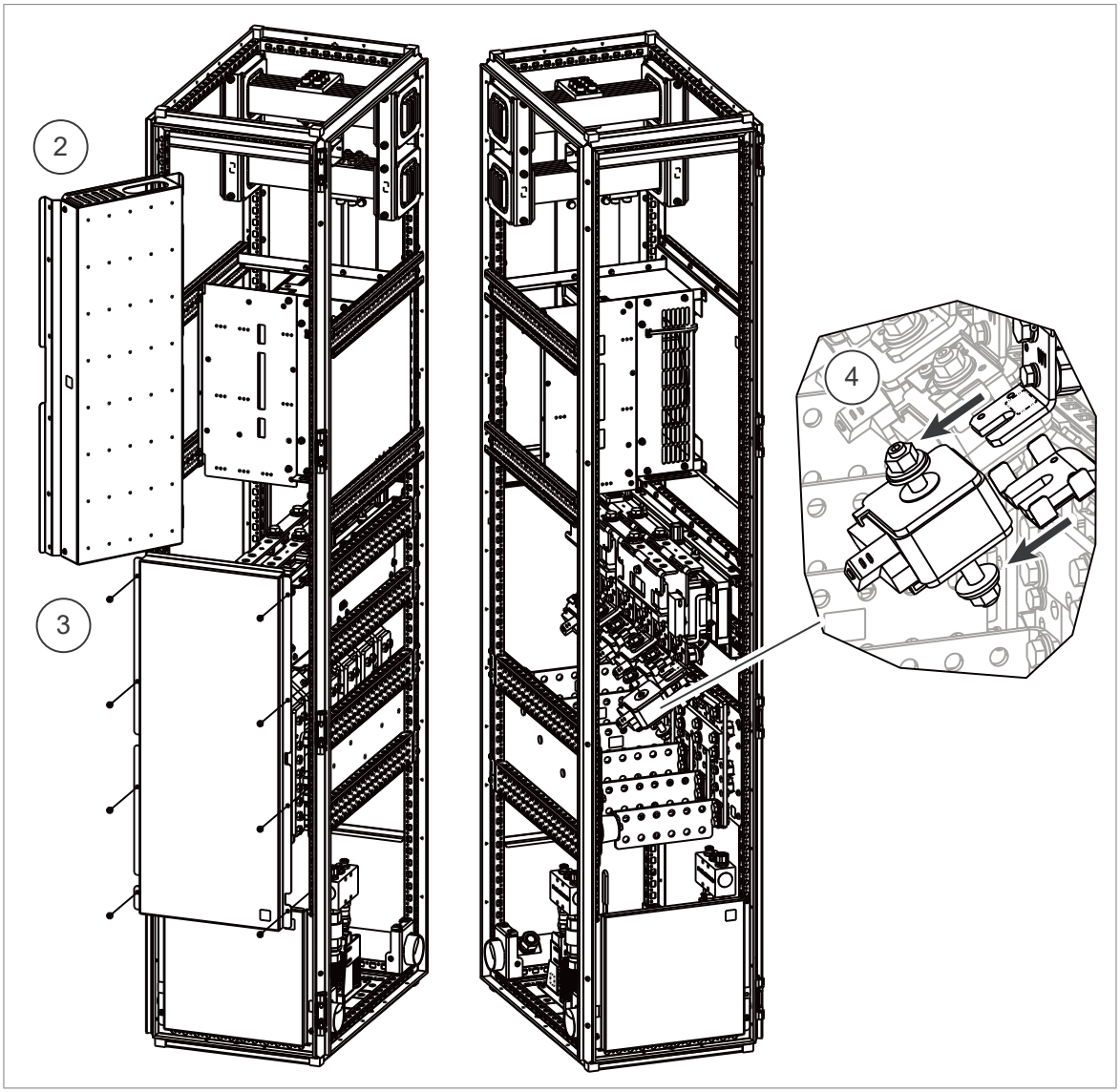
Checking and replacing the module AC fuses

WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrive cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

If you are not a qualified electrical professional, do not do installation or maintenance work.

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Repeat the steps described in section Electrical safety precautions (page 56).
2. Undo the locking screws of the swing-out frame and open the swing-out frame.
3. Undo the six screws of the shroud in the middle and remove the shroud.
4. Slacken the nuts of the headless screws of the fuses so that you can slide out the fuse blocks. Make note of the order of the washers on the screws.
5. Remove the screws, nuts and washers from the old fuses and attach them to the new fuses. Make sure to keep the washers in the original order.
6. Install the new fuses in reverse order.



Fans

The lifespan of the cooling fans of the drive depends on running time, ambient temperature and dust concentration. See the firmware manual for the actual signal which indicates the running time of the cooling fan. Reset the running time signal after fan replacement. See also CIO-01 I/O module for distributed I/O bus control user's manual (3AXD50000126880 [English]).

Replacement fans are available from ABB. Do not use other than ABB-specified spare parts.

Replacing the cabinet fan

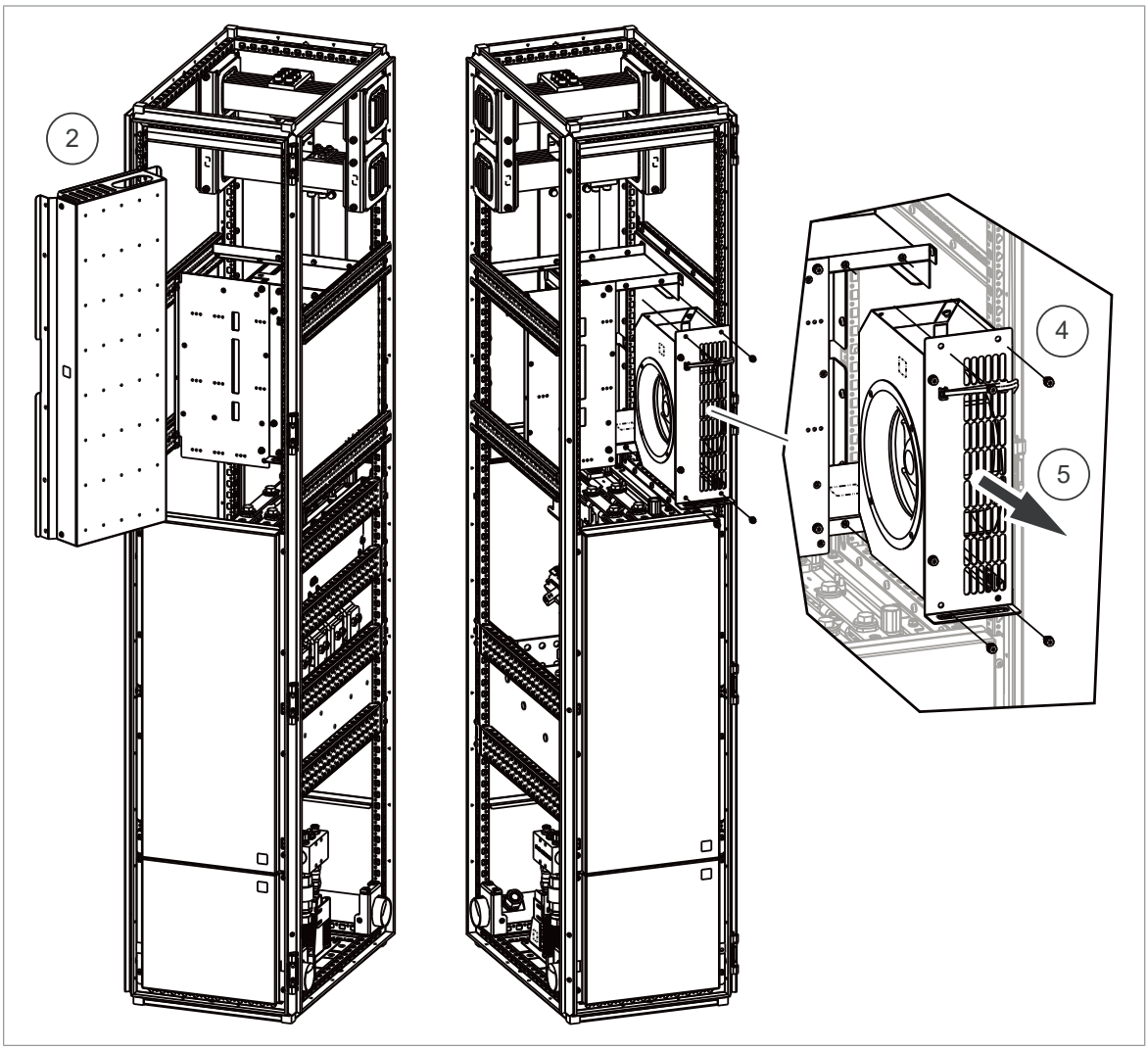
WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrive cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

If you are not a qualified electrical professional, do not do installation or maintenance work.

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Repeat the steps described in section Electrical safety precautions (page 56).
2. Undo the locking screws of the swing-out frame and open the swing-out frame.
3. Disconnect the fan wiring.
4. Undo the four fastening screws of the fan.
5. Pull the fan out.
6. Replace the fan and install in reverse order.

   Note: Insert the fan box into its place so that the side with the extension in the front is down. See the figure.



Supply module

Replacing the supply module

WARNING!
Obey the safety instructions given in ACS880 liquid-cooled multidrive cabinets and modules safety instructions (3AXD50000048633 [English]). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.

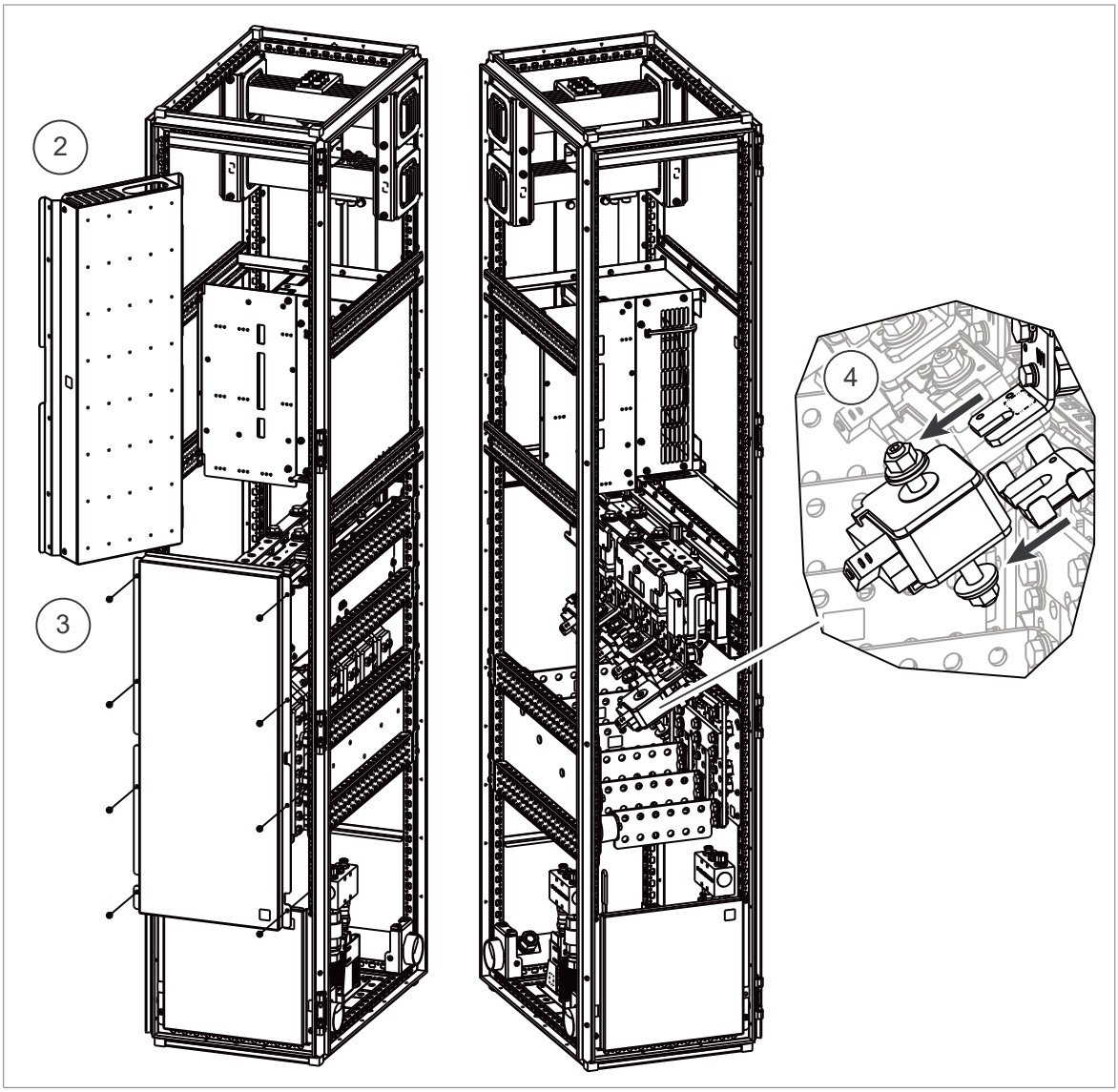
If you are not a qualified electrical professional, do not do installation or maintenance work.

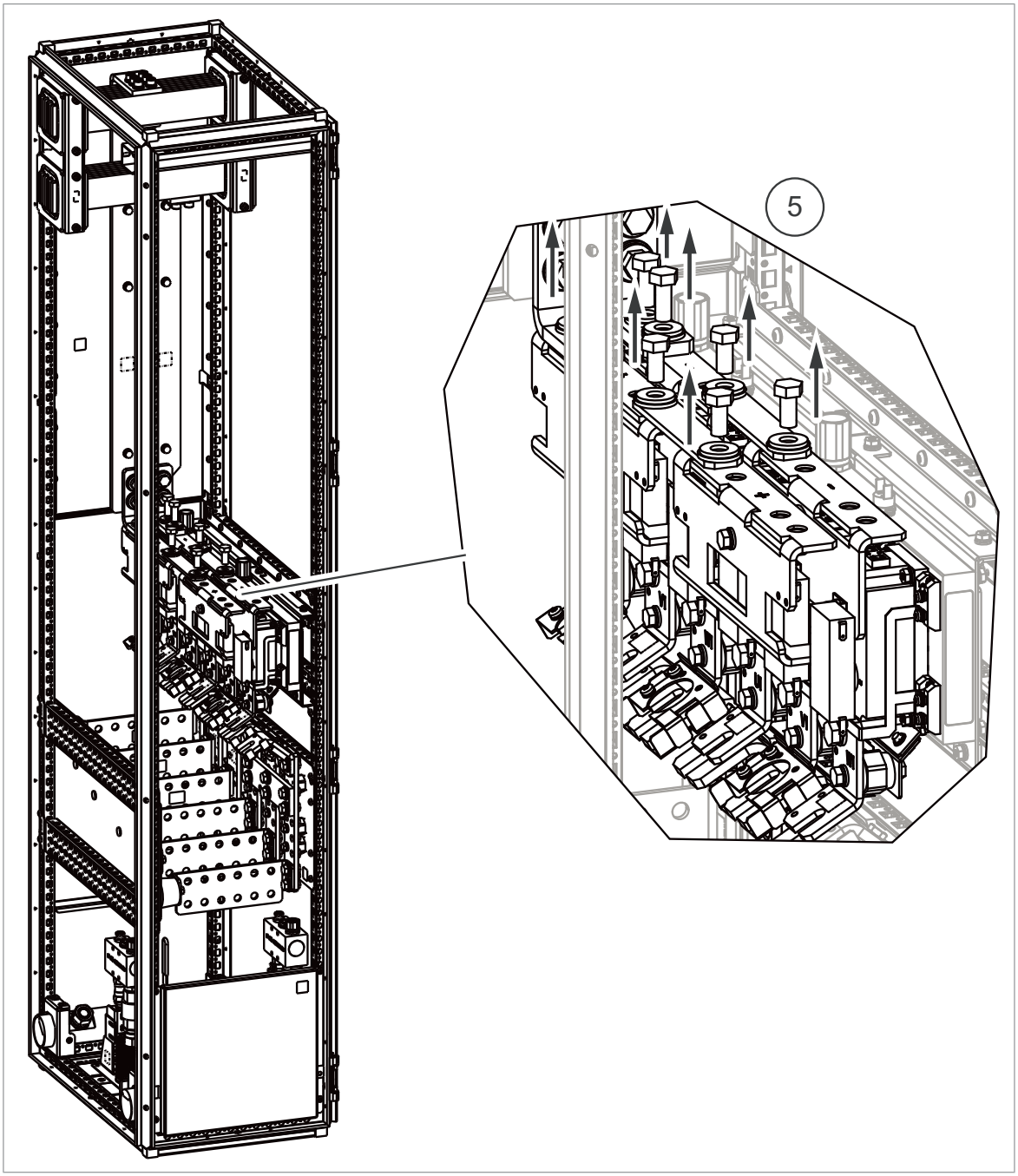
WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

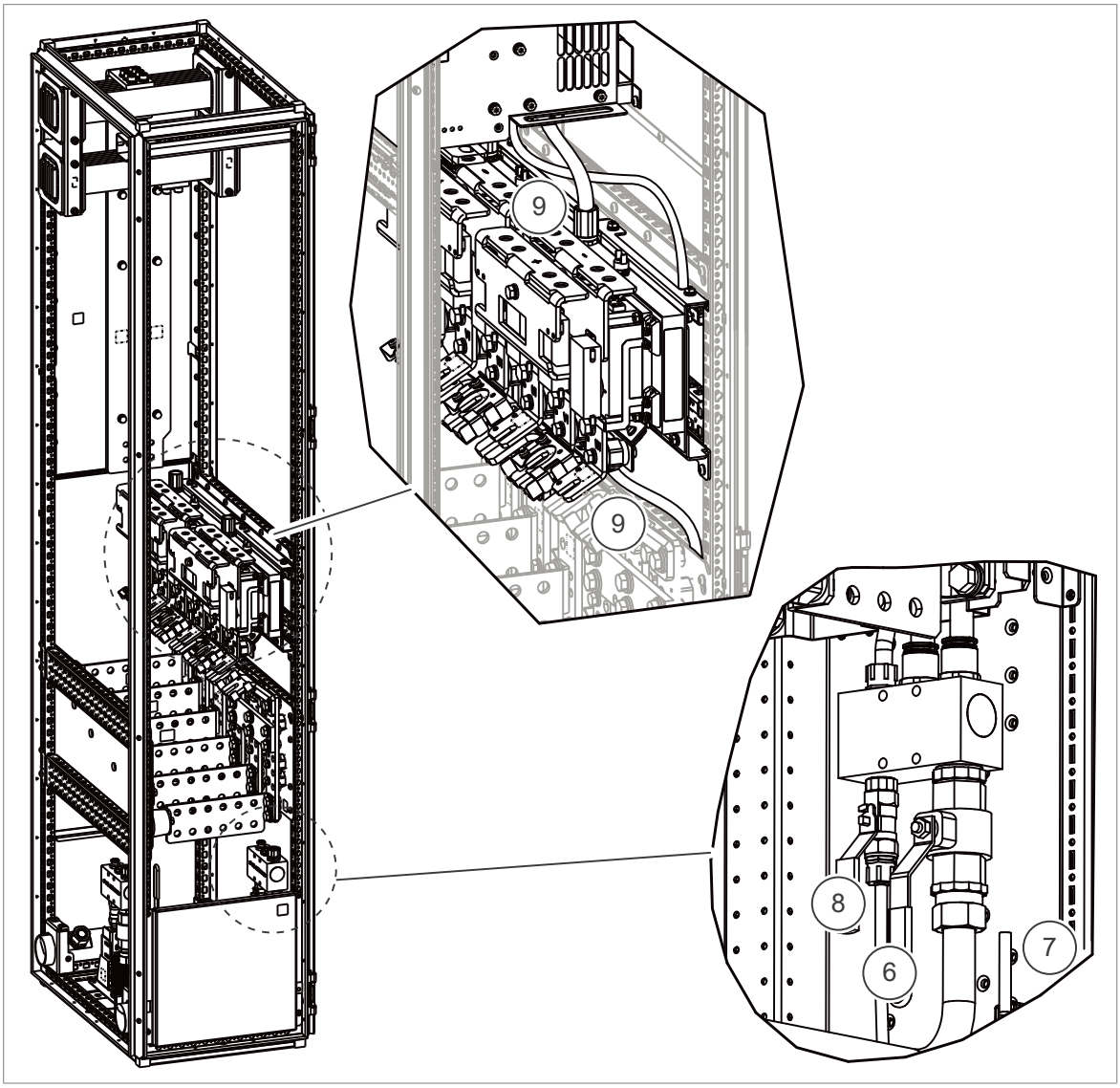
1. Repeat the steps described in section Electrical safety precautions (page 56).
2. Undo the locking screws of the swing-out frame and open the swing-out frame.
3. Undo the eight screws of the shroud in the middle and remove the shroud.
4. To remove the fuses connected to the modules that will be replaced: Slacken the nuts of the headless screws of the fuses so that you can slide out the fuse blocks.
5. Remove the DC connection busbars and M12 bolts connected to the modules.
6. Close the inlet and outlet valves.
7. Attach hoses to the drain valves and lead the hoses into a suitable container. For more information, see Filling up and bleeding the internal cooling circuit (page 112).
8. Open the drain valves located behind the inlet and outlet valves. Make sure the ends of the hoses are not immersed at any point of the draining so that air can displace the coolant in the system. Wait until all coolant has drained.
9. Disconnect the coolant pipes of the module to be removed. The quick connectors are above and below each module. Disconnect the wiring of the thermal switch. For the location, see also Layout drawing of the D8D module (page 25).
10. Undo the four screws of the module that is located in the front and remove the module.
11. Undo the four screws of the second module and remove the module.
12. Install the new module in reverse order:
    - For the module that was located behind the first module: Put the module back in its place and tighten the module's screws. Put the DC connection busbars in their places and tighten also their screws.
    - For the module in the front: Put the module back in its place and tighten the module's screws. Tighten also the DC connection screws. For the tightening torque, see Tightening torques (page 125).
    - Connect the coolant pipes. Fill in the coolant. For the instructions, see Filling up and bleeding the internal cooling circuit (page 112).

WARNING!
For a reliable connection, the end of the pipe entering the connector must be completely intact for a length of at least 5 cm (2 in). Make sure that the pipe is perfectly round where it enters the connector, and not deformed eg. by any bends nearby. The piping must not exert any tension or torque on the connector.

- Slide the fuse blocks back in their places. Tighten the nuts of the fuses.
- Attach the shroud in the middle.
- Close the swing-out frame and tighten its screws.
- Connect the voltage sources. See Electrical safety precautions (page 56).




5


9
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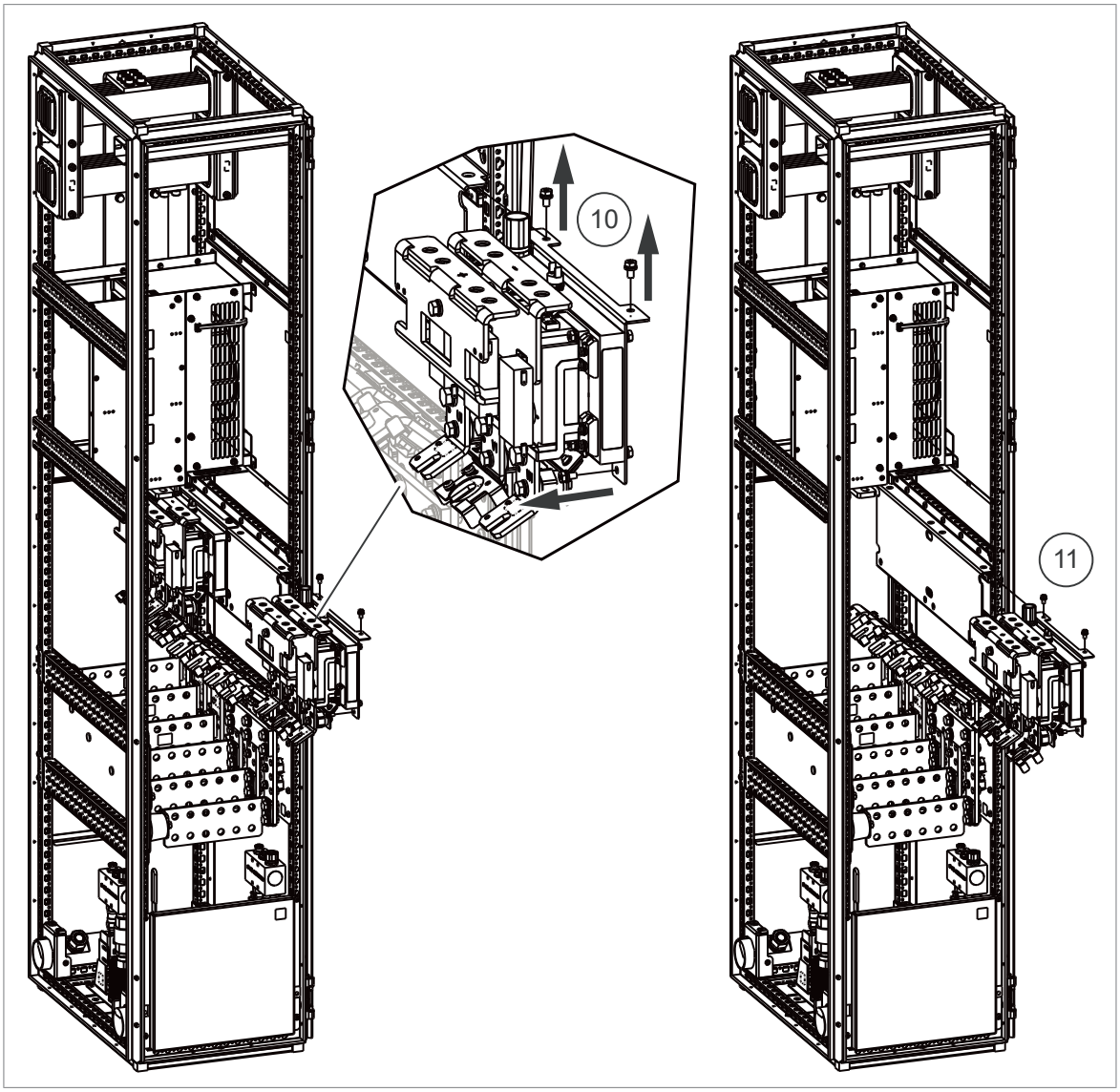


Control panel

Refer to ACS-AP-I, -S, -W and ACH-AP-H, -W Assistant control panels user's manual (3AUA0000085685 [English]).

Control unit

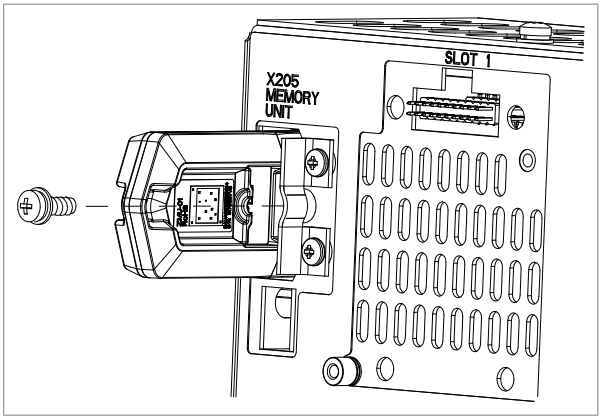
Replacing the memory unit

After replacing a control unit, you can keep the existing parameter settings by transferring the memory unit from the defective control unit to the new control unit.

WARNING!
Do not remove or insert the memory unit when the control unit is powered.

1. Stop the drive and do the steps in section Electrical safety precautions (page 56) before you start the work.
2. Make sure that the control unit is not powered.

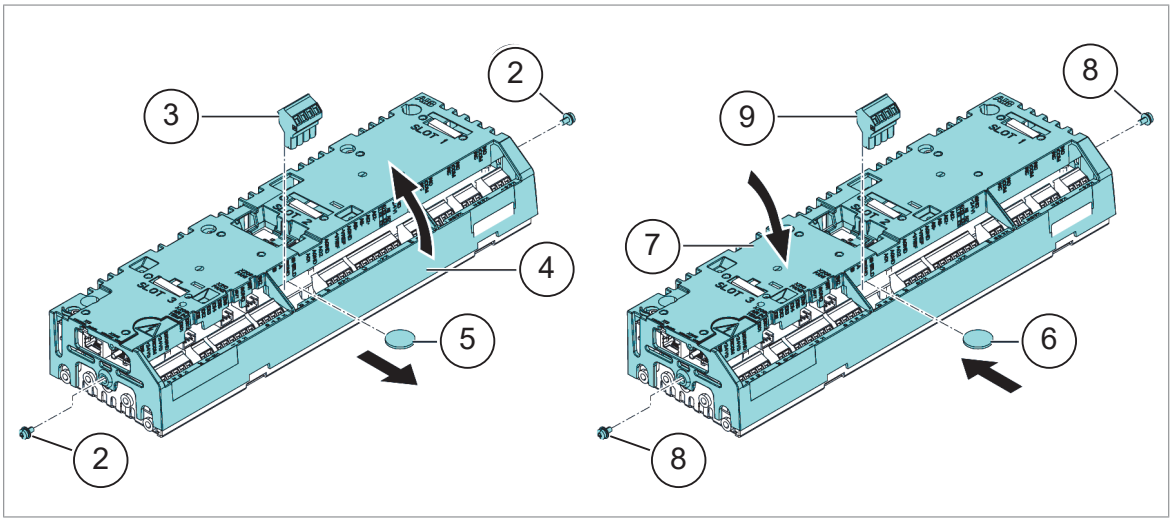
3. Remove the fastening screw and pull the memory unit out.
4. Install a memory unit in reverse order.



Replacing the ZCU-14 control unit battery

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur.

1. Stop the drive and do the steps in section Electrical safety precautions (page 56) before you start the work.
2. Remove the M4×8 (T20) screws at the ends of the control unit.
3. To see the battery, remove the XD2D terminal block.
4. Carefully lift the edge of the control unit cover on the side with the I/O terminal blocks.
5. Carefully pull the battery out of the battery holder.
6. Carefully put a new CR2032 battery into the battery holder.
7. Close the control unit cover.
8. Tighten the M4×8 (T20) screws.
9. Install the XD2D terminal block.



LEDs and other status indicators

Warnings and faults reported by the control program are displayed on the control panel or in the Drive composer PC tool. For further information, see the firmware manual.

Control panel and panel platform/holder LEDs

The ACS-AP-… control panel has a status LED. The control panel mounting platform or holder has two status LEDs. For their indications, see the following table.

Location	LED	Indication
Control panel	Continuous green	The unit is functioning normally.
	Flickering green	Data is transferred between the PC and the unit through the USB connection of the control panel.
	Blinking green	There is an active warning in the unit.
	Continuous red	There is an active fault in the unit.
	Blinking red	There is a fault that requires the stopping and restarting of the drive/converter/inverter.
	Blinking blue (ACS-AP-W only)	The Bluetooth interface is enabled, in discoverable mode, and ready for pairing.
	Flickering blue (ACS-AP-W only)	Data is being transferred through the Bluetooth interface of the control panel.
Control panel mounting platform or holder (with the control panel removed)	Red	There is an active fault in the unit.
	Green	Power supply for the control unit is OK.

9

Ordering information

Contents of this chapter

This chapter lists the types and ordering codes of the unit components.

You can find the kit-specific assembly drawings, step-by-step instructions and detailed kit information on the Internet. Go to https://sites-apps.abb.com/sites/lvacdrivesengineeringsupport/content. If necessary, contact your local ABB representative.

Note:

- This chapter only lists the installation accessories available from ABB. All other parts must be sourced from a third party (such as Rittal) by the system integrator. For a listing, refer to the kit-specific installation instructions available at https://sites-apps.abb.com/sites/lvacdrivesengineeringsupport/content. For access, contact your local ABB representative.
- Parts that are labeled suitable for generic enclosures are not designed for any specific enclosure system. These parts are intended as a basis for further engineering, and may require additional parts to be fully usable.
  Installation accessories designed for generic enclosures are in fact designed for an inside width of 50 mm less than the nominal width of the enclosure. For example, a mechanical kit intended for 800 mm wide generic enclosure is designed for an inside width of 750 mm, and will not fit a 800 mm wide Rittal VX25 enclosure.

Kit code key

The kit codes shown in this chapter break down as follows.

The format of the kit code is x-w-s-yyy(-VX), for example, L-6-8-401 where:

- x = cooling method

  - A = air-cooled (some of these kits are also used with liquid-cooled drives)
  - L = liquid-cooled
- w = cabinet width
  - 4 = 400 mm
  - 6 = 600 mm
  - 8 = 800 mm
- s = module frame size / sizes
  - 1 = R1i
  - 2 = R2i
  - 3 = R3i
  - 4 = R4i
  - 5 = R5i
  - 6 = R6i/D6D
  - 7 = R7i/D7D/D7T
  - 8 = R8i/D8D/D8T
  - X = any, or not defined.
- yyy = consecutive numbering
  - 001…099 = Kits related to cabinets, for example, adapter plates

001…019	Common AC- and DC-related kits
020…049	Cabinet mechanics kits
050…059	Swing frame kits

  - 100…199 = Kits related to AC connection, for example, busbars

100…129	Kits with connection to AC
130…149	Kits with connection to module
150…199	Other kits related to AC connection

  - 200…299 = Kits related to DC connection, for example, busbars

200…229	Kits with connection to common DC
230…249	Kits with connection to module
250…299	Other kits related to DC connection

- 300…399 = Kits related to module installation, for example, mechanical supports

300…330	Module supporting kits, basic mechanical support
350…379	Shroud kits

- 400…499 = Other kits

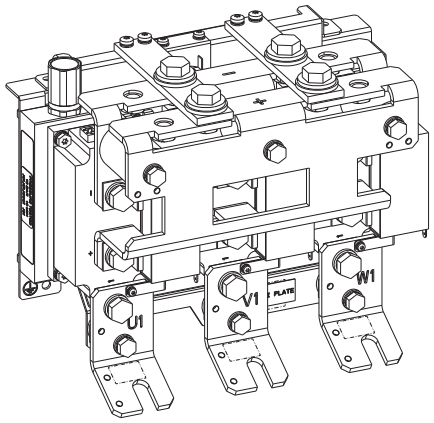
400…419	Fan kits
420…439	Air guides
440…459	Cooling circuit kits

- VX = Kit specifically designed for the Rittal VX25 enclosure system. Many kits without this designation are also used with the VX25 system.

Frame D8D

Diode supply modules

Delivery of the supply module includes the following items:

Ordering code	Frame size	Qty	Contents
U_N = 690 V			
ACS880-304LC-0820A-7+A019	1×D8D	1	Liquid-cooled diode supply module (+A019) with uncontrolled diode bridge 
ACS880-304LC-1540A-7+A019	2×D8D	2	
ACS880-304LC-2290A-7+A019	3×D8D	3	
ACS880-304LC-3040A-7+A019	4×D8D	4	

Note: The following components are always required to construct a working unit and must be ordered separately (the amounts given here are for one diode supply module):

- ZCU kit. For the contents of the kit, see ZCU kit (page 97).
- cabinet cooling system. For examples, see Cooling system parts (page 104).

The other parts listed

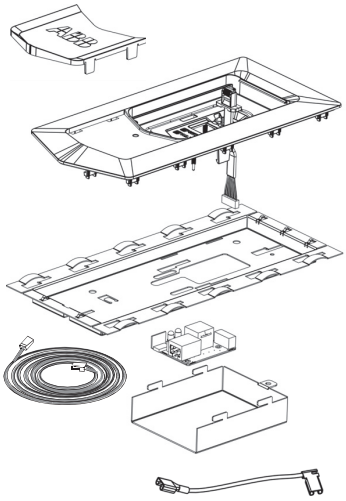
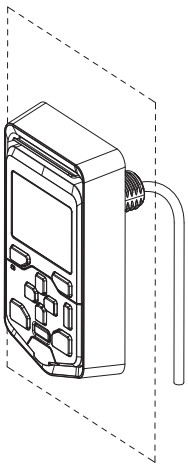
- may be required by the application, or
- make the installation or use of the module easier.

For the module dimensions, see Liquid-cooled D8D module (page 140).

Control panel

The control panel is not included with the module but must be ordered separately. One control panel is required for the commissioning of an ACS880 drive system, even if the Drive Composer PC tool is used.

The control panel can be flush mounted on the cabinet door with the help of a door mounting kit. For more information on the control panel, see ACS-AP-I, -S, -W and ACH-AP-H, -W Assistant control panels user's manual (3AUA0000085685 [English]).

Type	Description	Ordering code	Illustration
ACS-AP-W	Control panel with Bluetooth	3AXD50000025965	
DPMP-01	Door mounting kit (IP55)	3AUA0000108878	
DPMP-02	Door mounting kit (IP65)	3AXD50000009374	

For more information on the door mounting kits, such as the contents of the kit, see the installation manuals:

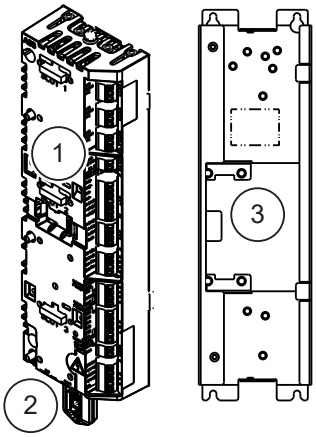
- DPMP-01 mounting platform for control panels installation guide (3AUA0000100140 [English])
- DPMP-02/03 mounting platform for control panels installations guide (3AUA0000136205 [English]).

Control electronics

The customer must organize cabling of the electronics outside the module, for example, 24 V DC power supply for the control unit.

ZCU kit

Each diode supply unit requires a control unit.

Module type	Control unit	Qty	Ordering code	Illustration
All	ZCU kit	1	3AXD50000000933	

The ZCU kit contains:

- ZCU-14 control unit (1)
- ZMU-02 memory unit with ACS880 diode supply control program (2)
- support plate for ZCU-14 (3).

For more information, see the dimension drawings.

Note: Fiber optic communication between the supply unit and inverter unit requires an FDCO-01 DDCS communication module.

CIO-01 I/O module

CIO-01 I/O module for distributed I/O bus control is not included in the module delivery but must be ordered separately. The distributed I/O bus controls and supervises each cabinet fan separately. It indicates malfunctioning fans by warning or fault messages. One CIO-01 can monitor and control up to 4 cabinet fans.

For more information, see CIO-01 I/O module for distributed I/O bus control (3AXD50000126880 [English]).

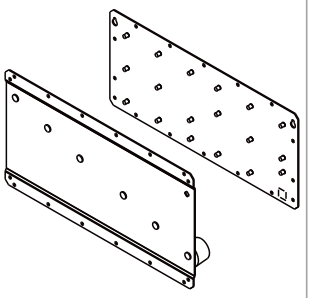
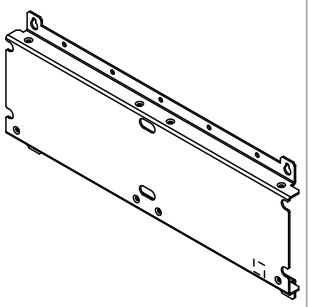
Type	Data	Qty	Ordering code
CIO-01	CIO-01 I/O module for distributed I/O bus control	1	3AXD50000041983

Mechanical installation accessories

These kits include parts that are used for installing the module in the enclosure.

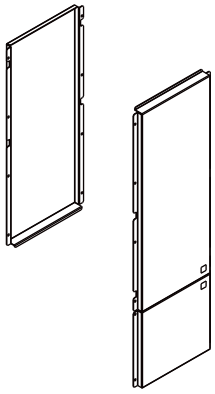
Module installation mechanics kit

Module installation mechanics kit includes parts for installing the D8D modules and the AC connection kits.

Used with ...	Qty	Ordering code	Kit code	Illustration
400 mm Rittal VX25 and generic enclosure	1 kit per 1×D8D and 2×D8D; 2 kits per 3×D8D and 4×D8D	3AXD50000513628	L-4-8-153-VX	 Instruction code: 3AXD50000511730
400 mm Rittal VX25 and generic enclosure	1 kit per cubicle	3AXD50000513611	L-468-8-305-VX	 Instruction code: 3AXD50000512430

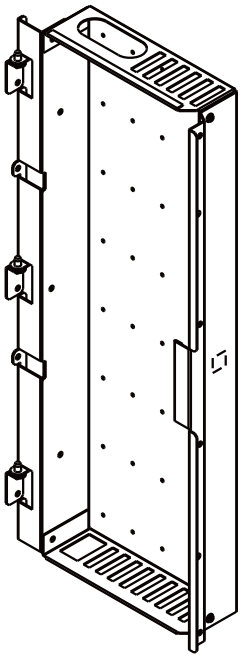
Shrouding (for Rittal VX25 enclosures)

The shroud kit contains plastic air guides and shrouds with the necessary brackets and screws. For details on the shroud kit, see the instructions available at https://sites-apps.abb.com/sites/lvacdrivesengineeringsupport/content.

Used with ...	Qty	Ordering code	Kit code	Illustration
400 mm VX25 enclosure	1 kit per cubicle	3AXD50000513659	L-4-8-026-VX	 Instruction code: 3AXD50000516742

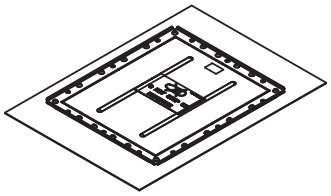
Swing-out frame (for Rittal VX25 enclosures)

The swing-out frame is a hinged compartment for installing the control unit and other electrical equipment.

Used with ...	Qty	Ordering code	Kit code	Illustration
400 mm VX25 enclosure	1 kit per cubicle	3AXD50000361045	L-4-X-051-VX	 Instruction code: 3AXD50000345106

Explosion exhaust kit (for Rittal VX25 enclosures)

The explosion exhaust plate acts as a pressure relief vent in case of arcing inside the cubicle. This part is installed on the roof of the cabinet.

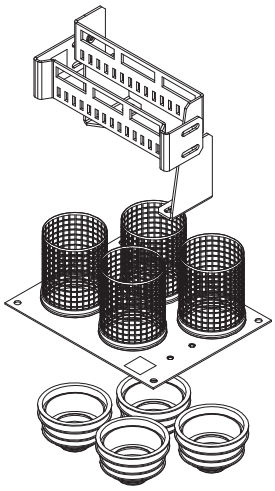
Used with ...	Qty	Ordering code	Kit code	Illustration
400/600/800mm VX25 enclosure	1 kit per cubicle	68797560	-	 Instruction code: 68834341

AC-side components

Lead-through kit for bottom plate

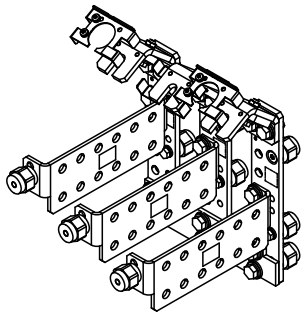
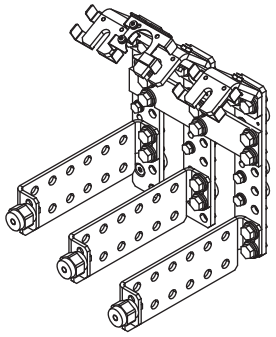
Cable entry kit, to be installed on the bottom plate of the enclosure, contains four 60 mm diameter inlets for cables with grommets, wire meshing for 360° grounding, and a strain relief bracket.

Note: In 400 mm Rittal VX25 cabinets, the maximum number of the cable entries of the supply unit is 8. If you need all 8 cable entries for power supply cables, you cannot use standard Rittal VX25 bottom plates for entering charging and control cables.

Used with ...	Qty	Ordering code	Kit code	Illustration
All enclosure types	1 per module (minimum)	3AXD50000004385	A-468-8-441	 Instruction code: 3AXD50000004817

AC connection kits

AC connection kits are used for connecting supply units to AC.

Used with ...	Qty	Ordering code	Kit code	Illustration
400 mm Rittal VX25 and generic enclosure	1 kit per 1×D8D and 2×D8D	3AXD50000163274	L-468-8-146	 Instruction code: 3AXD50000164394
400 mm Rittal VX25 and generic enclosure	1 kit per 2×D8D in addition to kit L-468-8-146	3AXD50000163281	L-468-8-147	 Instruction code: 3AXD50000167616

AC fuses

The AC fuses protect the input cables and the module against short circuits.

ACS880-304LC-...	Fuse kit		Qty
	Contents	Ordering code	
U_N = 690 V			
0820A-7+A019	Fuse 170M6467, 1400 A, 690 V, SIZE 3, TYPE K Microswitch 170H0069, 2 A, 250 V AC	3AXD50000040007	3
1540A-7+A019			6
2290A-7+A019			9
3040A-7+A019			12

Charging kits

The capacitor banks of the ACS880 inverter modules connected to the DC bus together with the diode supply unit need to be charged with a low charging current during the start-up.

Note: The charging components are dimensioned for DC link capacitances equal to:

- 1…3×ACS880-104LC-0850A-7 (R8i) DC capacitance (< 29 mF) and
- 4×ACS880-104LC-0850A-7 (R8i) DC capacitance (< 58 mF).

If the total DC link capacitance exceeds these limits, the components must be re-dimensioned. Contact your local ABB representative for more information.

The charging kit contains the main parts of the charging circuit. The following table shows the IEC charging kits available for each module type.

ACS880-304LC-...	Frame size	Ordering code (IEC)	
		1...3×R8i	4×R8i
U_N = 690 V			
0820A-7+A019	1×D8D	3AXD50000038780	3AXD50000038841
1540A-7+A019	2×D8D		
2290A-7+A019	3×D8D		
3040A-7+A019	4×D8D		

ACS880-304LC-...	Frame size	Ordering code (UL)	
		1...3×R8i	4×R8i
U_N = 690 V			
0820A-7+A019	1×D8D	3AXD50000775590	3AXD50000775606
1540A-7+A019	2×D8D		
2290A-7+A019	3×D8D		
3040A-7+A019	4×D8D		

Charging kit contents

The charging kit contains:

- switch disconnector unit (switch fuse type) OS40FD12000
- shaft 6×150 mm (1…3×R8i, 4×R8i)
- handle OHB65J6 (1…3×R8i, 4×R8i)
- charging contactor:
  - 1…3×R8i: AF16-30-10-13
  - 4×R8i: AF26-30-00-13
- fuse links (3 pcs):
  - 1…3×R8i: OFAA000GG16
  - 4×R8i: OFAA000GG25
- fuse 170M4831 (2 pcs)

- fuse holders 170H1007 (2 pcs)
- normally-open auxiliary contact OA1G10
- mounting frame for auxiliary contacts OSZ4 (1…3×R8i, 4×R8i)
- diode bridges SKKD 81/22H4 (3 pcs)
- connection busbars (2 pcs)
- terminal blocks DBL80 80A (6 pcs)
- resistors CBH 165 C H 414 5R0 4500 J:
  - 1…3×R8i: 3 pcs
  - 4×R8i: 6 pcs
- list of kit contents.

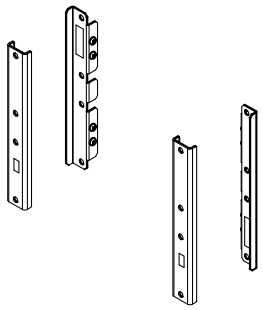
For charging component dimensions, see Charging circuit components (page 146).

DC-side components

DC bus installation parts (for Rittal VX25 enclosures)

The brackets in this kit act as a mounting base for the busbar supports of the Rittal Flat-PLS DC bus and ensure its correct placement and alignment inside the cabinet line-up.

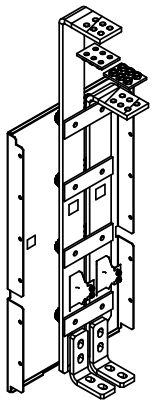
The designs shown in this manual for Rittal VX25 enclosures use the Rittal Flat-PLS busbar system. Make sure that the current in the drive system does not exceed the current-carrying capacity of the busbars.

Used with …	Qty	Ordering code	Kit code	Illustration
VX25 enclosure	1 kit per cubicle	3AXD50000333387	A-468-X-001-VX	 Instruction code: 3AXD50000333639

DC busbars (for Rittal VX25 enclosures)

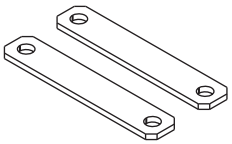
DC busbars provide connection from the module DC output to the common DC bus.

Note: The bolts that connect the DC busbars to the DC link are not included in the kits.

Used with ...	Qty	Ordering code	Kit code	Illustration
400 mm VX25 enclosure	1 kit per cubicle	3AXD50000513635	L-4-8-206-VX	 Instruction code: 3AXD50000512393

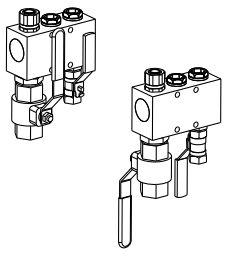
DC connection kit

The DC connection kit connects two adjacent modules and has a shroud to be installed between the modules.

Used with ...	Qty	Ordering code	Kit code	Illustration
400 mm Rittal VX25 and generic enclosure	1 kit per 2×D8D	3AXD50000163625	L-468-8-232	 Instruction code: 3AXD50000165070

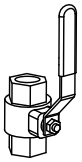
Cooling system parts

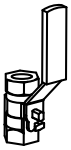
Coolant distribution manifold kits

Enclosure	Qty	Ordering code	Kit code	Illustration
400/600/800mm VX25 and generic enclosure	1 kit per 1×D8D, 2×D8D	3AXD50000044084	L-468-8-441	 Instruction code: 3AXD50000048217

The manifold kits contain:


Inlet and outlet manifolds


Inlet and outlet valves


Drain valves


Nipples for connecting the valves to manifolds


Connectors for PA piping


Plugs for unused piping connectors


Chokes for flow limitation – not used with the ACS880-304LC +A019.

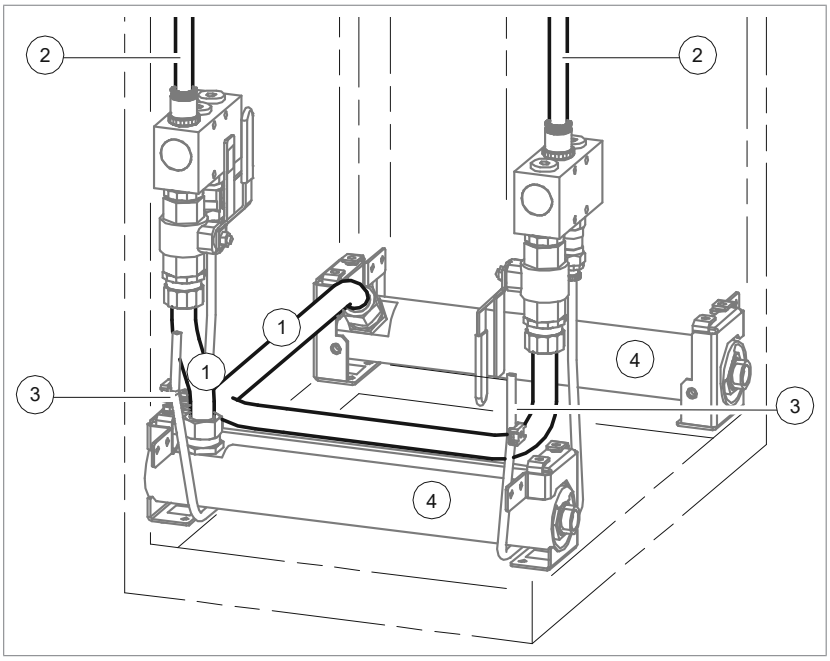
You must order the following parts separately as they are not included in the manifold kits:

- Connectors to attach to inlet, outlet and drain valves
- Connectors to attach to main pipes
- Pipes between main pipe and inlet/outlet valves
- Main pipes
- Drain pipes.

Note: The inlet and outlet valves have an R3/4" internal thread. The drain valves have an R3/8" internal thread.

Piping

PA (polyamide) pipe is available in various diameters on 50-meter reels. Refer to the image for application.

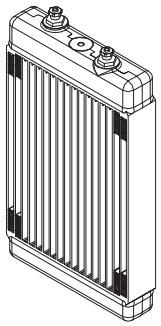


Item	Data	Ordering code
1	PA12P40, 22/18 mm, 50 m	3AXD50000441419
2[1)]	PA12P40, 16/13 mm, 50 m	3AXD50000047488
3	PA11P40, 8/6 mm, 50 m	3AXD50000419302
4	Not part of standard product offering	

1) Use 16/13 mm pipe between the modules and the manifolds. If the heat exchanger is connected in parallel with the module(s), use 8/6 mm pipe between the heat exchanger and the manifolds. If the heat exchanger is connected in series, use 16/13 mm pipe.

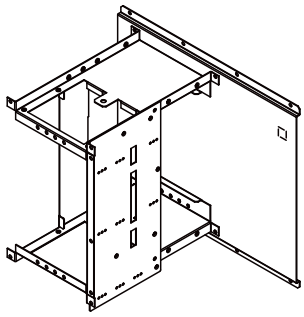
Heat exchanger

The kits include the heat exchanger and the connectors for piping.

Used with ...	Qty	Ordering code	Kit code	Illustration
All enclosure types	1 kit per cubicle for 2×D8D	3AXD50000479795	L-468-8-446	

Cabinet fan support

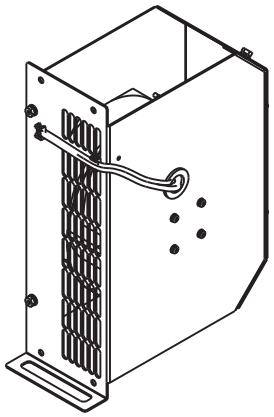
Note: Fans are not included in the kit.

Used with ...	Qty	Ordering code	Kit code	Illustration
400 mm Rittal VX25 and generic enclosure	1 kit per cubicle	3AXD50000513642	L-4-8-402-VX	 Instruction code: 3AXD50000514830

Cooling fans

The cubicle fan is needed for circulating the air inside the cubicle.

Select the fan according to the auxiliary voltage.

Enclosure	Qty	Ordering code	Kit code	Illustration
400 mm Rittal VX25 and generic enclosure	1 fan (230 V) per cubicle	3AXD50000043885	-	 Instruction code: 3AXD50000514830
	1 fan (115 V) per cubicle	3AXD50000045413	-	

10

Internal cooling circuit

Contents of this chapter

The cooling system of a liquid-cooled drive consists of two circuits: the internal cooling circuit and the external cooling circuit. The internal cooling circuit covers the heat-generating electrical components of the drive and transfers the heat to the cooling unit. In the cooling unit, the heat is transferred to the external cooling circuit which is usually part of a larger external cooling system. This chapter deals with the internal cooling circuit.

Applicability

The information in this chapter is applicable to cabinet-built ACS880 liquid-cooled drives. Except where otherwise indicated, the information is also applicable to drives built out of ACS880 liquid-cooled multidrives modules.

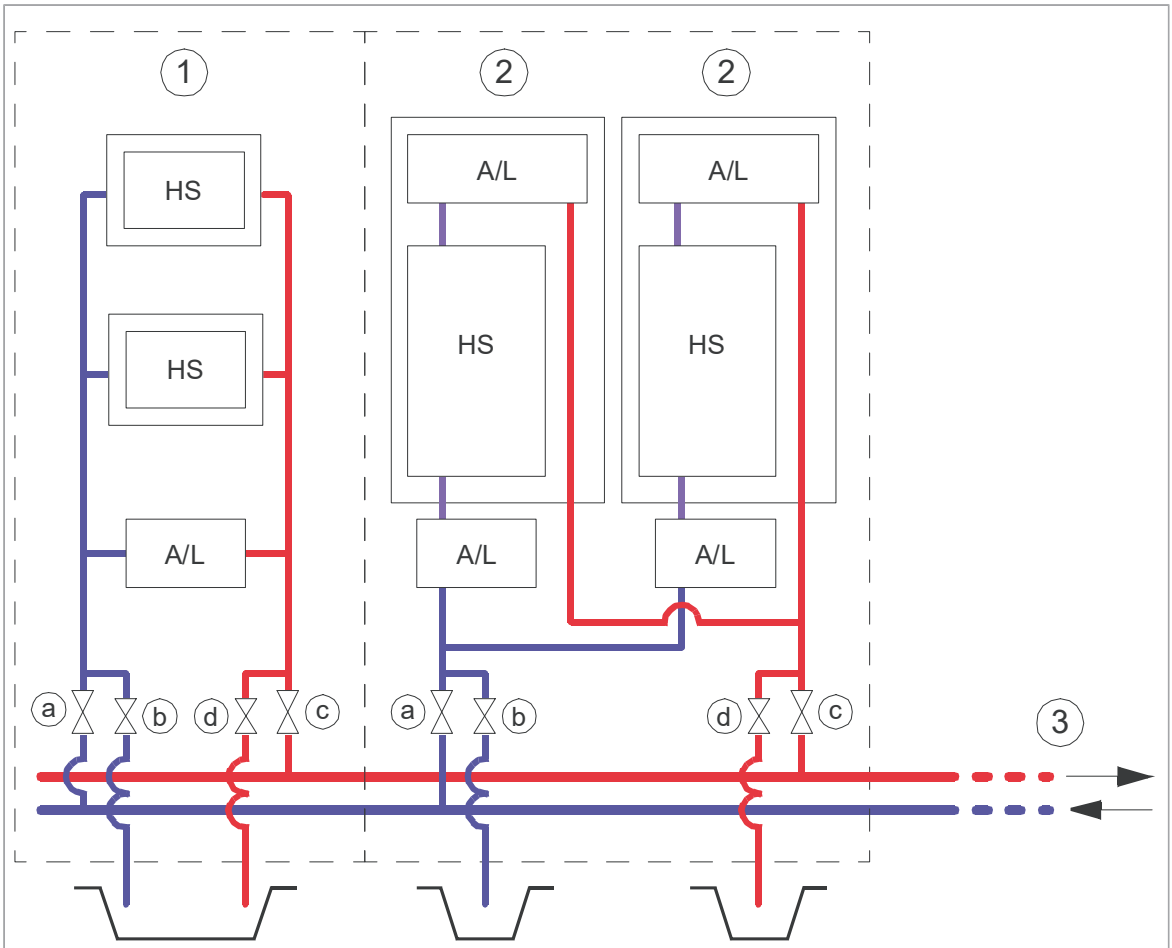
Internal cooling system

Each cubicle has an inlet and an outlet manifold, fitted with a stop valve and a drain valve. The stop valves can be closed to isolate all modules in the cubicle from the main cooling circuit.

In cabinet line-ups built by ABB, valves are color-coded:

- Blue – Open during operation
- Red – Closed during operation

The following diagram shows the coolant pipe connections in a drive system consisting of a supply unit and an inverter unit. Other units, such as brake units, DC/DC converter units have similar cooling arrangements. Other cubicles containing components that require cooling may also contain heat exchangers.



1	Supply modules. The drawing shows the configuration of a diode supply unit with two modules, ie. there is a common air-to-liquid exchanger in the cubicle. With an IGBT supply unit, each module has a dedicated air-to-liquid exchanger as shown for item 2.
2	Inverter modules
3	To/From cooling unit
A/L	Air-to-liquid heat exchanger
HS	Heat sink
a	Inlet valve
b	Inlet-side drain valve
c	Outlet valve
d	Outlet-side drain valve

The coolant used with ACS880 liquid-cooled drive systems is Antifrogen® L 25% or 50% mixture. See Coolant specification (page 114).

Connection to a cooling unit

Connection to an ACS880-1007LC cooling unit

Refer to ACS880-1007LC cooling unit user's manual (3AXD50000129607 [English]).

Connection to a custom cooling unit

General requirements

Equip the system with an expansion vessel to damp pressure rise due to volume changes when the temperature varies. Equip the system with a pump that provides a nominal flow and pressure. Keep the pressure within the limits specified in Technical data (page 114). Install a pressure regulator to make sure that the maximum permissible operating pressure is not exceeded.

Install a bleed valve at the highest point of the cooling circuit, and a drain valve at the lowest point.

The materials that can be used are listed in Cooling circuit materials (page 116).

Coolant temperature control

The temperature of the coolant in the internal cooling circuit must be kept within the limits specified in Technical data (page 114). Note that the minimum temperature is dependent on ambient temperature and relative humidity.

Filling up and bleeding the internal cooling circuit

Both the drive and coolant must be at room temperature before filling up the cooling circuit.

WARNING!
Make sure that the maximum permissible operating pressure is not exceeded. When necessary regulate the pressure to appropriate level by draining excess coolant out of the system.

WARNING!
Bleeding of the cooling circuit is very important and has to be done with great care. Air bubbles in the cooling circuit may reduce or completely block coolant flow and lead to overheating. Let the air out of the cooling system while filling in coolant and, eg. after any power module replacements.

Drive line-ups with an ACS880-1007LC cooling unit

Obey the filling up and bleeding instructions in ACS880-1007LC cooling unit user's manual (3AXD50000129607 [English]).

Drive line-ups with a custom cooling unit

Note:

- In filling up the system, the drain valves in the line-up are used only to vent the air from the circuit so that it can be displaced by the coolant. The actual bleeding of the circuit must be done via an external bleed valve installed at the highest point of the cooling circuit. The most practical location for the valve is usually near or at the cooling unit.
- Observe the instructions given by the manufacturer of the cooling unit. Pay special attention to filling up and bleeding the pumps properly as they may be damaged if operated when dry.
- Draining coolant into the sewer system is not allowed.

1. Open the bleed valve at the cooling unit.
2. Open the inlet valve and the outlet-side drain valve of one cubicle. Keep the outlet valve and the inlet-side drain valve closed.
3. Attach a hose to the outlet-side drain valve and lead it into a suitable container.
4. Fill the circuit with coolant. For the coolant specification, refer to section Coolant specification (page 114).
   To minimize foaming, do not exceed the filling flow rate of 5 l/min (1.3 US gallon/min).
5. As the piping and modules in the cubicle fills up, coolant starts to flow from the hose. Let some coolant flow out, then close the drain valve.
6. Close the inlet valve.
7. Repeat steps 2…6 for all cubicles in the line-up.
8. Open the inlet and outlet valves in all cubicles. Let any air remaining in the system out through the bleed valve at the cooling unit.

9. Close the bleed valve at the cooling unit.
10. Continue to fill in coolant until a base pressure of 100…150 kPa is achieved.
11. Open the bleed valve of the pump to let out any air.
12. Re-check the pressure and add coolant if necessary.
13. Start the coolant pump. Let any air remaining in the system out through the bleed valve at the cooling unit.
14. After one to two minutes, stop the pump or block the coolant flow with a valve.
15. Re-check the pressure and add coolant if necessary.
16. Repeat steps 13…15 a few times until all air is let out of the cooling circuit. Listen for a humming sound and/or feel the piping for vibration to find out if there is still air left in the circuit.

Draining the internal cooling circuit

The modules in each cubicle can be drained through the drain valves without draining the whole internal cooling circuit.

WARNING!
Hot, pressurized coolant can be present in the cooling circuit. Do not work on the cooling circuit before the pressure is released by stopping the pumps and draining coolant.

1. Attach hoses to each drain valve in the cubicle to be drained. Lead the hoses into a suitable container. Make sure the ends of the hoses are not immersed in coolant at any point so that air can displace the coolant in the system.
2. Open the drain valves. Wait until all coolant has drained.

   Note: Draining coolant into the sewer system is not allowed.
3. If required, dry the piping with compressed oil-free air of less than 6 bar.
4. If the drive is to be stored in temperatures below 0 °C (32 °F),
   - dry the cooling circuit with air,
   - fill the cooling circuit with coolant specified under Coolant specification (page 114).
   - drain the cooling circuit again.

Maintenance intervals

As a general rule, the quality of the coolant should be checked at intervals of two years. This can be done by distributors of Antifrogen® L (see www.clariant.com) if a 250 milliliter sample is provided.

Technical data

Coolant specification

Coolant type

Antifrogen® L (by Clariant International Ltd, www.clariant.com) 25% or 50% mixture, available from Clariant distributors and ABB Service representatives.

Note: Do not dilute the coolant. It is ready to use.

Antifrogen® L 25% mixture is usable in storage temperatures down to -16 °C (3.2 °F). Antifrogen® L 50% mixture is usable in storage temperatures down to -40 °C (-40 °F).

Note that operation below 0 °C (32 °F) is not permitted regardless of the freezing point of the coolant.

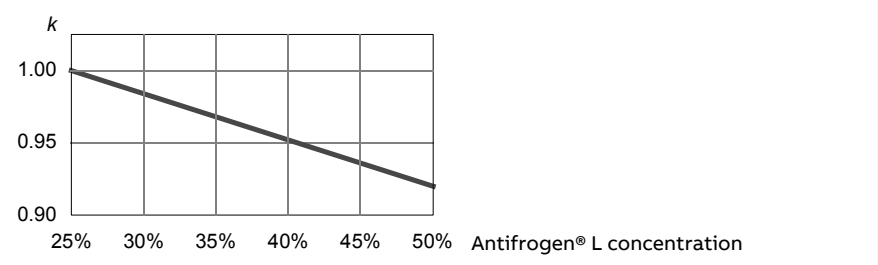
WARNING!
The warranty does not cover damage that occurs from the use of incorrect coolant.

Temperature limits

Freeze protection: The freezing point of the coolant is determined by the concentration of heat transfer fluid in the mixture.

The higher the concentration of heat transfer fluid, the higher the viscosity of the coolant. This results in a higher pressure loss in the system. See Pressure limits (page 116).

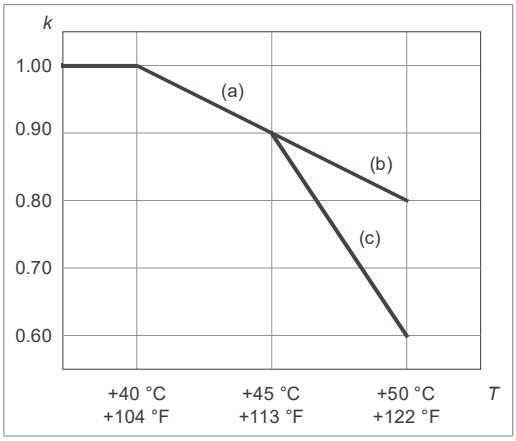
The nominal current ratings of drive system modules apply to an Antifrogen® L / water solution of 25/75% (volume). With the Antifrogen® L concentration between 25% and 50%, the drive output current must be derated by 1/3 percentage point per 1 p.p. increase in Antifrogen® L concentration. The drawing below shows the derating factor *(k)* in relation to Antifrogen® L concentration.



Incoming coolant temperature:

- 0…40 °C (32…104 °F): no drive output current derating required
- 40…45 °C (104…113 °F): drive output current must be derated by 2 percentage points per 1 °C (1.8 °F) temperature increase, as shown by curve (a).
- 45…50 °C (113…122 °F):
  - If components with a maximum operating temperature of 55 °C (131 °F) are installed in the same space as the drive modules, drive output current must be derated by 6 percentage points per 1 °C (1.8 °F) temperature increase, as shown by curve (c).
  - If there are no components with a maximum operating temperature of 55 °C (131 °F) installed in the same space as the drive modules, drive output current must be derated by 2 percentage points per 1 °C (1.8 °F) temperature increase, as shown by curve (b).

The drawing below shows the derating factor *(k)* in relation to coolant temperature.



Condensation is not permitted. The minimum coolant temperature to avoid condensation (at an atmospheric pressure of 1 bar) is shown below as a function of relative humidity (RH) and ambient temperature (T_{air}).

T_{air} (°C)	Min. $T_{coolant}$ (°C)				
	RH = 95%	RH = 80%	RH = 65%	RH = 50%	RH = 40%
5	4.3	1.9	-0.9	-4.5	-7.4
10	9.2	6.7	3.7	-0.1	-3.0
15	14.2	11.5	8.4	4.6	1.5
20	19.2	16.5	13.2	9.4	6.0
25	24.1	21.4	17.9	13.8	10.5
30	29.1	26.2	22.7	18.4	15.0
35	34.1	31.1	27.4	23.0	19.4
40	39.0	35.9	32.2	27.6	23.8
45	44.0	40.8	36.8	32.1	28.2
50	49.0	45.6	41.6	36.7	32.8
55	53.9	50.4	46.3	42.2	37.1

	= Not permitted as standard but the coolant temperature must be 0 °C (32 °F) or more.
Example:	At an air temperature of 45 °C and relative humidity of 65% the coolant temperature must not be less than +36.8 °C

Maximum temperature rise: Depends on heat losses and mass flow. Typically 10 °C (18 °F) with nominal losses and flow.

Pressure limits

Base pressure: 250 kPa (recommended); 300 kPa (maximum). “Base pressure” denotes the pressure of the system compared with the atmospheric pressure when the cooling circuit is filled with coolant.

Air counterpressure in expansion vessel (with ACS880-1007LC cooling unit): 80 kPa

Design pressure (PS): 600 kPa

Nominal pressure difference: 120 kPa with Antifrogen® L 25% coolant solution, 140 kPa with Antifrogen® L 50% coolant solution. This has to be taken into account when dimensioning the liquid cooling circuit.

Maximum pressure difference: 160 kPa

Coolant flow rate limits

The maximum coolant flow rate for all drive equipment is 1.3 × nominal. See the technical data chapter for nominal values.

Cooling circuit materials

Materials used in the internal cooling circuit are listed below.

- stainless steel AISI 316L (UNS 31603)
- heavy gauge aluminum
- plastic materials such as PA, PEX and PTFE

Note: PVC hoses are not suitable for use with antifreeze.

- rubber gasketing NBR (nitrile rubber).

WARNING!
If you connect external piping to the internal cooling circuit, use only materials that are specified above. Other materials can cause galvanic corrosion. If the external piping contains other materials, use a cooling unit with a heat exchanger (for example, ACS880-1007LC) to keep the external piping separate from the internal cooling circuit.

11

Technical data

Contents of this chapter

This chapter contains the technical data for the supply modules.

Ratings

Module type ACS880-304LC-...	No overload use						Light overload use		Heavy-duty use	
	I_1	I_2	I_{max_1}	S_N	I_{max_2}	P_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
	A (AC)	A (DC)	A (DC)	kVA	A (AC)	kW (DC)	A (DC)	kW (DC)	A (DC)	kW (DC)
U_N = 690 V										
0820A-7+A019	820	1000	1500	980	1225	932	960	895	800	745
1540A-7+A019	1540	1880	2820	1840	2303	1752	1805	1682	1504	1401
2290A-7+A019	2290	2805	4208	2737	3435	2614	2693	2509	2244	2091
3040A-7+A019	3040	3720	5580	3633	4556	3466	3571	3328	2976	2773

Definitions

Nominal ratings

U_N Nominal input voltage. For U_1, see Electrical power network specification (page 126). For U_2, see DC connection data (page 126).

I_1 Continuous rms input (AC) current. No overload capability at the coolant temperature of 40 °C (104 °F) and air temperature of 45 °C (113 °F).

I_2 Continuous rms output (DC) current. No overload capability at the coolant temperature of 40 °C (104 °F) and air temperature of 45 °C (113 °F).

I_{max_1} Maximum output (DC) current. Available for 10 s at start, otherwise as long as allowed by module temperature.

S_N Nominal apparent (AC) power

I_{max_2} Maximum input (AC) current

P_N Nominal output (DC) power

Light-overload use 10% overload capability) ratings

I_{Ld} Continuous current. 10% overload is allowed for one minute every 5 minutes.

P_{Ld} Output power in light-overload use

Heavy-duty use (50% overload capability) ratings

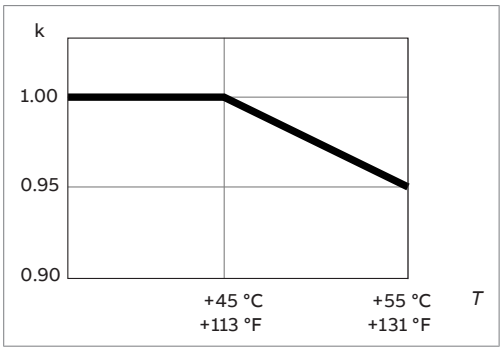
I_{Hd} Continuous current. 50% overload is allowed for one minute every 5 minutes.

P_{Hd} Output power in heavy-duty use

Derating

Surrounding air temperature derating

In the temperature range +45…55 °C (+113…131 °F), the rated output current is derated by 0.5 percentage points for every added 1 °C (1.8 °F). The output current can be calculated by multiplying the current given in the rating table by the derating factor *(k)*:



Coolant temperature derating

For the coolant temperature derating, see Temperature limits (page 114).

Antifreeze content derating

For the antifreeze content derating, see Temperature limits (page 114).

Altitude derating

At altitudes 0…2000 m (6561.7 ft), no derating. For altitudes over 2000 m (6561.7 ft), contact ABB.

Type equivalence table and frame sizes

Module type	Basic module type	Frame size
U_N = 690 V		
ACS880-304LC-0820A-7+A019	ACS880-304LC-0820A-7-A019	1×D8D
ACS880-304LC-1540A-7+A019	ACS880-304LC-0820A-7-A019	2×D8D
ACS880-304LC-2290A-7+A019	ACS880-304LC-0820A-7-A019	3×D8D
ACS880-304LC-3040A-7+A019	ACS880-304LC-0820A-7-A019	4×D8D

Fuses

AC fuses

For the AC fuse types and ordering codes, see section AC fuses (page 101). For the locations of the AC fuses in the main circuit, see section Overview diagrams (page 19).

Dimensions and weights

The dimensions of the supply module are:

- height 242 mm (9.53 in)
- depth 292.0 mm (11.50 in)
- width 170 mm (6.69 in)
- weight 12 kg (26.5 lb).

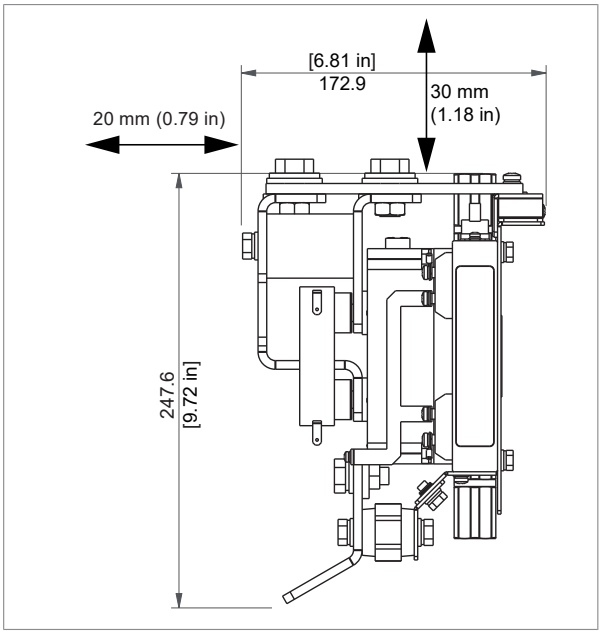
For the dimensional drawing, see Liquid-cooled D8D module (page 140).

Free space requirements

Leave 20 mm (0.79 in) free space in front of the module for smooth installation and to enable cooling air flow and also 30 mm (1.18 in) above the module for air flow.

Leave also enough space for installing the pipes to the coolant connectors. For a reliable connection, the end of the pipe entering the connector must be completely intact for a length of at least 5 cm (2 in).

For the free space requirements of the cabinet, see *Cabinet design and construction instructions for ACS880 air-cooled and liquid-cooled multidrive modules* (3AUA0000107668 [English]).



Losses, cooling circuit data and efficiency

Module type ACS880-304LC-...	Frame	Power loss [1]	Coolant volume		Coolant flow rate		Pressure loss	Noise level	Efficiency [2]
			Modules	Modules + cabinet	Modules	Modules + cabinet			
		kW	l (US qt)	l (US qt)	l/min (US gal/min)		kPa	dB	%
U_N = 690 V									
0820A-7+A019	1×D8D	3.5	0.2 (0.2)	3.1 (3.3)	12 (3.2)	12 (3.2)	120	63	99.6
1540A-7+A019	2×D8D	6.6	0.3 (0.3)	3.6 (3.8)	12 (3.2)	22 (5.8) *	120	63	99.6
2290A-7+A019	3×D8D	9.8	0.5 (0.5)	4.1 (4.3)	24 (6.3)	24 (6.3)	120	63	99.6
3040A-7+A019	4×D8D	13.0	0.7 (0.7)	4.5 (4.8)	24 (6.3)	34 (9.0) *	120	63	99.6

[1] These losses are not calculated according to the ecodesign standard IEC 61800-9-2.
[2] The efficiency is not calculated according to the ecodesign standard IEC 61800-9-2.

Definitions

*	Heat exchanger is installed in parallel and not in series with the diode supply module flows.
Power loss	Total heat dissipation
Mass flow	Total mass flow of module(s). See section Cabinet configuration overview (page 36).
Pressure loss	Pressure loss with nominal liquid flow

Energy efficiency data (ecodesign)

Energy efficiency data is not provided for the drive/unit. The multidrives are not in the scope of the EU ecodesign requirements (Regulation EU/2019/1781) or the UK ecodesign requirements (Regulation SI 2021 No. 745).

Auxiliary circuit current consumption

Device	U_N	f	I_{max}	I_N
	V	Hz	A	A
Control unit ZCU-14 with options	24 V DC	-	2.05	-
Cabinet fan	200…240 V AC	50/60	-	1.4
Cabinet fan	100…130 V AC	50/60	-	2.2
CIO-01 I/O module	24 V DC	-	-	-

Definitions

f Supply frequency

I_{max} Maximum current consumption

I_N Nominal current consumption

U_N Nominal voltage

Tightening torques

Unless a tightening torque is specified in the text, the following torques can be used.

Electrical connections

Size	Torque	Strength class
M3	0.5 N·m (4.4 lbf·in)	4.6...8.8
M4	1 N·m (9 lbf·in)	4.6...8.8
M5	4 N·m (35 lbf·in)	8.8
M6	9 N·m (6.6 lbf·ft)	8.8
M8	22 N·m (16 lbf·ft)	8.8
M10	42 N·m (31 lbf·ft)	8.8
M12	70 N·m (52 lbf·ft)	8.8
M16	120 N·m (90 lbf·ft)	8.8

Mechanical connections

Size	Max. torque	Strength class
M5	6 N·m (53 lbf·in)	8.8
M6	10 N·m (7.4 lbf·ft)	8.8
M8	24 N·m (17.7 lbf·ft)	8.8

Insulation supports

Size	Max. torque	Strength class
M6	5 N·m (44 lbf·in)	8.8
M8	9 N·m (6.6 lbf·ft)	8.8
M10	18 N·m (13.3 lbf·ft)	8.8
M12	31 N·m (23 lbf·ft)	8.8

Cable lugs

Size	Max. torque	Strength class
M8	15 N·m (11 lbf·ft)	8.8
M10	32 N·m (23.5 lbf·ft)	8.8
M12	50 N·m (37 lbf·ft)	8.8

Electrical power network specification

Supply voltage (U_1)	6-pulse, 12-pulse and 24-pulse supply modules: ACS880-304LC-xxxxx-7+A019: 525 … 690 V AC (525 … 600 V AC for UL/CSA) 3-phase ± 10%. This is indicated in the type designation label as typical input voltage levels 3~525/600/690 V AC (600 V AC for UL/CSA). **Note:** Specifications in this section are valid for modules installed in Rittal VX25 or generic cabinets with kits and components defined in the manual or corresponding cabinet structure. Cabinet construction and busbar placement must be dimensioned according to the short-circuit requirements indicated in this manual.
Frequency	50/60 Hz, Variation ± 5% of the nominal frequency
Imbalance	Maximum 3% of nominal phase-to-phase voltage
Short-circuit withstand strength **(IEC/EN 61439-1)**	Short-circuit withstand strength of one DSU cabinet containing from one to two D8D modules with the cabinet construction described in this manual: • rated peak withstand current (I_{pk}) = 143 kA • rated short-time withstand current (I_{CW}) = 65 kA / 1 s Rated conditional short-circuit current of a D8D module (I_{cc}) is 65 kA with the module's AC fuses given in this manual.
Short-circuit current protection (UL 508A, CSA C22.2 No. 14-13)	The drive is suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes ar 600 V maximum when the input cable is protected with class T fuses.
Power factor	Fundamental power factor = 0.97…0.98 (at nominal load)
Overvoltage category	OVCIII
Input terminals	See dimension drawings of Liquid-cooled D8D module (page 140).

Transformer for 12-pulse supply according to IEC60076-1:2011	
Connection	Dy 11 d0 or Dyn 11 d0
Phase shift between secondaries	30° electrical
Voltage difference between secondaries	< 0.5%
Short-circuit impedance of secondaries	> 5%
Short-circuit impedance difference between secondaries	<10% of the percentage impedance
No grounding of the secondaries allowed. Static shield recommended.	

DC connection data

Voltage (U_2) 6-pulse, 12-pulse and 24-pulse modules	ACS880-304LC-xxxxA-7+A019: 709 … 932 V DC ±10% (709 … 810 V DC for UL/CSA). This is indicated in the type designation label as typical output voltage levels 709/810/932 V DC (810 V DC for UL/CSA).
Output terminals	See dimension drawings of Liquid-cooled D8D module (page 140). M12, torque 70 N·m (52 lbf·ft).

Coolant connection data

The coolant connectors are for 16/13 mm PA (polyamide) pipe. For more information on the pipes, see Piping (page 106).

Power systems

TN (grounded) and IT (ungrounded) systems)

Protection classes for module

Degrees of protection (IEC/EN 60529)	IP00
Enclosure types (UL 50/50E)	UL Open Type
Overvoltage category (IEC/EN 60664-1)	III
Protective class (IEC/EN 61800-5-1)	I

Optical components

The specifications of the optic cable are as follows:

- Storage temperature: -55 … +85 °C (-67 … +185 °F)
- Installation temperature: -20 … +70 °C (-4 … +158 °F)
- Maximum short-term tensile force: 50 N (11.2 lbf)
- Minimum short-term bend radius: 25 mm (1.0 in)
- Minimum long-term bend radius: 35 mm (1.4 in)
- Maximum long-term tensile load: 1 N (3.6 ozf)
- Flexing: Max. 1000 cycles

ABB drive products in general utilize 5 and 10 MBd (megabaud) optical components from Avago Technologies' Versatile Link range. Note that the optical component type is not directly related to the actual communication speed.

Note: The optical components (transmitter and receiver) on a fiber optic link must be of the same type.

Plastic optical fiber (POF) cables can be used with both 5 MBd and 10 MBd optical components. 10 MBd components also enable the use of Hard Clad Silica (HCS®) cables, which allow longer connection distances thanks to their lower attenuation. HCS® cables cannot be used with 5 MBd optical components.

The maximum lengths of fiber optic links for POF and HCS® cables are 20 and 200 meters (65.6 ft and 656 ft) respectively.

Ambient conditions

The unit is to be used in a heated indoor controlled environment.			
	Operation installed for stationary use	**Storage** in protective package	**Transportation** in protective package

Altitude above sea level	0 … 2000 m (0 … 6561.7 ft) no derating. For altitudes over 2000 m (6561.7 ft), contact ABB.	-	-
Air temperature	0 … +45 °C (+32 … +113 °F), no condensation allowed. Output derated in the range +45 … +55 °C (+113 … +131 °F).	-40 … +70 °C (-40 … +158 °F)	-40 … +70 °C (-40 … +158 °F)
Relative humidity	Maximum 95%, no condensation allowed	Maximum 95%, no condensation allowed	Maximum 95%, no condensation allowed
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination	IEC/EN 60721-3-3:2002: Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use of weather protected locations	IEC 60721-3-1:1997	IEC 60721-3-2:1997
Chemical gases	Class 3C2	Class 1C2	Class 2C2
Solid particles	Class 3S1	Class 1S3 (packing must support this, otherwise 1S2)	Class 2S2
	No conductive dust allowed.		
Vibration	IEC 61800-5-1 IEC 60068-2-6:2007, EN 60068-2-6:2008 Environmental testing Part 2: Tests -Test Fc: Vibration (sinusoidal) 10 … 57 Hz, max. 0.075 mm amplitude 57 … 150 Hz 1 *g* D8D modules in a 400 mm wide Rittal VX25 enclosure tested in a typical cabinet assembly, marine tested according to: Max. 1 mm (0.04 in.) (peak value, 5 … 13.2 Hz), max. 0.7 *g* (13.2 … 100 Hz) sinusoidal	IEC/EN 60721-3-1:1997	IEC/EN 60721-3-1:1997
Shock IEC 60068-2-27:2008, EN 60068-2-27:2009 Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	Not allowed	With packing max. 100 m/s^2 (330 ft./s^2) 11 ms	With packing max. 100 m/s^2 (330 ft./s^2) 11 ms

Cooling

Cooling method: Liquid cooling

Materials

Module	Busbars are made of tin plated copper sheet.
Package	The material of the package is: Plywood support, plywood box with metal corners, PET straps or screws. The package consists of a plywood sleeve, bottom and top element, and of a plywood support. The plywood support is attached onto the box bottom with nails, screws or staples. The product is screwed onto the support to keep it in position inside the package. Protection against conditions causing corrosion is achieved by wrapping the product in VCI sheet. Packaging is secured with screws or plastic straps.
Internal cooling circuit	See chapter Internal cooling circuit (page 109).
Disposal	The main parts of the drive can be recycled to preserve natural resources and energy. Product parts and materials should be dismantled and separated. Generally all metals, such as steel, aluminum, copper and its alloys, and precious metals can be recycled as material. Plastics, rubber, cardboard and other packaging material can be used in energy recovery. Printed circuit boards and large electrolytic capacitors need selective treatment according to IEC 62635 guidelines. To aid recycling, plastic parts are marked with an appropriate identification code. Contact your local ABB distributor for further information on environmental aspects and recycling instructions for professional recyclers. End of life treatment must follow international and local regulations. See ACS880 cabinet-installed drives and multidrives modules recycling instructions and environmental information (3AXD50000153909 [English]).

Standards

See *ACS880 liquid-cooled multidrive cabinets and modules electrical planning instructions* [3AXD50000048634 (English)].

Markings

See *ACS880 liquid-cooled multidrive cabinets and modules electrical planning instructions* [3AXD50000048634 (English)].

Disclaimer

Generic disclaimer

The manufacturer shall have no obligation with respect to any product which (i) has been improperly repaired or altered; (ii) has been subjected to misuse, negligence or accident; (iii) has been used in a manner contrary to the manufacturer's instructions; or (iv) has failed as a result of ordinary wear and tear.

Cybersecurity disclaimer

This product can be connected to and communicate information and data via a network interface. The HTTP protocol, which is used between the commissioning tool (Drive Composer) and the product, is an unsecured protocol. For independent and continuous

operation of product such connection via network to commissioning tool is not necessary. However it is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, prevention of physical access, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Notwithstanding any other provision to the contrary and regardless of whether the contract is terminated or not, ABB and its affiliates are under no circumstances liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

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The control unit

Contents of this chapter

This chapter

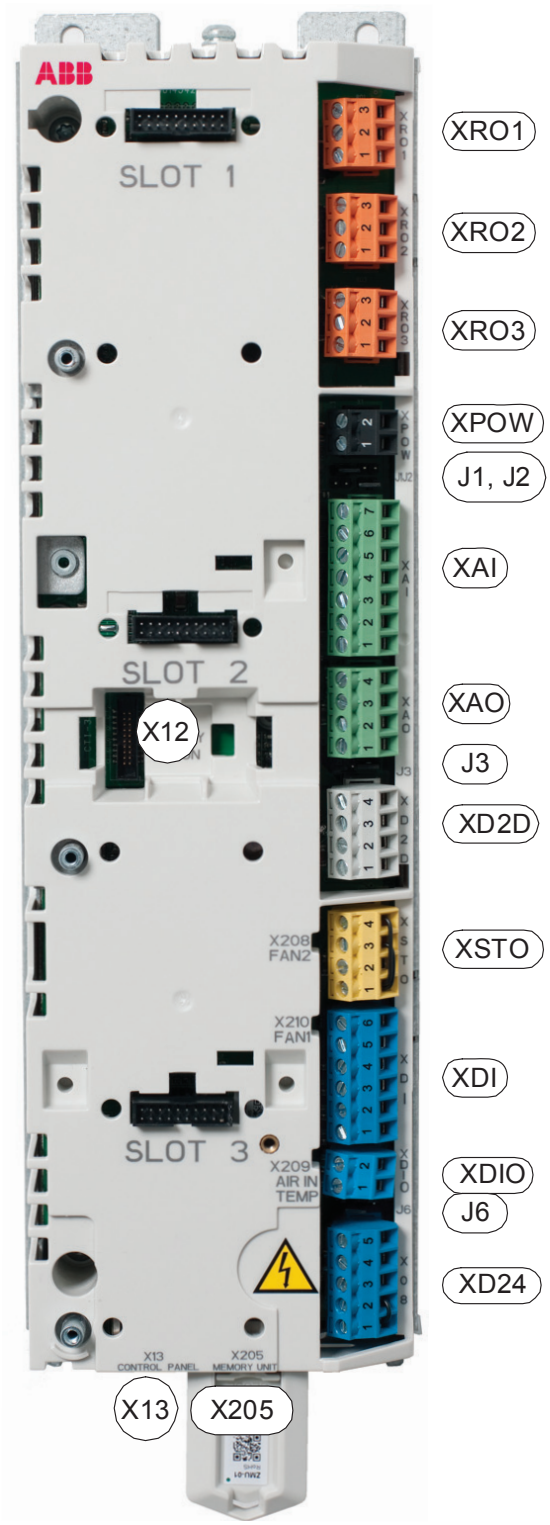
- describes the connections of the control unit
- contains the specifications of the inputs and outputs of the control unit.

General

A ZCU-14 control unit controls the supply unit. The ZCU-14 control unit consists of a ZCON control board contained in a plastic housing.

The control unit of D8D modules is a separate unit and it is always installed in the cabinet (on the cabinet wall etc), NOT on the module. For the connections, see chapter Example circuit diagrams (page 153). ABB does not offer ready cables or cable sets for connecting the control unit.

ZCU-14 layout



	Description
XPOW	External power input
XAI	Analog inputs
XAO	Analog outputs
XD2D	Drive-to-drive link
XRO1	Relay output RO1
XRO2	Relay output RO2
XRO3	Relay output RO3
XD24	Digital input interlock (DIIL) and +24 V output
XDIO	Digital input/outputs
XDI	Digital inputs
XSTO	Safe torque off connection (inverter unit only). **Note:** This connection only acts as a true Safe torque off input when the ZCU is controlling an inverter unit. When the ZCU is controlling a supply unit, de-energizing the inputs will stop the unit but will not constitute a true safety function.
X12	Connection for FSO-xx safety functions module (inverter unit only).
X13	Control panel connection
X202	Option slot 1
X203	Option slot 2
X204	Option slot 3
X205	Memory unit connection (memory unit inserted in the drawing)
J1, J2	Voltage/Current selection jumpers (J1, J2) for analog inputs
J3	Drive-to-drive link termination switch (J3)
J6	Common digital input ground selection jumper (J6).

ZCU-14 default I/O connection diagram

The diagram shows the control connections of the supply unit, and the default meaning or use of the signals in the supply unit control program.

The wire size accepted by all screw terminals (for both stranded and solid wire) is 0.5 … 2.5 mm^2 (24…12 AWG). The torque is 0.5 N·m (5 lbf·in).

Note: As the same control program is in use with different diode supply types, the default connections shown are not applicable to them all. For example, some units have a DC link charging circuit, some do not. The default parameter settings and I/O connections are valid for the version without the charging circuit.

Terminal			Description	
XRO1, XRO2, XRO3			Relay outputs	
13 12 11 23 22 21 33 32 31	13	NO	Norm. open	XRO1: **Running**[1] (Energized = running) 250 V AC / 30 V DC, 2 A
	12	COM	Common	
	11	NC	Norm. closed	
	23	NO	Norm. open	XRO2: **Fault (-1)**[1] (Energized = no fault) 250 V AC / 30 V DC, 2 A
	22	COM	Common	
	21	NC	Norm. closed	
	33	NO	Norm. open	XRO3: **MCB ctrl**[2] (Energized = closes main contactor/breaker) 250 V AC / 30 V DC, 2 A
	32	COM	Common	
	31	NC	Norm. closed	
XPOW			External power input	
2 1	2	GND	24 V DC, 2 A minimum (without optional modules)	
	1	+24VI		
J1, J2			AI current/voltage selection	
	J1		AI1 current/voltage selection jumper	
	J2		AI2 current/voltage selection jumper	
XAI			Analog inputs, reference voltage output	
7 6 5 4 3 2 1	7	AI2-	Not in use by default. 0(4)…20 mA, R_{in} = 100 ohm[3]	
	6	AI2+		
	5	AI1-	Not in use by default. 0(2)…10 V, R_{in} > 200 kohm[4]	
	4	AI1+		
	3	AGND	Ground	
	2	-VREF	-10 V DC, R_L 1…10 kohm	
	1	+VREF	10 V DC, R_L 1…10 kohm	
XAO			Analog outputs	
4 3 2 1	4	AGND	**Zero** (no signal indicated)[1] 0…20 mA, R_L < 500 ohm	
	3	AO2		
	2	AGND	**Zero** (no signal indicated)[1] 0…20 mA, R_L < 500 ohm	
	1	AO1		
J3			Drive-to-drive link termination	
	J3		Drive-to-drive link termination switch[5]	

Terminal			Description
XD2D			Drive-to-drive link
4 3 2 1	4	SHIELD	Not in use by default
	3	BGND	
	2	A	
	1	B	
XSTO			Safe torque off [6]
4 3 2 1	4	IN2	Factory connection. Both circuits must be closed for the unit to start (IN1 and IN2 must be connected to OUT).
	3	IN1	
	2	SGND	
	1	OUT	
XDI			Digital inputs
6 5 4 3 2 1	6	DI6	**Reset** [1] (0 -> 1 = fault reset)
	5	DI5	Not in use by default. Can be used for eg. earth fault monitoring.
	4	DI4	**Auxiliary circuit breaker fault** [1]
	3	DI3	**MCB feedback** [2] (0 = main contactor/breaker open)
	2	DI2	**Run enable** [1] (1 = run enable)
	1	DI1	**Temp fault** [1] (0 = overtemperature)
XDIO			Digital input/outputs
2 1	2	DIO2	Not in use by default
	1	DIO1	Not in use by default
XD24			Auxiliary voltage output
5 4 3 2 1	5	DIOGND	Digital input/output ground
	4	+24VD	+24 V DC 200 mA [7]
	3	DICOM	Digital input ground
	2	+24VD	+24 V DC 200 mA [7]
	1	DIIL	Not in use by default. Can be used for eg. emergency stop.
J6			Ground selection
● ● ○	J6		Ground selection jumper [8]
X12			Not in use in supply units
X13			Control panel connection
X205			Memory unit connection

1) Default use of the signal in the control program. The use can be changed by a parameter. See also the delivery-specific circuit diagrams.
2) Use of the signal in the control program (fixed). See also the delivery-specific circuit diagrams.
3) Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by jumper J2. Change of setting requires reboot of control unit.
4) Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by jumper J1. Change of setting requires reboot of control unit.
5) Must be set to ON when the supply unit is the first or last unit on the drive-to-drive (D2D) link. On intermediate units, set termination to OFF.
6) This input only acts as a true Safe torque off input in inverter units. In other applications (such as a supply or brake unit), de-energizing the IN1 and/or IN2 terminal will stop the unit but not constitute a true safety function.
7) Total load capacity of these outputs is 4.8 W (200 mA at 24 V) minus the power taken by DIO1 and DIO2.

[8] Determines whether DICOM is separated from DIOGND (ie, common reference for digital inputs floats).

 DICOM connected to DIOGND

 DICOM and DIOGND separate

External power supply for the control unit (XPOW)

The control unit is powered from a 24 V DC, 2 A supply through terminal block XPOW.

Using an external supply is recommended, if:

- the control unit needs to be kept operational during input power breaks, for example, because of continuous fieldbus communication
- immediate restart is needed after a power break (that is, no control unit power-up delay is allowed).

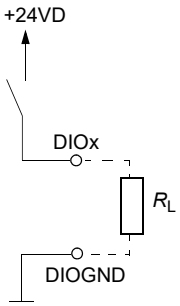
Safe torque off (XSTO)

Note: The XSTO input only acts as a true Safe torque off input on the inverter control unit. De-energizing the IN1 and/or IN2 terminals of other units (supply, DC/DC converter, or brake unit) will stop the unit but not constitute a true safety function.

FSO safety functions module connection (X12)

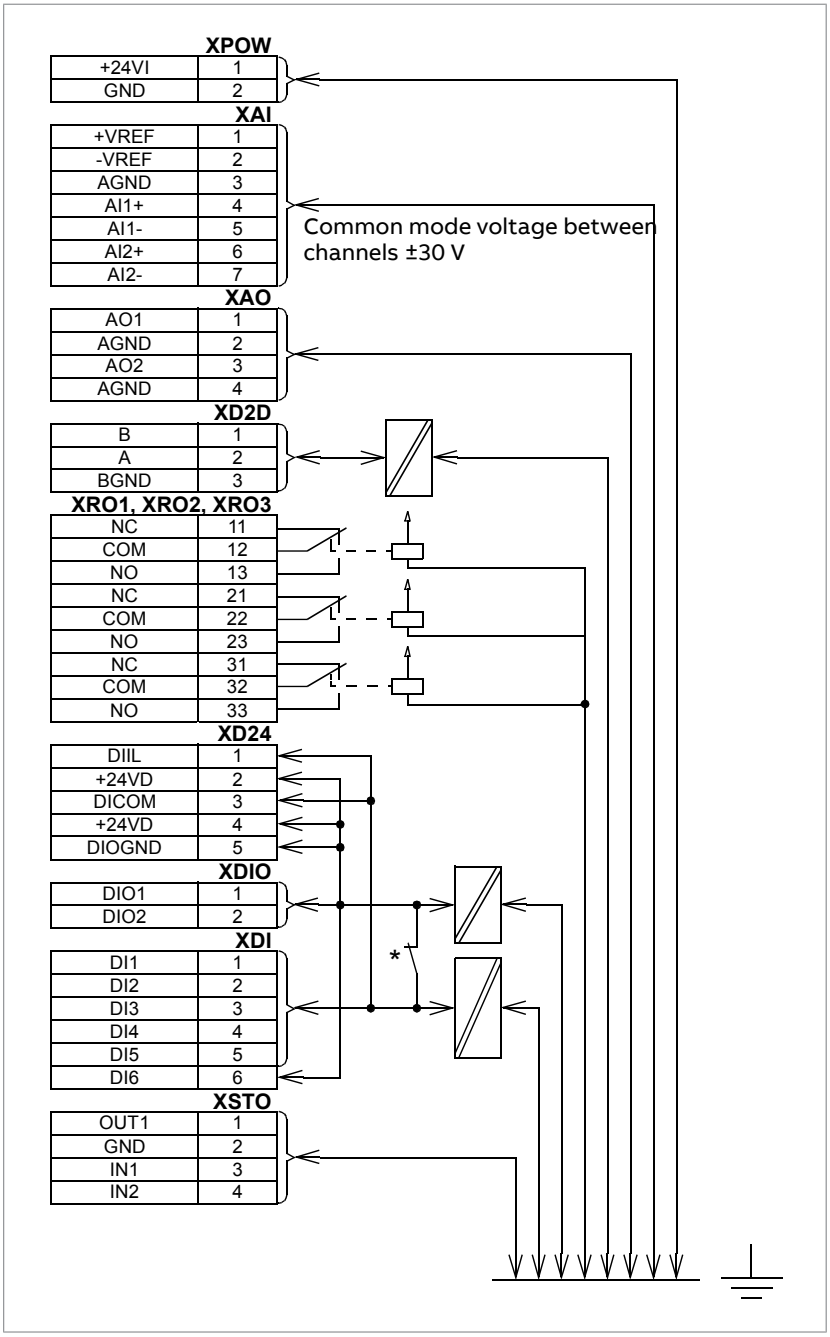
Refer to the applicable FSO module user's manual. Note that the FSO safety functions module is not used in supply, DC/DC converter or brake units.

Connector data

Power supply (XPOW)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) 24 V (±10%) DC, 2 A External power input.
Relay outputs RO1…RO3 (XRO1…XRO3)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) 250 V AC / 30 V DC, 2 A Protected by varistors
+24 V output (XD24:2 and XD24:4)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Total load capacity of these outputs is 4.8 W (200 mA / 24 V) minus the power taken by DIO1 and DIO2.
Digital inputs DI1…DI6 (XDI:1…XDI:6)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) 24 V logic levels: “0” < 5 V, “1” > 15 V R_{in}: 2.0 kohm Input type: NPN/PNP (DI1…DI5), PNP (DI6) Hardware filtering: 0.04 ms, digital filtering up to 8 ms DI6 (XDI:6) can alternatively be used as an input for a PTC sensor. "0" > 4 kohm, "1" < 1.5 kohm. I_{max}: 15 mA (DI1…DI5), 5 mA (DI6)
Start interlock input DIIL (XD24:1)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) 24 V logic levels: "0" < 5 V, "1" > 15 V R_{in}: 2.0 kohm Input type: NPN/PNP Hardware filtering: 0.04 ms, digital filtering up to 8 ms
Digital inputs/outputs DIO1 and DIO2 (XDIO:1 and XDIO:2) Input/output mode selection by parameters. DIO1 can be configured as a frequency input (0…16 kHz with hardware filtering of 4 microseconds) for 24 V level square wave signal (sinusoidal or other wave form cannot be used). DIO2 can be configured as a 24 V level square wave frequency output. See the firmware manual, parameter group 111/11.	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) As inputs: 24 V logic levels: "0" < 5 V, "1" > 15 V. R_{in}: 2.0 kohm. Filtering: 1 ms. As outputs: Total output current from +24VD is limited to 200 mA 
Reference voltage for analog inputs +VREF and -VREF (XAI:1 and XAI:2)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) 10 V ±1% and -10 V ±1%, R_{load} 1…10 kohm Maximum output current: 10 mA
Analog inputs AI1 and AI2 (XAI:4 … XAI:7). Current/voltage input mode selection by jumpers	Connector pitch 5 mm, wire size 0.5 … 2.5 mm² (22…12 AWG) Current input: -20…20 mA, R_{in} = 100 ohm Voltage input: -10…10 V, R_{in} > 200 kohm Differential inputs, common mode range ±30 V Sampling interval per channel: 0.25 ms Hardware filtering: 0.25 ms, adjustable digital filtering up to 8 ms Resolution: 11 bit + sign bit Inaccuracy: 1% of full scale range

Analog outputs AO1 and AO2 (XAO)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) 0…20 mA, R_{load} < 500 ohm Frequency range: 0…300 Hz Resolution: 11 bit + sign bit Inaccuracy: 2% of full scale range
XD2D connector	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Physical layer: RS-485 Transmission rate: 8 Mbit/s Cable type: Shielded twisted-pair cable with a twisted pair for data and a wire or another pair for signal ground (nominal impedance 100 … 165 ohm, for example Belden 9842) Maximum length of link: 50 m (164 ft) Termination by jumper
Safe torque off connection (XSTO)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Input voltage range: -3…30 V DC Logic levels: "0" < 5 V, "1" > 17 V. **Note:** For the unit to start, both connections must be “1”. This applies to all control units (including drive, inverter, supply, brake, DC/DC converter etc. control units), but true Safe torque off functionality is only achieved through the XSTO connector of the drive/inverter control unit. EMC (immunity) according to IEC 61326-3-1 and IEC 61800-5-2
Control panel connection (X13)	Connector: RJ-45 Cable length < 100 m (328 ft)
The terminals of the control unit fulfill the Protective Extra Low Voltage (PELV) requirements. The PELV requirements of a relay output are not fulfilled if a voltage higher than 48 V is connected to the relay output.	

ZCU-1x ground isolation diagram



* Ground selector (J6) settings

 •

All digital inputs share a common ground (DICOM connected to DIOGND). This is the default setting.

• 

Ground of digital inputs DI1…DI5 and DIIL (DICOM) is isolated from DIO signal ground (DIOGND). Isolation voltage 50 V.

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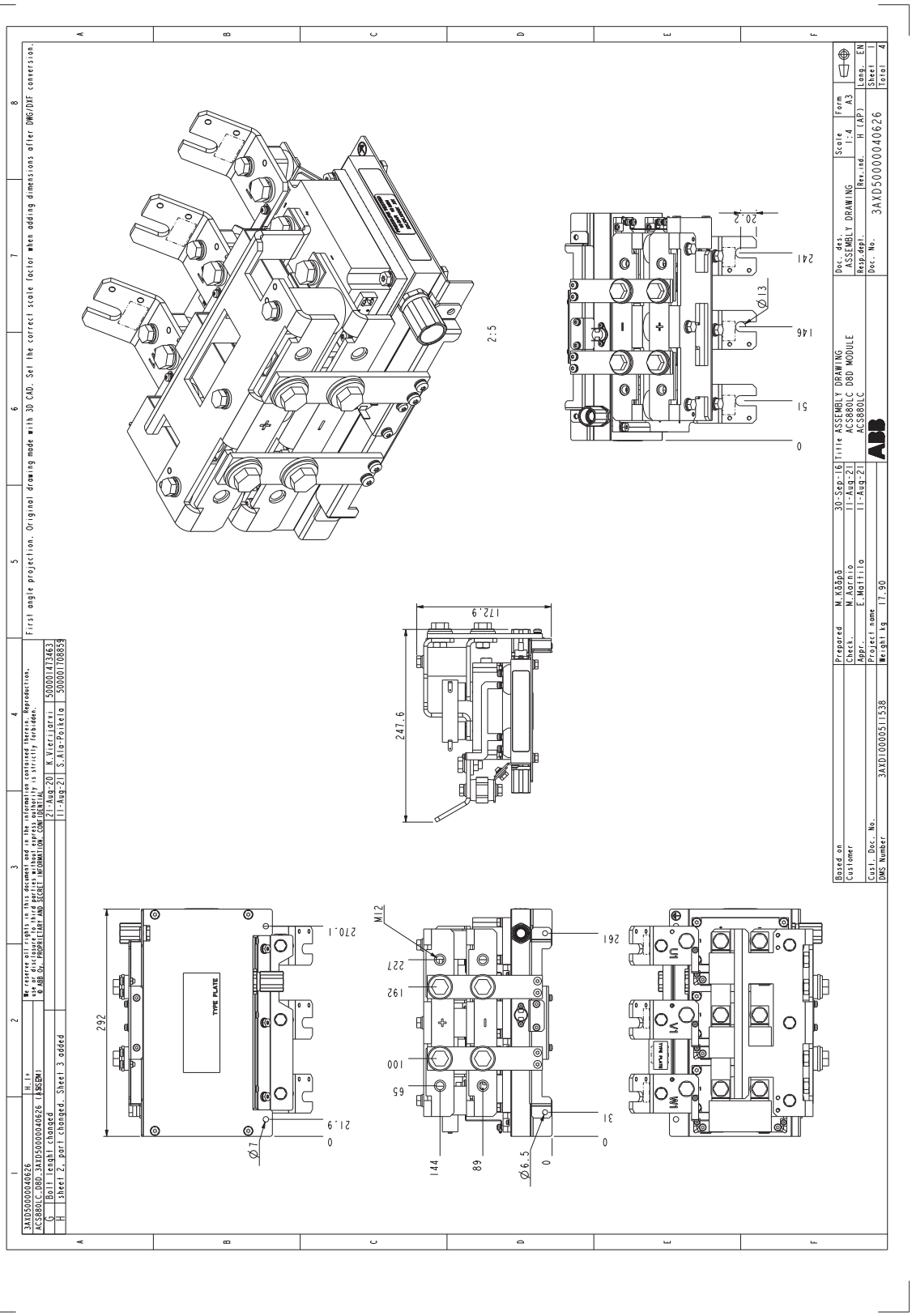
Dimension drawings

Contents of this chapter

This chapter shows dimensions of the supply modules and accessories.

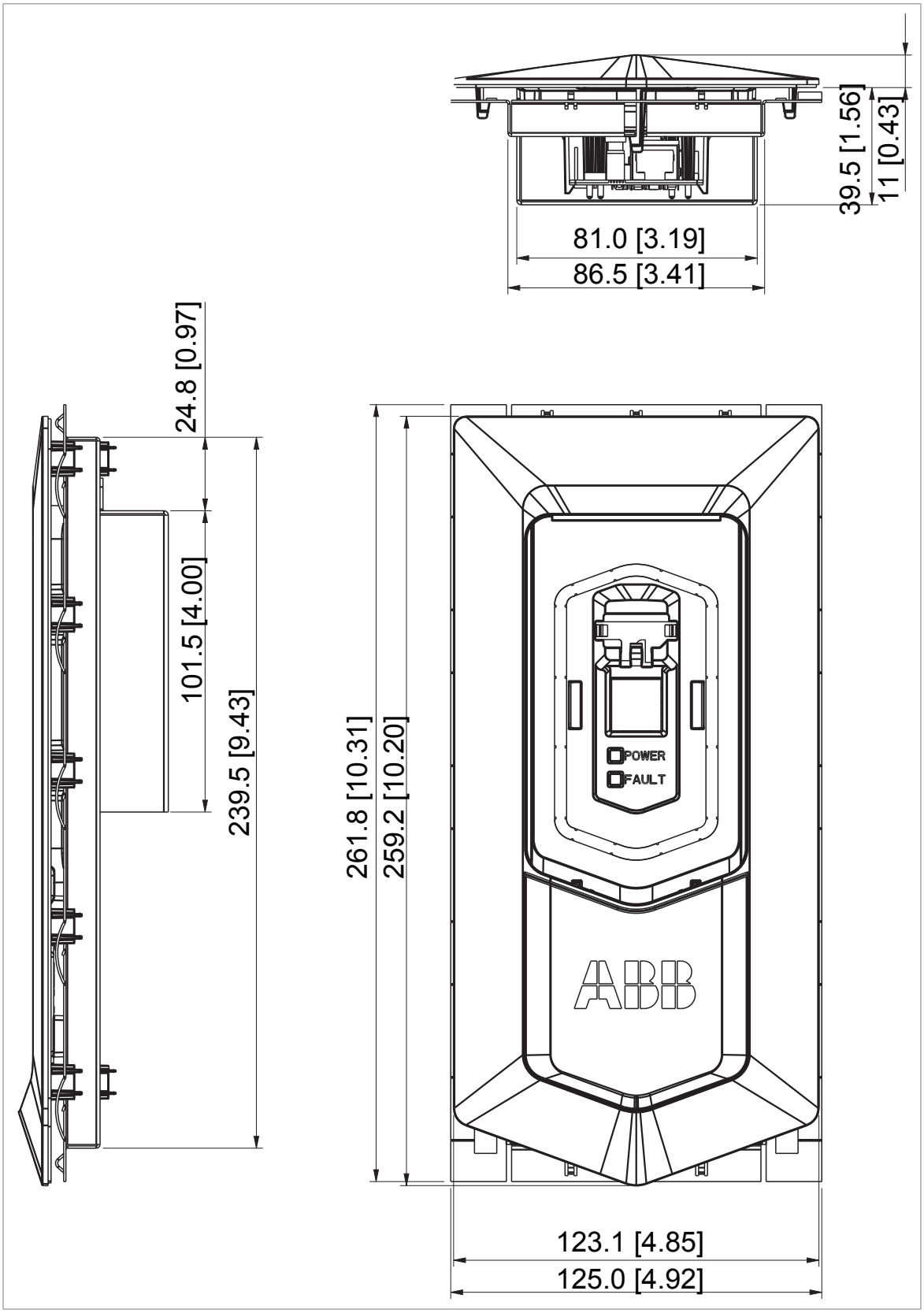
Liquid-cooled D8D module



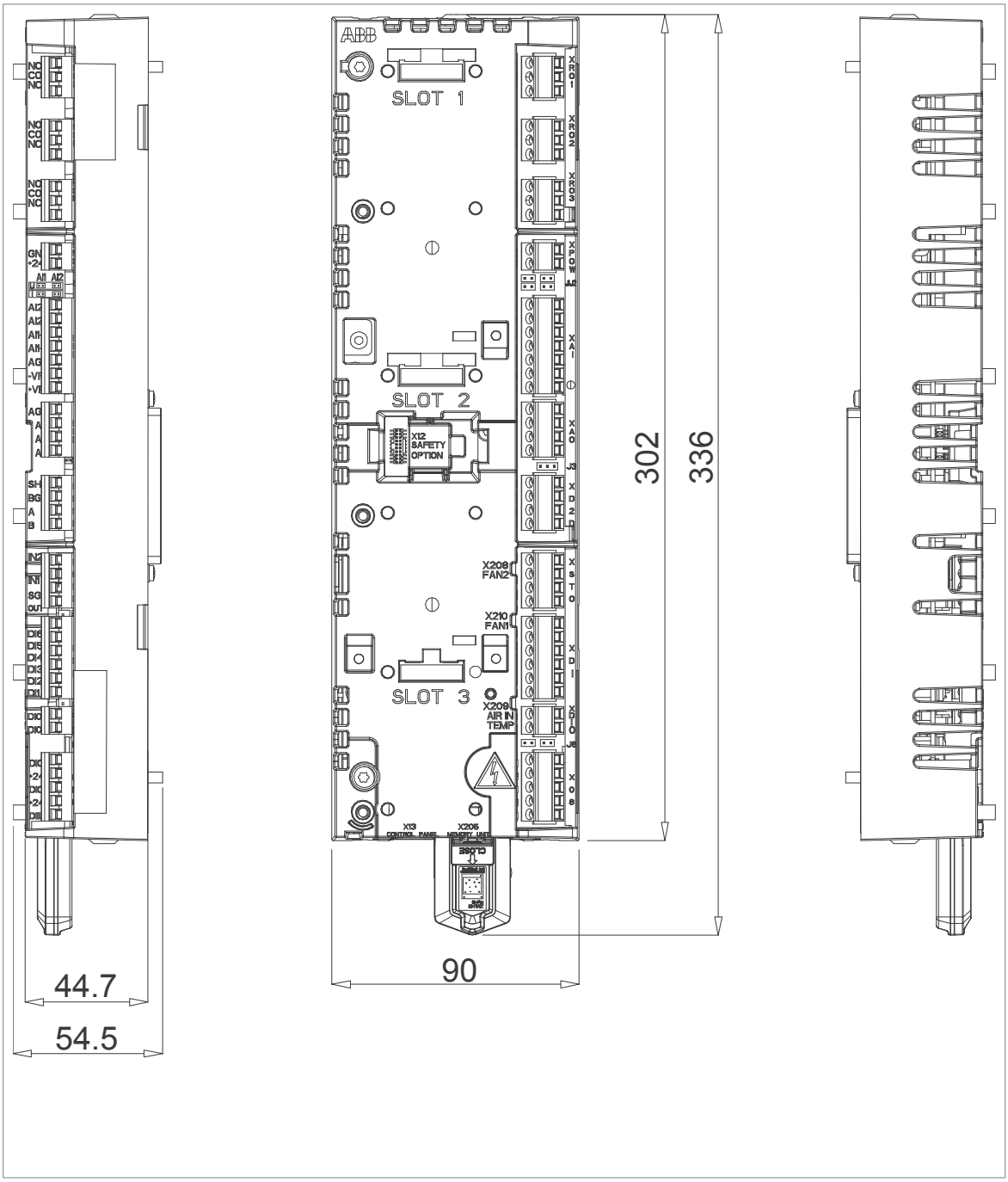
Dimensions in mm

1 mm = 0.0394 in

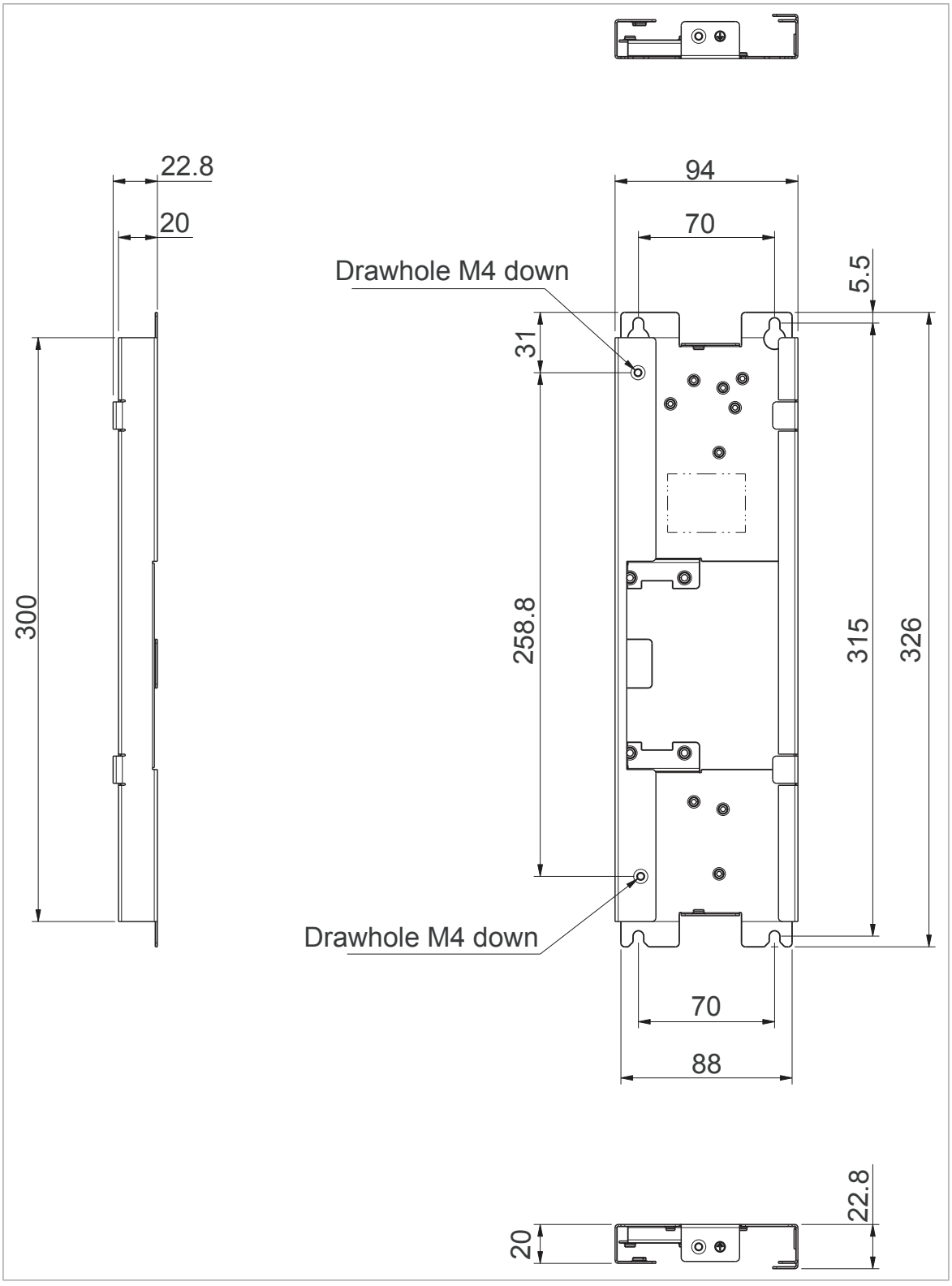
DPMP-01 mounting kit



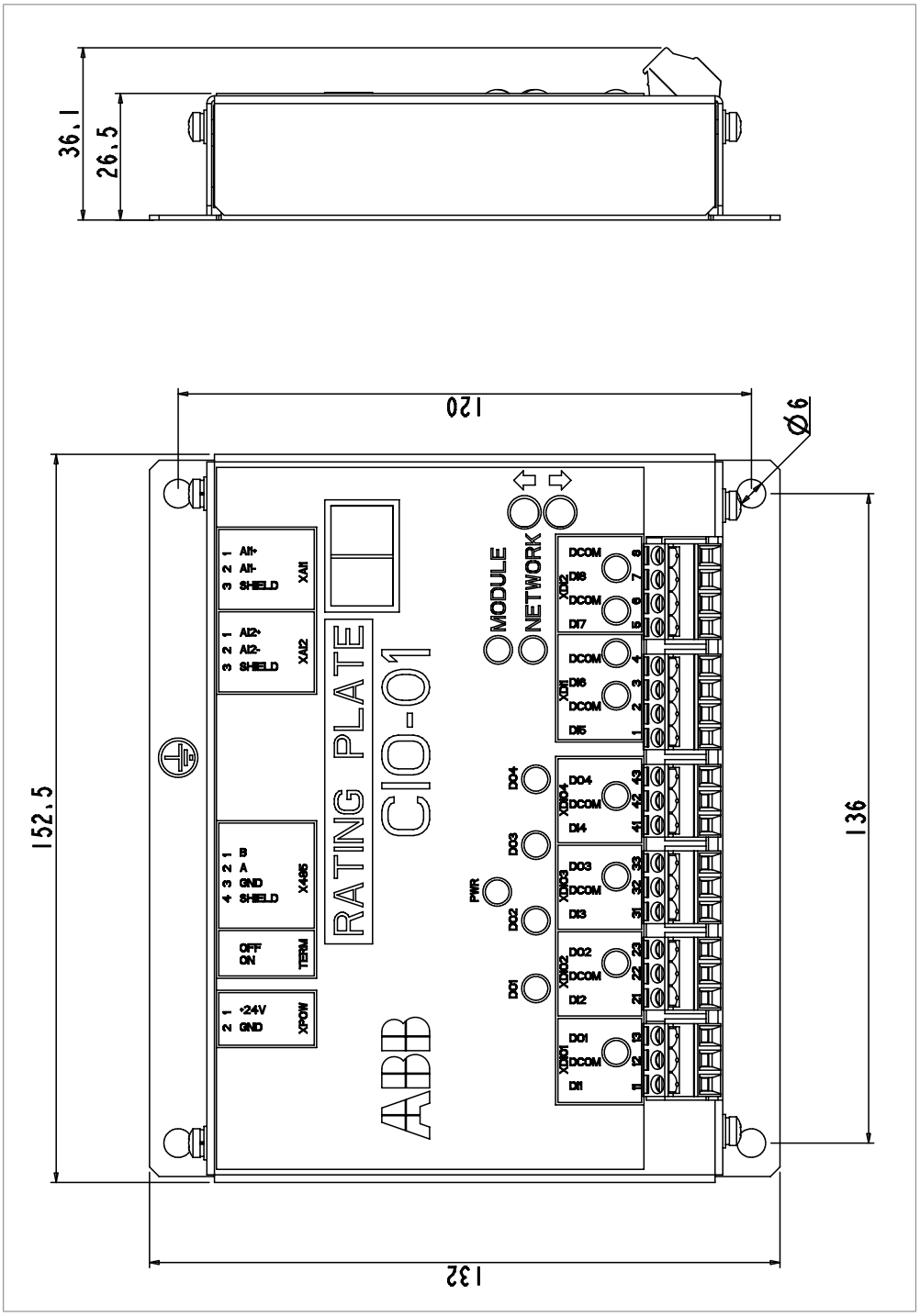
ZCU-14 control unit



Support plate for ZCU-14

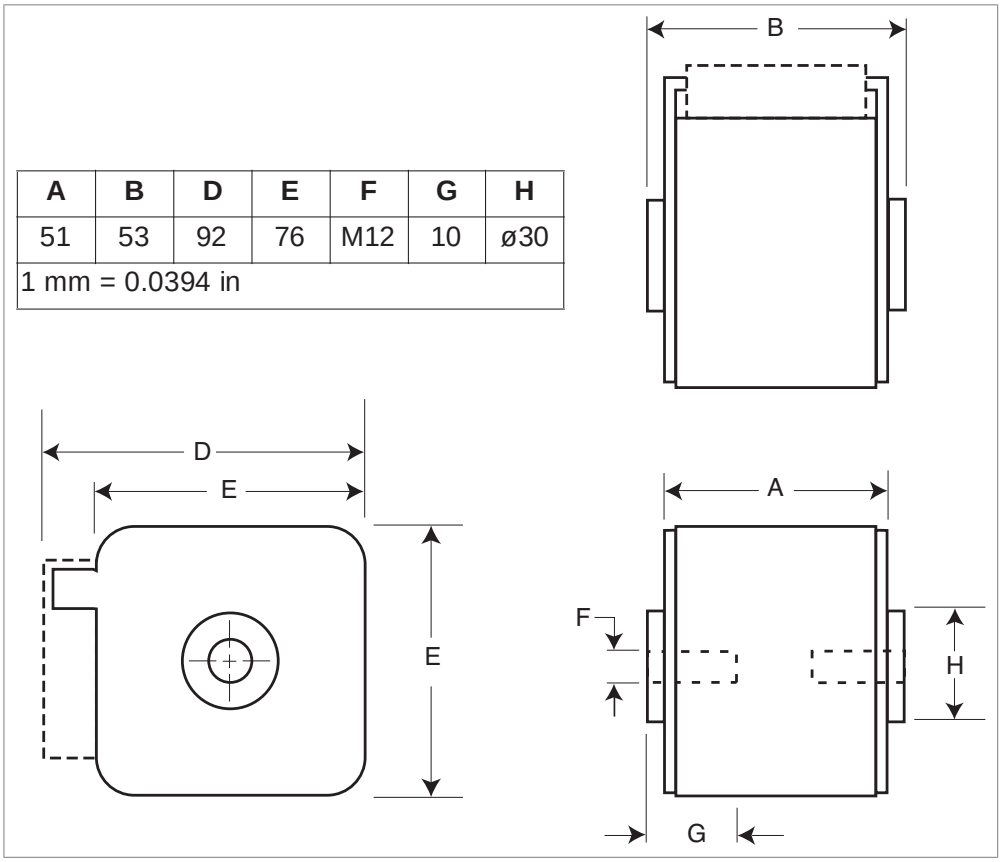


CIO-01 module

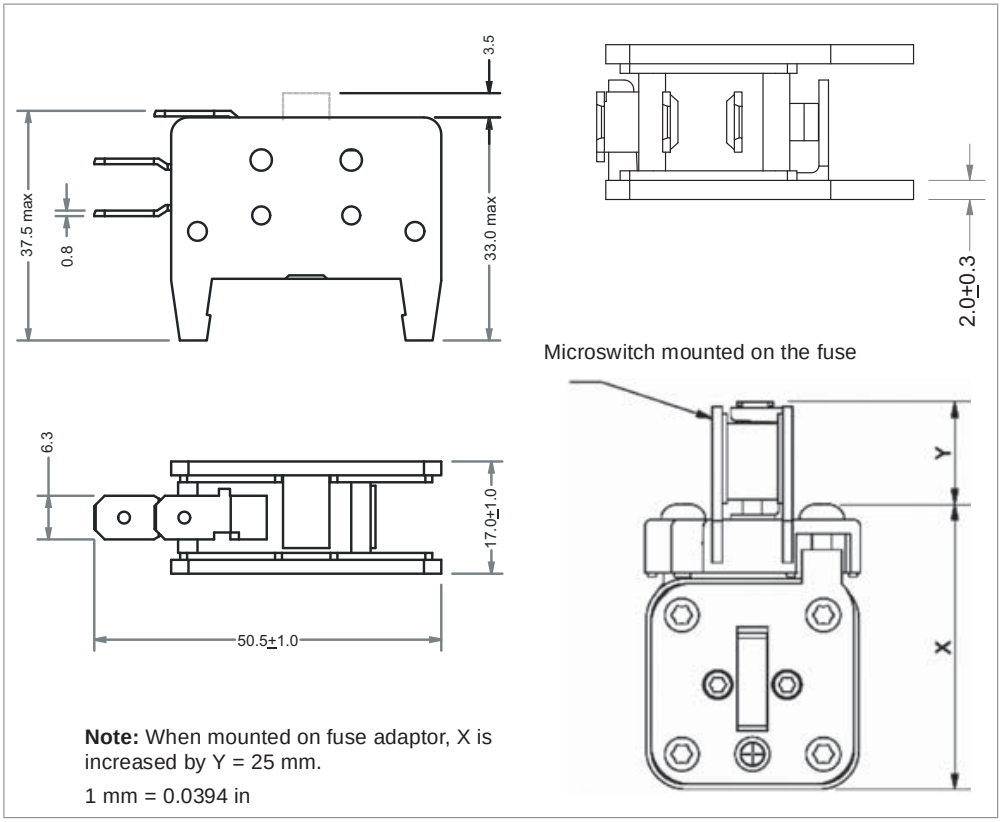


AC fuse 170M6467

A	B	D	E	F	G	H
51	53	92	76	M12	10	ø30
1 mm = 0.0394 in						



Microswitch 170H0069

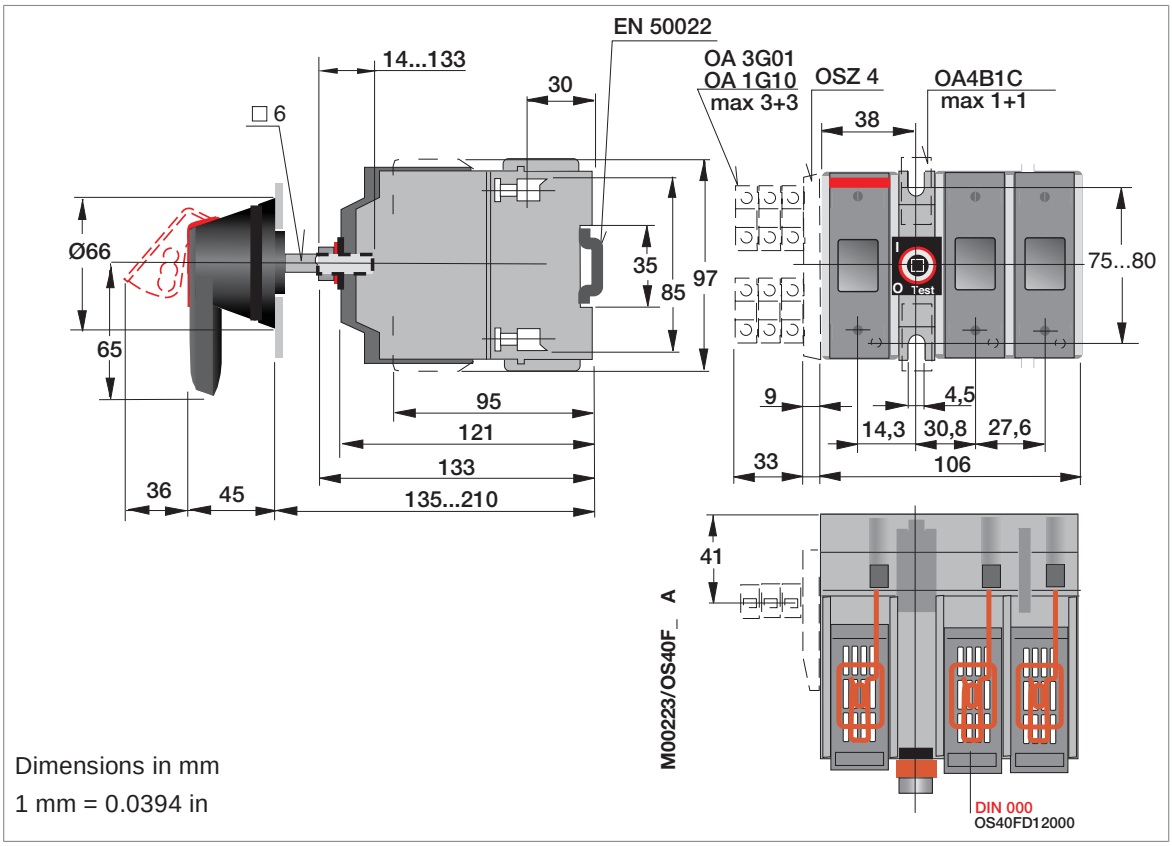


Note: When mounted on fuse adaptor, X is increased by Y = 25 mm.

1 mm = 0.0394 in

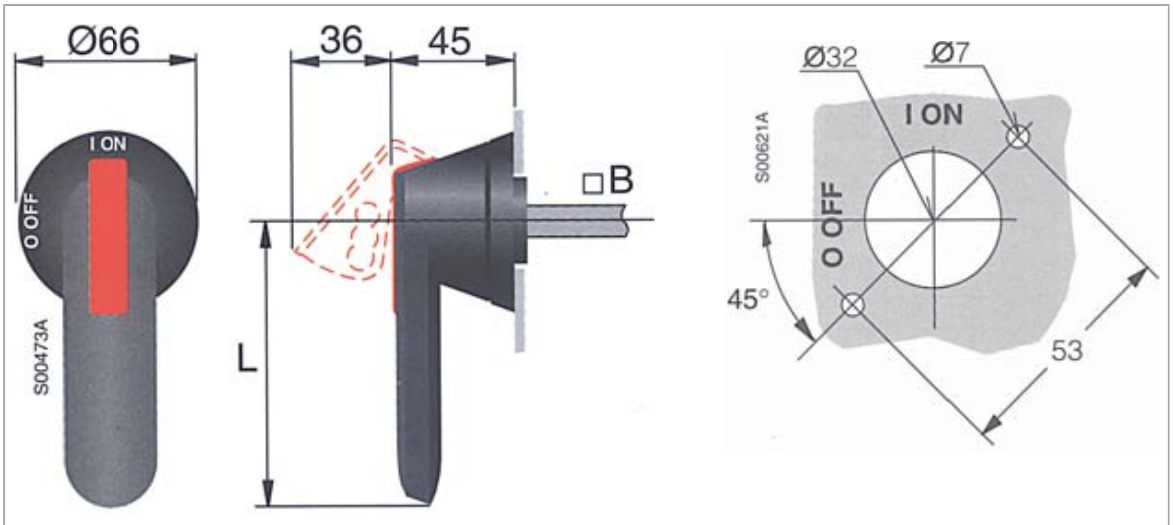
Charging circuit components

Charging switch OS40FD12000



Dimensions in mm
1 mm = 0.0394 in

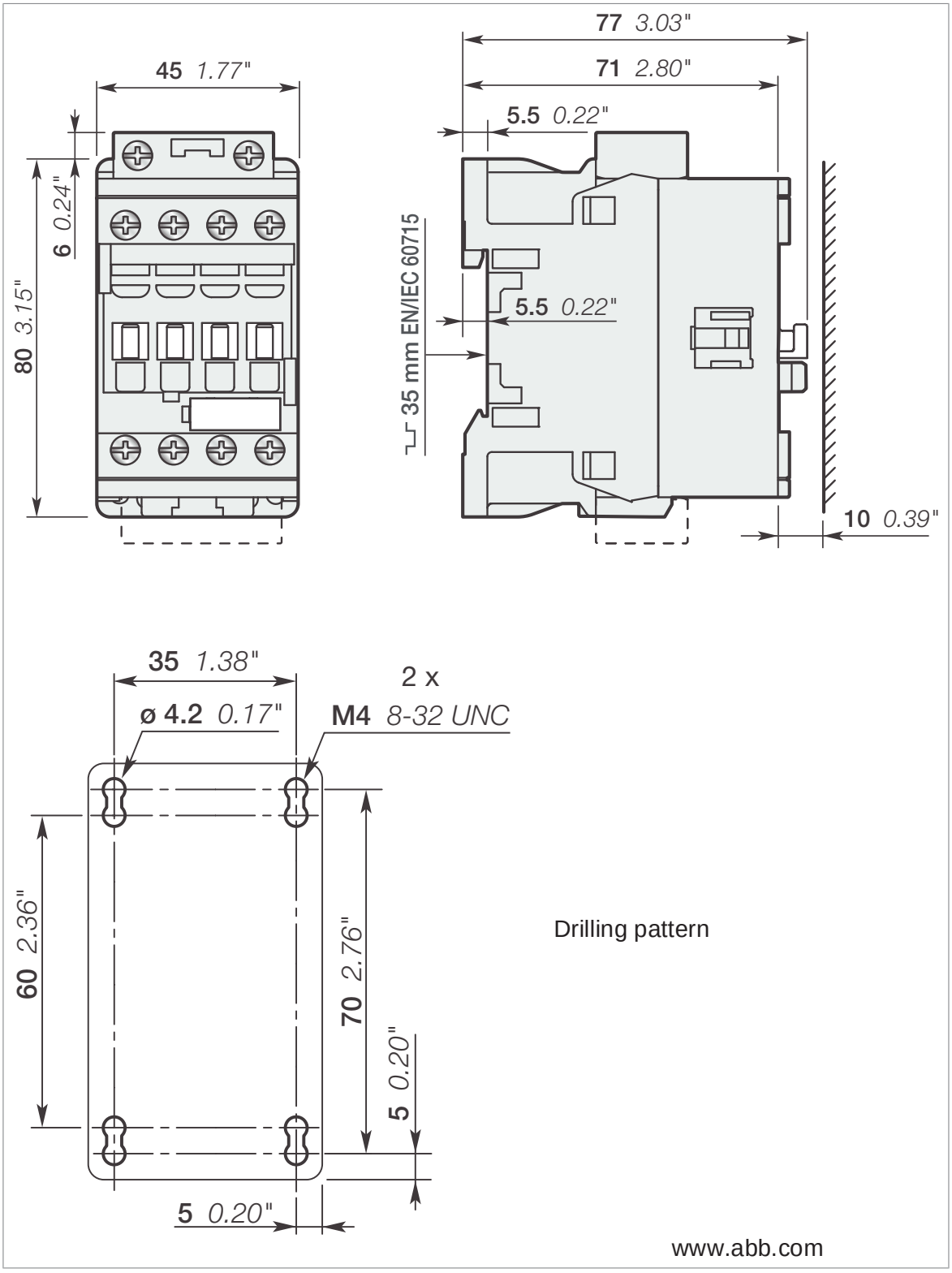
Handle OHB65J6



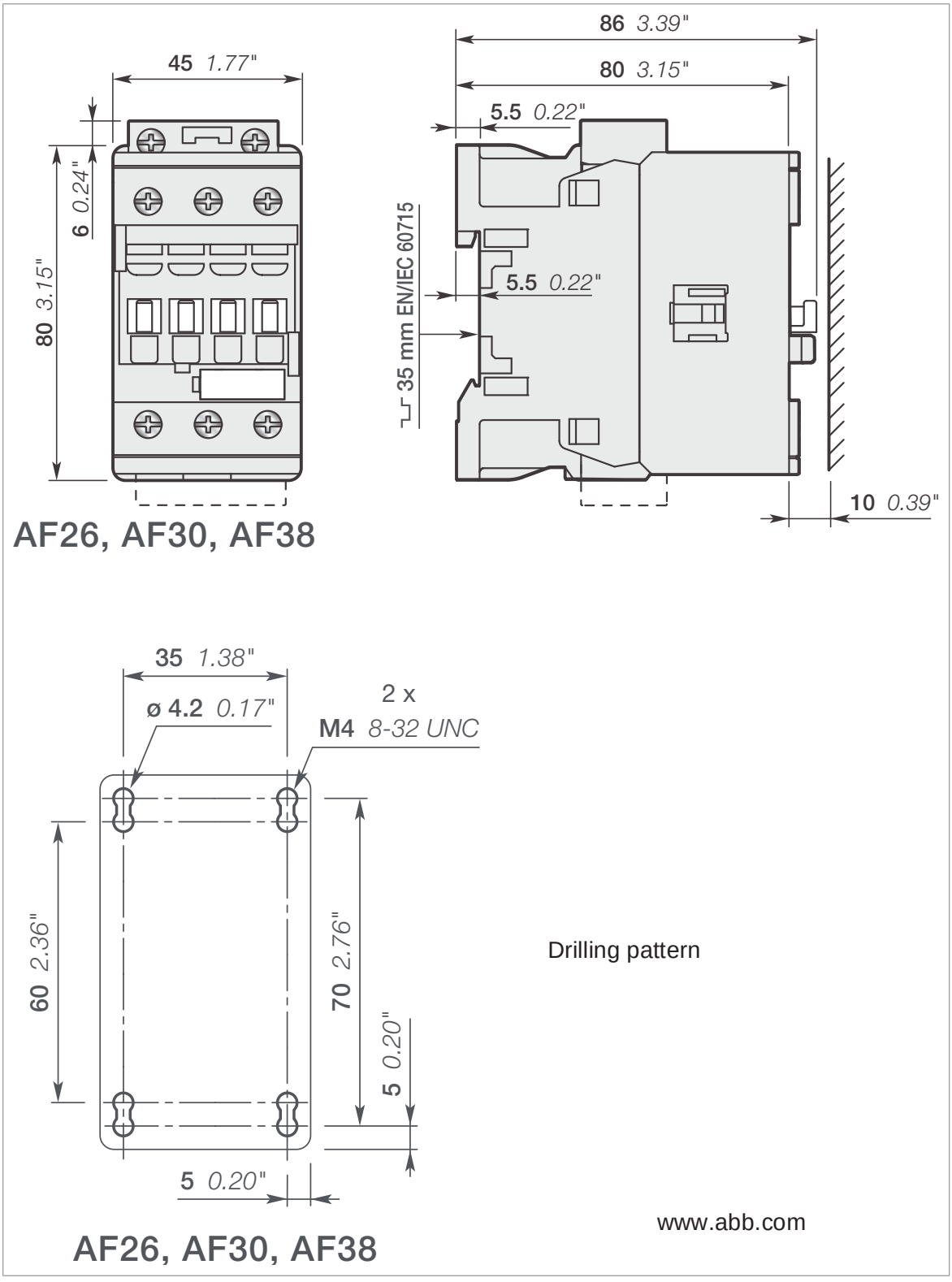
Handle type	L (mm)	B (mm)	Notes
OHB65J6	65	6 × 6	Used with OS_, OT200_

Contactors

AF16-30-10-13

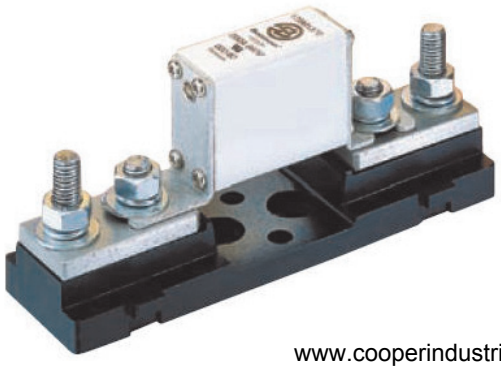


AF26-30-00-13


45 1.77"
6 0.24"
80 3.15"
86 3.39"
80 3.15"
5.5 0.22"
5.5 0.22"
35 mm EN/IEC 60715
10 0.39"
AF26, AF30, AF38
35 1.38"
ø 4.2 0.17"
2 x
M4 8-32 UNC
60 2.36"
70 2.76"
5 0.20"
5 0.20"
Drilling pattern
www.abb.com
AF26, AF30, AF38

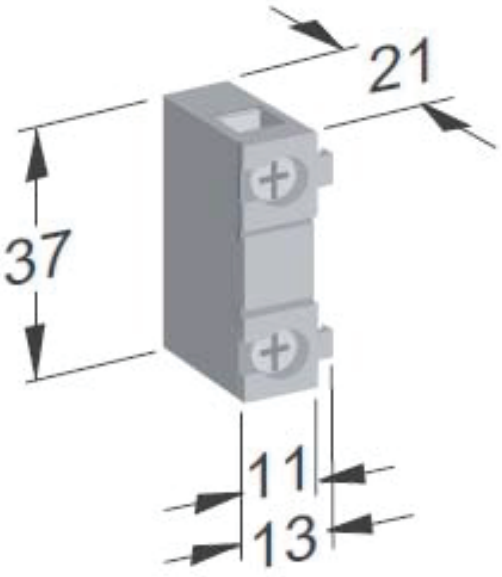
Fuse holders

170H1007



H		W		D	
mm	in	mm	in	mm	in
145	5.71	43	1.69	50.5	1.97

Auxiliary contact OA1G10

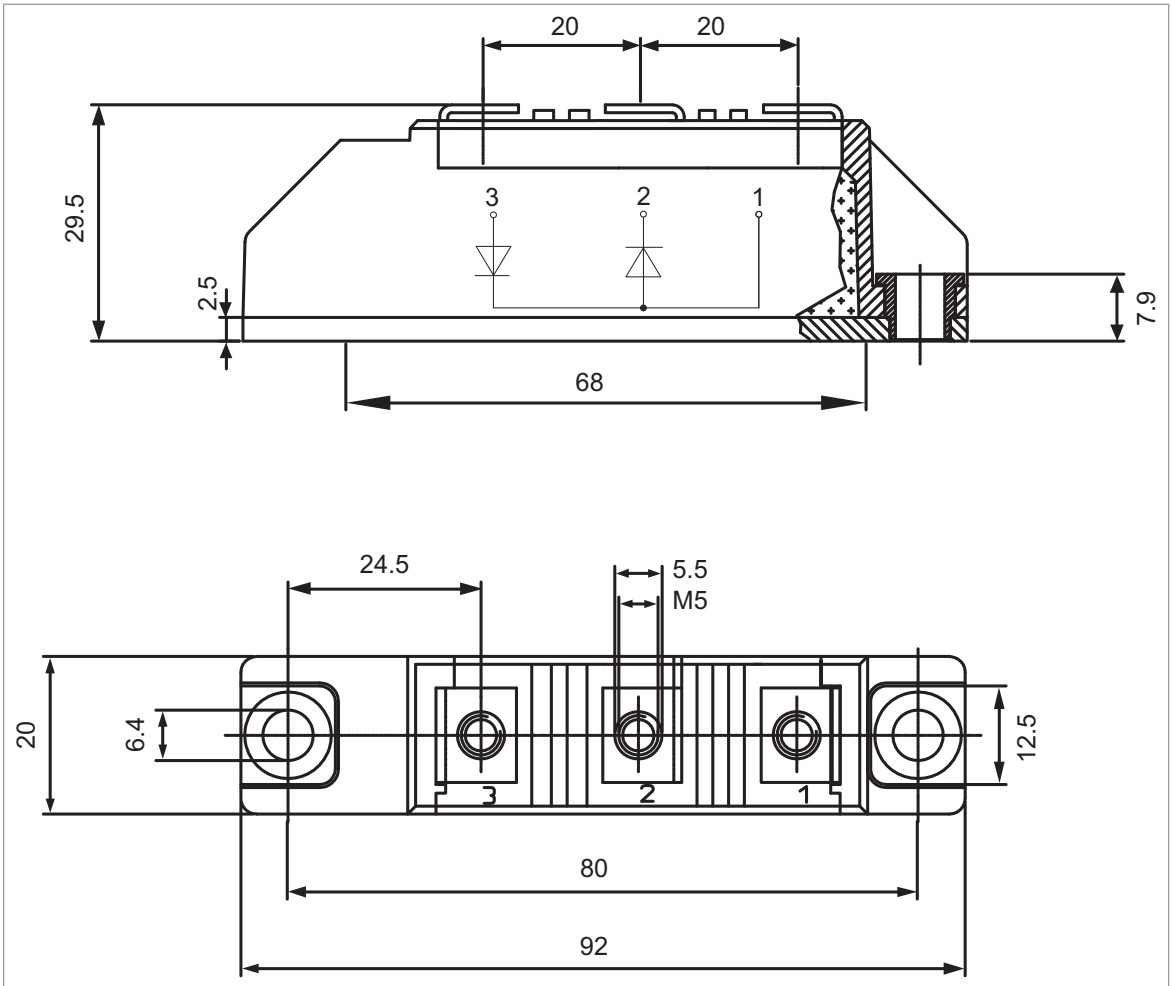


2×0.75…2.5 mm² (2×18…14 AWG)

0.8 N·m (7 lbf·in)

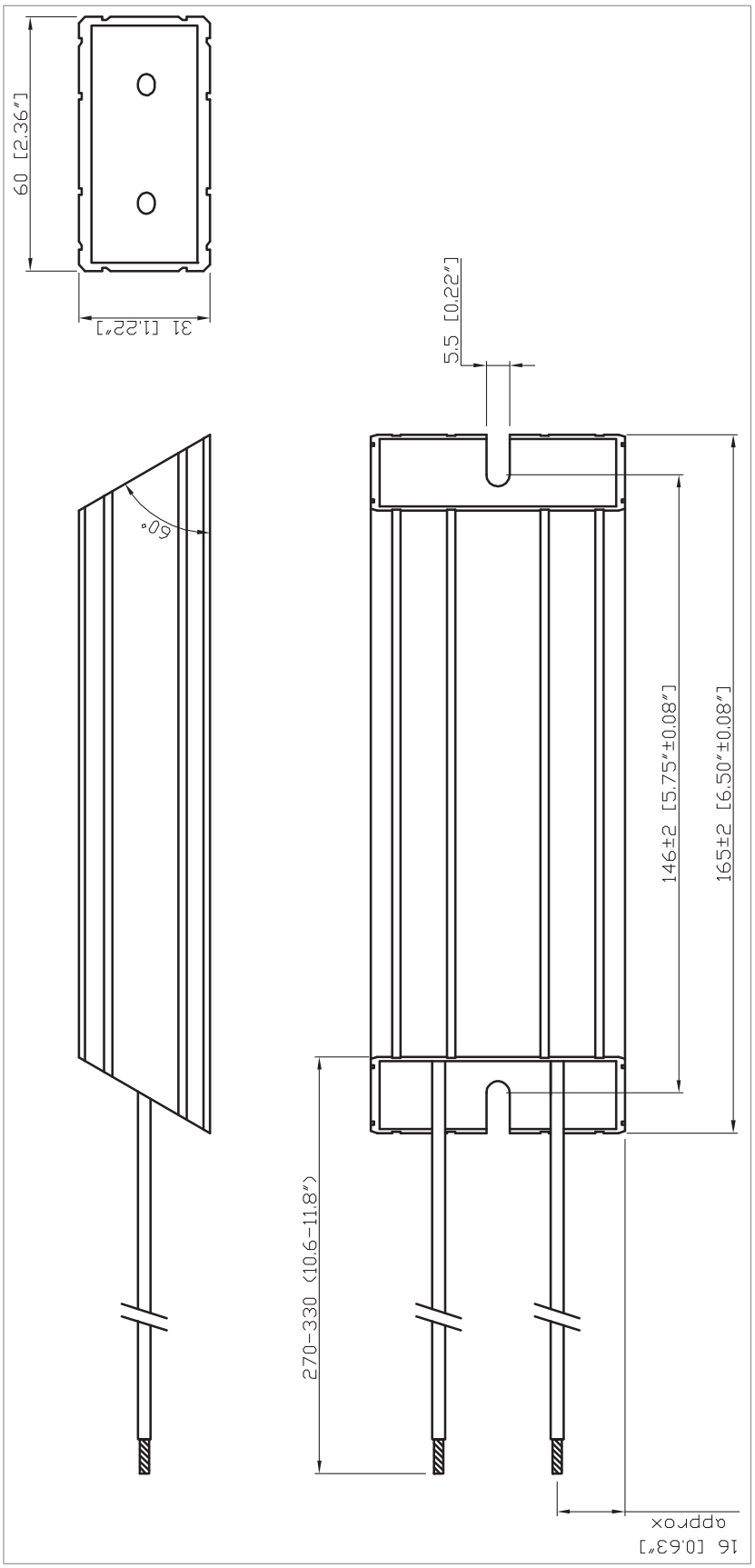
Pozidriv M3.5 Form 2

Diode bridge SKKD 81/22H4



Dimensions in mm
1 mm = 0.0394 in
www.semikron.com

Charging resistor CBH165 C



14

Example circuit diagrams

Contents of this chapter

This chapter contains two example circuit diagram sets. The diagram sets include:

- ACS880-304LC…+A019 frame 1×D8D, analog input AI2 set for charging, no FDCO-01 DDCS communication module in use, direct fan control though XRO3 from control unit
- ACS880-304LC…+A019 frames 2×D8D, FDCO-01 DDCS communication module (inverter unit – supply unit communication) in use, CIO-01 board for cabinet fan control

and with

- internal charging circuit (ABB charging kit inside supply unit cubicle)
- external 115/230 V AC control and fan supply organized by the cabinet builder
- cabinet fan
- customer terminal connections (in the circuit diagrams referring to ABB SACE Emax 2 main breaker)
- ZCU-14 control unit.

Notes:

- The IO diagram in section Default I/O connection diagram shows the default IO settings of the ACS880 diode supply control program. The default parameter settings and IO connections are valid for the supply units without the charging circuit.
- These diagrams do not necessarily match the installation-specific circuit diagrams of a tailor-made cabinet-installed unit.

The purpose of these diagrams is to help in:

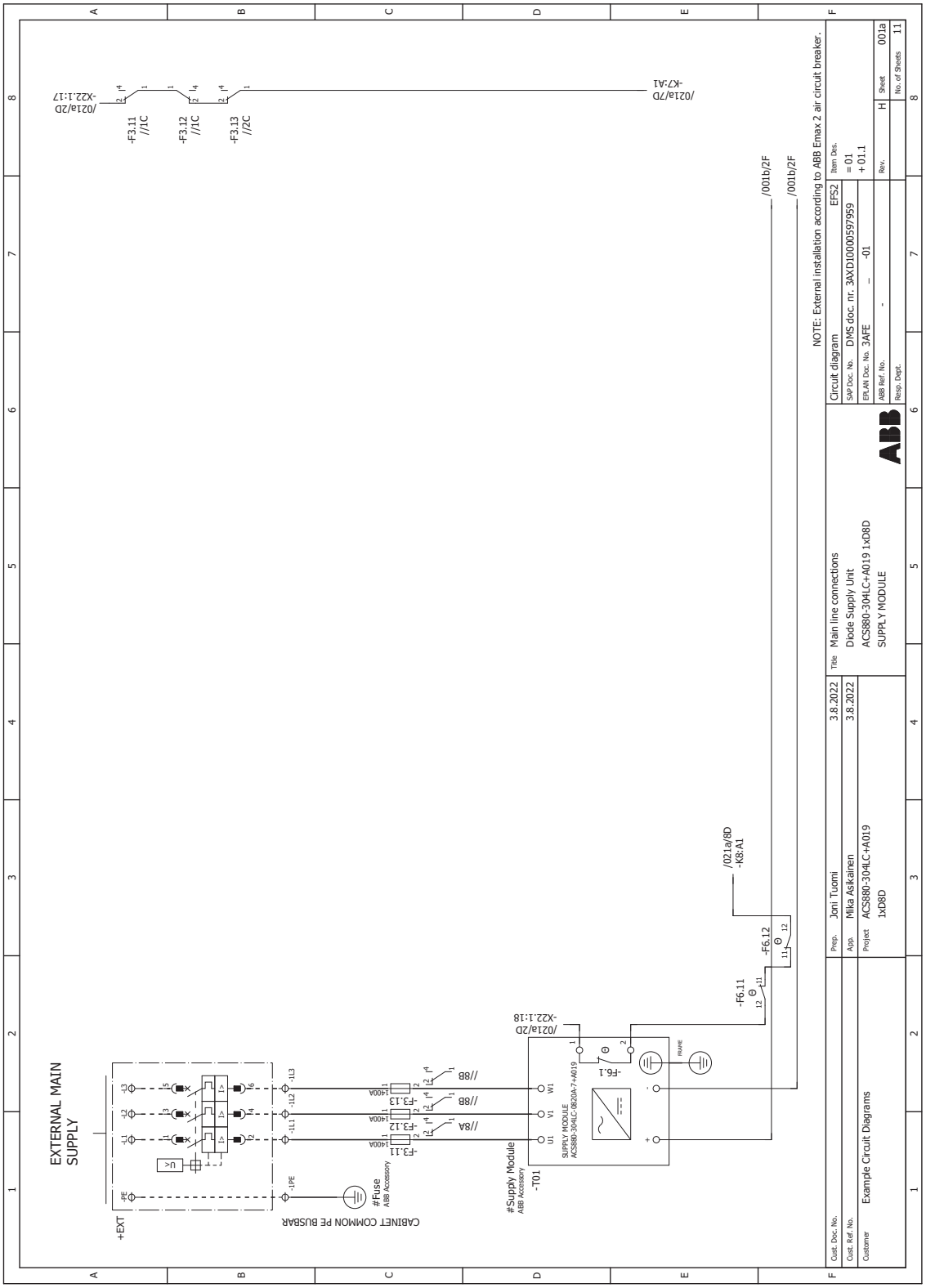
- understanding the internal connections and operation of the cabinet-installed drive with a diode supply unit, and
- learning how to wire a (ACS880-304LC…+A019) diode supply module when installed in a user-defined cabinet.

Component designations used in the diagrams

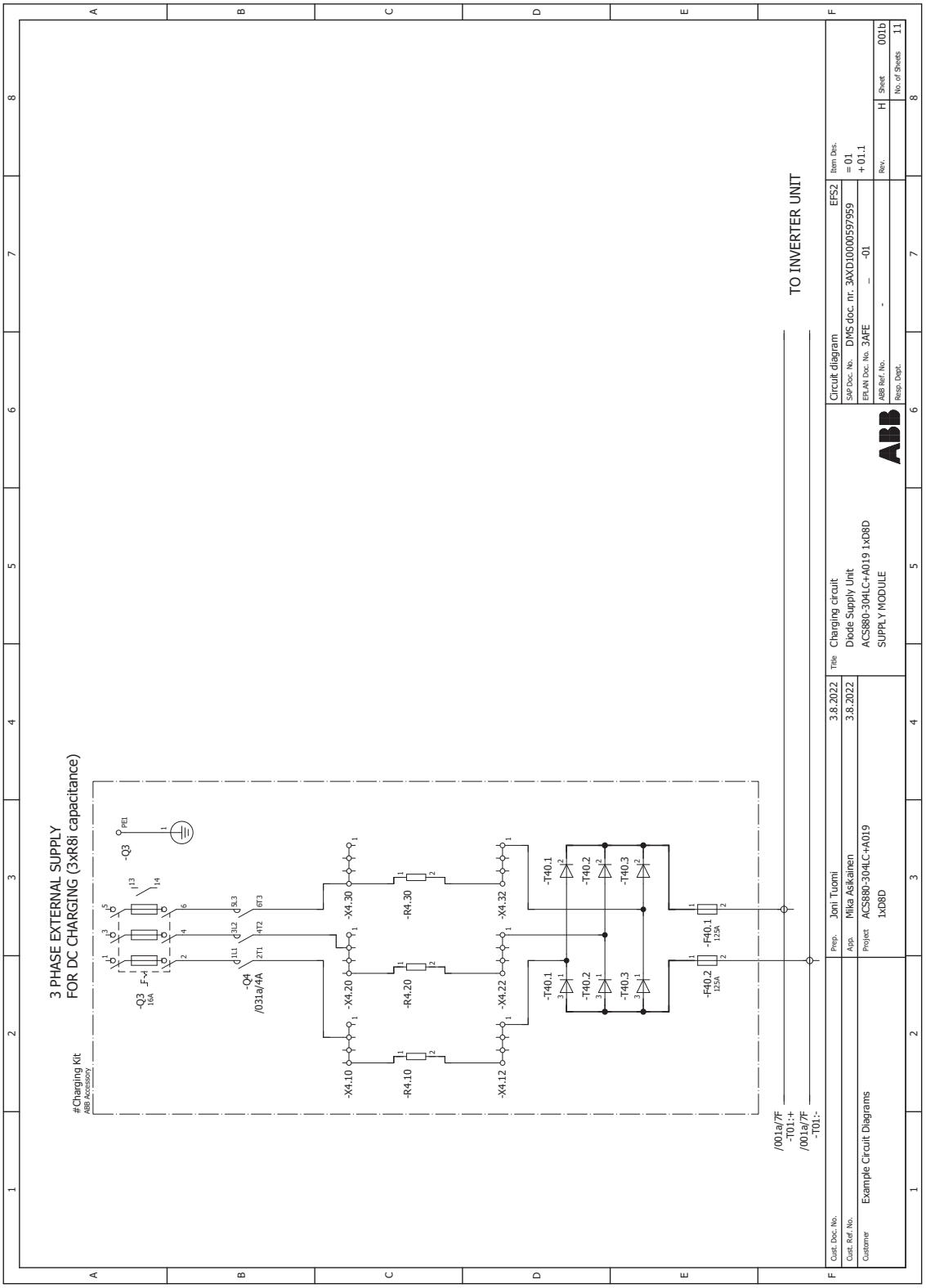
The circuit diagrams include:

Designation	Component
A51	ZCU-14 control unit
A51_MEM	ZMU-02 memory unit kit
A57	FDPI-02 diagnostics and panel interface
A58	DDPI board, included in a DPMP-01 panel mounting platform kit
A59	ACS-AP-W control panel
A115.10	CIO-01 fan control kit
A518	FDCO-0x DDCS communication module
F3.11…F3.43	AC fuses for protecting the supply module
F6.1	Thermal switch for temperature supervision inside the supply module
F6.11…F6.14	Thermal switches for cabinet temperature supervision
F20, F22.x	Circuit breakers, auxiliary voltage circuits
F40.x	Charging DC fuses
G115	Cabinet fan
Q3	Charging switch fuse
Q4	Charging contactor
Q20, Q22	Auxiliary voltage switch-disconnector
Q26	Fan contactor
R4.xx	Charging resistor
S21	Operating switch
T01…T04	D8D diode supply module (ACS880-304LC…+A019)
T22	24 V DC power supply
T40.x	Charging diode bridge
X4	Terminal block

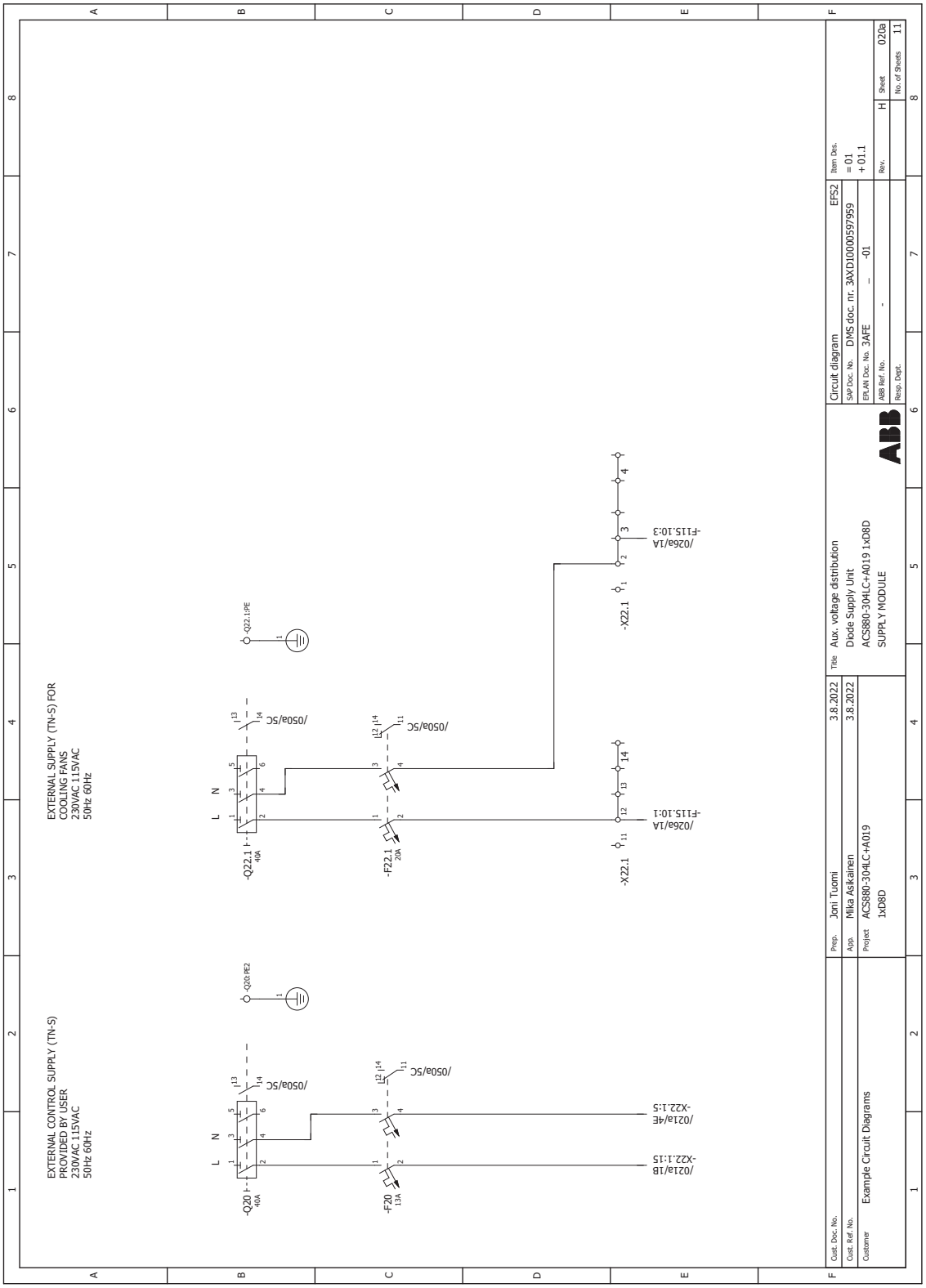
Frame 1×D8D – Main line connections (sheet 001a)



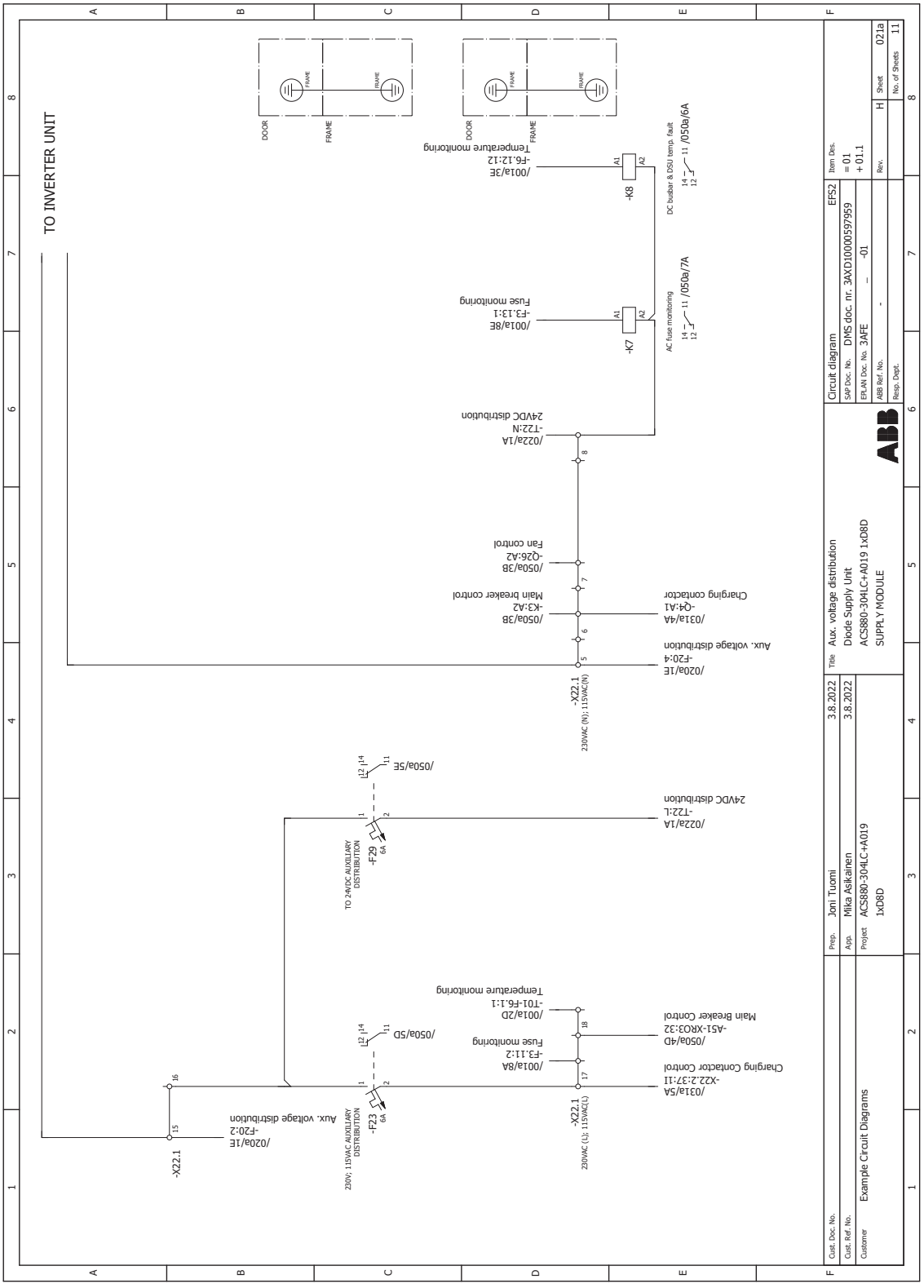
Frame 1×D8D – Charging circuit (sheet 001b)



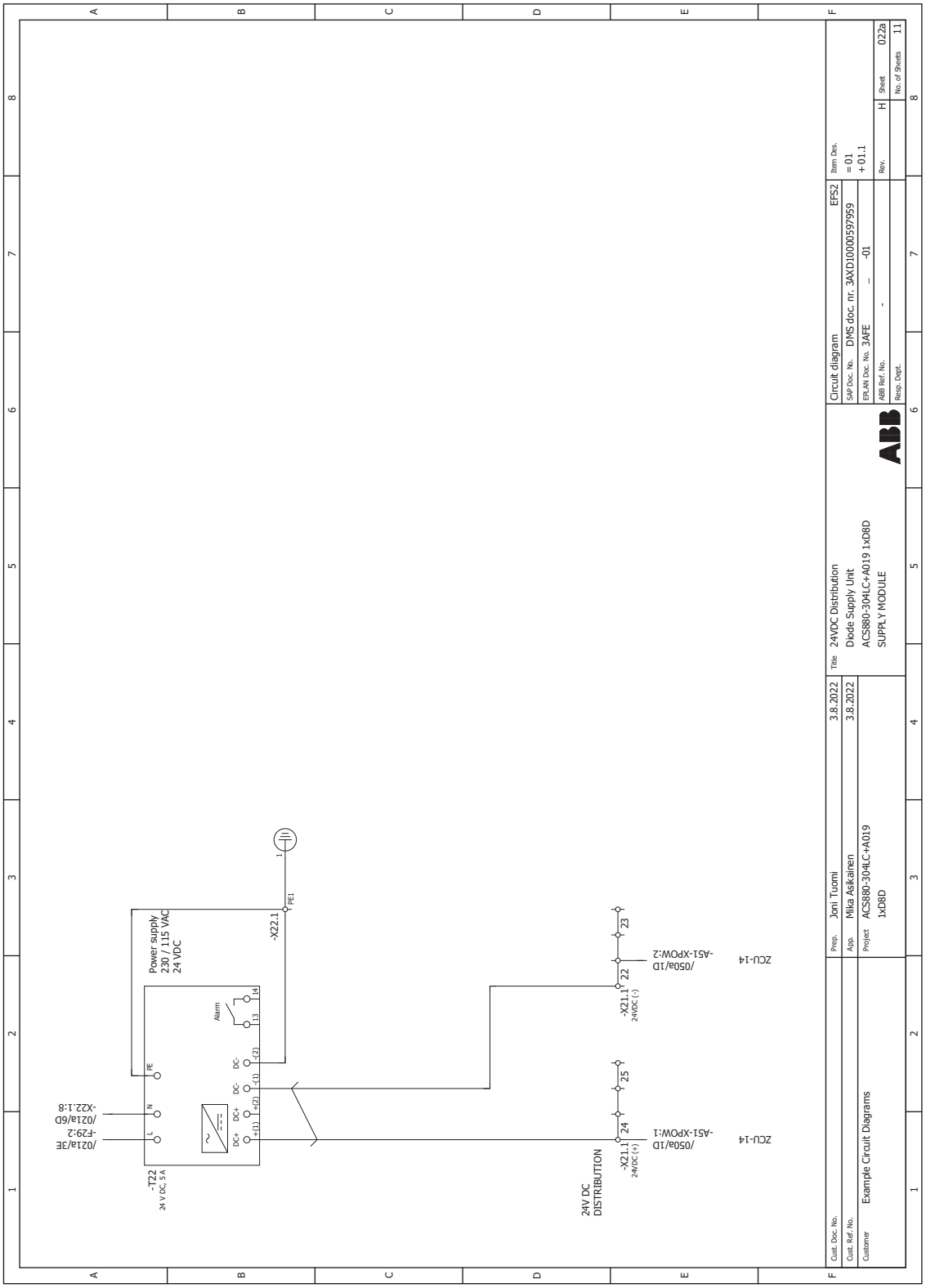
Frame 1×D8D – Auxiliary voltage distribution (sheet 020a)



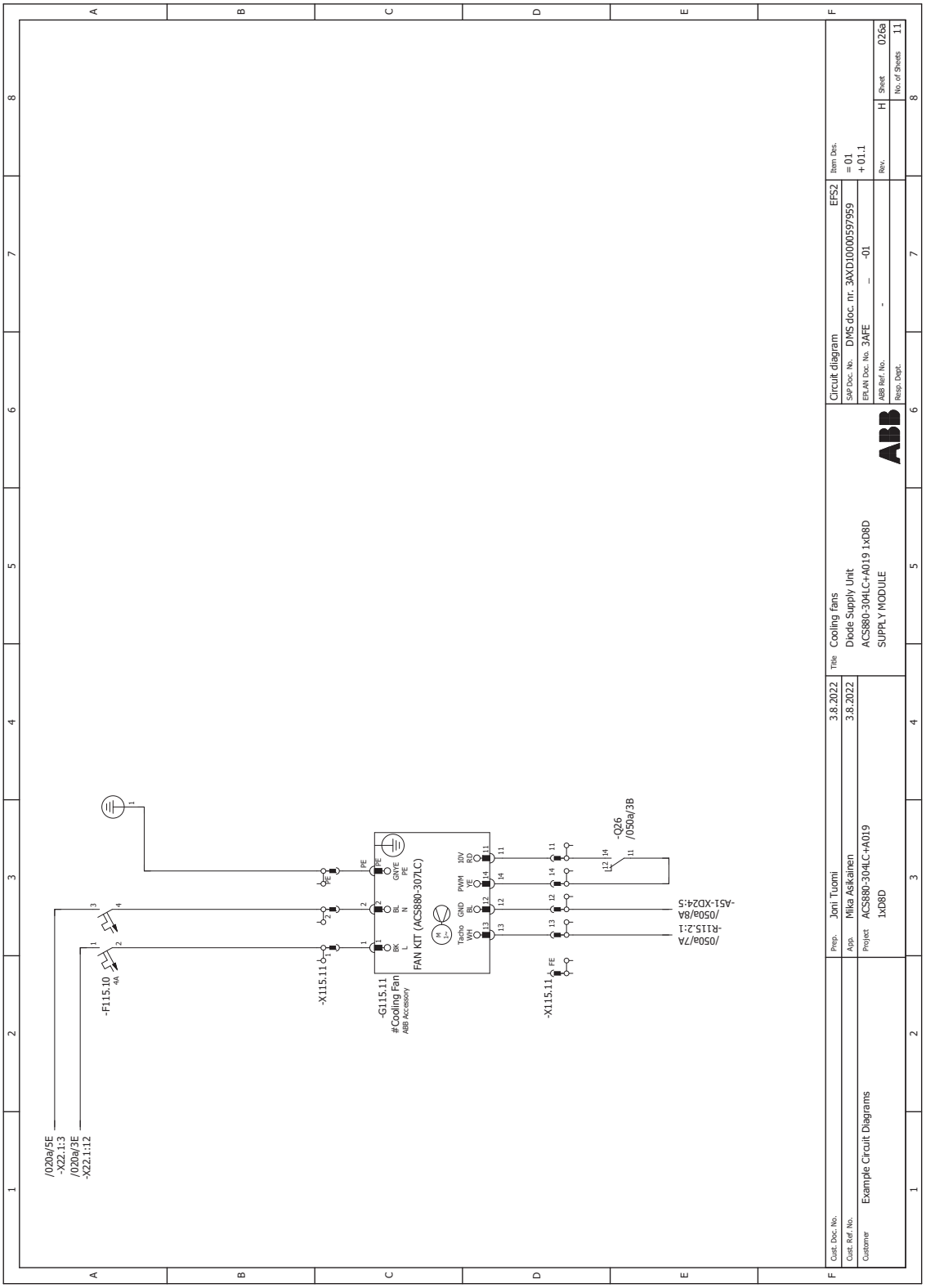
Frame 1×D8D – 115/230 V AC distribution (sheet 021a)



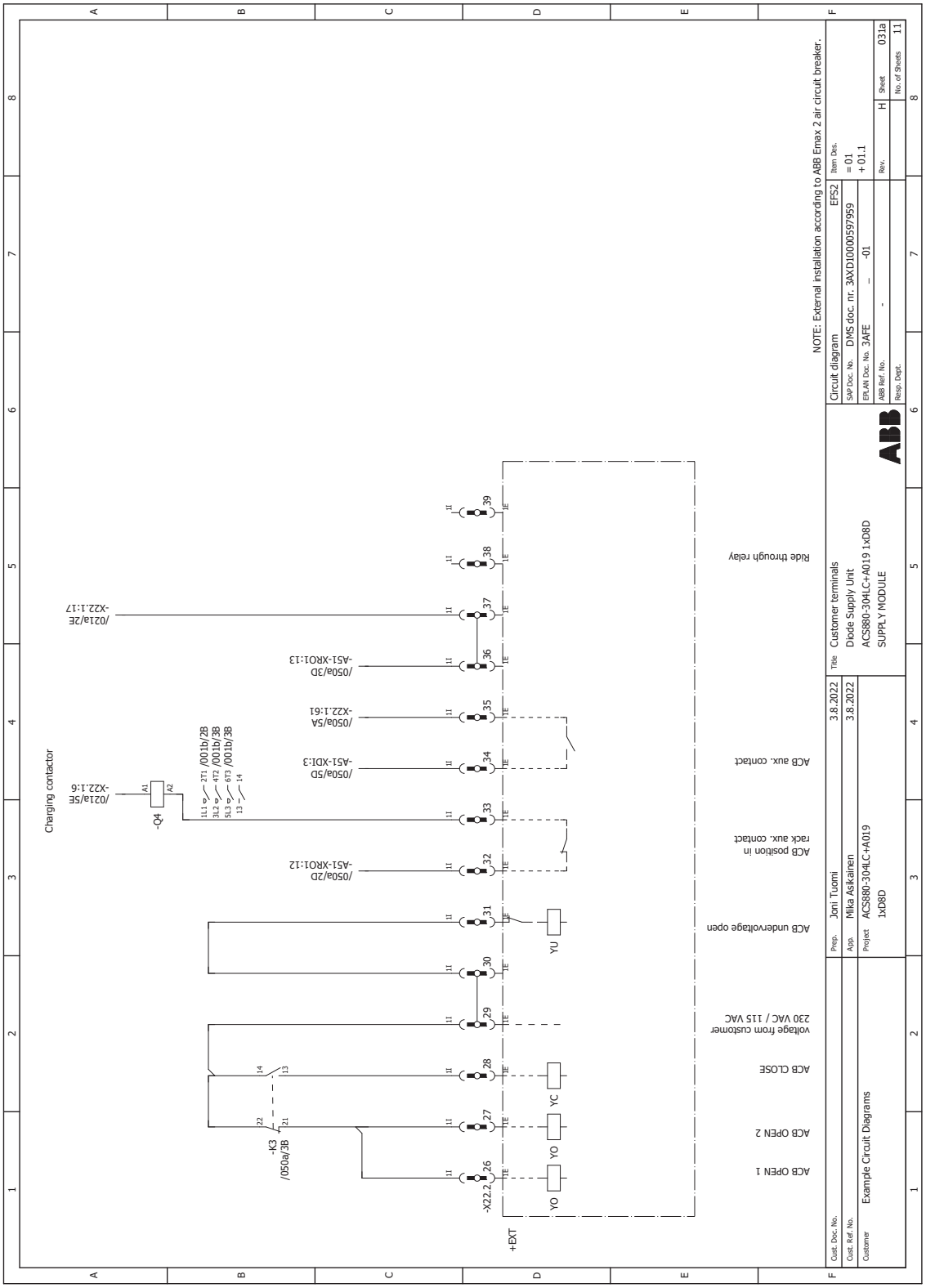
Frame 1×D8D – 24 V DC distribution (sheet 022a)



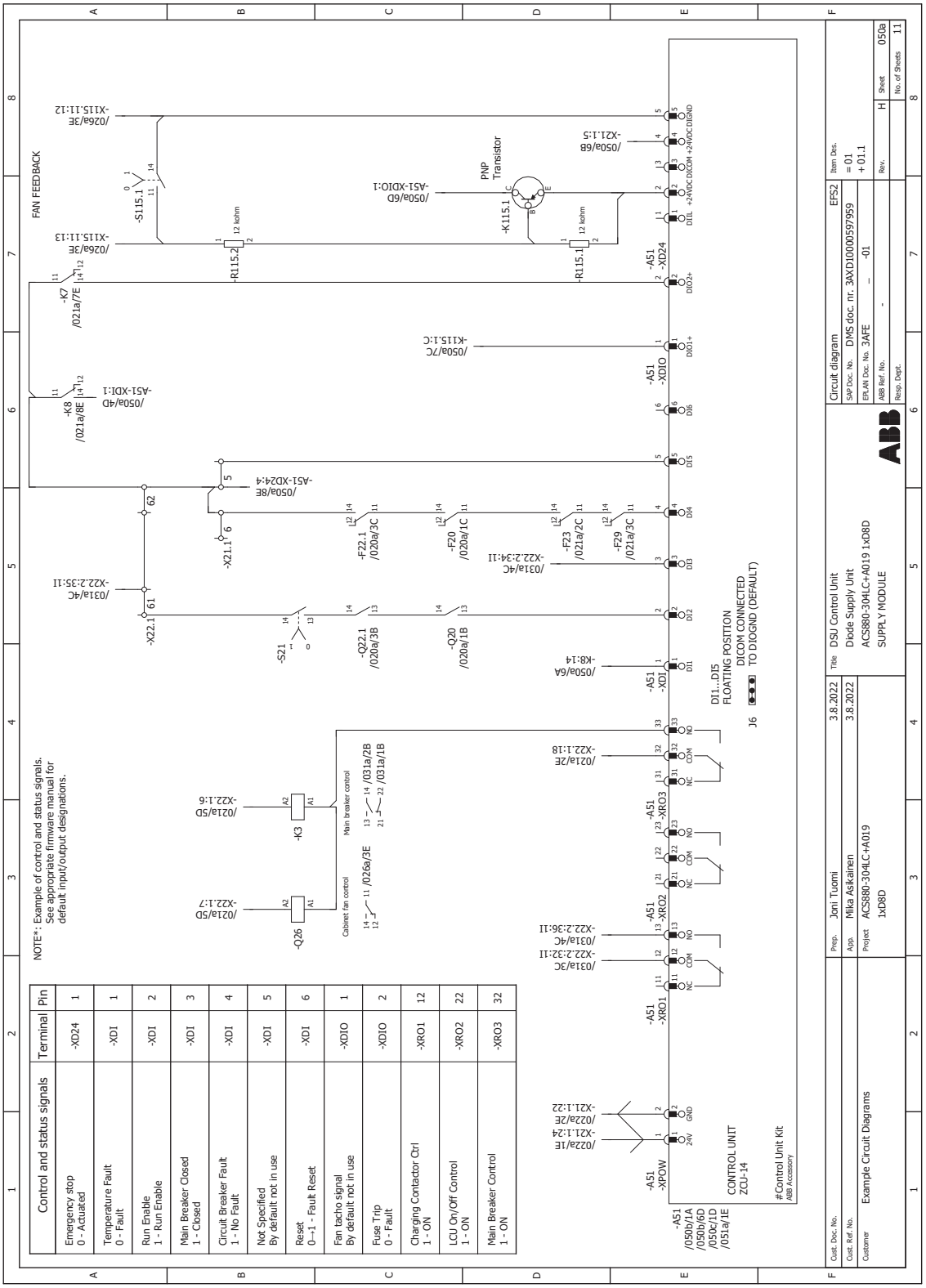
Frame 1×D8D – Cabinet fans (sheet 026a)



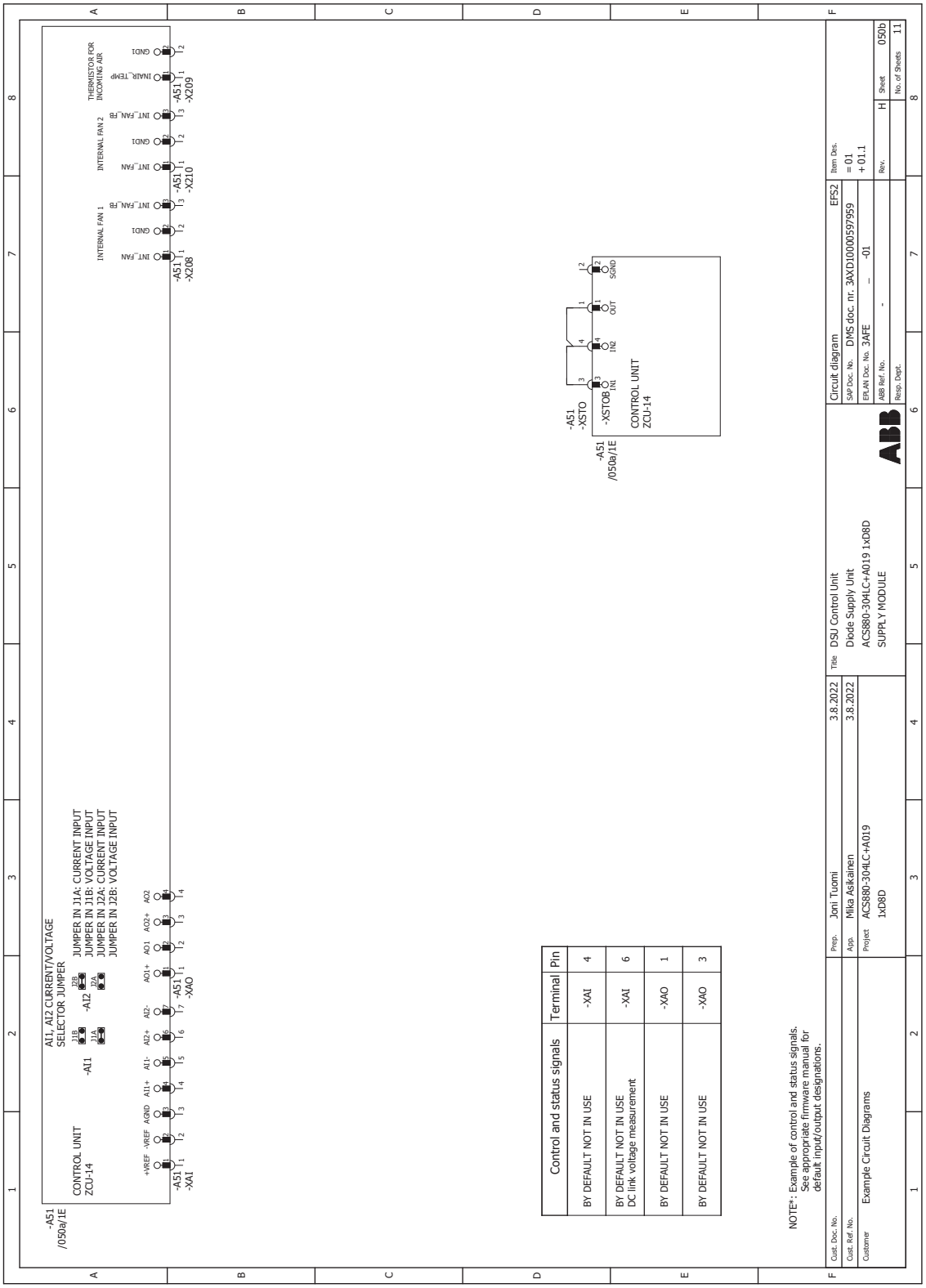
Frame 1×D8D – Customer terminals (sheet 031a)



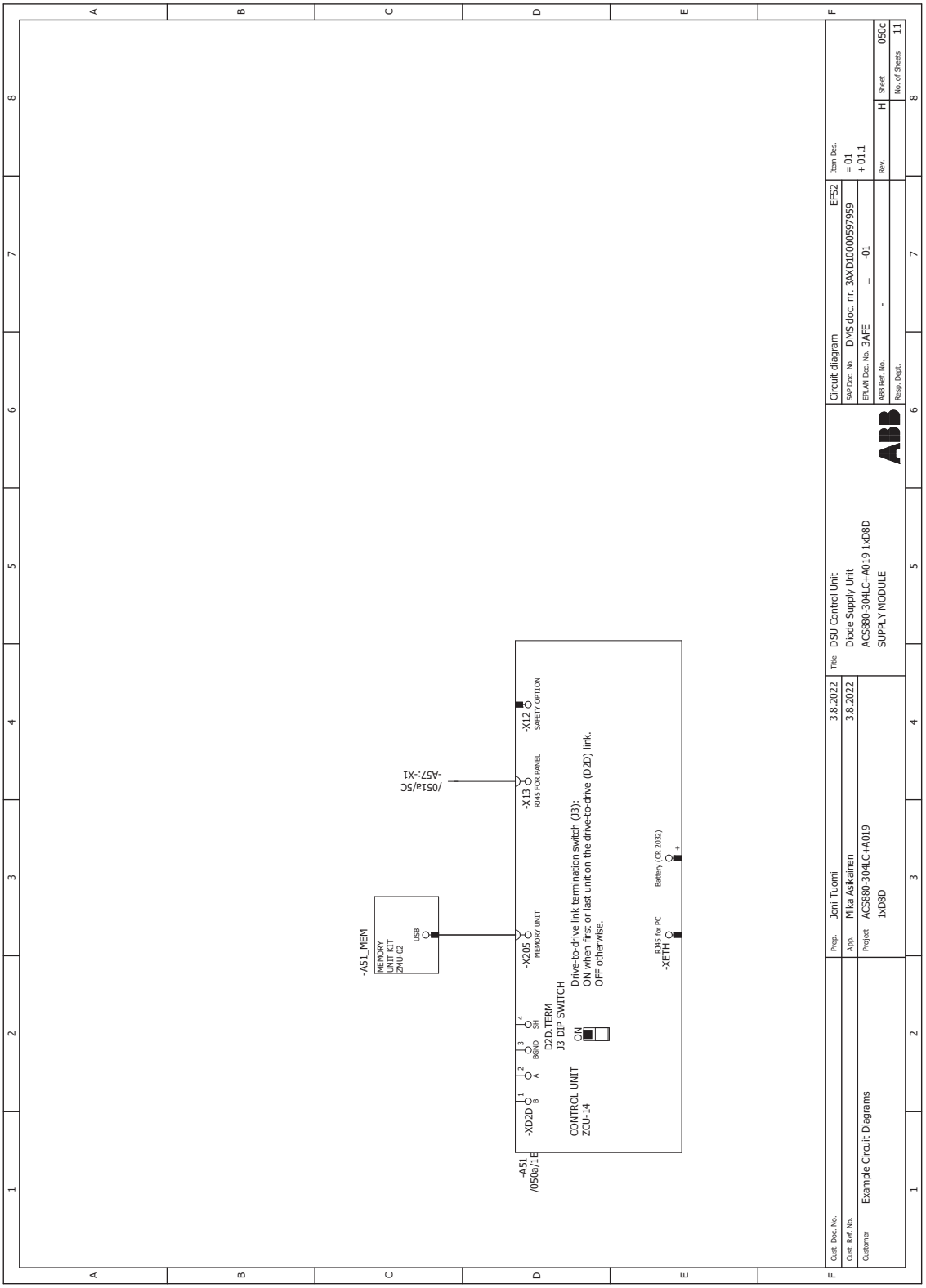
Frame 1×D8D – Supply control board (sheet 050a)



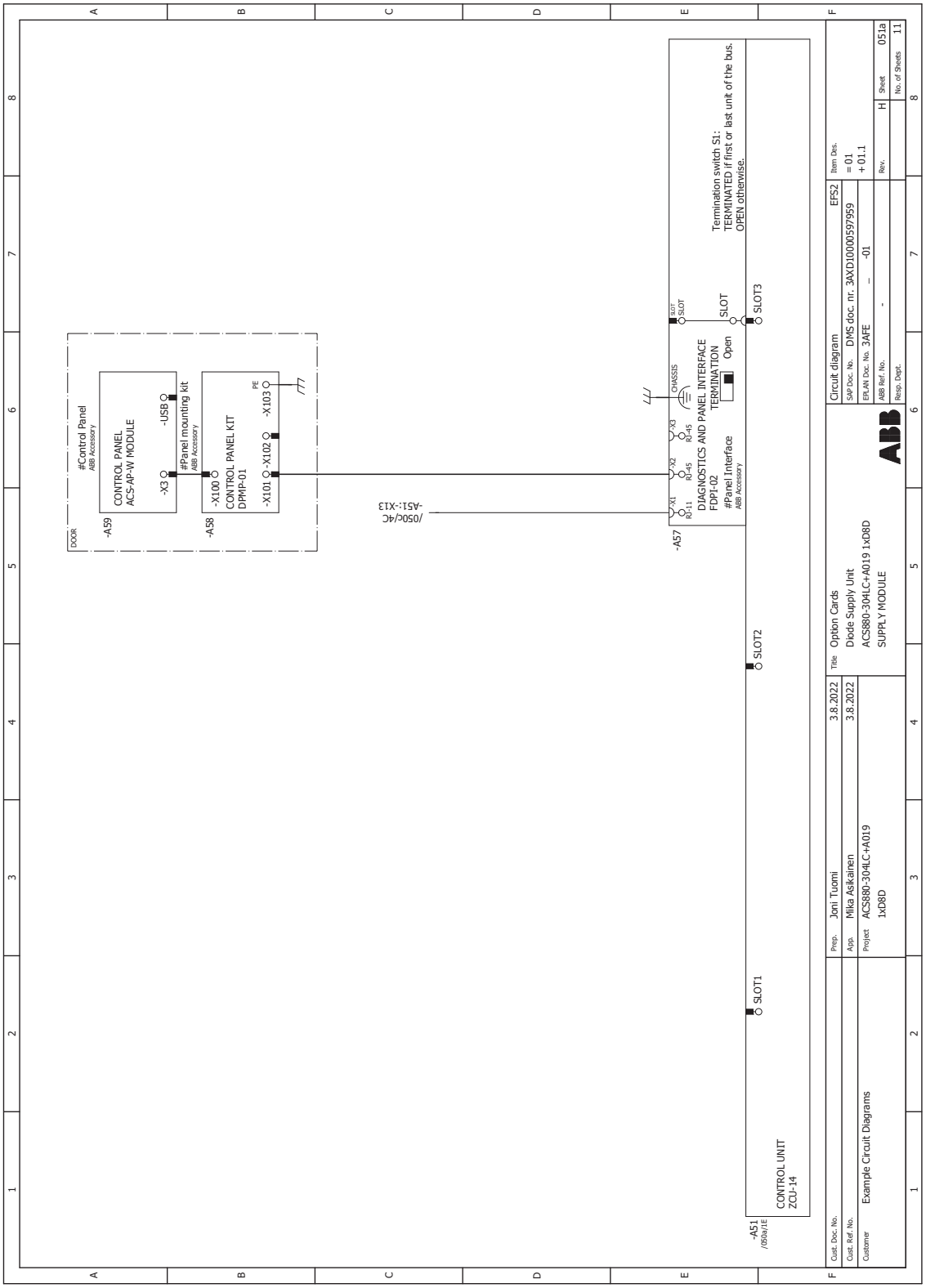
Frame 1×D8D – Supply control board (sheet 050b)



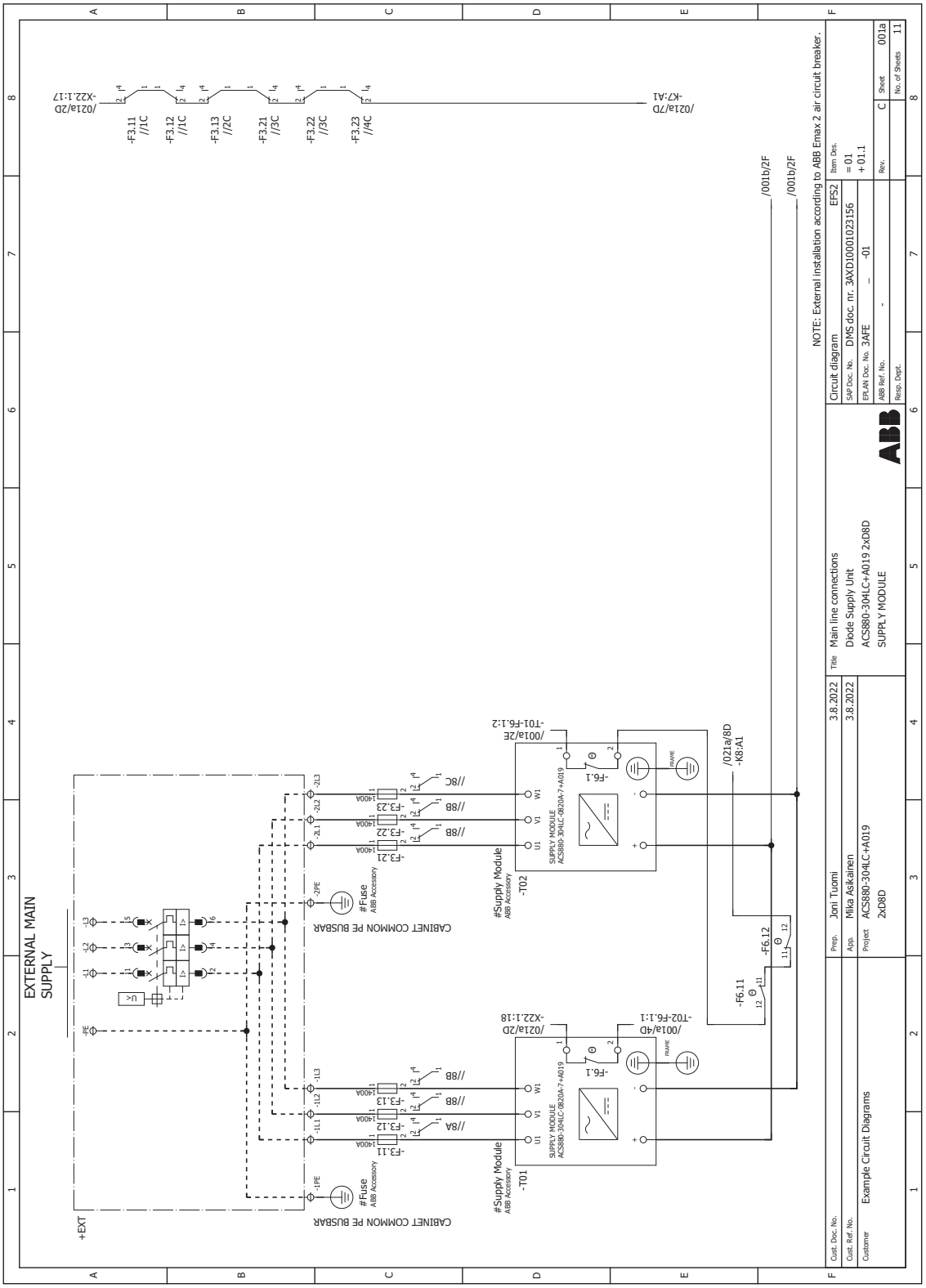
Frame 1×D8D – Supply control board (sheet 050c)



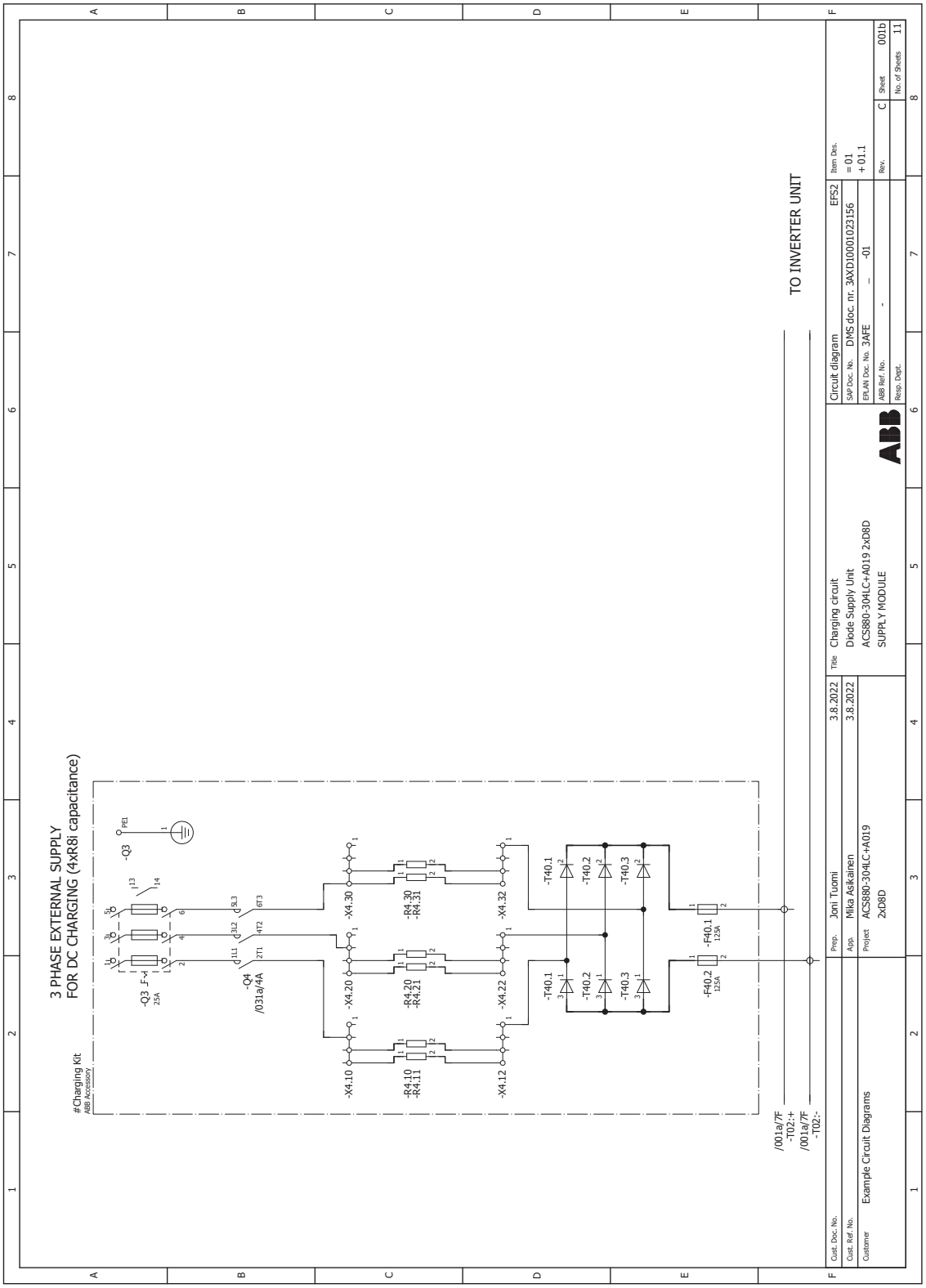
Frame 1×D8D – Option cards (sheet 051a)



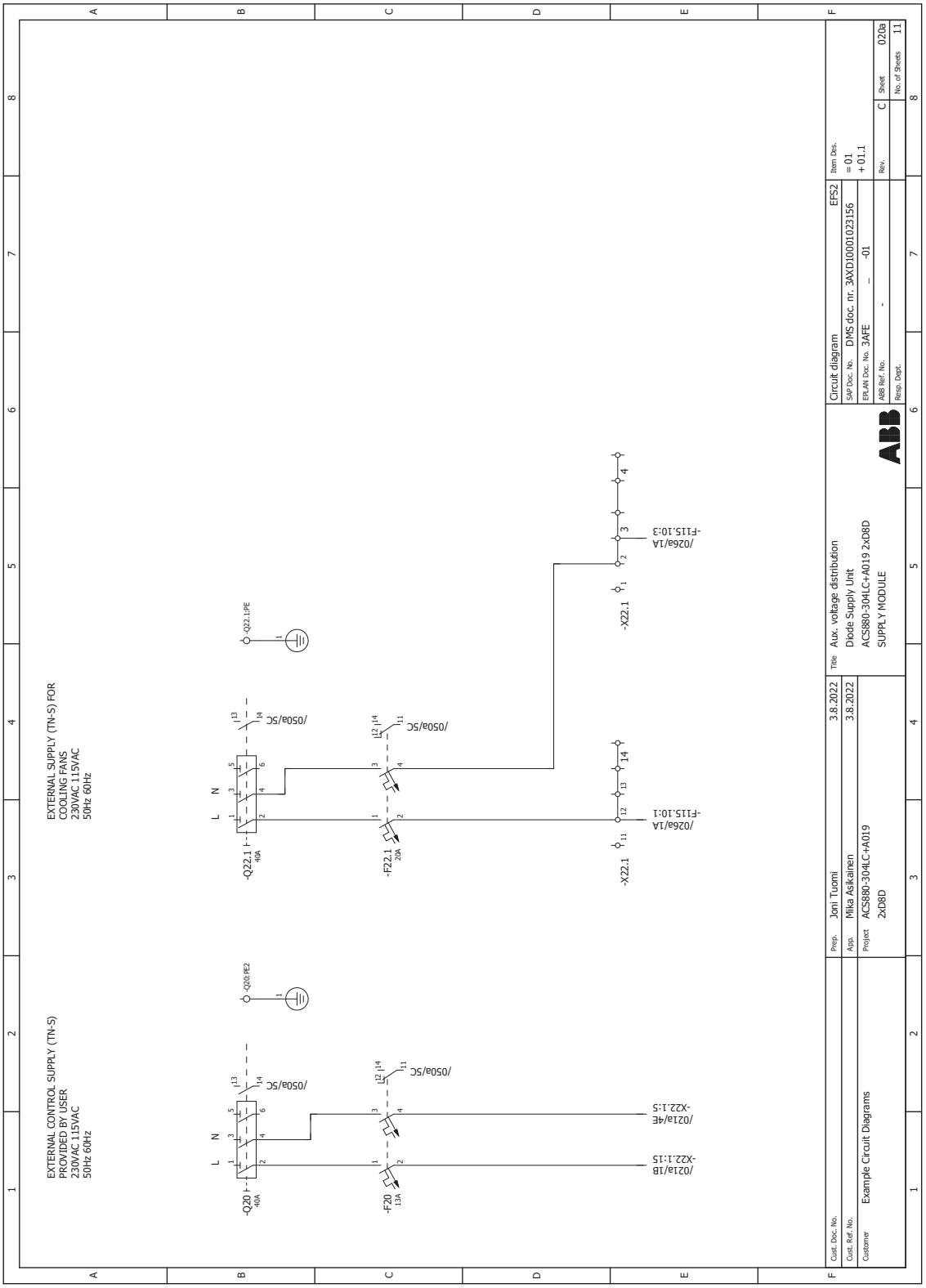
Frames 2×D8D – Main line connections (sheet 001a)



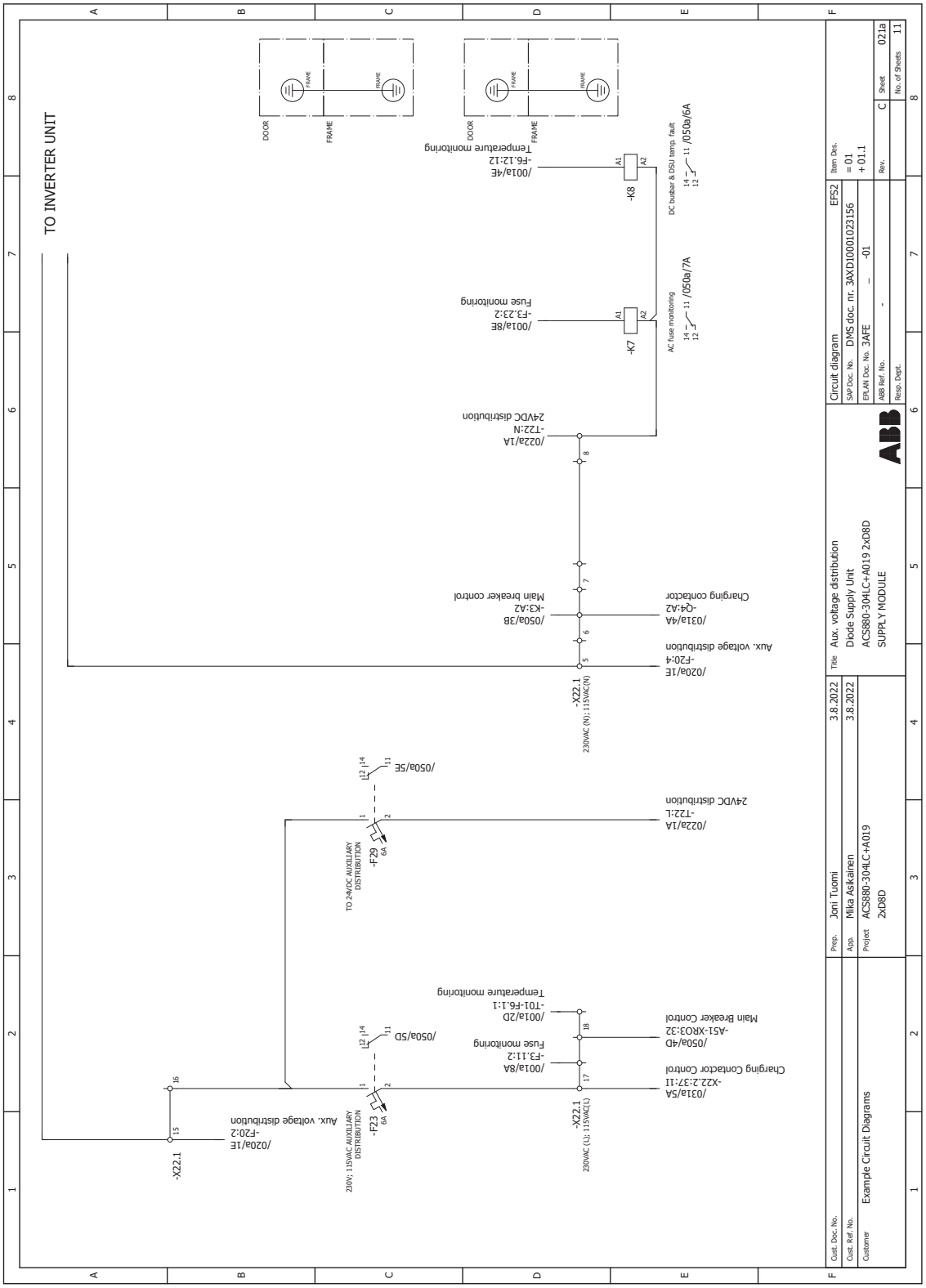
Frames 2×D8D – Charging circuit (sheet 001b)



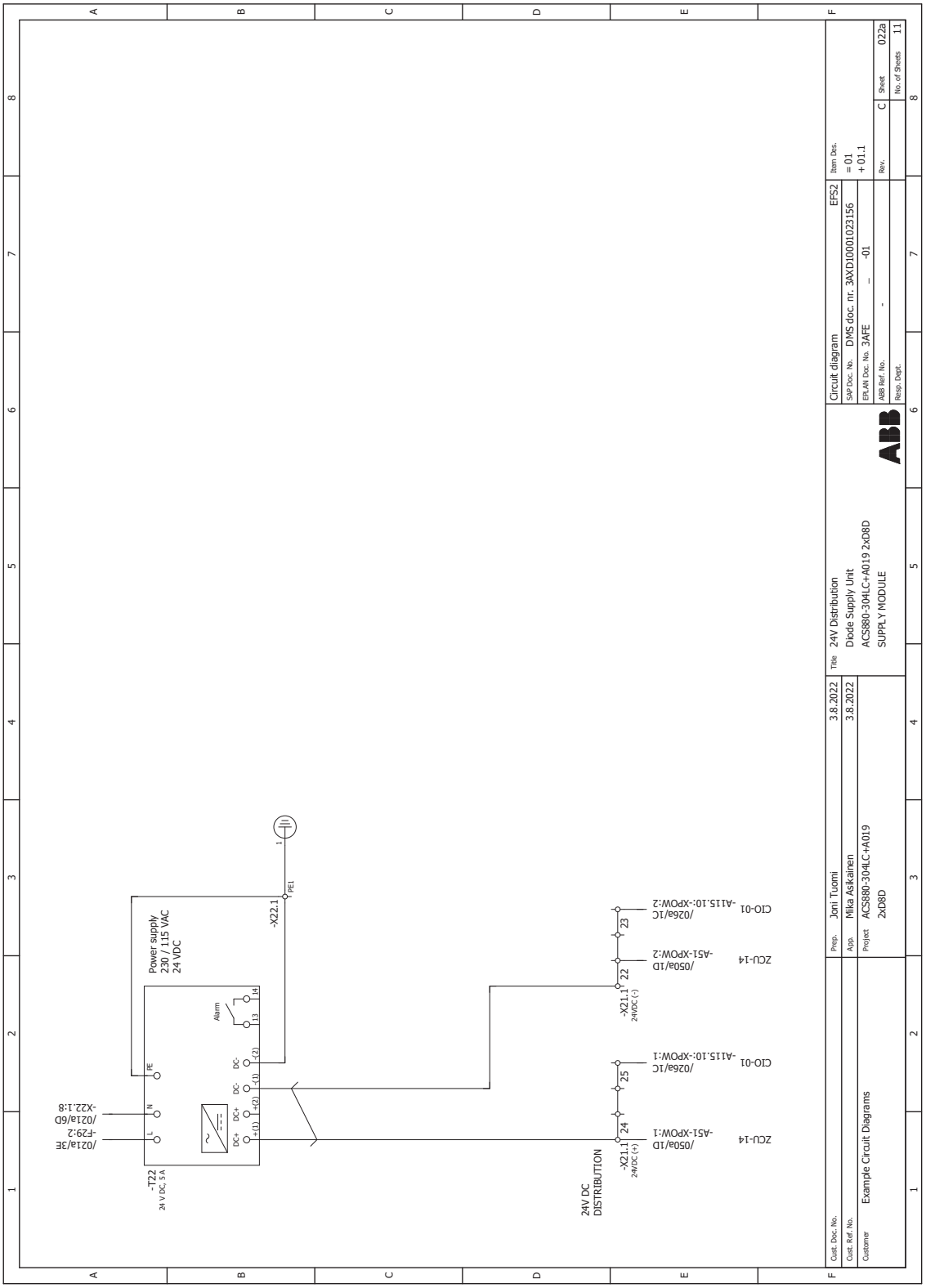
Frames 2×D8D – Auxiliary voltage distribution (sheet 020a)



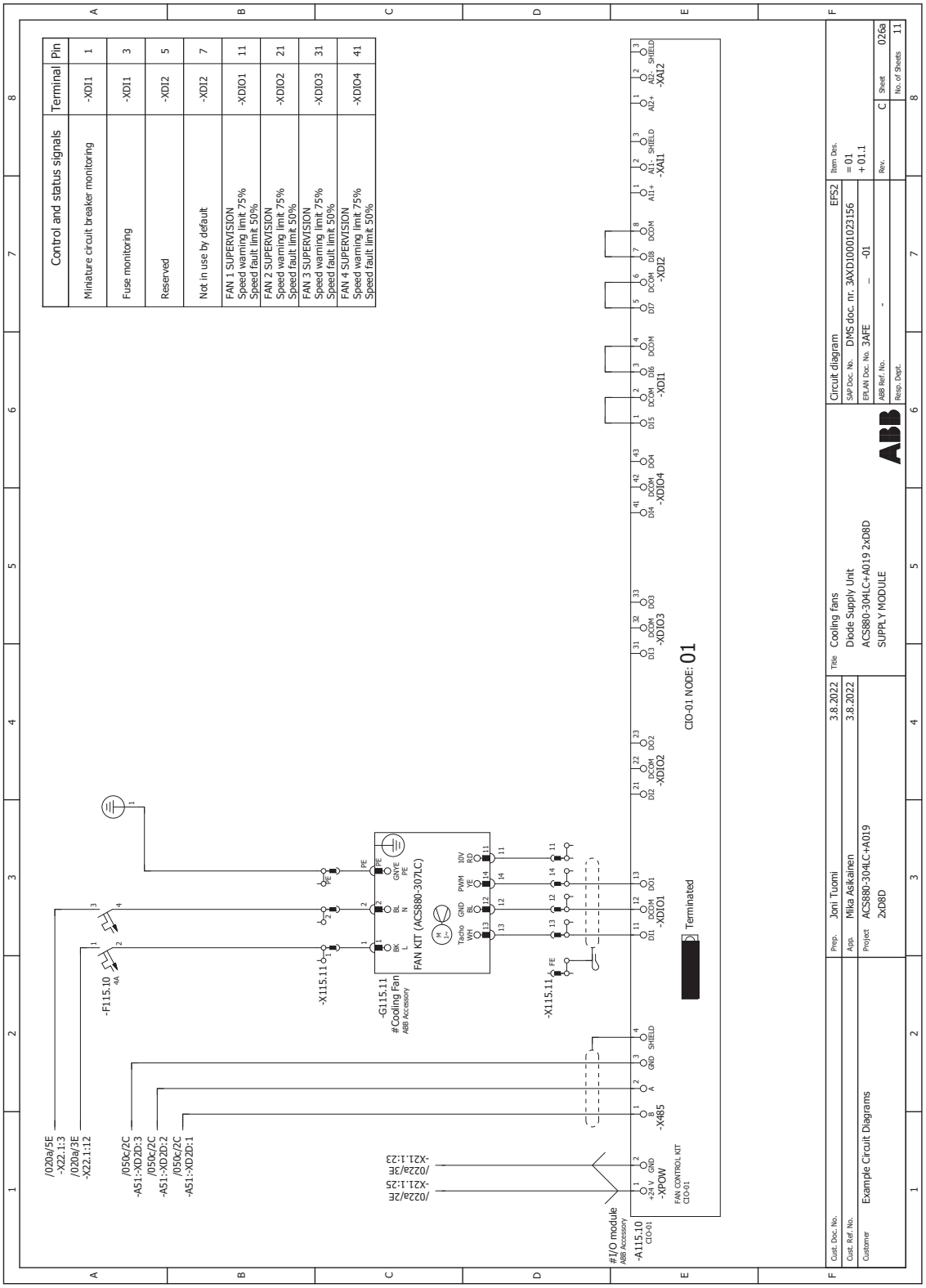
Frames 2×D8D – 115/230 V AC distribution (sheet 021a)



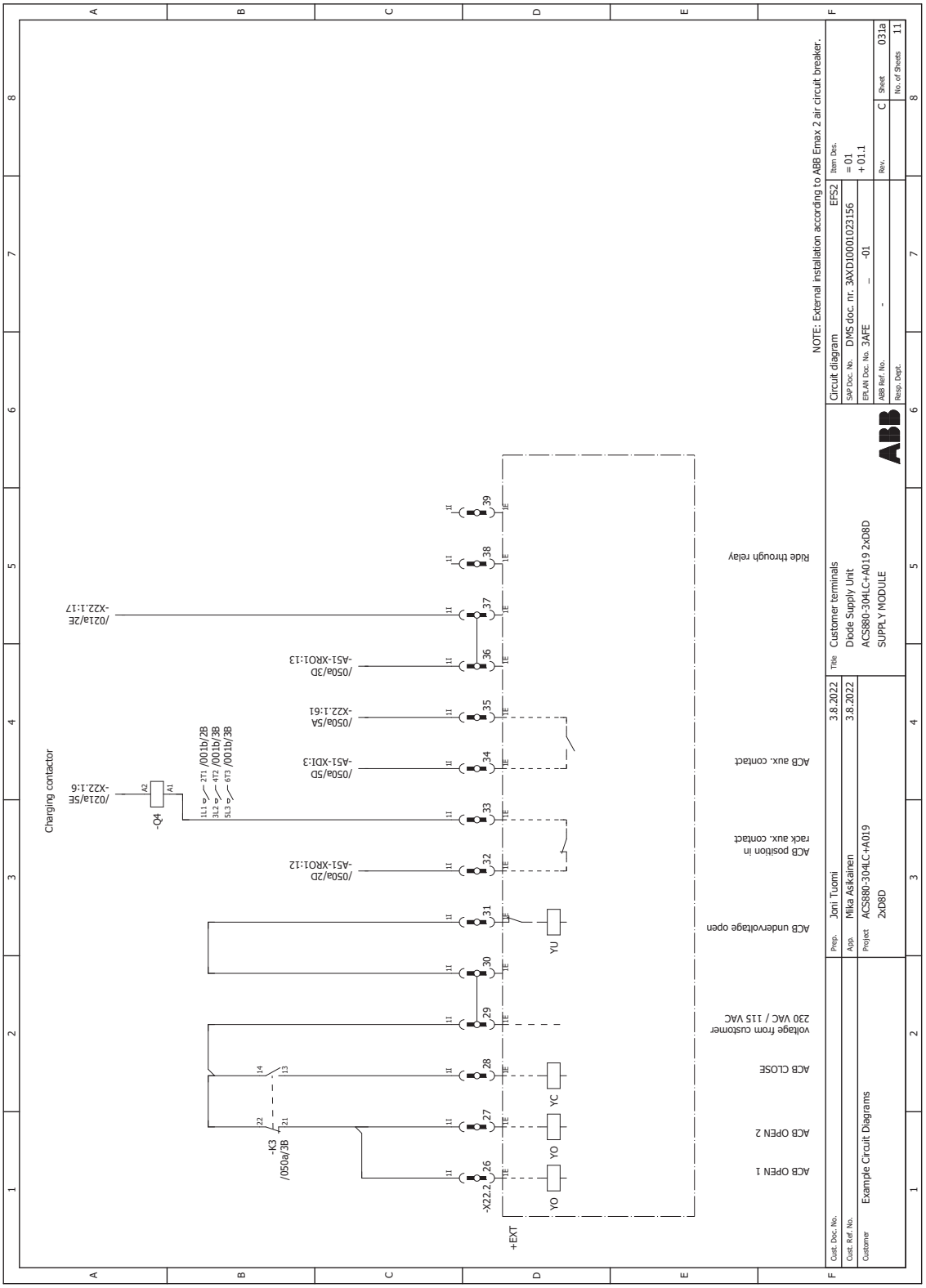
Frames 2×D8D – 24 V DC distribution (sheet 022a)



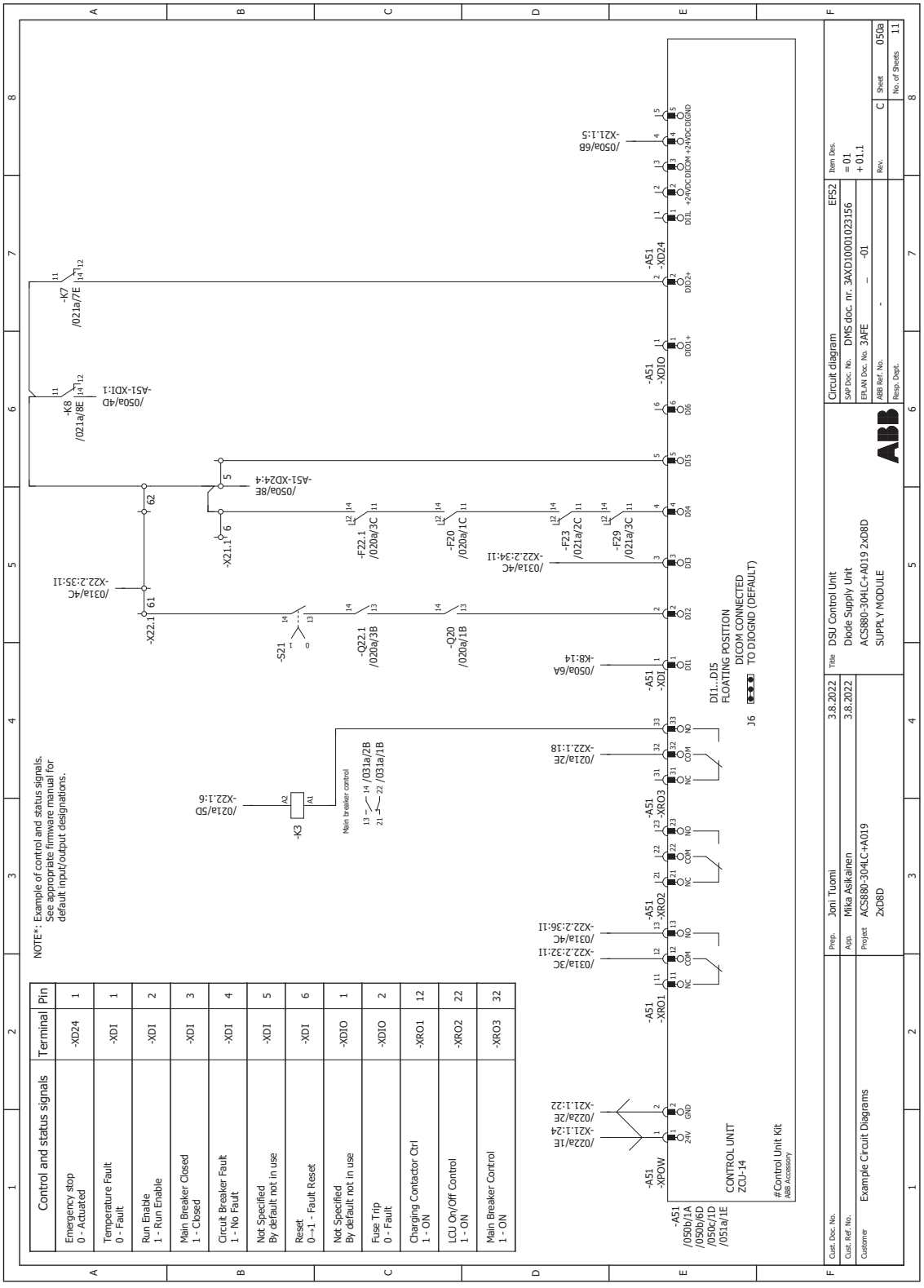
Frames 2×D8D – Cabinet fan (sheet 026a)



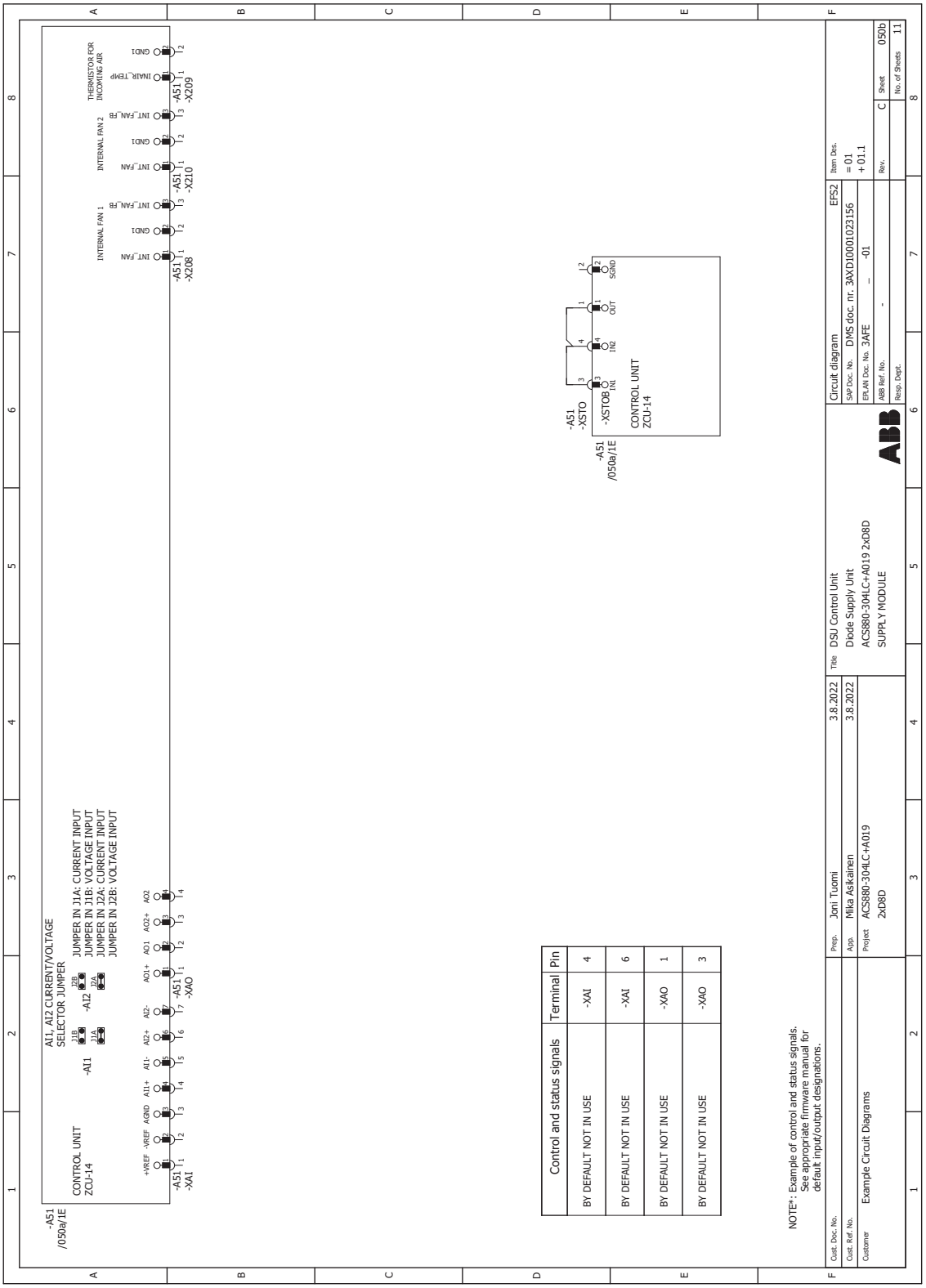
Frames 2×D8D – Customer terminals (sheet 031a)



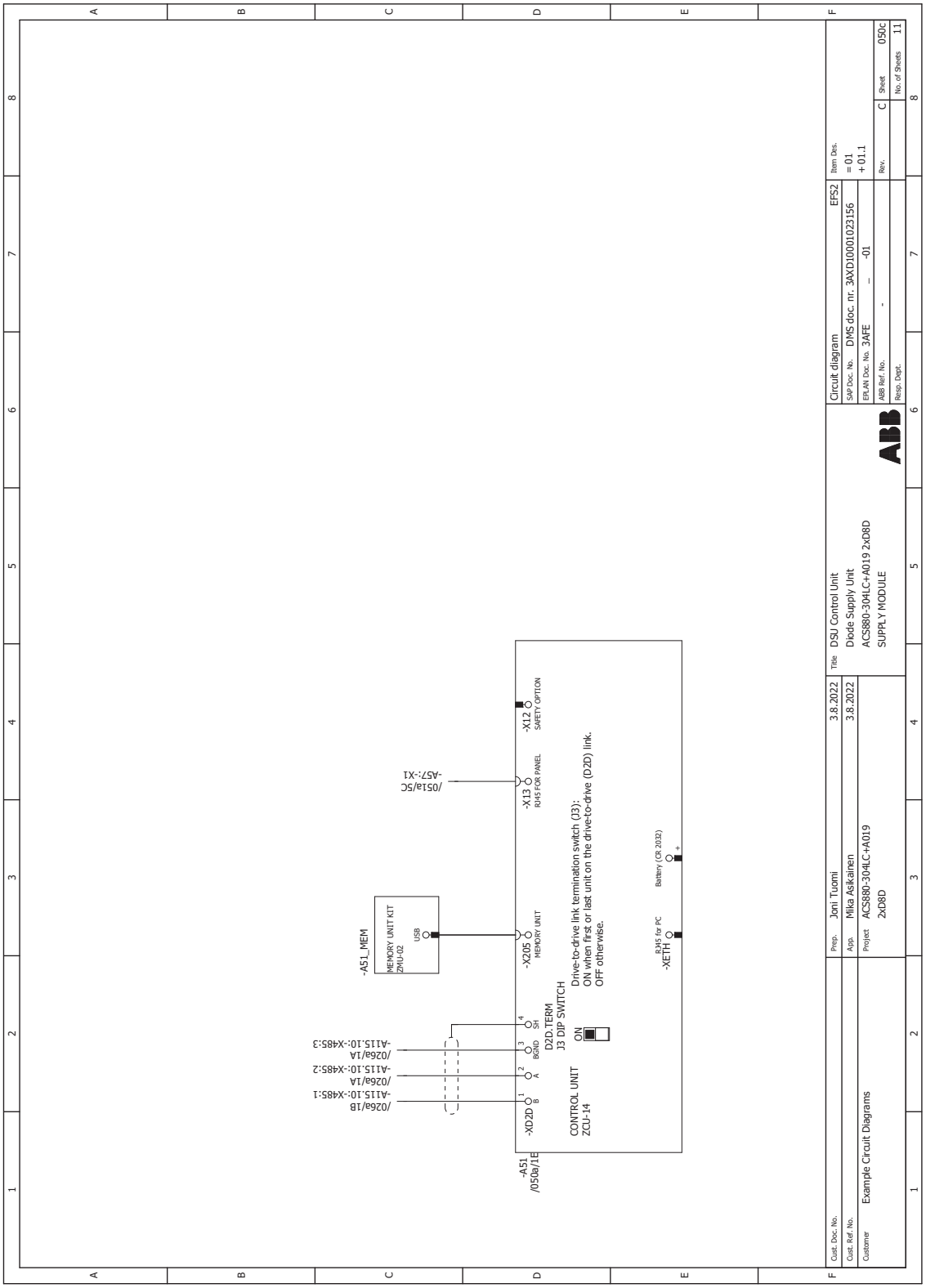
Frames 2×D8D – Supply control board (sheet 050a)



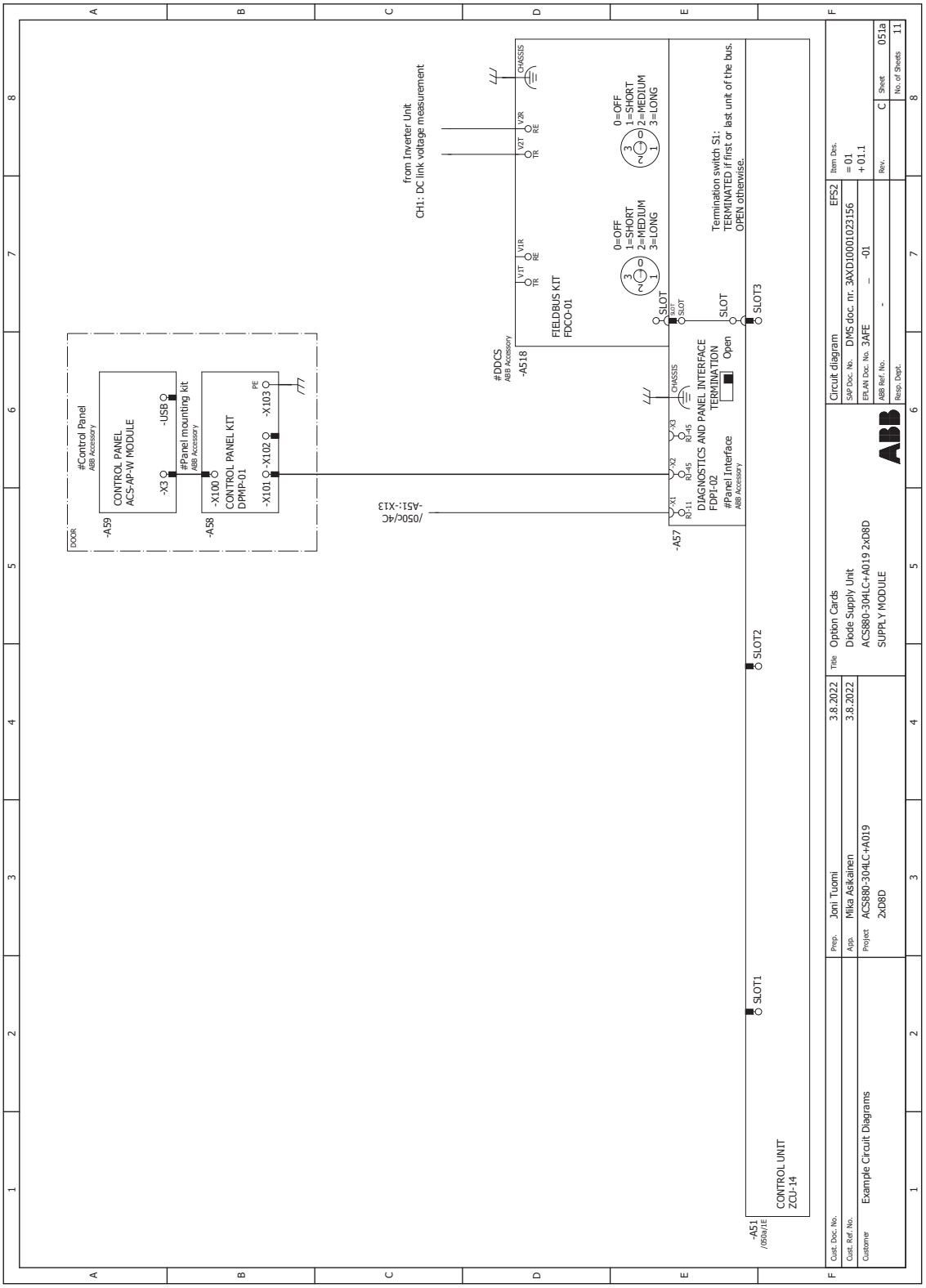
Frames 2×D8D – Supply control board (sheet 050b)



Frames 2×D8D - Supply control board (sheet 050c)



Frames 2×D8D – Option cards (sheet 051a)



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