ABB MACHINERY DRIVES

ACS880-M04 drive

Hardware manual



3

Operation principle and hardware description

Contents of this chapter

The chapter describes the operating principle and construction of the drive module.

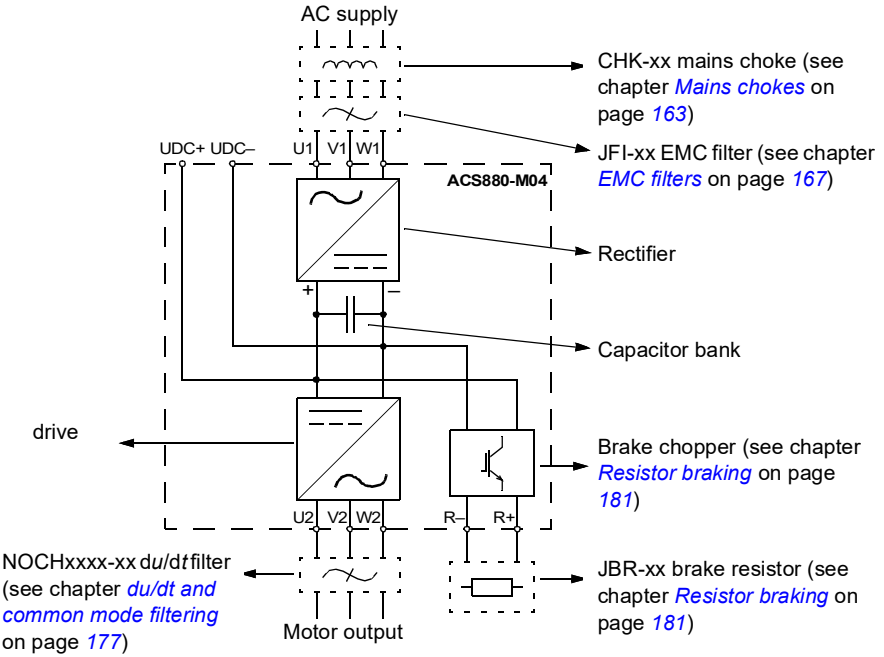
ACS880-M04 drive overview

The ACS880-M04 is an air-cooled IP20 drive module for controlling asynchronous induction motors, permanent magnet motors and ABB synchronous reluctance motors. It must be installed into a cabinet by the customer.

The drive is available in several frame sizes depending on the output power. All frame sizes use the same control unit of ZCU type.

Operation principle

Main circuit



Motor control

The motor control is based on direct torque control. Two phase currents and DC link voltage are measured and used for the control. The third phase current is measured for earth fault protection.

Layout

General

The DC input terminals are located at the top of the module and the AC output terminals are located at the bottom of the module.

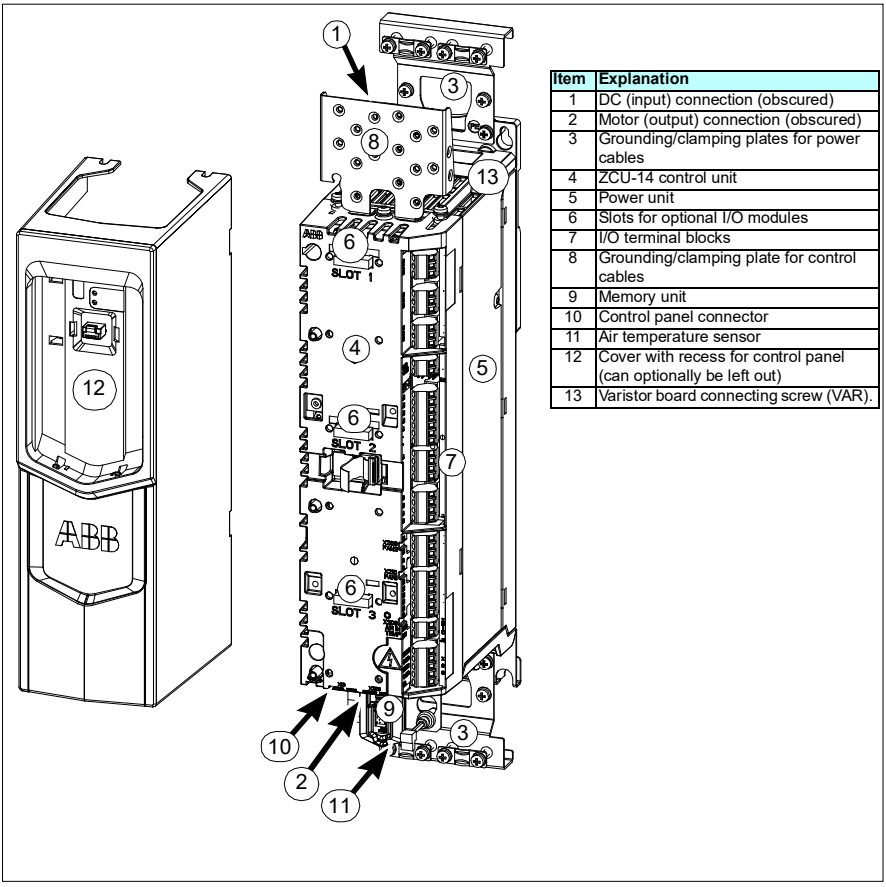
The ZCU-14 control unit is mounted onto the module. The control unit contains the basic I/Os and slots for optional I/O modules. For descriptions of the I/O terminals on the control unit, see *Connecting the control unit* on page *87*.

Other optional equipments are primarily installed on separate mounting plates.

The modules are fitted with external DC fuses. The frames R1...R4 modules have an internal capacitor pre-charge circuit.

Module layout – Frame R1

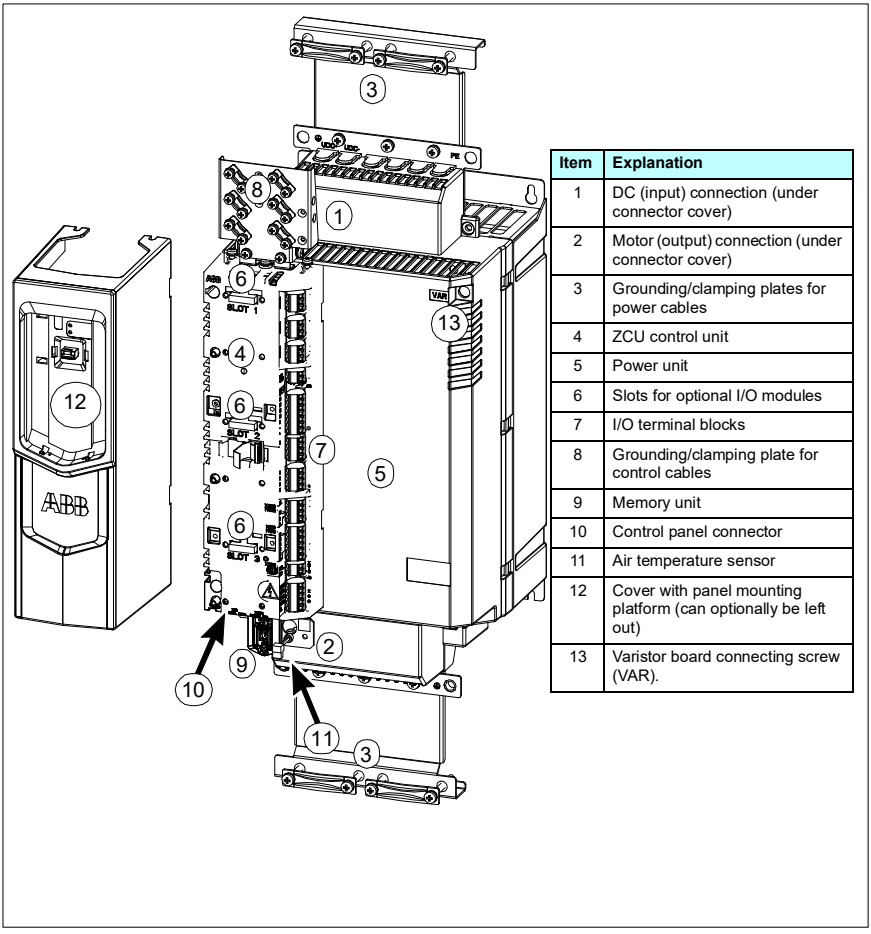
(Note that frame R2 has a similar layout)



Item	Explanation
1	DC (input) connection (obscured)
2	Motor (output) connection (obscured)
3	Grounding/clamping plates for power cables
4	ZCU-14 control unit
5	Power unit
6	Slots for optional I/O modules
7	I/O terminal blocks
8	Grounding/clamping plate for control cables
9	Memory unit
10	Control panel connector
11	Air temperature sensor
12	Cover with recess for control panel (can optionally be left out)
13	Varistor board connecting screw (VAR).

Module layout – Frame R4

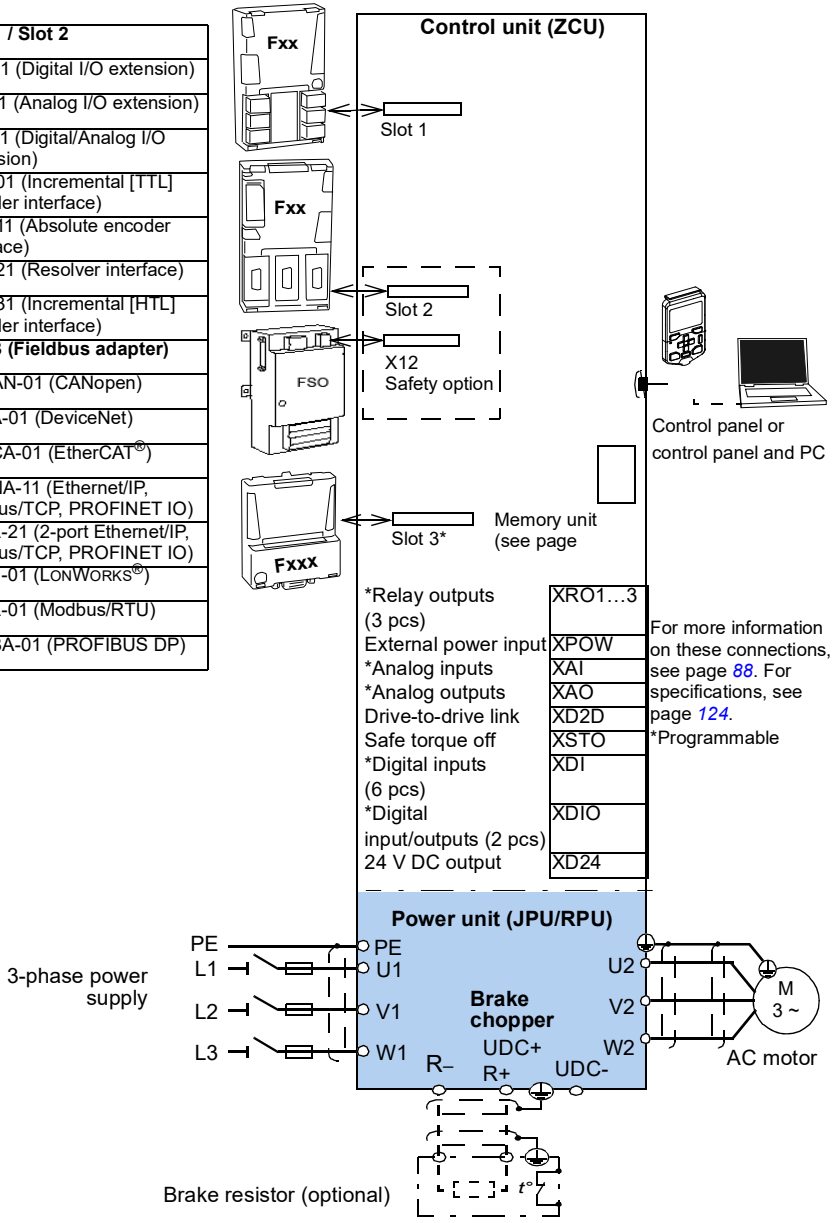
(Note that frame R3 has a similar layout.)



Item	Explanation
1	DC (input) connection (under connector cover)
2	Motor (output) connection (under connector cover)
3	Grounding/clamping plates for power cables
4	ZCU control unit
5	Power unit
6	Slots for optional I/O modules
7	I/O terminal blocks
8	Grounding/clamping plate for control cables
9	Memory unit
10	Control panel connector
11	Air temperature sensor
12	Cover with panel mounting platform (can optionally be left out)
13	Varistor board connecting screw (VAR).

Power connections and control interfaces

Slot 1 / Slot 2
FIO-01 (Digital I/O extension)
FIO-11 (Analog I/O extension)
FIO-21 (Digital/Analog I/O extension)
FEN-01 (Incremental [TTL] encoder interface)
FEN-11 (Absolute encoder interface)
FEN-21 (Resolver interface)
FEN-31 (Incremental [HTL] encoder interface)
Slot 3 (Fieldbus adapter)
**FCAN-01 (CANopen)
FDNA-01 (DeviceNet)
**FECA-01 (EtherCAT®)
**FENA-11 (Ethernet/IP, Modbus/TCP, PROFINET IO)
FENA-21 (2-port Ethernet/IP, Modbus/TCP, PROFINET IO)
FLON-01 (LONWORKS®)
FSCA-01 (Modbus/RTU)
**FPBA-01 (PROFIBUS DP)



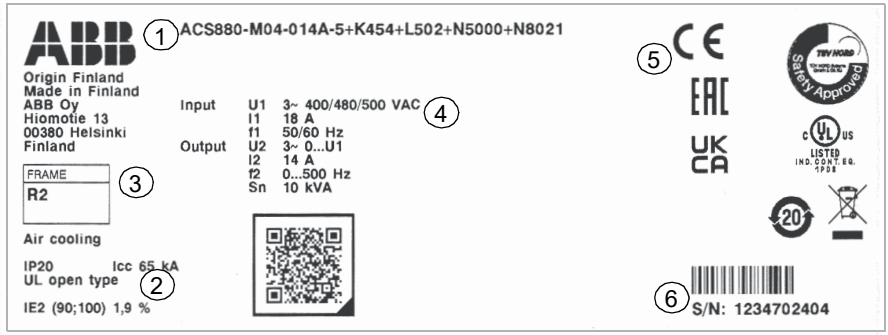
Note:

*Reserved for fieldbus is included in delivery.

**Also supports M-series fieldbuses.

Type designation label

This is a sample type designation label.



No.	Description
1	Type designation, see *Type designation key* below.
2	Degree of protection
3	Frame (size)
4	Nominal ratings, see *Ratings* on page *112*.
5	Valid markings
6	S/N: Serial number in format MYYWWXXXX, where M: Manufacturer YY: Year of manufacture: 15, 16, 17, ... for 2015, 2016, 2017, ... W: Week of manufacture: 01, 02, 03, ... for week 1, week 2, week 3, ... XXXX: Running item number starting each week from 0001.

Type designation key

The type designation key tells you the specifications and configuration of the drive. The table shows the primary drive variants.

Sample type code: ACS880-M04-04A8-5+XXXX

- The first digits from left indicate the basic configuration (ACS880-M04-04A8-5).
- The optional selections are given thereafter, preceded by + signs (e.g. +L501).

The main selections are described below.

Note: Not all selections are necessarily available for all types; refer to *ACS880-M04 ordering information*, available on request.

Selection	Alternatives	
Product series	ACS880	
Type	M04	Drive module. When no options are selected: IP20 (UL Open Type), plain front cover, no control panel, no mains choke (frames R1 and R2), internal mains choke (frames R3 and R4), no EMC filter, internal brake chopper, coated boards, Safe torque off, Primary control program, *Quick installation and start-up Guide*.
Current rating	04A8	For example, 04A8 refers to a nominal output current of 4.8 A. See *Ratings* on page *112*.
Voltage range	2 5	200…240 V 380…500 V
Option codes (plus codes)		
Filters	E...	+E200: EMC filter, C3, 2nd Environment, Unrestricted (Earthed network) (External with frames R1 and R2, internal with frames R3 and R4)
Control panel and front cover options	J...	+0C168: No drive module front cover, no control panel +J400: Control panel mounted on drive module front cover +J410: Control panel with door mounting platform kit including 3 m cable +J414: Control panel mounting platform on drive module (no control panel included)
Fieldbus	K...	+K451: FDNA-01 DeviceNet adapter module +K452: FLON-01 LonWorks® adapter module +K454: FPBA-01 PROFIBUS DP adapter module +K457: FCAN-01 CANopen adapter module +K458: FSCA-01 Modbus/RTU adapter module +K473: FENA-11 Ethernet/IP™, Modbus/TCP and PROFINET IO adapter module +K469: FECA-01 EtherCAT® adapter module

Selection	Alternatives	
I/O extensions and feedback interfaces	L...	+L500: FIO-11 analog I/O extension module +L501: FIO-01 digital I/O extension module +L502: FEN-31 HTL encoder interface module +L516: FEN-21 resolver interface module +L517: FEN-01 TTL encoder interface module +L518: FEN-11 absolute TTL encoder interface module +L519: FIO-21 analog/digital I/O extension module
Programs	N...	+N5050: Crane control program **Note:** The following technology library is required with the Crane control program: +N3050: Crane technology library +N5000: Winder control program +N8200 High-speed control program
Specialties		+P904: Extended warranty
Printed hardware and firmware manuals in specified language (The delivered manual set can include manuals in English if the translation is not available.)	R...	+R700: English +R701: German +R702: Italian +R703: Dutch +R704: Danish +R705: Swedish +R706: Finnish +R707: French +R708: Spanish +R709: Portuguese +R710: Portuguese spoken in Brazil +R711: Russian +R714: Turkish

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Ratings

Nominal ratings with 230 V AC supply

Drive type ACS880-M04	Frame size	Input ratings		Output ratings									
				Nominal		No-overload use		Light-overload use			Heavy-duty use		
		I_{1N} A	*I_{1N} A	I_{2N} A	I_{Max} A	P_N kW	P_N hp	I_{Ld} A	P_{Ld} kW	P_{Ld} hp	I_{Hd} A	P_{Hd} kW	P_{Hd} hp
-03A0-2	R1	2.1	3.5	3.0	4.4	0.37	0.5	2.8	0.37	0.5	2.5	0.37	0.5
-03A6-2	R1	2.9	5.2	3.6	5.3	0.55	0.75	3.4	0.55	0.75	3.0	0.37	0.5
-04A8-2	R1	3.7	6.3	4.8	7.0	0.75	1	4.5	0.75	1	4.0	0.55	0.75
-06A0-2	R1	5.2	8.9	6.0	8.8	1.1	1.5	5.5	1.1	1.5	5.0	0.75	1
-08A0-2	R1	6.3	10.7	8.0	10.5	1.5	2	7.6	1.5	2	6.0	1.1	1.5
-010A-2	R2	8.3	13	10.5	13.5	2.2	3	9.7	2.2	3	9.0	1.5	2
-014A-2	R2	11	17	14	16.5	3	3	13.0	3	3	11.0	2.2	3
-018A-2	R2	15	21	18	21	4	5	16.8	4	5	14.0	3	3
-025A-2	R3	19	–	25	33	5.5	7.5	23	5.5	7.5	19.0	4	5
-030A-2	R3	26	–	30	36	7.5	10	28	7.5	10	24	5.5	7.5
-035A-2	R3	30	–	35	44	7.5	10	32	7.5	10	29	7.5	10
-044A-2	R3	35	–	44	53	11	15	41	11	15	35	7.5	10
-050A-2	R3	42	–	50	66	11	15	46	11	15	44	11	15
-061A-2	R4	54	–	61	78	15	20	57	15	20	52	11	15
-078A-2	R4	64	–	78	100	18.5	25	74	18.5	25	69	15	20
-094A-2	R4	81	–	94	124	22	30	90	22	30	75	18.5	25

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See symbol definitions on page 114.

Nominal ratings with 400 V AC supply

Drive type ACS880-M04	Frame size	Input ratings		Output ratings						
				Nominal		No-overload use	Light-overload use		Heavy-duty use	
		I_{1N} A	*I_{1N} A	I_{2N} A	I_{Max} A	P_N kW	I_{Ld} A	P_{Ld} kW	I_{Hd} A	P_{Hd} kW
-03A0-5	R1	2.3	3.8	3.0	4.4	1.1	2.8	1.1	2.5	0.75
-03A6-5	R1	3.1	5.6	3.6	5.3	1.5	3.4	1.5	3.0	1.1
-04A8-5	R1	4.0	6.8	4.8	7.0	2.2	4.5	1.5	4.0	1.5
-06A0-5	R1	5.5	9.4	6.0	8.8	2.2	5.5	2.2	5.0	2.2
-08A0-5	R1	6.6	11.2	8.0	10.5	3.0	7.6	3.0	6.0	2.2
-010A-5	R2	8.7	13	10.5	13.5	4.0	9.7	4.0	9.0	4.0
-014A-5	R2	12	18	14	16.5	5.5	13.0	5.5	11.0	5.5
-018A-5	R2	16	23	18	21	7.5	16.8	7.5	14.0	7.5
-025A-5	R3	20	–	25	33	11.0	23	11	19.0	7.5
-030A-5	R3	26	–	30	36	15.0	28	15	24	11.0
-035A-5	R3	30	–	35	44	18.5	32	15	29	15.0
-044A-5	R3	36	–	44	53	22	41	22	35	18.5

Drive type ACS880-M04	Frame size	Input ratings		Output ratings						
				Nominal		No-overload use	Light-overload use		Heavy-duty use	
		I_{1N} A	*I_{1N} A	I_{2N} A	I_{Max} A	P_N kW	I_{Ld} A	P_{Ld} kW	I_{Hd} A	P_{Hd} kW
-050A-5	R3	42	–	50	66	22	46	22	44	22
-061A-5	R4	55	–	61	78	30	57	30	52	22
-078A-5	R4	65	–	78	104	37	74	37	66	37
-094A-5	R4	82	–	94	124	45	90	45	75	37

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See symbol definitions on page *114*.

Nominal ratings with 460 V AC supply

Drive type ACS880-M04	Frame size	Input ratings		Output ratings						
				Nominal		No-overload use	Light-overload use		Heavy-duty use	
		I_{1N} A	*I_{1N} A	I_{2N} A	I_{Max} A	P_N hp	I_{Ld} A	P_{Ld} hp	I_{Hd} A	P_{Hd} hp
-03A0-5	R1	2.3	3.8	3.0	4.4	1.5	2.8	1.0	2.5	1.0
-03A6-5	R1	3.1	5.6	3.6	5.3	2.0	3.4	2.0	3.0	1.5
-04A8-5	R1	4.0	6.8	4.8	7.0	3.0	4.5	2.0	4.0	2.0
-06A0-5	R1	5.5	9.4	6.0	8.8	3.0	5.5	3.0	5.0	3.0
-08A0-5	R1	6.6	11.2	8.0	10.5	5.0	7.6	5.0	6.0	3.0
-010A-5	R2	8.7	13	10.5	13.5	5.0	9.7	5.0	9.0	5.0
-014A-5	R2	12	18	14	16.5	7.5	13.0	7.5	11.0	7.5
-018A-5	R2	16	23	18	21	10	16.8	10	14.0	10
-025A-5	R3	20	–	25	33	15	23	15	19.0	10
-030A-5	R3	26	–	30	36	20	28	20	24	15
-035A-5	R3	30	–	35	44	25	32	20	29	20
-044A-5	R3	36	–	44	53	30	41	30	35	25
-050A-5	R3	42	–	50	66	30	46	30	44	30
-061A-5	R4	55	–	61	78	40	57	40	52	40
-078A-5	R4	65	–	78	104	50	74	50	66	50
-094A-5	R4	82	–	94	124	60	90	60	75	50

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See symbol definitions on page *114*.

Nominal ratings with 500 V AC supply

Drive type ACS880-M04	Frame size	Input ratings		Output ratings						
				Nominal		No-overload use	Light-overload use		Heavy-duty use	
		I_{1N} A	*I_{1N} A	I_{2N} A	I_{Max} A	P_N kW	I_{Ld} A	P_{Ld} kW	I_{Hd} A	P_{Hd} kW
-03A0-5	R1	2.3	3.8	3.0	4.4	1.5	2.8	1.1	2.5	1.1
-03A6-5	R1	3.1	5.6	3.6	5.3	1.5	3.4	1.5	3.0	1.5
-04A8-5	R1	4.0	6.8	4.8	7.0	2.2	4.5	2.2	4.0	2.2
-06A0-5	R1	5.5	9.4	6.0	8.8	3.0	5.5	3.0	5.0	2.2
-08A0-5	R1	6.6	11.2	8.0	10.5	4.0	7.6	4.0	6.0	3.0
-010A-5	R2	8.7	13	10.5	13.5	5.5	9.7	5.5	9.0	4.0
-014A-5	R2	12	18	14	16.5	7.5	13.0	7.5	11.0	5.5
-018A-5	R2	16	23	18	21	11.0	16.8	7.5	14.0	7.5
-025A-5	R3	20	–	25	33	15.0	23	11.0	19.0	11.0
-030A-5	R3	26	–	30	36	18.5	28	15.0	24	15.0
-035A-5	R3	30	–	35	44	22	32	18.5	29	18.5
-044A-5	R3	36	–	44	53	30	41	22	35	22
-050A-5	R3	42	–	50	66	30	46	30	44	30
-061A-5	R4	55	–	61	78	37	57	37	52	30
-078A-5	R4	65	–	78	104	45	74	45	66	45
-094A-5	R4	82	–	94	124	55	90	55	75	45

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See symbol definitions below.

Definitions

I_{1N}	Nominal input current (rms) at 40 °C (104 °F). *Without mains choke.
I_{2N}	Nominal output current.
I_{Max}	Maximum output current. Available for at least 10 seconds at start, otherwise as long as allowed by drive temperature.
P_N	Typical motor power for no-overload use.
I_{Ld}	Continuous rms output current. 10% overload is allowed for 1 minute every 5 minutes.
P_{Ld}	Typical motor power for light-overload use.
I_{Hd}	Continuous rms output current. 50% overload is allowed for 1 minute every 5 minutes.
P_{Hd}	Typical motor power for heavy-duty use.

Note: To achieve the rated motor power given in the table, the rated current of the drive must be higher than or equal to the rated motor current.

The DriveSize dimensioning tool available from ABB is recommended for selecting the drive, motor and gear combination.

The maximum allowed motor shaft power is limited to $1.5 \cdot P_{Hd}$, $1.1 \cdot P_N$ or $P_{cont.max}$ (whichever value is the greatest). If the limit is exceeded, motor torque and current are automatically restricted. The function protects the input bridge of the drive against overload.

Derating

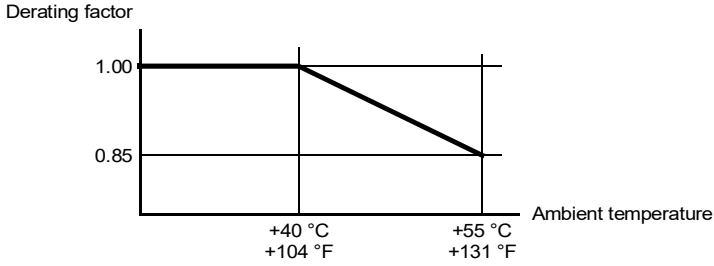
The continuous output currents stated above must be derated if any of the following conditions apply:

- ambient temperature exceeds 40 °C (+104°F)
- drive is installed higher than 1000 m above sea level
- parameter-adjustable motor noise level is set as low.

Note: The final derating factor is a multiplication of all applicable derating factors.

Ambient temperature derating

In the temperature range 40…55 °C (+104…131 °F), the rated output current is derated by 1% for every added 1 °C (1.8 °F) as follows:



Altitude derating

At altitudes from 1000 to 2000 m (3300 to 6562 ft) above sea level, the derating is 1% for every 100 m (328 ft). For a more accurate derating, use the DriveSize PC tool.

Low motor noise derating

Low motor noise is activated with a drive parameter (see the *firmware manual*). With low motor noise, drive loadability is reduced and derating must be applied if a certain constant output current is needed. See the derated values in the below tables.

For definitions of symbols used in the below tables, see *Definitions* on page *114*.

Dimensions and weights

See the *Dimension drawings* on page *189*.

Frame size	Height (without cable clamp plates) H1		Height (with cable clamp plates) H2		Width[1] W		Depth[2] (without options, cover and control panel) D1		Depth (+J400 / with cover and control panel) D2	
	mm	in	mm	in	mm	in	mm	in	mm	in
R1	364	14.33	474	18.66	90	3.54	157	6.18	237	9.33
R2	380	14.96	476	18.74	100	3.94	234	9.21	315	12.40
R3	567	22.32	658	25.91	165	6.50	235	9.25	316	12.44
R4	567	22.32	744	29.29	220	8.66	235	9.25	316	12.44

[1] With option +J400 (with cover and control panel) the width is increased by 5 mm (0.20 in)
[2] Depth is increased with options (Fieldbus communication, I/O extension, encoder interface and their cabling

Frame size	Weight	
	kg	lbs
R1	3.4	7.50
R2	5.6	12.35
R3	15.8	34.83
R4	21.5	47.40

***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 is 50 V.

AC input (supply) connection

Voltage (U_1)	200…240 V AC +/-10%, 3-phase 380…500 V AC +10%/-15%, 3-phase
Network type	Symmetrically grounded TN-S system, IT (ungrounded)
Short-circuit withstand strength (IEC 60439-1	100 kA when protected by fuses given in the on page 128. Frames R1 and R2: Thermal dimensioning of the DC capacitors is based on max. 5 kA short-circuit current. An input choke should be used to achieve 100 kA.
Short-circuit current protection (UL 61800-5-1, CSA C22.2 No. 274-13)	US and Canada: The drive is suitable for use on a circuit capable of delivering not more than 100 kA symmetrical amperes (rms) at 500 V maximum when protected by fuses given in the on page 128.
Frequency	50…60 Hz ±5%
Imbalance	Max. ±3% of nominal phase to phase input voltage
Fundamental power factor (cos phi$_1$)	0.98 (at nominal load)
Terminals	Frame R1: Detachable screw terminal block for 0.25…4 mm^2 wire. Frame R2: Detachable screw terminal block for 0.5…6 mm^2 wire. Frames R3 and R4: Screw lugs for 6…70 mm^2 wire included. Suitable crimp lugs can be used instead.

DC connection

Voltage

243…356 V DC (ACS880-M04-xxxx-2 drives)
436…743 V DC (ACS880-M04-xxxx-5 drives)

Ratings, fuse recommendations

Drive type ACS880-M04 -xxxx-2/5	I_{dcN} (A)	C (µF)	IEC fuse			UL fuse		
			Rated current (A)	Voltage (V)	Class	Rated current (A)	Voltage (V)	Class
-03A0	3.3	120	16	690	aR	12	690	URC
-03A6	3.9	120	16	690	aR	12	690	URC
-04A8	4.8	240	16	690	aR	12	690	URC
-06A0	6.5	240	16	690	aR	12	690	URC
-08A0	8.7	240	16	690	aR	12	690	URC
-010A	12	370	20	690	aR	16	690	URC
-014A	15	740	32	690	aR	32	690	URD
-018A	20	740	32	690	aR	32	690	URD
-025A	29	670	63	690	aR	63	690	URQ
-030A	38	670	63	690	aR	63	690	URQ
-035A	44	1000	100	690	aR	100	690	URQ
-044A	54	1000	100	690	aR	100	690	URQ
-050A	54	1000	100	690	aR	100	690	URQ
-061A	73	1340	160	690	aR	160	690	URQ
-078A	85	2000	160	690	aR	160	690	URQ
-094A	98	2000	160	690	aR	160	690	URQ

I_{dcN}	Average DC input current requirement when running a typical induction motor at P_N at a DC link voltage of 540 V (which corresponds to an AC input voltage of 400 V).
C	Capacitance of DC link.

Terminals

Frame R1: Detachable screw terminal block for 0.25…4 mm^2 wire.
Frame R2: Detachable screw terminal block for 0.5…6 mm^2 wire.
Frames R3 and R4: Screw lugs for 6…70 mm^2 wire included. Suitable crimp lugs can be used instead.

Motor connection

Motor types	Asynchronous induction motors, permanent magnet motors, ABB synchronous reluctance motors
Frequency	0…500 Hz
Current	See section *Ratings.*
Switching frequency	3 kHz (default)
Maximum motor cable length	Frames R1 and R2: 150 m (492 ft)* Frames R3 and R4: 300 m (984 ft)* *100 m with EN 61800-3 Category C3 filter Longer cables cause a motor voltage decrease which limits the available motor power. The decrease depends on the motor cable length and characteristics. Contact ABB for more information. Note that a sine filter (optional) at the drive output also causes a voltage decrease.
Terminals	Frame R1: Detachable screw terminal block for 0.25…4 mm^2 wire. Frame R2: Detachable screw terminal block for 0.5…6 mm^2 wire. Frames R3 and R4: Screw lugs for 6…70 mm^2 wire included. Suitable crimp lugs can be used instead.

Efficiency

Approximately 98% at nominal power level

The efficiency is not calculated according to the ecodesign standard IEC61800-9-2.

Energy efficiency data (ecodesign)

Energy efficiency data according to IEC-61800-9-2 is available from the ecodesign tool (https://ecodesign.drivesmotors.abb.com).

Cooling

Method	Internal fan, flow from bottom to top. Air-cooled heatsink. See *Cooling and degrees of protection* on page *42*.
Free space around the unit	See *Free space requirements* on page *39*.

Protection classes

	Environmental limits for the drive are given below. The drive must be used in a heated, indoor, controlled environment.
Degree of protection (IEC/EN 60529)	IP20 / UL open type. See *Cooling and degrees of protection* on page *42*.
Overv. cat. (IEC 60664-1)	III
Pollution degr. (IEC 60664-1)	2