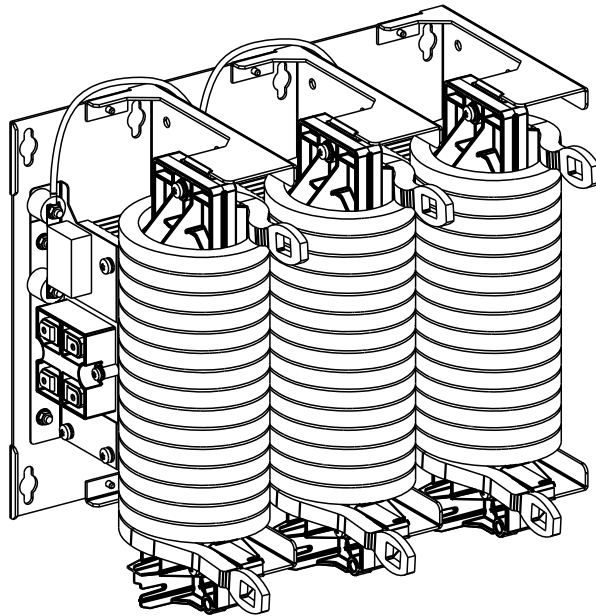


ABB drives

Hardware manual
du/dt filter
BOCH-0350A-7



ABB

du/dt filter
BOCH-0350A-7

Hardware manual

3AXD50000019720 Rev A
EN
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About this manual

What this chapter contains

The chapter describes the manual in short.

Target audience

The manual is intended for people who select, plan the installation, install, commission and use the du/dt filter. Read the manual before working on the filter. The reader is expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

Safety

Only qualified specialists are allowed to install, commission and maintain the du/dt filter.

The complete safety instructions for the drive/inverter are given in the drive hardware manual or separate safety instructions manual. Read and follow the complete safety instructions before working on the drive/inverter.

The following instructions are intended for all who install and service the du/dt filter. Ignoring the following instructions can cause physical injury or death, or damage to the equipment.



WARNING!

- Ground the filter to the protective earth (PE) terminal of the cabinet. No separate grounding conductor is needed if there is proper galvanic connection through the filter fixing screws, conductive metallic fixing base and the PE busbar of the cabinet.
 - Beware of hot surfaces. The surface temperature of the du/dt filter can exceed 150 °C (302 °F) during operation. After the operation, let the filter cool off for two hours before working on it.
 - Ensure sufficient cooling. See chapter [Installation](#).
-

Operation principle

What this chapter contains

The chapter describes the operation of the du/dt filter and the intended use.

Operation principle

The drive/inverter employs modern IGBT inverter technology. Regardless of frequency, the drive/inverter output comprises pulses of approximately the drive/inverter DC bus voltage with a very short rise time. The pulse voltage can almost double at the motor terminals, depending on the attenuation and reflection properties of the motor cable and the terminals. This can cause additional stress on the motor and motor cable insulation.

Modern variable speed drives/inverters with their fast rising voltage pulses and high switching frequencies can generate current pulses that flow through the motor bearings, which can gradually erode the bearing races and rolling elements.

There are optional *common mode filters* and *du/dt filters* available for the ABB drives. The common mode filters mainly reduce bearing currents. The du/dt filters also protect the motor insulation system.

To avoid damage to motor bearings and insulation system:

- Select and install the cables according to the instructions given in the hardware manual.
- Check if the installation needs to be equipped with additional protection equipment, such as insulated N-end bearings in the motor, or the drive/inverter output filters. The requirements are specified in the drive *Hardware manual*. See chapter *Planning the electrical installation*, section *Selecting the motor*, and chapter *du/dt filter*.

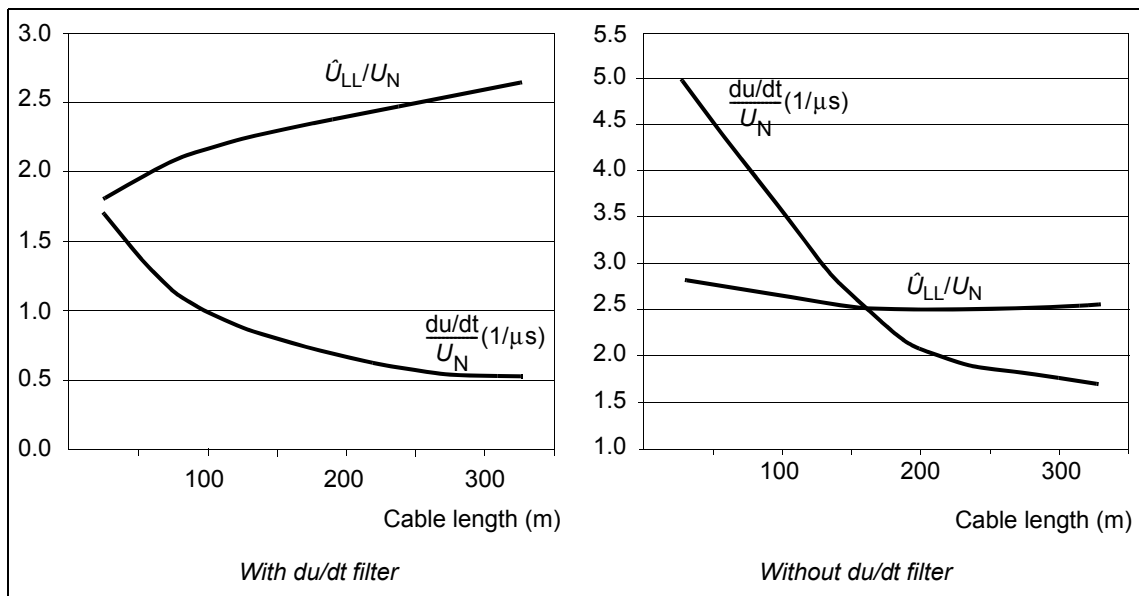
Graphs illustrating the effect of the du/dt filter

The graphs show the peak line-to-line voltage ($\hat{U}_{LL}$) and voltage change (du/dt) at the motor terminals as a function of the motor cable length. $\hat{U}_{LL}$ and du/dt are scaled to the nominal line-to-line voltage (U_N). To calculate the actual peak voltage value in volts and du/dt value in volts per microsecond, multiply the values of the graph by the supply voltage (U_N).

The values in the first graph are measured with an ABB du/dt filter while the second graph without any output filtering. The values in the second graph are only representative. The actual unfiltered du/dt values depend on the drive/inverter type, and are usually in the range of 1 to 5 kV/microsecond.

In case of drives/inverters with an IGBT supply unit or resistor braking, the $\hat{U}_{LL}$ and du/dt values are approximately 20% higher.

The voltage rise time can be calculated as follows: $\Delta t = 0.8 \cdot \hat{U}_{LL}/(\text{du/dt})$.



Selecting the du/dt filter

What this chapter contains

The chapter instructs in selecting a du/dt filter for your drive/inverter.

Filter selection procedure

Step	What to do	More information
1.	Check whether a du/dt filter is needed in the installation.	The requirements are specified in a separate planning instructions or a drive hardware manual in chapter <i>Planning the electrical installation</i> . ¹⁾
2.	Pre-select a filter according to the drive/inverter type.	Filter selection tables are in the drive hardware manual. ¹⁾ The pre-selected filter is suitable for most applications.
3.	Check that the pre-selected filter is suitable for your application.	Use the pre-selected filter.

¹⁾ For the ACS880 drives, the data can be found either from an appropriate drive hardware manual, or from *ACS880 multidrive cabinets and modules electrical planning instructions* (3AUA0000102324 [English]). The PDF files are available at www.abb.com/drives.

Installation

What this chapter contains

The chapter contains mechanical and electrical installation instructions.

Warnings and restrictions



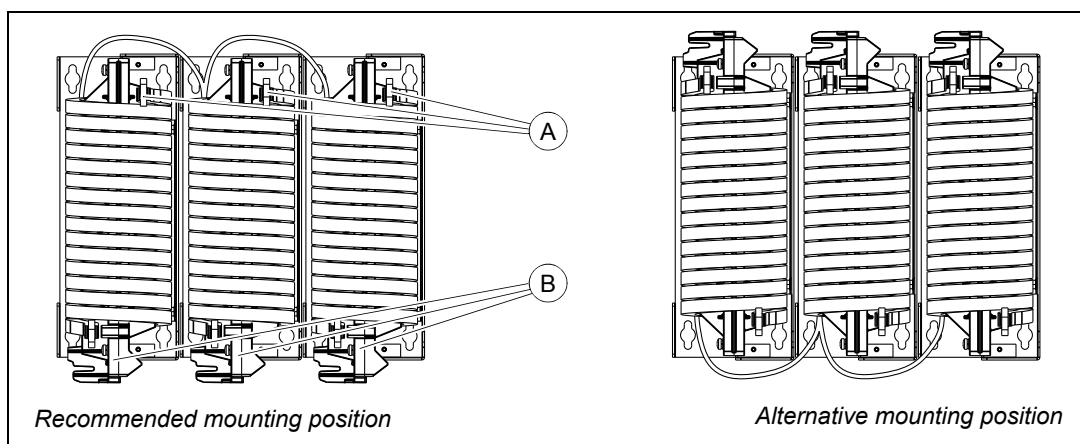
WARNING! Do not attempt any work on a powered drive/inverter. After switching off the mains, always allow the intermediate circuit capacitors 5 minutes to discharge before working on the frequency converter, the motor or the motor cable. Check (with a voltage indicating instrument) that the drive/inverter is in fact discharged before beginning work.

- Encase the non-enclosed (IP00) filters to meet the safety requirements (for cabinet installation solely).
- Use a shielded cable between enclosures.
- Mount the filter on a mounting structure that is of non-flammable material and strong enough to carry the weight of the filter.

Planning the installation

See chapter [Technical data](#) for allowed ambient conditions, maximum cable length between the drive/inverter output and the filter, maximum motor cable length and other technical data.

See chapter [Dimension drawings](#) for the dimensions. The filter can be mounted in an upright position with the output terminals down or up. Other mounting positions are possible with an extra fan.



A	Input terminals
B	Output terminals

Mounting plate

The filter must be mounted on a grounded metal plate or cabinet frame. The structure must be of non-flammable material and strong enough to carry the weight of the unit.

Encasing

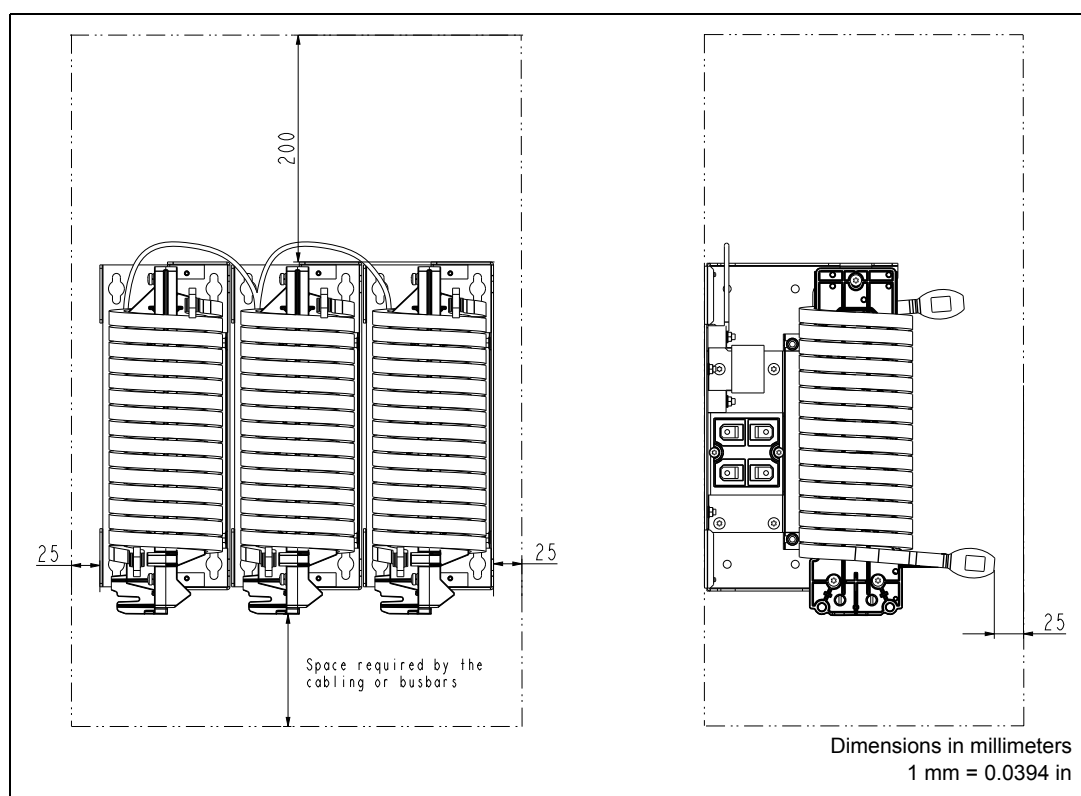
The unprotected (IP00) filter must be encased or placed in a cabinet according to the local safety requirements.

Electrical connections

Busbars are recommended for connections to the filter input terminals. If cables are used, they must be rated for at least 105 °C (221 °F). If the filter is not installed in the same cabinet as the drive/inverter, shielded symmetrical cable must be used between the drive/inverter cabinet and the filter enclosure.

Free space around the filter

Free space is required around the unit for cooling as follows. The distances apply to ABB's standard cabinet solutions. With forced cooling, less free space is required.



Clearance distances from the input and output terminals and coil surfaces

Clearance distances from the input and output terminals and coil surfaces must be at least 15 mm (0.59 in.). Pay attention to the local regulations.

Note: Due to high temperature of the coil surfaces during operation, route the motor cables at least 50 mm (1.97 in.) away from the coil surfaces and secure them appropriately.

Cooling

The filters are designed to cool directly under the R6i/R7i module. If filters are located elsewhere, it is essential that equal airflow is arranged for filters. The rate of the airflow is 2 m/s. The fans must be monitored if the filters are located in another cabinet. The space above the filter is hot [up to 70 °C (158 °F) depending on the installation and operating conditions]. Take this into account in the cabinet design.

Tightening torques

The following table applies to grade 8.8 screws with or without joint compound.

Screw size	Torque	
	Nm	lbf ft
M5	3.5	2.6
M6	9	6.6
M8	20	14.8
M10	40	29.5
M12	70	51.6
M16	180	132.8

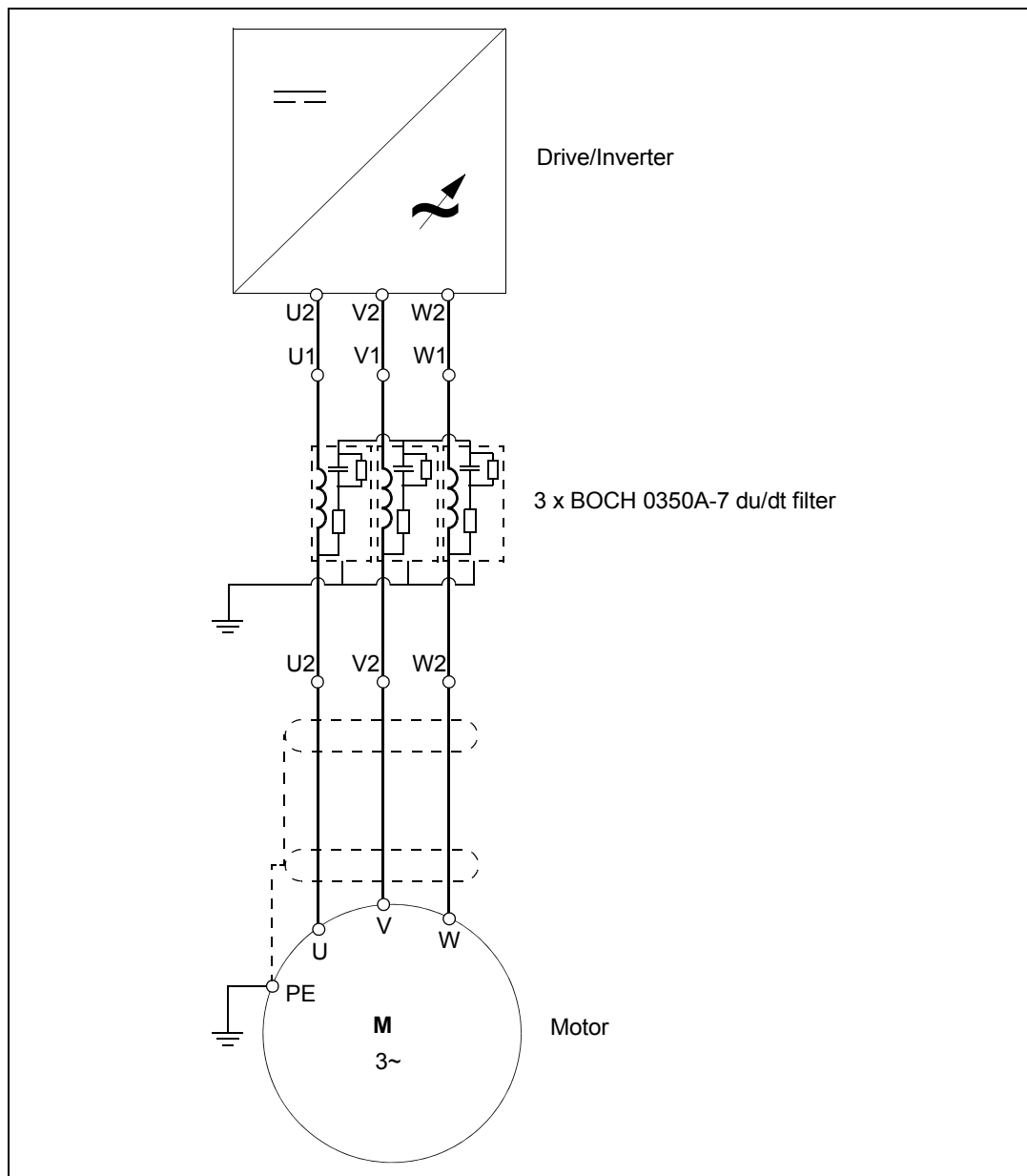
Mechanical installation



WARNING! Do not attempt any work on a powered drive/inverter. After switching off the mains, always allow the intermediate circuit capacitors 5 minutes to discharge before working on the frequency converter, the motor or the motor cable. Check (with a voltage indicating instrument) that the drive/inverter is in fact discharged before beginning work.

Lift the filter by the lifting holes to the installation position. Fasten each filter with four screws according to the assembly instructions. Make sure that a proper galvanic connection is achieved by removing paint from support mechanics and the cabinet frame if necessary.

Electrical installation



Grounding



WARNING! The filter is grounded through the four fastening screws to its mounting plate. Ensure that the mounting plate has a proper connection to the nearest grounding (PE) busbar/terminal. If that is not the case, use a separate grounding conductor between the filter frame and the PE busbar/terminal.

Connections to input terminals U1, V1, W1

The input terminals (U1, V1, W1) of the filter are made of aluminium. Use cable lugs suitable for aluminium busbars and joint grease to avoid corrosion and to ensure good electrical connection. The oxide layer must be scrubbed off from the joints before applying the grease. It is recommended

- to use screws included in the delivery
- to retighten the connections 30 minutes after their installation.

Output terminals U2, V2, W2

The output terminals (U2, V2, W2) of the filter are tin-plated copper.

Strain relief of cables

Secure the cables mechanically.

Technical data

This chapter contains the technical specifications of the du/dt filter and its installation.

Input voltage (U_1): 380 ... 500 VAC 3-phase $\pm 10\%$, 380 ... 690 VAC 3-phase $\pm 10\%$.

Ratings, weights and maximum cable sizes:

Filter type	BOCH-0350A-7
Order code	3AXD50000018892
U_N (V)	690
I_N (A)	350
Power loss (W)	550 (maximum power loss at I_N)
Weight (kg, lb)	16 (35)
Maximum motor cable size in mm ²	3x240
Output connection size	M12
Input connection size	M12

3AXD000000601909

Note: Values are for three single-phase filters

Derating:

The load capacity (current and power) decreases if the installation site altitude exceeds 1000 metres (3281 ft), or if the ambient temperature exceeds 40 °C (104 °F).

Temperature derating

In the temperature range +40 °C (+104 °F) to +50 °C (+122 °F), the rated output current is decreased 1% for every additional 1 °C (1.8 °F). The output current is calculated by multiplying the current given in the rating table by the derating factor.

Example If the ambient temperature is 50 °C (+122 °F), the derating factor is $100\% - 1 \frac{\%}{^{\circ}\text{C}} \cdot 10^{\circ}\text{C} = 90\%$ or 0.90. The output current is then $0.90 \cdot I_{\text{thmax}}$. For I_{thmax} .

Altitude derating

At altitudes from 1000 to 4000 m (3281 to 13123 ft) above sea level, the derating is 1% for every 100 m (328 ft). For a more accurate derating, use the *DriveSize* PC tool. The value calculated for the drive/inverter applies also to its du/dt filter.

Maximum drive/inverter output frequency: 200 Hz

Maximum allowed average switching frequency:

3 kHz (converter units with supply voltage < 500 V) or

2 kHz (converter units with supply voltage > 500 V)

Change the switching frequency with a drive/inverter parameter. For the ACS880 drive, set parameter 95.20 (13) Du/dt filter activation to value 1.

Maximum cable length between the drive/inverter output and the filter: 3 m

Maximum motor cable length: 300 m.

Degree of protection: IP00

Applicable standards and markings: EN 60204-1, EN 60529, EN 61800-3, EN 50178, CE marking, UL approved insulation system, cUL approval pending.

Ambient conditions

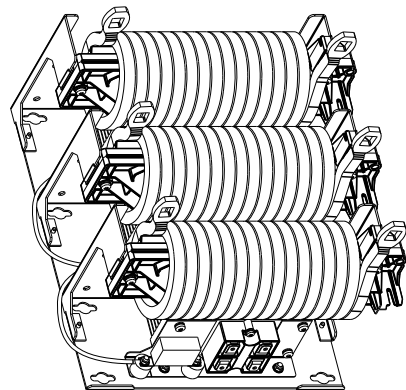
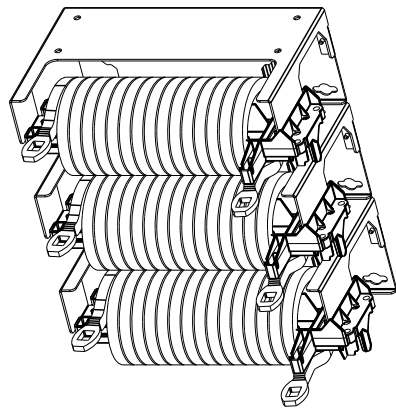
The du/dt filter is to be used in a heated, indoor, controlled environment.

	Operation installed for stationary use	Storage in the protective package	Transportation in the protective package
Installation site altitude	0 to 4000 m (13123 ft) above sea level [above 1000 m (3281 ft), see <i>Derating</i> on page 19.]	-	-
Air temperature	-15 to +50 °C (5 to 122 °F). See <i>Derating</i> on page 19.	-40 to +70 °C (-40 to +158 °F)	-40 to +70 °C (-40 to +158 °F)
Relative humidity	5 to 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination levels (IEC 60721-3-3, IEC 60721-3-2, IEC 60721-3-1)	No conductive dust allowed.		
	Chemical gases: Class 3C2 Solid particles: Class 3S2	Chemical gases: Class 1C2 Solid particles: Class 1S3	Chemical gases: Class 2C2 Solid particles: Class 2S2
Atmospheric pressure	70 to 106 kPa 0.7 to 1.05 atmospheres	70 to 106 kPa 0.7 to 1.05 atmospheres	60 to 106 kPa 0.6 to 1.05 atmospheres
Vibration (IEC 60068-2)	Max. 1 mm (0.04 in.) (5 to 13.2 Hz), max. 7 m/s ² (23 ft/s ²) (13.2 to 100 Hz) sinusoidal	Max. 1 mm (0.04 in.) (5 to 13.2 Hz), max. 7 m/s ² (23 ft/s ²) (13.2 to 100 Hz) sinusoidal	Max. 3.5 mm (0.14 in.) (2 to 9 Hz), max. 15 m/s ² (49 ft/s ²) (9 to 200 Hz) sinusoidal
Shock (IEC 60068-2-29)	Not allowed	Max. 100 m/s ² (330 ft./s ²), 11 ms	Max. 100 m/s ² (330 ft./s ²), 11 ms
Free fall	Not allowed	203 mm (7.99 in.)	203 mm (7.99 in.)

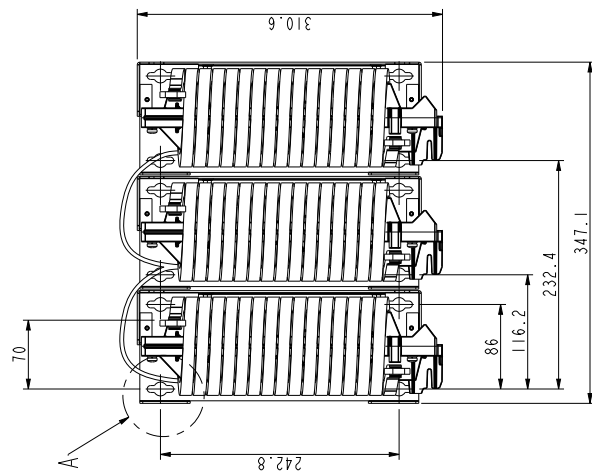
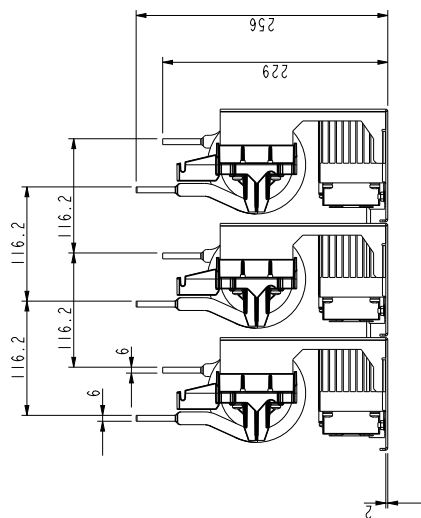
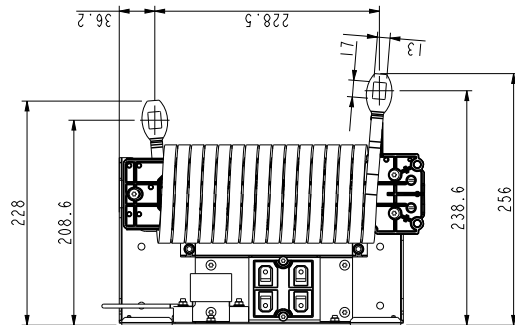
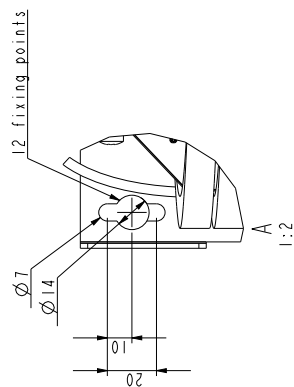
Dimension drawings

The dimensions are given in millimetres and [inches] below.

BOCH-0350A-7



Dimensions in mm
1mm = 0.0394 in



3AXD10000355369

Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/drives and selecting *Sales, Support and Service network*.

Product training

For information on ABB product training, navigate to www.abb.com/drives and select *Training courses*.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Go to www.abb.com/drives and select *Document Library – Manuals feedback form (LV AC drives)*.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet. Go to www.abb.com/drives and select *Document Library*. You can browse the library or enter selection criteria, for example a document code, in the search field.



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ABB Oy

Drives
P.O. Box 184
FI-00381 HELSINKI
FINLAND
Telephone +358 10 22 11
Fax +358 10 22 22681
Internet <http://www.abb.com>

ABB Inc.

Automation Technologies
Drives & Motors
16250 West Glendale Drive
New Berlin, WI 53151
USA
Telephone 262 785-3200
800-HELP-365
Fax 262 780-5135

ABB Beijing Drive Systems Co. Ltd.

No. 1, Block D, A-10 Jiuxianqiao Beilu
Chaoyang District
Beijing, P.R. China, 100015
Telephone +86 10 5821 7788
Fax +86 10 5821 7618
Internet <http://www.abb.com>