MULTI AXIS DRIVES
DM2020

L-CAM2-E-171

COMPACT MULTI AXIS SERVO DRIVE

WHAT MOVES YOUR WORLD

MOOG

If you need the best performance and design flexibility, look no further than Moog and its expertise. Based on our partnership, creativity and cutting-edge technological solutions, we can help you tackle the toughest problems and improve the performance of your machines.

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SYSTEM OVERVIEW

Flexible, modular design for top productivity

- The DM2020 is a compact, digital servodrive for controlling top-performing multi-axis systems.
- The modular platform, high performance control card and advanced control software all help to improve performance levels in a wide range of industrial applications requiring optimum dynamics and precision, and where greater efficiency in terms of energy conversion and system integration means an essential plus factor for the new markets. These markets include electric and hybrid propulsion, wind generation, and the conversion of general mechanical energy into electrical energy.
- The flexible design (based on "functional blocks") and the support of our engineers when it comes to machine design, means we can personalise the product to cater to our customers' needs, improving machine performance and reducing overall costs.

A compact design, to reduce space and cut wiring costs

- The multi-axis architecture, with a shared power supply unit, reduces the dimensions of the axis module and the overall system dimensions by about 50% compared with a similar stand-alone configuration. The auxiliary power supplies between each axis are distributed by means of internal connections.
- The electrical connections in the system (via bus bar) reduce the wiring complexity and the number of components around the housing (switches, filters, counters and in-line inductors).

Designed to work with different motor types and feedback devices

- The system manages a wide range of controlled motors (brushless and asynchronous) and accepted transducers - Resolver (any number of poles can be configured via the SW) or Encoder (incremental, sinusoidal, single and multi-turn or fully digital) - to meet all application requirements.

Energy savings

- The configuration with shared DC BUS allows an exchange of energy between the axes, reducing both energy waste from the dynamic brake resistor and the system's total energy consumption.

User-friendly graphic user interface (GUI)

- The new graphic user interface offers easy access to all the functions, simplifying the settings, initial start-up and system monitoring.
- The high frequency data registration and system identification functions, together with the assisted calibration function, make it easier to configure even the most complex systems.

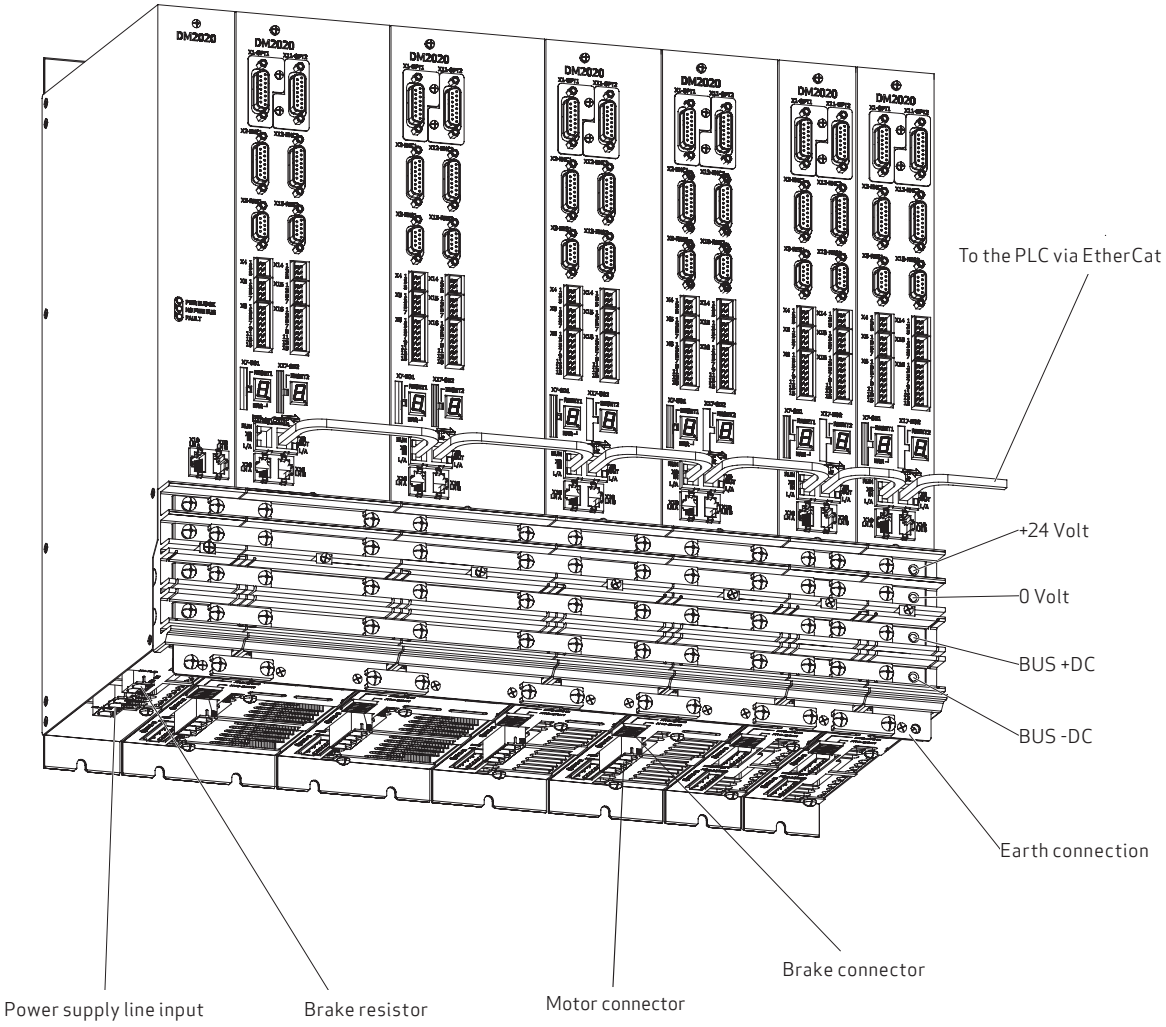
Maximum synchronisation between the axes

- The dual-axis layout implemented in a single module, plus the connection between different modules (via CANopen), is essential to ensure synchronisation between high performance axes; this in turn is fundamental for improving configurations such as Master/Slave, bridge (gantry) crane, and electrical energy conversion lines.

Customised applications

- Applications for controlling multi-axis systems in industrial automation.
- Applications with high precision and the maximum dynamics.
- Applications for energy savings.
- Applications with customised functions.
- Applications requiring quick, precise synchronisation between the axes.
- Energy conversion (from mechanical to electrical and vice versa), where performance, efficiency and excellent integration are needed.

Note: The DS2020 drives do not belong to the lists of "dual use" products, as defined in the framework regulation EC 428/2009, and are therefore not subject to its restrictions regarding sale and transportation.



Configuration description:
the figure shows an example of a 12-axis system consisting on the left of a 50mm power supply unit, followed by 2 size L100 modules, 2 size L75 modules, and 2 size L50 modules. All the modules are made up of 2 axes.

Characteristics of the axis module

- The dimensions of the standard module, with a height and depth (455mm/10.04 inches and 249mm/9.80 inches) are the same for all modules; the width is variable and increases according to the rated current, starting from 50mm/1.97 inches for smaller modules.
- The main control interface is a real time, high performance EtherCat Fieldbus; the consolidated analogue/simulated encoder interface and CANOpen interface are also available as a standard configuration. CIA 402 control modules may be used.
- Different transducers are managed as feedback from the motor; each axis module has (as standard) a resolver interface and programmable encoder, and both can be configured as the main or secondary transducer.
  The resolver interface has attenuation correction, cable phase correction and amplitude gain, to improve precision in all conditions.
  The encoder interface can be configured via software to read the various sensor technologies, including:
  - Heidenhain EnDat 2.2 (single and absolute multi-turn) with SinCos or full digital signals
  - Stegman Hiperface Encoder (single and absolute multi-turn) with SinCos signals
  - SinCos encoder (with a power supply from 5 to 8 Volt)

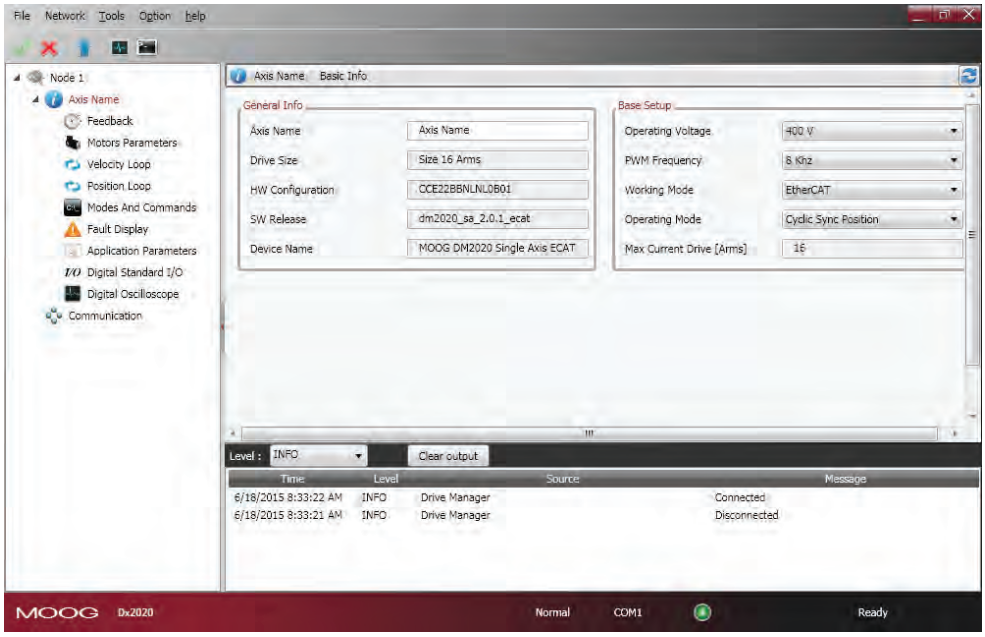
  A second optional encoder interface is available, with the same characteristics as the main interface.
- The control software architecture is designed with high-performance flexible structures, with rapid, high precision analogue/digital conversion. It can easily be customised with the aid of high-level instruments (e.g. Simulink and MatLab) to improve motor control performance, optimise the accuracy of the control and positioning, and meet the needs and expectations of even the most demanding customer.
- Configuration of the control module with one or two axes. In the 2-axis configuration, the first can be the Master and the other one the Slave; alternatively, the two axes may be independent. From a practical viewpoint, the only difference between the Master and the Slave is that the HW for EtherCat and CANopen is only available in the Master axis. With this implementation, there is just one EtherCat and CANopen node for each module, thereby reducing the number of Fieldbus nodes in the system.
- The STO (Safe Torque Off) function is available on all axes with independent management for each module axis.
- The interface of the MMC card for memorising all the axis parameters is available for every axis, so the module can be replaced more easily and a new axis can be configured quickly. This memory support also offers considerable data storage space, and high speed data recording.
- The signal and power connections are separated in the internal drive layout. This improves EMC characteristics and the rejection of electrical noise generated by the wiring. The signals reach the upper part of the front drive panel, and the current is situated on the lower panel.
- The 24 Volt auxiliary connection and DC BUS use the same type of bus bar, to reduce the number of components and spare parts. The bus bar current may reach 250 Amps.
- The motor power connectors on the bottom have screws so that cables can be connected easily, without needing special crimping tools.
- On the bottom of the module, there is an interface for controlling the motor brake (2 Amp 24 Volt) - one for each axis.
- There is an optional slot for each axis on the front panel, for the customisable interface cards (unless it is occupied by the "second encoder" option).

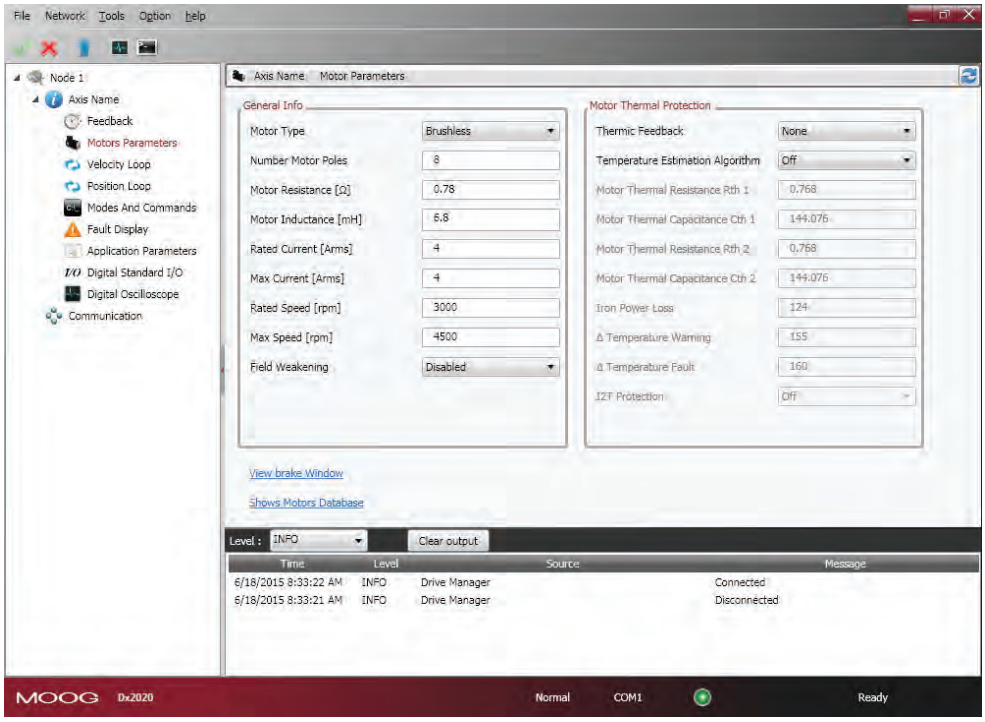
Characteristics of the power supply module

- Centralised power supply module of the system for AC/DC conversion and DC current sharing.
- CANopen connection for internal communications and parameter configuration with PC/GUI directly from the power supply unit.
- Monitoring (via a control card with CPU) of: DC BUS voltage, three input phases, power supply module temperature, and dynamic braking commands of the drive. The information is shared amongst the various modules via CANopen.

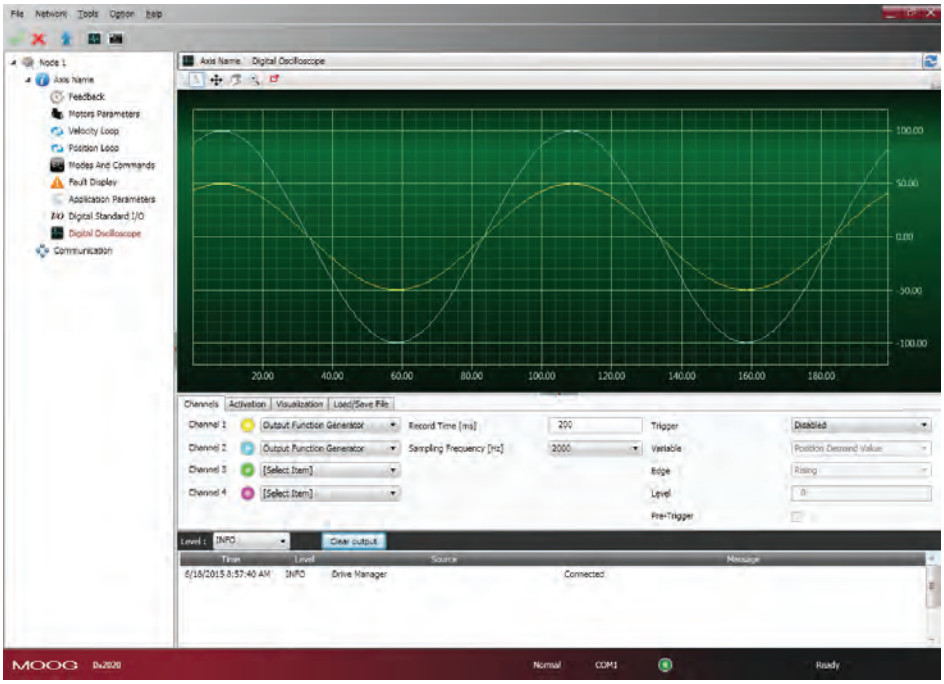
GUI functions

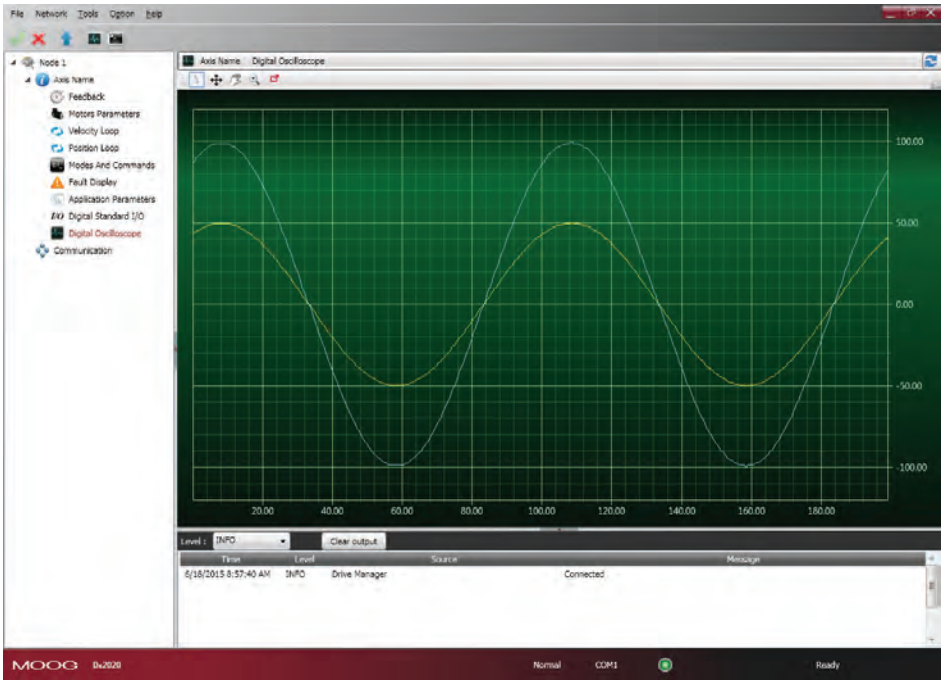
- SW based on the Windows™ operating system.
- RS232 or CANopen communication interface.
- Access to all the system variables for configuration, direct drive control, initial start-up, troubleshooting, drive monitoring, assisted axis calibration.
- The system configuration can be stored on File System and loaded in a simple, intuitive manner.





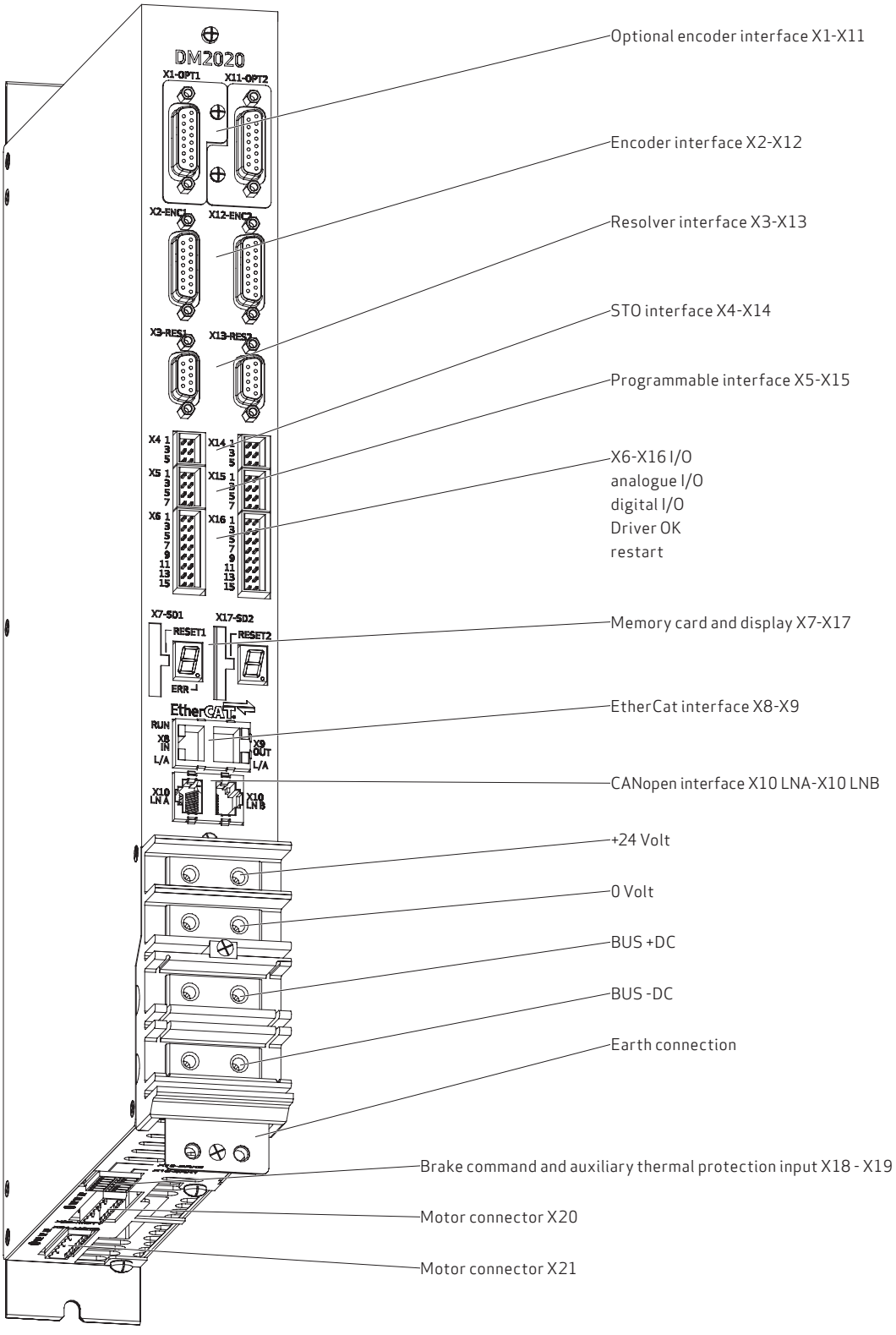
- A 4-trace oscilloscope is available for monitoring internal drive dimensions and checking performance levels. The high frequency (up to 16 KHz) data sampling method is supported by the MMC memory card.
- The oscilloscope function allows you to view analogue data from the drive in real time (e.g. resolver feedback amplitude, analogue input, output current); this is useful for the initial start-up and for troubleshooting.





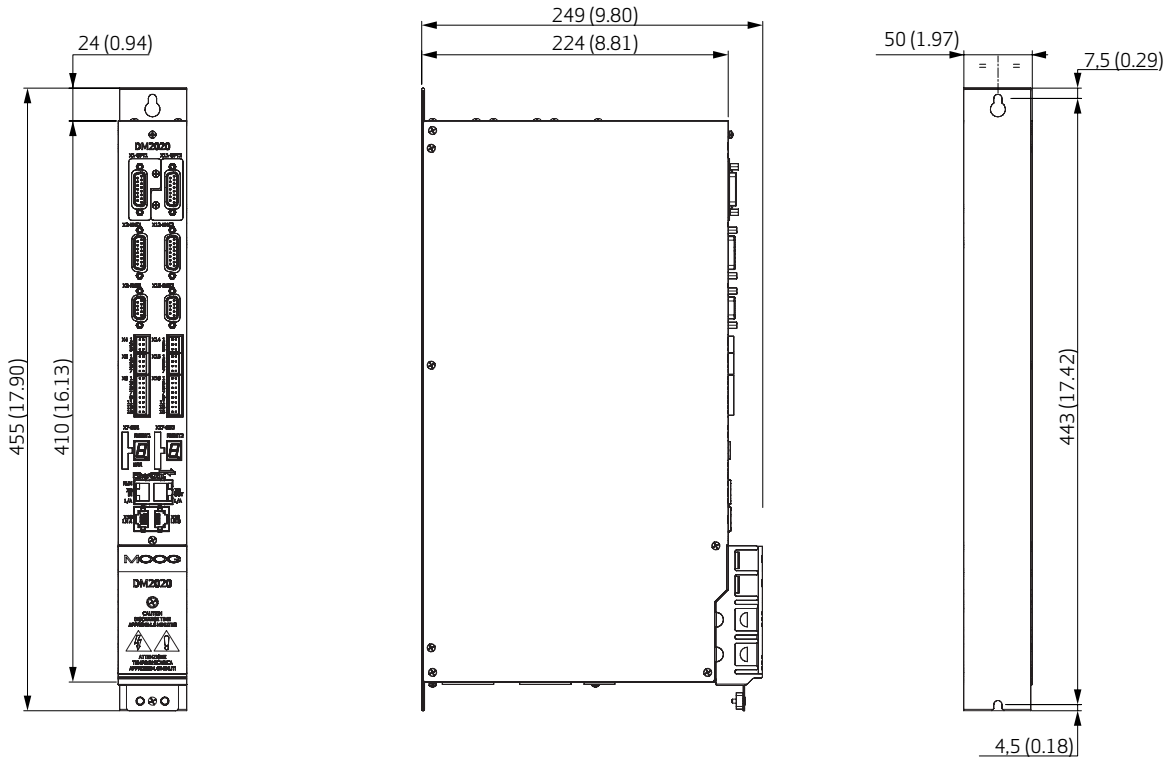
AXIS MODULE

Interface

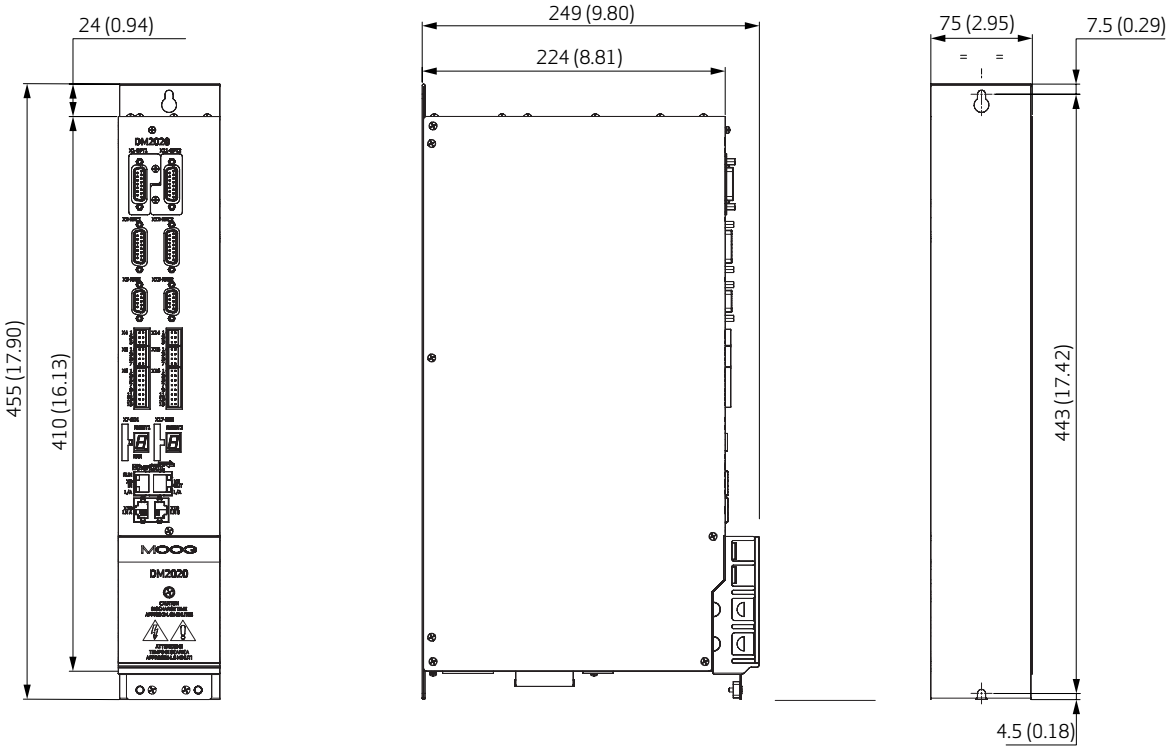


Technical data

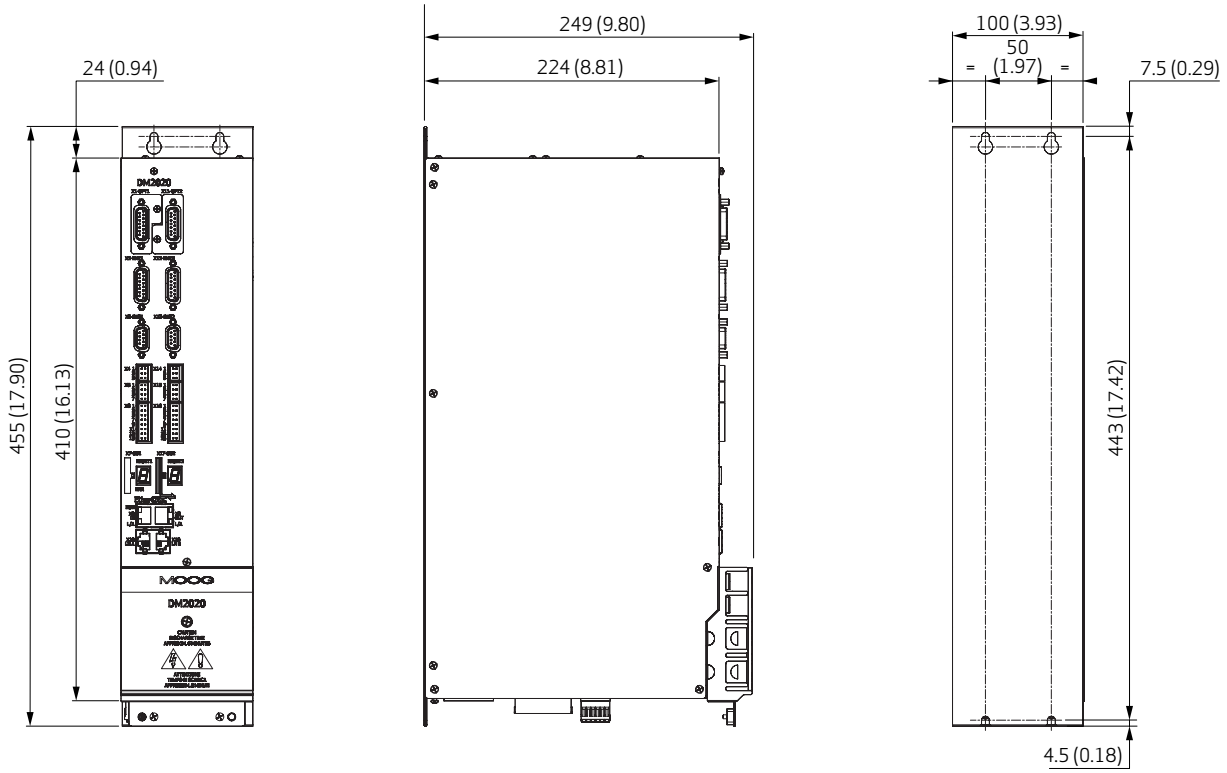
Single and double axis module - 50mm/1.97 inches



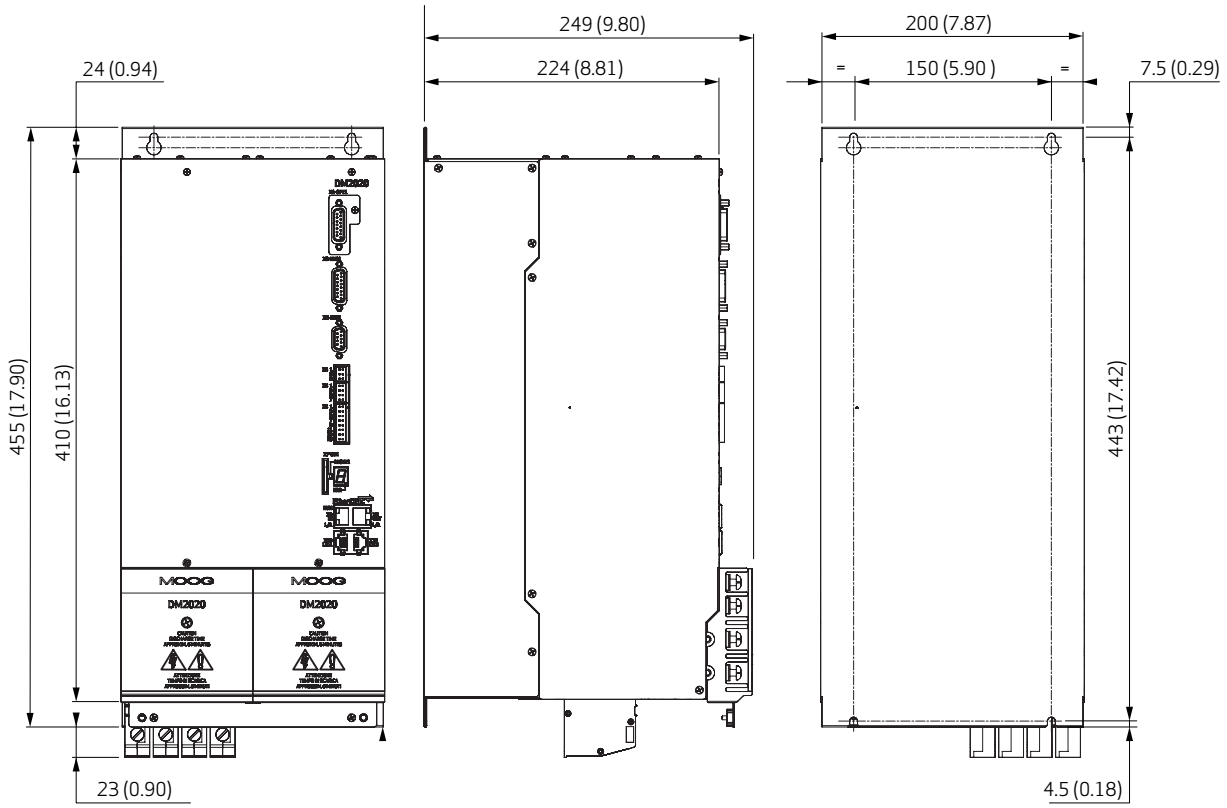
Single and double axis module - 75mm/2.95 inches



Single and double axis module - 100mm/3.93 inches



Single and double axis module - 200mm/7.87 inches



Models

Model/Code	CC111SNNLNNxxxx		CC111ANNLNNxxxx		CC121SSNLNxxxxx		CC112BNNLNNxxxx		CC122ASNLNxxxxx	
Mechanical dimensions	50mm/1.97 inches									
Configuration	Single		Single		Double		Single		Double	
Type	L50A		L50A		L50A		L50B		L50B	
Module current @ 8kHz	2		4		4		8		6	
Arms rated current	2	-	4	-	2	2	8	-	4	2
Arms peak current	4	-	8	-	4	4	16	-	8	4
Cooling	Natural						Incorporated ventilation			
Weight [kg]	4,4		4,4		5,0		5,2		5,8	
Total uF capacity	135		135		135		135		135	
Connector code	BC7111R		BC7111R		BC7221R		BC7111R		BC7221R	

Model/Code	CC122AANLNxxxxx		CC122BSNLNxxxxx		CC122BANLNxxxxx		CC114CNNLNNxxxx		CC124BBNLNxxxxx	
Mechanical dimensions	50mm/1.97 inches									
Configuration	Double		Double		Double		Single		Double	
Type	L50B		L50B		L50B		L50C		L50C	
Module current @ 8kHz	8		10		12		16		16	
Arms rated current	4	4	8	2	8	4	16	-	8	8
Arms peak current	8	8	16	4	16	8	32	-	16	16
Cooling	Incorporated ventilation									
Weight [kg]	5,8		5,8		5,8		5,8		5,8	
Total uF capacity	135		135		135		135		135	
Connector code	BC7221R		BC7221R		BC7221R		BC7113R		BC7221R	

Model/Code	CC116DNNLNNxxxx		CC116ENNLNNxxxx		CC126CSNLNxxxxx		CC126CANLNxxxxx		CC126CBNLNxxxxx	
Mechanical dimensions	75mm/2.52 inches									
Configuration	Single		Single		Double		Double		Double	
Type	L75		L75		L75		L75		L75	
Module current @ 8kHz	24		32		18		20		24	
Arms rated current	24	-	32	-	16	2	16	4	16	8
Arms peak current	48	-	64	-	32	4	32	8	32	16
Cooling	Incorporated ventilation									
Weight [kg]	6,6		6,6		7,2		7,2		7,2	
Total uF capacity	340		340		340		340		340	
Connector code	BC7113R		BC7113R		BC7225R		BC7225R		BC7225R	

Model/Code	CC126CCNLNxxxxx		CC126DSNLNxxxxx		CC126DANLNxxxxx		CC126DBNLNxxxxx	
Mechanical dimensions	75mm/2.52 inches							
Configuration	Double		Double		Double		Double	
Type	L75		L75		L75		L75	
Module current @ 8kHz	32		26		28		32	
Arms rated current	16	16	24	2	24	4	24	8
Arms peak current	32	32	48	4	48	8	48	16
Cooling	Incorporated ventilation							
Weight [kg]	7,2		7,2		7,2		7,2	
Total uF capacity	340		340		340		340	
Connector code	BC7225R		BC7225R		BC7225R		BC7225R	

Model/Code	CC118FNNLNNxxxx		CC118GNNLNNxxxx		CC128DCNLNxxxxx		CC128DDNLNxxxxx		CC128ESNLNxxxxx	
Mechanical dimensions	100mm/3.94 inches									
Configuration	Single		Single		Double		Double		Double	
Type	L100		L100		L100		L100		L100	
Module current @ 8kHz	48		64		40		48		34	
Arms rated current	48	-	64	-	24	16	24	24	32	2
Arms peak current	96	-	128	-	48	32	48	48	64	4
Cooling	Incorporated ventilation									
Weight [kg]	8,0		8,0		8,6		8,6		8,6	
Total uF capacity	340		340		340		340		340	
Connector code	BC7113R		BC7114R		BC7225R		BC7225R		BC7225R	

Model/Code	CC128EANLNxxxxx		CC128EBNLNxxxxx		CC128ECNLNxxxxx		CC128EDNLNxxxxx		CC128EENLNxxxxx	
Mechanical dimensions	100mm/3.94 inches									
Configuration	Double		Double		Double		Double		Double	
Type	L100		L100		L100		L100		L100	
Module current @ 8kHz	36		40		48		56		64	
Arms rated current	32	4	32	8	32	16	32	24	32	32
Arms peak current	64	8	64	16	64	32	64	48	64	64
Cooling	Incorporated ventilation									
Weight [kg]	8,6		8,6		8,6		8,6		8,6	
Total uF capacity	340		340		340		340		340	
Connector code	BC7225R		BC7225R		BC7225R		BC7225R		BC7225R	

Model/Code	CC128FSNLNxxxxx		CC128FANLNxxxxx		CC128FBNLNxxxxx		CC128FCNLNxxxxx	
Mechanical dimensions	100mm/3.94 inches							
Configuration	Double		Double		Double		Double	
Type	L100		L100		L100		L100	
Module current @ 8kHz	50		52		56		64	
Arms rated current	48	2	48	4	48	8	48	16
Arms peak current	96	4	96	8	96	16	96	32
Cooling	Incorporated ventilation							
Weight [kg]	8,6		8,6		8,6		8,6	
Total uF capacity	340		340		340		340	
Connector code	BC7225R		BC7225R		BC7225R		BC7225R	

Model/Code	CC130HNNLNNxxxx		CC130JNNLNNxxxx		CC140FDNLNxxxxx		CC140FENLNxxxxx		CC140FFNLNxxxxx	
Mechanical dimensions	200mm/7.87 inches									
Configuration	Single		Single		Double		Double		Double	
Type	L200		L200		L200		L200		L200	
Module current @ 8kHz	96		128		72		80		96	
Arms rated current	96	-	128	-	48	24	48	32	48	48
Arms peak current	192	-	256	-	96	48	96	64	96	96
Cooling	Incorporated ventilation									
Weight [kg]	17,5		17,5		17,5		17,5		17,5	
Total uF capacity	2720		2720		2720		2720		2720	
Connector code	BC7115R		BC7115R		BC7225R		BC7225R		BC7225R	

Model/Code	CC140GSNLNxxxxx		CC140GANLNxxxxx		CC140GBNLNxxxxx		CC140GCNLNxxxxx	
Mechanical dimensions	200mm/7.87 inches							
Configuration	Double		Double		Double		Double	
Type	L200		L200		L200		L200	
Module current @ 8kHz	66		68		72		80	
Arms rated current	64	2	64	4	64	8	64	16
Arms peak current	128	4	128	8	128	16	128	32
Cooling	Incorporated ventilation							
Weight [kg]	17,5		17,5		17,5		17,5	
Total uF capacity	2720		2720		2720		2720	
Connector code	BC7226R		BC7226R		BC7226R		BC7226R	

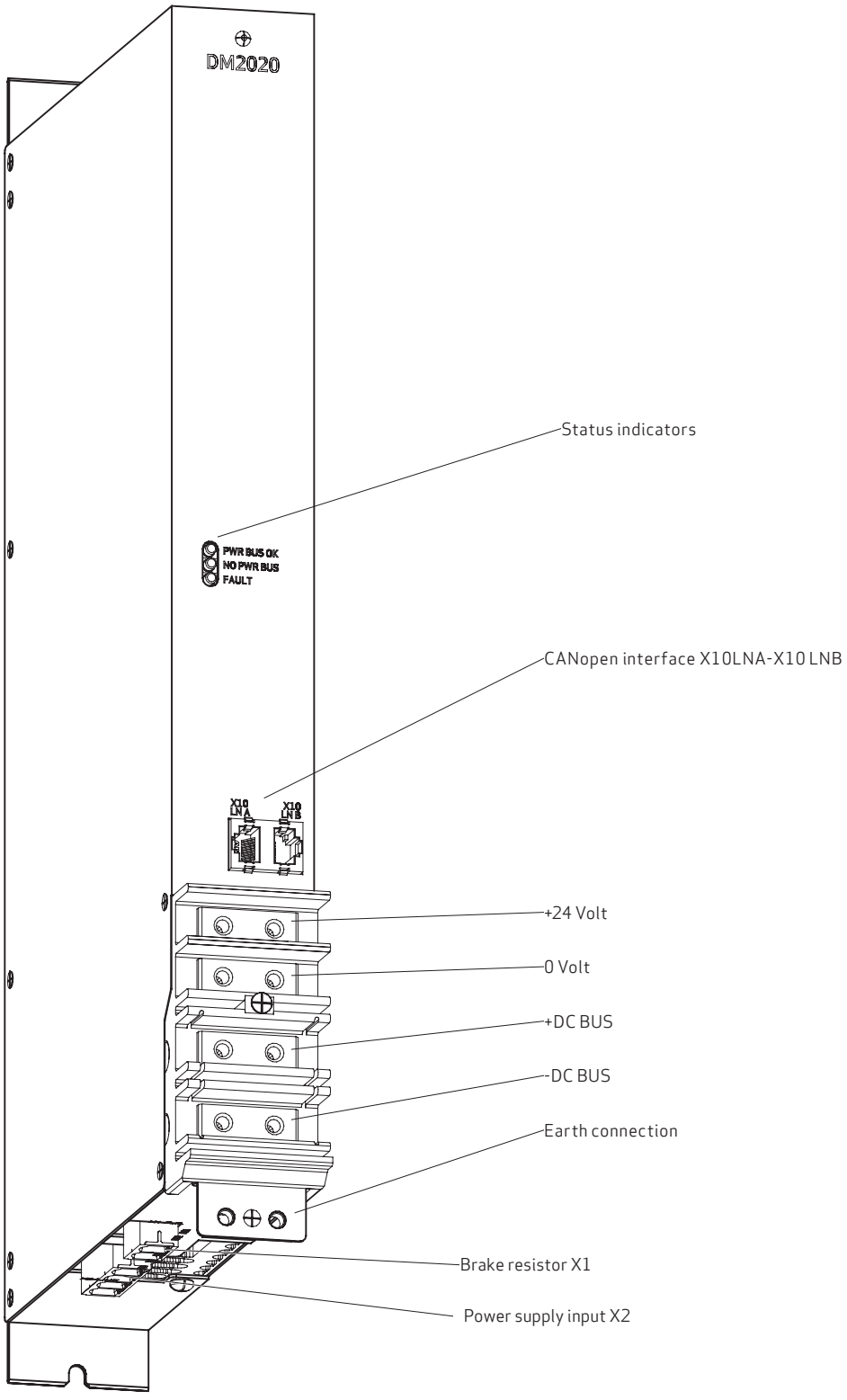
Model/Code	CC140GDNLNxxxxx		CC140GENLNxxxxx		CC140GFNLNxxxxx		CC140GGNLNxxxxx	
Mechanical dimensions	200mm/7.87 inches							
Configuration	Double		Double		Double		Double	
Type	L200		L200		L200		L200	
Module current @ 8kHz	88		96		112		128	
Arms rated current	64	24	64	32	64	48	64	64
Arms peak current	128	48	128	64	128	96	128	128
Cooling	Incorporated ventilation							
Weight [kg]	17,5		17,5		17,5		17,5	
Total uF capacity	2720		2720		2720		2720	
Connector code	BC7226R		BC7226R		BC7226R		BC7226R	

Further information on the drives is provided in the user manual

NB: in some modules, the current of the main axis is limited (reduced) in order to maintain the availability of the peak output current and, at the same time, to use all the rms current of the module.

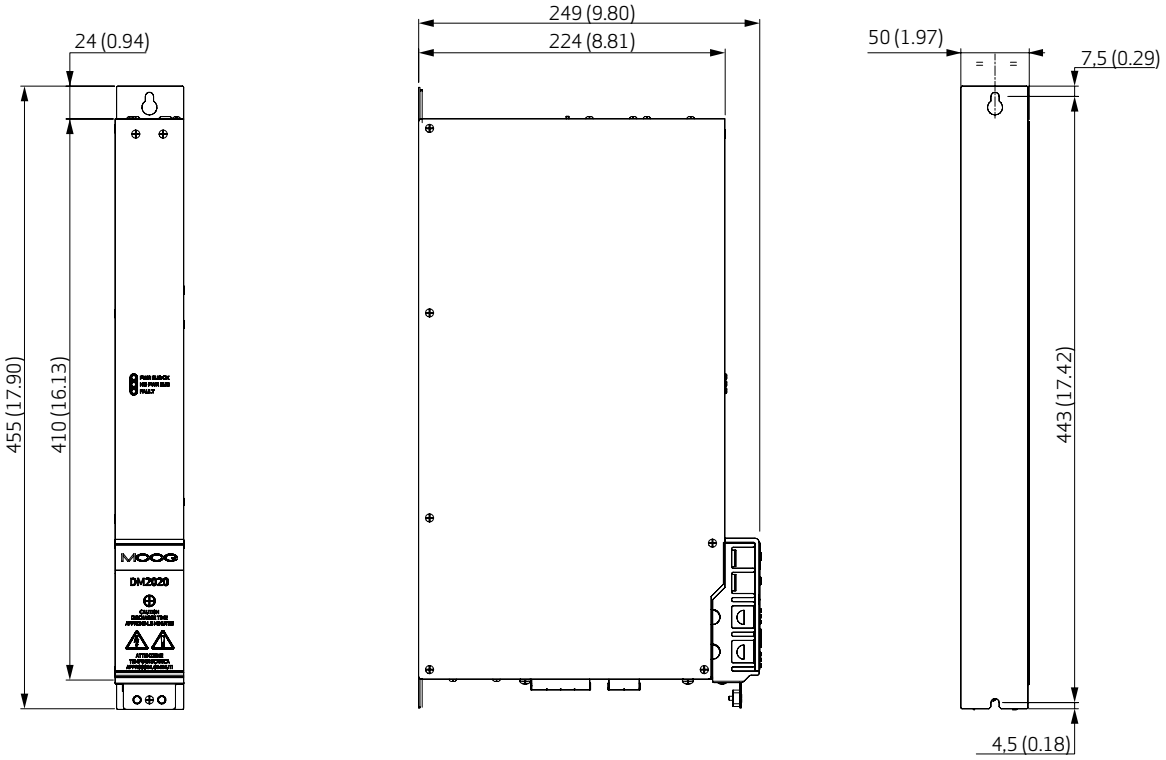
POWER SUPPLY MODULE

Interface

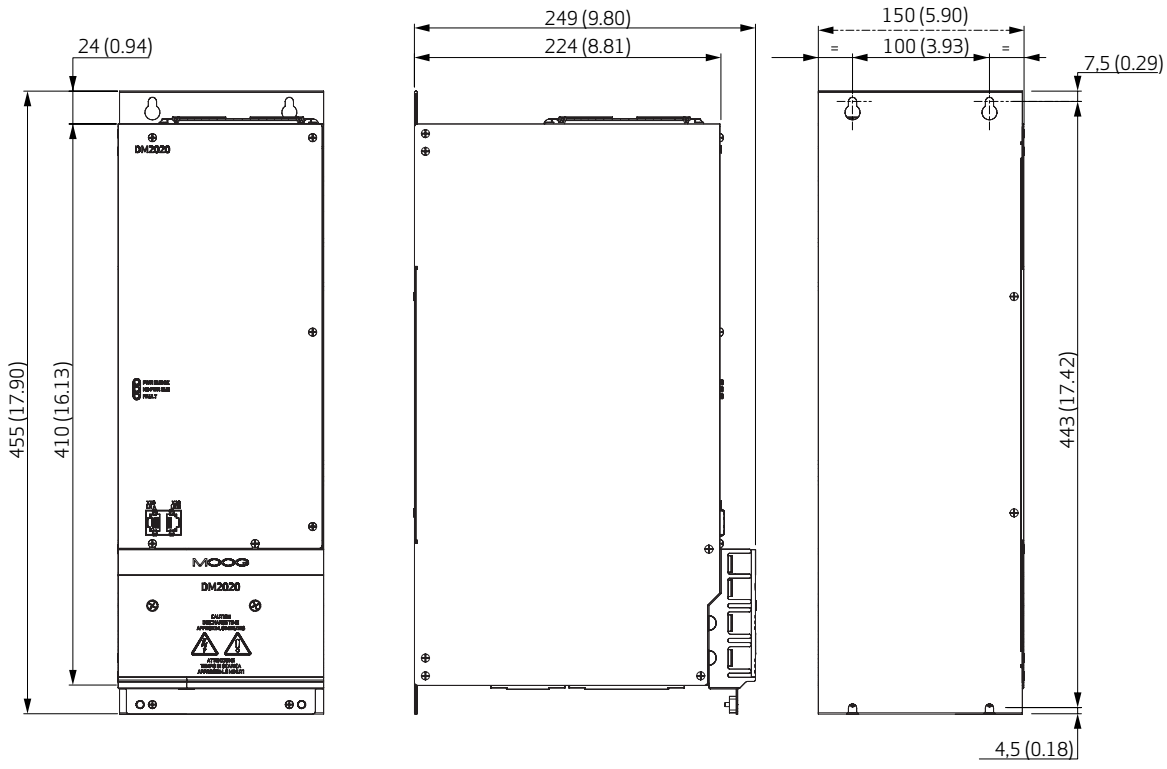


Technical data

Power supply module - 50mm/1.97 inches



Power supply module 150mm/5.90 inches



Models

Model/Code	CC201xxxxx	CC202xxxxx
Mechanical dimensions	50mm/1.97 inches	150mm/5.90 inches
Type	L50	L150
Electrical line power supply	3 phases, from 65 to 528V AC, 50/60 Hz	
Auxiliary bus bar power supply	24V DC +/- 10%, 1 A (external supply)	
Arms rated current	54	128
Arms peak current	130	256
Protection	Thermal protection on the heatsink +71°C Detection of loss during input phase Detection of insufficient voltage or overvoltage	
Communication	CANopen for sharing data amongst the drives	
Cooling	Incorporated ventilation	
Weight (kg)	5,1	13,5
Total uF capacity	1800	4500
Connector code	BC0004R	BC0006R

OPTIONS AND ACCESSORIES

Motor brake options

Each axis can be fitted with an optional internal module for controlling the motor brake, 2 Arms @ 24V DC; its connector is located in the lower part of the drive, in front of the motor connector.

Feedback option

Each axis can be fitted with an optional feedback module so that a second encoder channel can be used to control the machine (refer to the user manual for the configuration details); the possible modes are the same as those of the incorporated encoder, available as standard in the drive:

- SinCos, power supply from 5 to 8 Volt
- Hiperface

Brake resistor option

For the 50mm power supply, there are two different brake resistors:

- DBR S standard, 15 Ohm 370 Watt (supplied)
- DBR C insulated, 16 Ohm 500 Watt, available as an optional extra (to be ordered separately with code AR5974)

For the 150mm power supply, the standard brake resistor is not supplied. The recommended resistor is 4.7 Ohm/1000 Watt (to be ordered separately with code AR5988).

In the case of application conditions with dissipated power levels higher than 1000 Watt, contact the Application department to ensure the component is correctly sized.

Connector kit option

All the connectors can be ordered with a separate code. These kits are necessary for wiring the module and power supply unit, and as a spare part when repairing the wiring.

For the correct coupling of the connector kit (supplied) and module, refer to the tables showing the models (on the previous pages).

Each connector kit contains:

- for the axis module: all the signal and power connector kits
- for the power supply module: the power supply connectors and brake resistor connectors (DBR)

Memory Card option

A memory card (MMC) is available for recording, in real time, the data acquired during measurement operations.

The MMC is necessary for filing the data that may later be viewed via the GUI.

Download is via the PC-drive connection, or by removing the card and inserting it in the appropriate drive on the PC.

Thanks to storage on the MMC, you will always have a copy of the parameters if the data are repeated on a new drive.

ABC module

Auxiliary capacitor module

In the same 50mm/1.97 inch module structure, there is a capacitor module for increased braking energy.

The following table sums up the total capacity of each module.

Module ID	Total cap. uF
Auxiliary capacitor module ABC1	1800
Auxiliary capacitor module ABC2	2700
Auxiliary capacitor module ABC3	3600
Auxiliary capacitor module ABC4	4500
Auxiliary capacitor module ABC5	5400

For machines with a fast cycle and movement, the amount of energy dispersed by the brake resistor can be reduced.

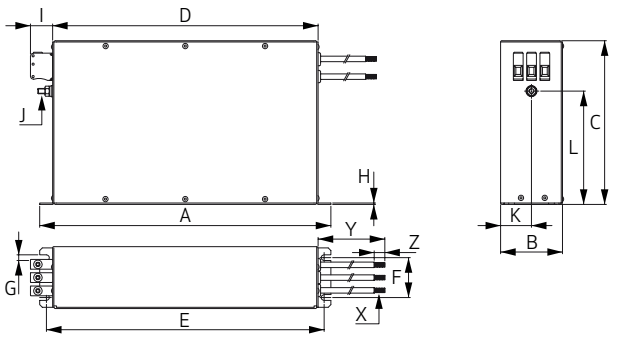
At 200 cycles/min, the addition of an ABC module can save up to 3 kW in braking energy; an application note will help the machine designer to decide whether to add ABCs in the DM2020 configuration (and if so, how many).

Line filters

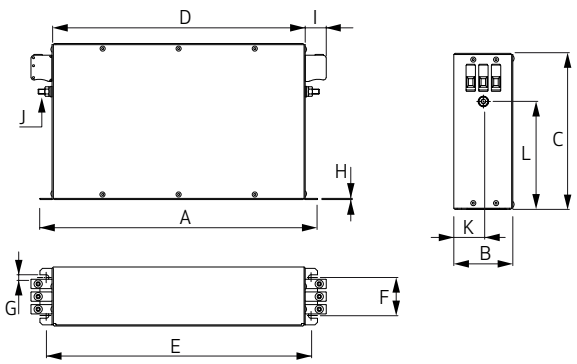
Filter code	AT6013 - AT6015
Rated voltage	3 x 480V, +10%, 50/60 Hz, at 50°C
Overload	1.5x for 60s, repeatable every 60 min.
Ambient temperature	From -25°C to +100°C, with current reduction starting from 60°C (1.3% / °C)
Assembly height	1000m, with current reduction up to 4000m (6% / 1000m)
Relative air humidity	15 - 85% (condensate not permitted)
Storage temperature	From -25°C to +70°C
IP protection rating	IP20
Acceptance test	Complies with CE
Industrial environment - EN61800-3 complies with radio screening	Permitted drive cable length - up to 100m

Code	Suitable for power supply:	Type	Rated current [A]	Total current loss [W]	Current on contact [mA]	Weight [kg]	Connection [mm^2]
AT6013	A	A 1	55	26	33,4	1,8	16mm^2 flex. PE M6 bolt
AT6015	L	L 1	100 (110)	51	21,6	5,6	50mm^2 flex. PE M10 bolt

Dimensions



AT6013	
A = 255mm/10.04 inches	I = 10.9mm/0.43 inches
B = 50mm/1.97 inches	J = M5
C = 126mm/4.96 inches	K = 25mm/0.98 inches
D = 225mm/8.86 inches	L = 85mm/3.35 inches
E = 240mm/9.45 inches	X = AWG 16
F = 25mm/0.98 inches	Y = 300 ± 10mm (11.81 ± 0.39 inches)
G = 6.5mm/0.26 inches	Z = 9mm/0.35 inches
H = 1mm/0.04 inches	



AT6015	
A = 379mm/14.92 inches	H = 1,5mm/0.06 inches
B = 90mm/3.54 inches	I = 45mm/1.77 inches
C = 220mm/8.66 inches	J = M10
D = 350mm/13.78 inches	K = 45mm/1.77 inches
E = 364mm/14.33 inches	L = 130mm/5.11 inches
F = 65mm/2.56 inches	X = AWG 1/0
G = 6.5mm/0.26 inches	

ENVIRONMENTAL DATA

Ambient operating temperature	from 0°C to 40°C up to 55°C with output current reduction (-2% / °C)
Storage temperature	from -25°C to 55°C
Transport temperature	from -25°C to 70°C
Relative humidity	15...85% (condensate not permitted)
Assembly height	Up to 1000m AMSL (over 1000m AMSL with reduced current) max. 2000m AMSL (-2% / 100m)
Certification	CE, UL (ID code E194181)
IP protection rating	IP20
Mechanical resistance in compliance with EN 60721-3-3	Vibration: 3mm in a 2-9 Hz frequency field Vibration: 9.8m/s^2 (1g) in a 9-200 Hz frequency field Shock: 98m/s^2 (10g) at 11ms
Machine safety	STO (Safe Torque Off) SILCL3 PL"e"

CE MARKING

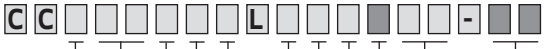
The DM2020 servodrives comply with the Low Voltage Directive (2006/95/CE) and EMC Directive (2004/108/CE).

The “Safe Torque Off” (STO) safety function built into the drive complies with the Machinery Directive (2006/42/CE).

To comply with European Directives, the drive meets the requisites of the relevant harmonised installation standards EN50178 (LVD), EN61800-3 (EMC) and EN 61800-5-2 (Machine Safety). The servodrives are CE-certified.

MODULE CODIFICATION

Axis module coding



Version	
1	Standard model
E	Special model

Mechanical hardware configuration		
Value	Width	Rated current (Axis 1 + Axis 2)
11	Single 50mm	4 Arms L50A
21	Double 50mm	
12	Single 50mm	12 Arms L50B
22	Double 50mm	
14	Single 50mm	16 Arms L50C
24	Double 50mm	
16	Single 75mm	32 Arms L75
26	Double 75mm	
18	Single 100mm	64 Arms L100
28	Double 100mm	
30	Single 200mm	128 Arms L200
40	Double 200mm	

Axis 1 - Currents (1)		
Value	Rated current	Peak current
S	2 Arms	4 Arms
A	4 Arms	8 Arms
B	8 Arms	16 Arms
C	16 Arms	32 Arms
D	24 Arms	48 Arms
E	32 Arms	64 Arms
F	48 Arms	96 Arms
G	64 Arms	128 Arms
H	96 Arms	192 Arms
J	128 Arms	256 Arms

Axis 2 - Currents (1)		
Value	Rated current	Peak current
N	(2)	(2)
S	2 Arms	4 Arms
A	4 Arms	8 Arms
B	8 Arms	16 Arms
C	16 Arms	32 Arms
D	24 Arms	48 Arms
E	32 Arms	64 Arms
F	48 Arms	96 Arms
G	64 Arms	128 Arms

Special variations
Value - Internal coding (4)

Special configurations	
Value	Description
00	Standard configuration
01	Brake option

Hardware revision
Value - Internal coding (4)

Fieldbus configuration	
Value	Version
0	Configuration with EtherCat
1	Configuration with analogue references
2	CANopen configuration

X15 - Slave Board Option (Axis 2)	
Value	Version
N	Not equipped (2)
L	Equipped

OPT2-SlaveBoard(Axis2-SecondTransducer Optional)	
Value	Version
N	Not equipped (2 3)
E	Encoder
I	Incremental encoder
R	Resolver

OPT1 - Master board (Axis 1 - Second Transducer Optional)	
Value	Version
N	Not equipped (3)
E	Encoder
I	Incremental encoder
R	Resolver

(1) With a double axis configuration, the most powerful axis is indicated first

(2) Not equipped - Single-axis version

(3) Standard version

(4) Values assigned by Moog

Coding of the power supply module

Version	
2	Standard model
E	Special model

Mechanical hardware configuration		
Value	Width	Rated current
01	50mm/1.97 inches	54 Arms / 130 Apk
02	150mm/5.90 inches	128Arms/256Apk

Hardware revision
Value - Internal coding (4)

OPT1 - Special configurations	
Value	Version
00	Standard

OPT2 - Special configurations	
Value	Version
00	Standard

Special variations
Value - Internal coding (4)

(4) Values assigned by Moog

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Moog designs a range of motors and motion control products to complement those featured in this document. Moog also provides service and support for all of our products. For more information, contact us.

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L-CAM2-E-171