

LOW VOLTAGE AC DRIVES

ABB machinery drives

ACS355, 0.5 to 30 hp/0.37 to 22 kW



**All your machine building needs
in one drive. ACS355 drives.**

Table of contents

4	Introduction to ACS355
6	Compact drives with big drive features
8	Typical applications
10	Ratings and types
11	Technical data
12	Dimensions and weights
13	Cooling
14	Fuses and circuit protection
15	Control connections
16	Control program example
19	Control program variants
22	Product variants
24	Options
27	Software tools
33	Resistors
40	Reactors
44	dv/dt output filters
46	ABB automation products
48	Services to match your needs
49	Drives service

Introduction to ACS355

ABB machinery drives

The ABB machinery drives are designed to be fast drives to install, parameter-set and commission. Thus saving hours of engineering work. They are highly compact and cost-effective. Equipped with cutting-edge intelligence and safety capability the drives are designed specifically to meet the production and performance needs of system integrators, original equipment manufacturers (OEMs) and panel builders, as well as the requirements of end users in a broad range of applications.

In the ABB machinery drives portfolio, ACS355 represents the micro drive range; meeting requirements like compact size, being optimized for a lower power range, cost-effectiveness, and ease of use. By choosing an ABB machinery drive, machine builders not only get all the clever things inside the drive, but also everything outside it: the entire global ABB. This means a full range of products and services designed to support their business.

Applications

ABB machinery drives are designed to meet the requirements of an extensive range of machinery applications. The drives are ideal for food and beverage, material handling, lifting, textile, printing, rubber and plastics, and woodworking applications.

Highlights

- Exceptionally compact drives and uniform design
- Quick commissioning with application macros and panel assistants
- Safe torque off function (SIL3) as standard
- Sensorless vector control for induction motors and permanent magnet motors up to 599 Hz
- Built-in braking chopper
- Coated boards - all variants
- IP66 product variant for harsh environments and solar pump drive variant available



Compact drives with big drive features

ACS355 drives are designed to maximize your machine's availability with drives that are easy to install and setup.

The drive is highly modular and supports a variety of fieldbus protocols thus providing flexible connectivity. In addition to a broad range of built-in options such as different I/O and communications, a wide selection of external accessories is also available. Wherever your machine is located, the local ABB will be there to support you and your clients.

Flexible performance

Reduce the need for external PLC components with built-in sequence programming providing simple drive control logic. Improve production flow and increase cost savings with built-in features, such as speed compensated stop enabling precision stopping, and patented smooth start for permanent magnet motors.

Quick and easy commissioning

Predefined I/O configurations for application macros and built-in assistants speed up commissioning of the drive, allowing you to concentrate on your business.

Compact and uniform design

Compact size, the broadest power range in its class from 0.37 to 22 kW and side-by-side mounting ensure optimized cabinet installation in a wide range of machinery applications, resulting in space and cost savings.

Supported motor types

Same drive can be used for sensorless induction and permanent magnet motor control without a feedback device.



Application-specific product variants

Ensure long life time of equipment and reliable energy supply with a drive for solar pumps including embedded pump-specific features protecting the pump. The high speed variant for spindle applications provides speed controller tuning without use of encoder.

Protection against harsh environments

Increase time and cost savings with NSF certified product variant for IP66/67/69K, UL Type 4X protection classes with no need to design special enclosures for applications that require a high ingress protection against dirt, dust and moisture.

Communication with major automation networks

Optional fieldbus adapters enable connectivity with major industrial automation networks.



Safety

Integrated safe torque off (STO) function up to SIL 3 is a cost-effective and certified solution for safe machine maintenance by fulfilling IEC 61508, EN 62061 and EN ISO 13849-1 standards. The safety function can also be used to implement Emergency Stop without contactors.

NEMA 1 (UL Type 1) enclosure kits

Enhance installation flexibility by allowing the drive to be wall-mounted outside of an enclosure or to provide finger-safe protection inside an enclosure.



Typical applications



Mixer

In mixing applications the drive provides a high starting torque. The silent operation mode adjusts the switching frequency of the drive to a higher level after the high-torque start, resulting in lower audible noise. The FlashDrop tool provides a quick and safe way to configure multiple drives for identical mixer applications.



Conveyor

Production lines often have multiple stages, including conveyors, which need to be efficiently linked with each other to provide high production output. A drive provides smooth start and stop of the conveyor, thereby reducing mechanical stress and lowering maintenance costs.



Packaging machine

Packaging machines often require a drive to provide a high degree of repeatability and accuracy during the packing operation. As such, the ACS355 is well suited for packaging duties and also provides good dynamic and static speed control accuracy. Sequence programming enables the drive to perform sequences of tasks, reducing the need for a PLC. Software features include timer, counter, brake control and jogging – all of which can be used in a packaging machine.



Bottling line

When filling the bottles with liquid, bottling lines require a drive which offers high accuracy. The ACS355 is perfect for this purpose, with its good dynamic and static speed control. When dealing with liquids, the ACS355 with a high protection class (IP66) would also be a good choice.

Winders

The ACS355 offers high static speed accuracy. When dealing with thin strings like in string winders, it is essential to control the winder speed accurately in order to prevent the strings from snapping. Surface winders, on the other hand, require high static speed accuracy to keep control of the material thickness or tension.

Ratings and types

Ratings IP20/UL Open type/ NEMA 1 option			Type designation	Frame size IP20	Frame size IP66
P_N (hp)	P_N (kW)	I_{2N} (A)			
1-phase AC supply, 200 to 240 V					+B063*
0.5	0.37	2.4	ACS355-01U-02A4-2	R0	-
1.0	0.75	4.7	ACS355-01U-04A7-2	R1	-
1.5	1.1	6.7	ACS355-01U-06A7-2	R1	-
2.0	1.5	7.5	ACS355-01U-07A5-2	R2	-
3.0	2.2	9.8	ACS355-01U-09A8-2	R2	-
3-phase AC supply, 200 to 240 V					+B063*
0.5	0.37	2.4	ACS355-03U-02A4-2	R0	R1
0.75	0.55	3.5	ACS355-03U-03A5-2	R0	R1
1.0	0.75	4.7	ACS355-03U-04A7-2	R1	R1
1.5	1.1	6.7	ACS355-03U-06A7-2	R1	R1
2.0	1.5	7.5	ACS355-03U-07A5-2	R1	R1
3.0	2.2	9.8	ACS355-03U-09A8-2	R2	R3
5.0	4.0	17.6	ACS355-03U-17A6-2	R2	R3
7.5	5.5	24.4	ACS355-03U-24A4-2	R3	-
10.0	7.5	31.0	ACS355-03U-31A0-2	R4	-
15.0	11.0	46.2	ACS355-03U-46A2-2	R4	-
3-phase AC supply, 380 to 480 V					+B063*
0.5	0.37	1.2	ACS355-03U-01A2-4	R0	R1
0.75	0.55	1.9	ACS355-03U-01A9-4	R0	R1
1.0	0.75	2.4	ACS355-03U-02A4-4	R1	R1
1.5	1.1	3.3	ACS355-03U-03A3-4	R1	R1
2.0	1.5	4.1	ACS355-03U-04A1-4	R1	R1
3.0	2.2	5.6	ACS355-03U-05A6-4	R1	R1
5.0	4.0	8.8	ACS355-03U-08A8-4	R1	R1
7.5	5.5	12.5	ACS355-03U-12A5-4	R3	R3
10.0	7.5	15.6	ACS355-03U-15A6-4	R3	R3
15.0	11.0	23.1	ACS355-03U-23A1-4	R3	-
20.0	15.0	31.0	ACS355-03U-31A0-4	R4	-
25.0	18.5	38.0	ACS355-03U-38A0-4	R4	-
30.0	22.0	44.0	ACS355-03U-44A0-4	R4	-

P_N for kW = Typical motor power in 400 V at normal use

P_N for hp = Typical motor power in 460 V at normal use

I_{2N} for A = Continuous rms current. 50% overload is allowed for one minute in ten minutes.

* See page 24 for details on +B063 variant

Type designation

This is the unique reference number (shown in column 4, right) that clearly identifies your drive by current rating and frame size. Once the drive's type designation has been selected, the frame size (column 5) can be used to determine the drive dimensions, shown on page 12.

Voltages

ACS355 is available in two voltage ranges:

2 = 200 to 240 V

4 = 380 to 480 V

Insert either "2" or "4", depending on your chosen construction, current rating, voltage, and option and variant codes into the type designation.

Current rating

Current rating represents the rated continuous drive output current inside the drive specification. Motor power stated in the table below states the typical motor power.

Variant code

This code states the factory installed SW variants to the drive. See pages 16 - 19 for details.

Construction

"01E" within the type designation varies depending on the drive phase and EMC filtering. Choose below the one you need.

01 = 1-phase

03 = 3-phase

U = EMC filter installed but disconnected. This is the standard configuration for drives stocked in the U.S. The "U" indicates that a plastic screw has been inserted in the "EMC" location on the side of the drive. To ground the EMC filter and make it active, remove the plastic screw and replace it with the metal screw provided in the parts bag.

Note: The European variant of the ACS355 drive may have an "E" in the type designation. This indicates the drive has been provided with the metal grounding screw inserted in the "EMC" location.

Technical data

Mains connection	
Voltage and power range	1-phase, 200 to 240 V $\pm$ 10% 0.5 to 3 hp (0.37 to 2.2 kW) 3-phase, 200 to 240 V $\pm$ 10% 0.5 to 15 hp (0.37 to 11 kW) 3-phase, 380 to 480 V $\pm$ 10% 0.5 to 30 hp (0.37 to 22 kW)
Frequency	48 to 63 Hz
Common DC connection	
Voltage and power range	230 V drives, 325 V $\pm$ 15% 400/480 V drives, 540 $\pm$ 15% (common DC manual) $P_{max} = P_n$ of the drive
Motor connection	
Voltage	3-phase, from 0 to U_{SUPPLY}
Frequency	0 to 599 Hz
Continuous loading capability (constant torque at a max. ambient temperature of 40 °C)	Rated output current I_{2N}
Overload capacity (at a max. ambient temperature of 40 °C)	1.5 $\times$ I_{2N} for 1 minute every 10 minutes At start 1.8 $\times$ I_{2N} for 2 s
Switching frequency Selectable	Default 4 kHz 4 to 16 kHz with 4 kHz steps
Acceleration time	0.1 to 1800 s
Deceleration time	0.1 to 1800 s
Braking	Built-in brake chopper as standard
Speed control Static accuracy Dynamic accuracy	20% of motor nominal slip < 1% s with 100% torque step
Torque control Torque step rise time Non-linearity	< 10 ms with nominal torque $\pm$ 5% with nominal torque
Environmental limits	
Ambient temperature	-10 to 40 °C (14 to 104 °F), no frost allowed 50 °C (122 °F) with 10% derating
Altitude	Rated current available at 0 to 1000 m. In altitudes from 1000 to 2000 m (3300 to 13,200 ft) above sea level, the derating is 1% for every 100 m (330 ft). If the installation site is higher than 2000 m (6600 ft) above sea level, please contact your local ABB distributor or office for further information.
Relative humidity	Lower than 95% (without condensation)
Degree of protection	IP20/optional NEMA 1/UL type 1 enclosure IP66/IP67/UL Type 4X as an option up to 7.5 kW, IP69K available for IP66/IP67 variant with compatible cable glands
Enclosure color	NCS 1502-Y, RAL 9002, PMS 420 C
Contamination levels	IEC721-3-3 No conductive dust allowed Class 1C2 (chemical gases) Class 1S2 (solid particles)
Transportation	Class 2C2 (chemical gases) Class 2S2 (solid particles)
Storage	Class 3C2 (chemical gases) Class 3S2 (solid particles)
Operation	Class 3S2 (solid particles)

Product compliance	
Low Voltage Directive 2006/95/EC Machinery Directive 2006/42/EC EMC Directive 2004/108/EC Quality assurance system ISO 9001 Environmental system ISO 14001 UL, cUL, CE, C-Tick/RCM and EAC RoHS compliant	
Programmable control connections	
Two analog inputs	
Voltage signal	
Unipolar	0 (2) to 10 V, $R_{in} > 312$ k Ω
Bipolar	-10 to 10 V, $R_{in} > 312$ k Ω
Current signal	
Unipolar	0 (4) to 20 mA, $R_{in} = 100$ Ω
Bipolar	-20 to 20 mA, $R_{in} = 100$ Ω
Potentiometer reference value	10 V $\pm$ 1% max. 10 mA, $R < 10$ k Ω
Resolution	0.1%
Accuracy	$\pm$ 2%
One analog output	0 (4) to 20 mA, load < 500 Ω
Auxiliary voltage	24 V DC $\pm$ 10%, max. 200 mA
Five digital inputs	12 to 24 V, PNP and NPN, programmable DI5 0 to 16 kHz pulse train 2.4 k Ω
Input impedance	
One relay output	
Type	NO + NC
Maximum switching voltage	250 V AC/30 V DC
Maximum switching current	0.5 A/30 V DC; 5 A/230 V AC
Maximum continuous current	2 A rms
One digital output	
Type	Transistor output
Maximum switching voltage	30 V DC
Maximum switching current	100 mA/30 V DC, short circuit protected
Frequency	10 Hz to 16 kHz
Resolution	1 Hz
Accuracy	0.2%
Serial and Ethernet communication	
Fieldbuses	Plug-in type
Refresh rate	< 10 ms (between drive and fieldbus module)
DeviceNet™	5-pin screw type connector, up to 500 kbit/s baud rate
PROFIBUS DP	9-pin D-connector, up to 12 Mbit/s baud rate
POWERLINK	2 pcs RJ-45 connector, 100 Mbit/s baud rate
ControlNet™	2 pcs 8P8C modular jacks
CANopen®	9-pin D-connector, up to 1 Mbit/s
Modbus RTU	4-pin screw type connector, up to 115 kbit/s baud rate
EtherNet/IP™, Modbus TCP, PROFINET IO	1 RJ45 connector (FENA-01 and -11) or 2 RJ45 connectors (FENA-21). 10/100Mbit/s baud rate
LonWorks®	3-pin screw type connector, up to 78 kbit/s baud rate
EtherCAT®	2 pcs RJ-45 connectors, 100 Mbit/s baud rate
Chokes	
AC input chokes	External option. For reducing THD in partial loads and to comply with EN/IEC 61000-3-12.
AC output chokes	External option. To achieve 2x longer motor cables

Dimensions and weights

Cabinet-mounted drives (IP20/UL Open)

Frame size	IP20/UL Open						Weight (lb)
	H1 (in)	H2 (in)	H3 (in)	W (in)	D1 (in)	D2 (in)	
R0	6.7	8.0	9.4	2.8	6.3	7.4	2.6
R1	6.7	8.0	9.4	2.8	6.3	7.4	2.6
R2	6.7	8.0	9.4	4.1	6.5	7.5	3.3
R3	6.7	8.0	9.3	6.7	6.7	7.7	5.5
R4	7.1	8.0	9.6	10.2	6.7	7.7	9.7

H1 = Height without fastenings and clamping plate

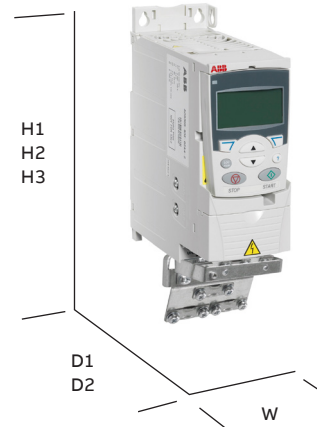
H2 = Height with fastenings but without clamping plate

H3 = Height with fastenings and clamping plate

W = Width

D1 = Standard depth

D2 = Depth with MREL, MPOW or MTAC option



Wall-mounted drives (NEMA 1/UL Type 1)

Frame size	NEMA 1/UL Type 1					Weight (lb)
	H4 (in)	H5 (in)	W (in)	D1 (in)	D2 (in)	
R0	10.1	11.0	2.8	6.7	7.4	3.5
R1	10.1	11.0	2.8	6.7	7.4	3.5
R2	10.1	11.1	4.1	6.7	7.5	4.2
R3	10.2	11.8	6.7	7.0	7.7	6.8
R4	10.6	12.6	10.2	7.0	7.7	11.0

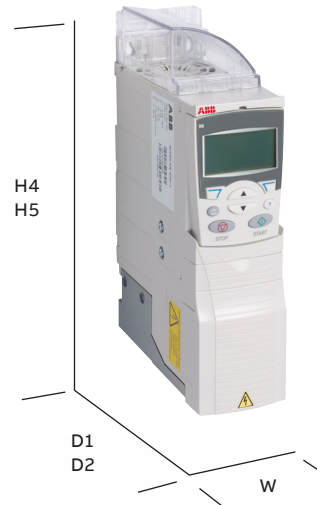
H4 = Height with fastenings and NEMA 1 connection box

H5 = Height with fastenings, NEMA 1 connection box and hood

W = Width

D1 = Standard depth

D2 = Depth with MREL, MPOW or MTAC option



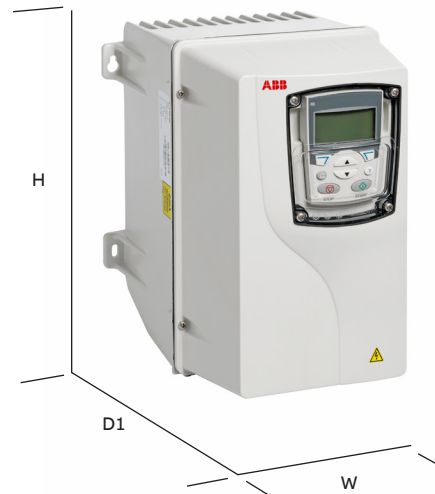
Wall-mounted drives (IP66/IP67/UL Type 4X)

Frame size	IP66/IP67/UL Type 4X				Weight (lb)
	H4 (in)	W (in)	D1 (in)		
R1	12.0	7.7	11.1		16.9
R3	17.2	9.7	10.9		28.6

H = Height

W = Width

D1 = Standard depth



Cooling

Cooling

ACS355 is fitted with cooling fans as standard. The cooling air must be free from corrosive substances and must not be above the maximum ambient temperature of 40 °C (50 °C with derating). Heat dissipation from IP66/IP67/UL Type 4X drive equals to the IP20 UL Open values. For more specific limits see the Technical specification – Environmental limits in this catalog.

Cooling air flow					
Type designation	Frame size	Heat dissipation		Air flow	
		(W)	BTU/hr ¹⁾	m ³ /h	ft ³ /min
1-phase AC supply, 200 to 240 V					
ACS355-01U-02A4-2	R0	48	163	— ²⁾	— ²⁾
ACS355-01U-04A7-2	R1	72	247	24	14
ACS355-01U-06A7-2	R1	97	333	24	14
ACS355-01U-07A5-2	R2	101	343	21	12
ACS355-01U-09A8-2	R2	124	422	21	12
3-phase AC supply, 200 to 240 V					
ACS355-03U-02A4-2	R0	42	142	— ²⁾	— ²⁾
ACS355-03U-03A5-2	R0	54	183	— ²⁾	— ²⁾
ACS355-03U-04A7-2	R1	64	220	24	14
ACS355-03U-06A7-2	R1	86	295	24	14
ACS355-03U-07A5-2	R1	88	302	21	12
ACS355-03U-09A8-2	R2	111	377	21	12
ACS355-03U-17A6-2	R2	180	613	52	31
ACS355-03U-24A4-2	R3	285	975	71	42
ACS355-03U-31A0-2	R4	328	1119	96	57
ACS355-03U-46A2-2	R4	488	1666	96	57
3-phase AC supply, 380 to 480 V					
ACS355-03U-01A2-4	R0	35	121	— ²⁾	— ²⁾
ACS355-03U-01A9-4	R0	40	138	— ²⁾	— ²⁾
ACS355-03U-02A4-4	R1	50	170	13	8
ACS355-03U-03A3-4	R1	60	204	13	8
ACS355-03U-04A1-4	R1	69	235	13	8
ACS355-03U-05A6-4	R1	90	306	19	11
ACS355-03U-08A8-4	R1	127	433	24	14
ACS355-03U-12A5-4	R3	161	551	52	31
ACS355-03U-15A6-4	R3	204	697	52	31
ACS355-03U-23A1-4	R3	301	1029	71	42
ACS355-03U-31A0-4	R4	408	1393	96	57
ACS355-03U-38A0-4	R4	498	1700	96	57
ACS355-03U-44A0-4	R4	588	2007	96	57

¹⁾ BTU/hr = British Thermal Unit per hour. BTU/hr is approximately 0.293 Watts.

²⁾ Frame size R0 with free convection cooling.

Free space requirements			
Enclosure type	Space above (in)	Space below (in)	Space on left/right (in)
All frame sizes	3.0	3.0	0.0
IP66/67 enclosure	3.0	3.0	0.8

Fuses and circuit protection

Fuses or manual motor protectors for circuit protection

Standard fuses or manual motor protectors can be used with ACS355 drives for branch circuit protection. Use the following table for selecting the correct fuse or protector for each drive.

Manual motor protectors

ABB UL file E211945 Volume 1, Section 4 lists the ABB Type E manual motor protectors MS132 & S1-M3-25, MS165, MS495-xxE as an alternate to UL classified fuses as a means of branch circuit protection. This is in accordance with the National Electrical Code (NEC).

When the correct ABB Type E manual motor protector is selected from the table and used for branch circuit protection the drive is suitable for use in a circuit capable of delivering not more than 65 kA RMS symmetrical amperes at the drive maximum rated voltage.

Drives with and without NEMA 1 enclosure kits are included in the UL file. The MMP selections in the table are also valid for drives having a NEMA 1 enclosure kit installed.

Selection table

Type designation	Frame size	IEC fuses	UL fuses	Manual motor protector		Min. Encl. Vol. (cu in) ⁷⁾
		Fuse type Gg ¹⁾ (A)	UL Class T or CC (600V) (A)	Input Amps	MMP Type E ^{3), 4)}	
1-phase AC supply, 200 to 240 V						
ACS355-01U-02A4-2	R0	10	10	6.1	MS132-6.3 & S1-M3-25 ³⁾	1152
ACS355-01U-04A7-2	R1	16	20	11	MS165-16	1482
ACS355-01U-06A7-2	R1	16/20 ²⁾	25	16	MS165-20	1482
ACS355-01U-07A5-2	R2	20/25 ²⁾	30	17	MS165-20	1482
ACS355-01U-09A8-2	R2	25/35 ²⁾	35	21	MS165-25	1482
3-phase AC supply, 200 to 240V						
ACS355-03U-02A4-2	R0	10	10	4.3	MS132-6.3 & S1-M3-25 ³⁾	1152
ACS355-03U-03A5-2	R0	10	10	6.1	MS132-6.3 & S1-M3-25 ³⁾	1152
ACS355-03U-04A7-2	R1	10	15	7.6	MS132-10 & S1-M3-25 ³⁾	1152
ACS355-03U-06A7-2	R1	16	15	11.8	MS165-16	1482
ACS355-03U-07A5-2	R1	16	15	12	MS165-16	1482
ACS355-03U-09A8-2	R2	16	20	14.3	MS165-16	1482
ACS355-03U-13A3-2	R2	25	30	22	MS165-25	1482
ACS355-03U-17A6-2	R2	25	35	25	MS165-32	1482
ACS355-03U-24A4-2	R3	63	60	41	MS165-45	1482
ACS355-03U-31A0-2	R4	80	80	50	MS165-65	1482
ACS355-03U-46A2-2	R4	100	100	69	MS495-75E or MS5100-100	1152
3-phase AC supply, 440 to 480V ⁶⁾						
ACS355-03U-01A2-4	R0	10	10	1.8	MS132-2.5 & S1-M3-25 ³⁾	1152
ACS355-03U-01A9-4	R0	10	10	3	MS132-4.0 & S1-M3-25 ³⁾	1152
ACS355-03U-02A4-4	R1	10	10	3.4	MS132-4.0 & S1-M3-25 ³⁾	1152
ACS355-03U-03A3-4	R1	10	10	5	MS132-6.3 & S1-M3-25 ³⁾	1152
ACS355-03U-04A1-4	R1	16	15	5.8	MS132-6.3 & S1-M3-25 ³⁾	1152
ACS355-03U-05A6-4	R1	16	15	8	MS132-10 & S1-M3-25 ³⁾	1152
ACS355-03U-07A3-4	R1	16	20	9.7	MS132-10 & S1-M3-25 ³⁾	1152
ACS355-03U-08A8-4	R1	20	25	11	MS165-16	1482
ACS355-03U-12A5-4	R3	25	30	16	MS165-20	1482
ACS355-03U-15A6-4	R3	35	35	18	MS165-20	1482
ACS355-03U-23A1-4	R3	50	50	26	MS165-32	1482
ACS355-03U-31A0-4	R4	80	80	43	MS165-54	1482
ACS355-03U-38A0-4	R4	100	100	51	MS165-65	1482
ACS355-03U-44A0-4	R4	100	100	56	MS165-65	1482

1) According to IEC-60269 standard

2) If 50% overload capacity is needed, use the bigger fuse alternative.

3) All manual motor protectors listed are Type E self-protected up to 65 kA. See ABB publication 2CDC131085M0201 – Manual Motor Starters – North American Applications for complete technical data on the ABB Type E manual motor protectors. In order for these manual motor protectors to be used for branch circuit protection, they must be UL listed Type E manual motor protectors, otherwise they can be used only as an At Motor Disconnect. "At Motor Disconnect" is a disconnect just ahead of the motor on the load side of the panel.

4) Manual motor protectors may require adjusting the trip limit from the factory setting at or above the drive input Amps to avoid nuisance tripping. If the manual motor protector is set to the maximum current trip level and nuisance tripping is occurring, select the next size MMP. (MS132-10 is the highest size in the MS132 frame size to meet Type E at 65kA; next size up is MS165-16.)

5) Requires use of the S1-M3-25 line side feeder terminal with the manual motor protector to meet Type E self-protection class.

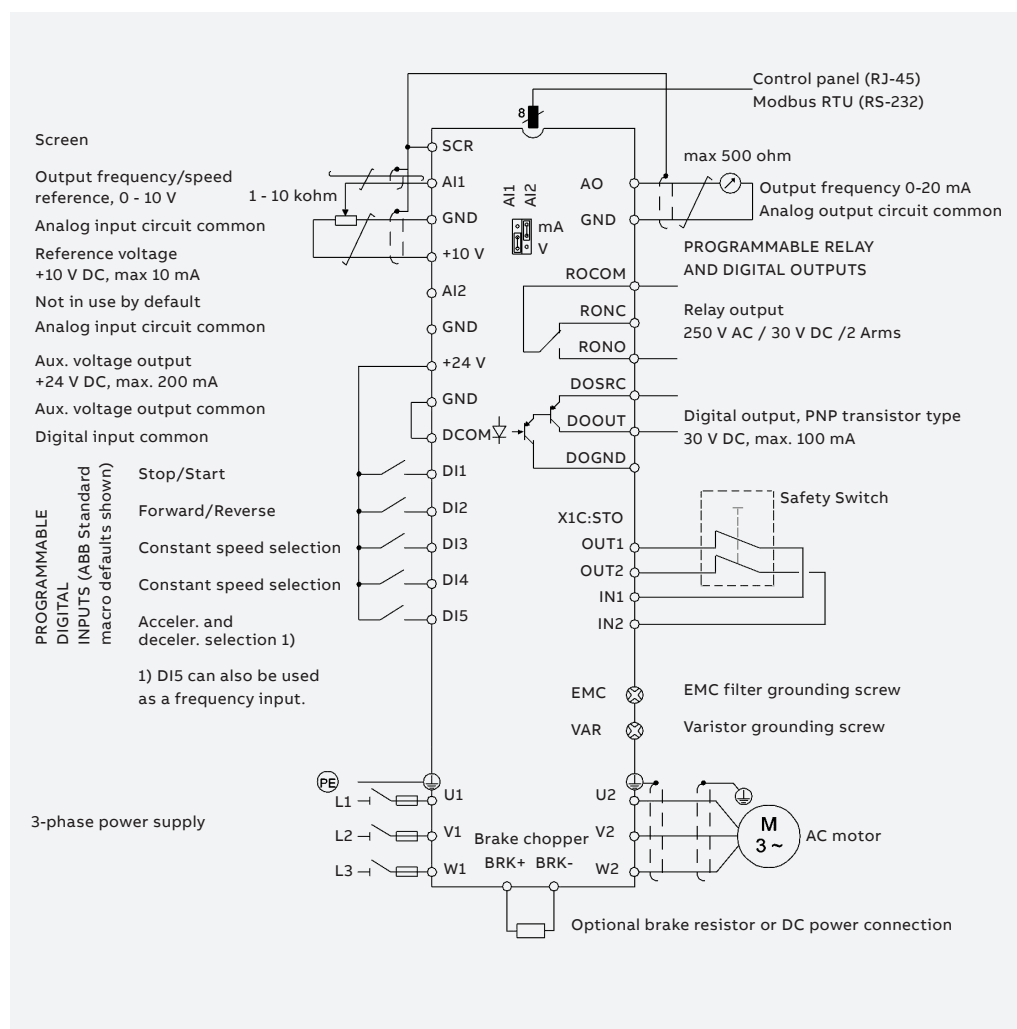
6) 480Y/277V delta systems only: Short-circuit protective devices with slash voltage ratings (e.g. 480Y/277 VAC) can be applied only in solidly grounded networks where the voltage from line-to-ground does not exceed the lower of the two ratings (e.g. 277 V AC), and the voltage from line-to-line does not exceed the higher of the two ratings (e.g. 480 V AC). The lower rating represents the device's interrupting capability per pole.

7) Minimum enclosure volume is specified in the UL listing for R0 & R1 frame drives when applied with the ABB Type E MMP shown in the table. ABB IP20 micro drives are intended to be mounted in an enclosure unless a NEMA 1 kit is added.

For all drives, the enclosure must be sized to accommodate the specific thermal considerations of the application as well as provide free space for cooling.

See the applicable ABB User Manual for free space requirements.

Control connections



Application macros

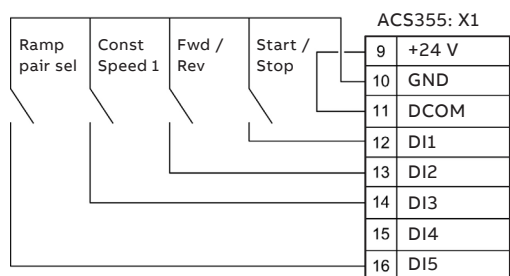
Application macros are preprogrammed parameter sets. While starting up the drive, the user typically selects one of the macros that is best suited for the application. The diagram below gives an overview of ACS355 control connections and shows the default I/O connections for the ABB standard macro.

ABB machinery drives have eight application macros:

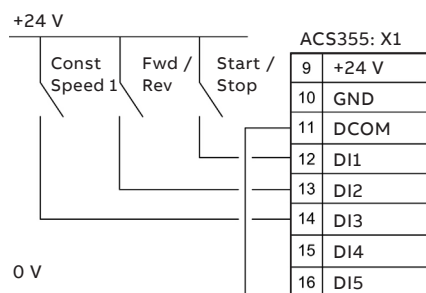
- ABB standard macro
- Torque control macro
- 3-wire macro
- Alternate macro
- AC500 Modbus macro
- Motor potentiometer macro
- Hand/auto macro
- PID control macro

In addition to the standard macros the user can create three user macros. The user macro allows the user to save the parameter settings for later use.

Sinking DI configuration (NPN connected)



Sourcing DI configuration (PNP connected) with external power supply



Control program example

The ACS355 drives have many solutions for common challenges. The following example explains how the COUNTER STOP function operates within a conveyor unloading routine. The function stops the conveyor after a predefined number of boxes have passed the sensor.

The operator starts the conveyor by activating the drive using switch, S. The switch is connected to digital input 1 (DI1). The drive accelerates to a constant speed of 30 Hz with a 1 second ramp time.

Meanwhile a sensor, or proximity switch, P, is connected to digital input 5 (DI5). This sensor generates one pulse, every time a box on the conveyor passes by. When the required number of boxes – in this case 20 – have passed the sensor, the drive stops with a 1 second ramp time.

Parameter settings

Startup data

The correct motor parameters are set within parameter group 99. However, if the current and voltage settings of the motor and drive match, this is not necessary. The ACS355 also features vector control, which can be used by setting the relevant parameters and undertaking an ID run.

Start/Stop/Direction logic

Parameter 1001 EXT1 COMMANDS is set to COUNTER STOP [24]. Under certain conditions the counter output will modify the start/stop signal for stopping.

Constant speed selection

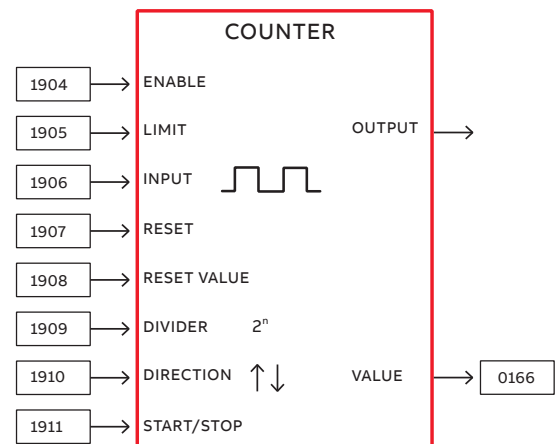
Parameter 1201 CONST SPEED SEL is set to DI1 [1]. Parameter 1202 CONST SPEED 1 acts as a speed reference source when digital input 1 is active.

Parameter 1202 CONST SPEED 1 is set to 30 Hz.

Start/Stop functions

Parameter 2101 START FUNCTION is set to AUTO [1], which is also the default value. If high torque is required for the conveyor to start, settings DC MAGN [2] can be used.

Parameter 2102 STOP FUNCTION is set to RAMP [2]. Thus the drive ramps down to 0 at a stop command.

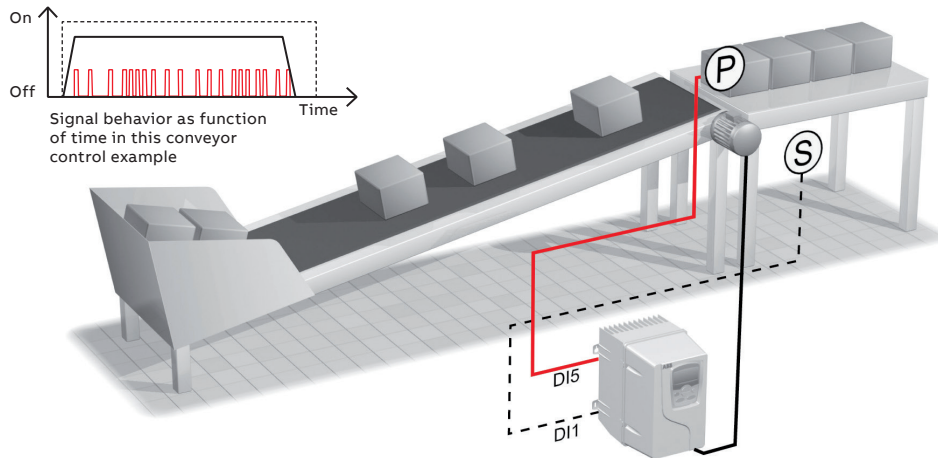


Counter parametrization

Parameter 1904 COUNTER ENABLE is set to DI1 [1]. Counter is enabled now by digital input 1. When digital input 1 is low, the counter is not counting.

Parameter 1905 COUNTER LIMIT is set to 20. In this example the loading station can only hold 20 boxes.

Parameter 1906 COUNTER INPUT is set to PLS IN (DI5) [1] which is also the default value. Pulse counter P is wired to digital input (DI5). This digital input can also handle high frequency pulses up to 10 kHz. If the counter signal edges are swinging, this parameter can be set to FILTERED DI5 [4].



Parameter 1907 COUNTER RESET is set to DI1 (INV) [-1]. When digital input 1 is low, the counter is reset to a value determined by parameter 1908 COUNTER RES VAL.

Parameter 1908 COUNTER RES VAL is set to zero, which is also the default value. The counter, in this example, runs from 0 to 20.

Parameter 1909 COUNT DIVIDER is set to zero, which is also the default value. This value is used to divide high frequency pulse numbers to lower values. For example a 1024 pulse incremental encoder would give 1024 pulses in one revolution. When using count divider 10 (2 to the power of 10) the counter would count up by 1 after 1024 pulses.

Parameter 1910 COUNT DIRECTION is set to UP [0], which is also the default value.

Parameter 1911 CNTR S/S COMMAND is set to DI1 [1]. Digital input 1 acts as the drive start command. Due to the setting of parameter 1001 EXT1 COMMANDS, the drive stops when the counter limit has been reached or digital input 1 goes low.

The counter's actual value can now be seen from signal 0166.

Acceleration and deceleration settings

Parameter 2201 ACC/DEC 1/2 SEL is set to NOT SEL [0]. Only one ramp is used in this application, thereby ramp changing is disabled.

Parameter 2202 ACCELER TIME 1 is set to 1s.

Parameter 2203 DECELER TIME 2 is set to 1s.

ACS355 control program functions

ACS355 control program provides the following functions:

- Counter start and stop
- Timer start and stop

- Speed compensated stop
- 3 independent supervision functions
- Automatic restart function
- 2 sets of ramping times
- S-curve for ramping
- 7 constant speeds
- 3 critical speed ranges
- Maintenance triggers
- Timed functions
- Configurable fault/protection functions
- 2 process PID functions
- PID sleep function
- PID trim function
- Mechanical brake control
- 8 state sequence programming
- 2 sets of user parameter sets
- Safe torque off
- Parameter lock

The ACS355 features the following motor control functions:

- Current, torque, speed and frequency limits
- Under- and overvoltage controllers
- Starting to the rotating machine
- Linear, squared and user defined U/f curves for scalar control
- IR compensation for scalar control
- Flux optimization for energy saving
- Flux braking for improved ramping down
- Drive temperature controlled switching frequency control
- Motor noise smoothing
- Sensorless vector control for induction motors
- Sensorless vector control for permanent magnet motors
- Smooth starting function for permanent magnet motors
- PID speed controller in vector controlled mode
- Acceleration compensation
- Speed controller auto tune
- Stand-alone and rotating motor identification runs
- Optional speed feed back for closed loop vector control



Control program variants

High speed application +N826

ACS355 high speed variant offers possibility to run the motor up to 1400 Hz in scalar mode or up to 32000 rpm in vector control mode. Both asynchronous motors and permanent magnet synchronous motors can be run without encoder. This firmware variant features speed controller tuning for different tools used in the spindle, as well as up to six user sets which can be used to

store for example acceleration and deceleration times. These make the drive suitable for spindle applications such as polishing, grinding and carving applications in glass, metal, plastic and wood working industries.

Following table shows the recommended drive selection parameters when using the drive with high speed motors.

Motor rated frequency range (Hz)		Minimum switching frequency	Recommended switching frequency	Switching frequency control (2607)	Minimum derating		Recommended derating		Max ambient temperature
					200 V drive	400 V drive	200 V drive	400 V drive	
0	300 to 600	4 kHz	8 kHz	0 = ON (LOAD)	No derating	No derating	90%	75%	40
300	800 to 1000	8 kHz	12 kHz	1 = ON	90%	75%	80%	50%	30
800	1400	12 kHz	12 kHz	1 = ON	80%	50%	80%	50%	30





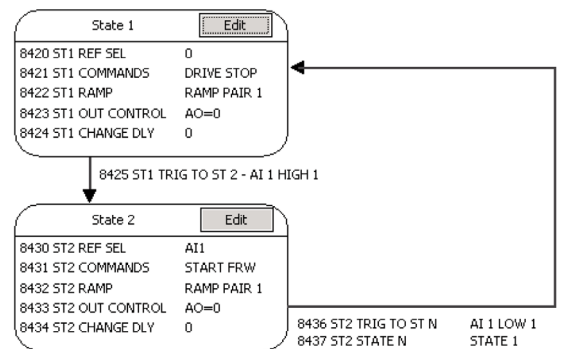
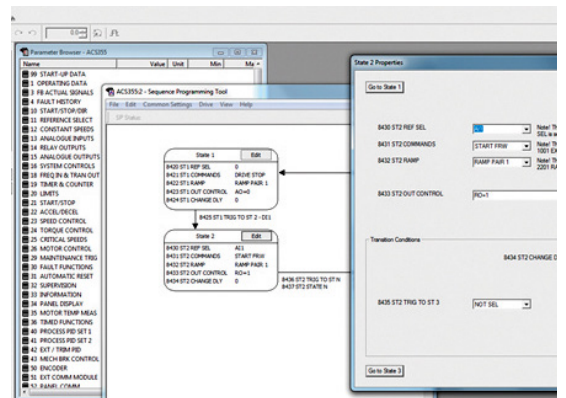
Enhanced sequence programming +N830

ACS355 enhanced sequence programming variant extends sequence programming up to 16 states with additional features. The program enables simple point-to-point positioning with 4 different targets when driving towards counter targets.

Transitions between the states can be controlled with IO and also from the fieldbus. It is possible to limit the torque and speed inside the state in addition to the existing control out of the state such as controlling the relay or analog output signal. Using relay extension module enables control of all 4 relays.

The firmware variant suits best to applications requiring repeatability or fixed driving sequences. Such applications are barriers in traffic control, automatic warehouse conveyors, assembly line conveyors and lifting equipment.

Enhanced sequence programming is at its best when programmed and commissioned with DriveWindowLight software offering graphical interface to each sequence state and its controls.



**Low ambient start +N828**

ACS355 low ambient start variant extends the minimum starting temperature to -39 degrees Celsius. This was done by reevaluating and adjusting the drive's low temperature thermal fault set point to -40 degrees Celsius.

This firmware variant also adds a motor heating feature. With motor heating feature enabled, a percentage of nominal motor current is DC inject into the motor windings when the drive is stopped but still powered. This DC current is used to keep the internal temperature of the motor and drive above ambient.

Operators and control systems are notified that the motor and drive still is being supplied with current by an alarm that is annunciated on the operator's panel or through the communication bus.

Combine the ACS355 +N828 drive with an AC500-XC to provide a Drive and PLC combination good to -40C.

Product variants

High protection class drive +B063

A range of ABB machinery drives with IP66 protection is designed for applications exposed to dust, moisture and cleaning chemicals such as screws, mixers, pumps, fans and conveyors. Typical industries that benefit from the drive include food and beverage, textile, ceramics, pulp and paper, water and wastewater, printing and rubber and plastics.

The heat sink's cooling fins are completely open from top to bottom, which allows easy washing to

ensure no dirt adheres to the surfaces. Assistant control panel housed within a plastic window is designed to resist moist and dusty atmospheres. Furthermore, the cooling fan is located inside the drive, thereby eliminating the need for an external cooling fan and the subsequent maintenance of external moving parts.

The drive's hygienic design and use of materials meeting current hygiene standards, means that the drive traps no bacteria and can withstand frequent washing. The drive is certified by NSF.

Mains connection, high protection class drive	
Voltage and power range	3-phase, 200 to 240 V $\pm$ 10% 0.5 to 5 hp (0.37 to 4 kW) 3-phase, 380 to 480 V $\pm$ 10% 0.5 to 10 hp (0.37 to 7.5 kW)
Common DC	Cannot be used with high degree protection class
Environmental limits, high protection class drive	
Ambient temperature	-10 to 40 °C (14 to 104 °F), no frost allowed
Degree of protection	IP66/IP67/UL Type 4X, indoor use only IP69K with compatible cable glands
Product compliance, high protection class drive	
Low Voltage Directive 2006/95/EC	
Machinery Directive 2006/42/EC	
EMC Directive 2004/108/EC	
Quality assurance system ISO 9001	
Environmental system ISO 14001	
UL, cUL, CE, C-Tick/RCM and EAC approvals	
RoHS compliant	
NSF Certified	
DIN40050-9 (IP69K)	



Ratings IP66/IP67/UL Type 4X			Type designation	Frame size
P_N (hp)	P_N (kW)	I_{2N} (A)		
1-phase AC supply, 200 to 240 V *				
0.5	0.37	3.5	ACS355-03U-06A7-2+B063(+F278)	R1
1.0	0.75	4.9	ACS355-03X-06A7-2+B063(+F278)	R1
2.0	1.5	102	ACS355-03X-07A5-2+B063(+F278)	R1
3-phase AC supply, 200 to 240 V				
0.5	0.37	2.4	ACS355-03X-02A4-2 + B063(+F278)	R1
0.75	0.55	3.5	ACS355-03X-03A5-2 + B063(+F278)	R1
1.0	0.75	4.7	ACS355-03X-04A7-2 + B063(+F278)	R1
1.5	1.1	6.7	ACS355-03X-06A7-2 + B063(+F278)	R1
2.0	1.5	7.5	ACS355-03X-07A5-2 + B063(+F278)	R1
3.0	2.2	9.8	ACS355-03X-09A8-2 + B063(+F278)	R3
4.0	3.0	13.3	ACS355-03X-13A3-2 + B063(+F278)	R3
5.0	4.0	17.6	ACS355-03X-17A6-2 + B063(+F278)	R3
3-phase AC supply, 380 to 480 V				
0.5	0.37	1.2	ACS355-03X-01A2-4 + B063(+F278)	R1
0.75	0.55	1.9	ACS355-03X-01A9-4 + B063(+F278)	R1
1.0	0.75	2.4	ACS355-03X-02A4-4 + B063(+F278)	R1
1.5	1.1	3.3	ACS355-03X-03A3-4 + B063(+F278)	R1
2.0	1.5	4.1	ACS355-03X-04A1-4 + B063(+F278)	R1
3.0	2.2	5.6	ACS355-03X-05A6-4 + B063(+F278)	R1
4.0	3.0	7.3	ACS355-03X-07A3-4 + B063(+F278)	R1
5.0	4.0	8.8	ACS355-03X-08A8-4 + B063(+F278)	R1
7.5	5.5	12.5	ACS355-03X-12A5-4 + B063(+F278)	R3
10.0	7.5	15.6	ACS355-03X-15A6-4 + B063(+F278)	R3

X within the type designation stands for E or U.

P_N for kW = Typical motor power in 400 V at normal use

P_N for hp = Typical motor power in 460 V at normal use

I_{2N} for A = Continuous rms current. 50% overload is allowed for one minute in ten minutes.

* Re-rated 3ph drives

(+F278) = Optional disconnect

Dimensions on page 12

Solar pump drive +N827

Solar pump system consists of a pump, photo voltaic (PV) panel system fitted to provide enough voltage and power to the pump, and solar pump drive converting the PV energy of DC voltage and DC current suitable for AC motor. Pump is very often submersible pump where motor is integrated to the pump itself.

ABB solar pump drive is environmentally friendly, with a long lifetime and low maintenance costs. It is independent from the grid and produces no pollution or noise. Typical applications are irrigation, community water supply, fish farming and agriculture.

This variant offers maximum power point tracking algorithm to maximize the solar panel output as well as water pumping specific functions such as dry running detection and flow calculation.



Ratings			Type designation	Frame size IP20	Typical losses W*)	MPPT voltage range		DC voltage range	
P _N (hp)	P _N (kW)	I _{2N} (A)				Min	Max	Min **)	Max ***)
1-phase AC supply, 125 to 400 V DC or 200 to 240 V									
0.5	0.37	4.7	ACS355-01E-04A7-2	R1	48	243	400	150	420
1.0	0.75	6.7	ACS355-01E-06A7-2	R1	68	243	400	150	420
1.5	1.1	7.5	ACS355-01E-07A5-2	R2	71	243	400	150	420
2.0	1.5	9.8	ACS355-01E-09A8-2	R2	90	243	400	150	420
3-phase AC supply, 125 to 400 V DC or 200 to 240 V									
0.5	0.37	3.5	ACS355-03E-03A5-2	R0	33	243	400	150	420
0.75	0.55	4.7	ACS355-03E-04A7-2	R1	41	243	400	150	420
1.0	0.75	6.7	ACS355-03E-06A7-2	R1	59	243	400	150	420
1.5	1.0	7.5	ACS355-03E-07A5-2	R1	61	243	400	150	420
2.0	1.5	9.8	ACS355-03E-09A8-2	R2	79	243	400	150	420
3.0	2.2	13.3	ACS355-03E-13A3-2	R2	50	243	400	150	420
4.0	3.0	17.6	ACS355-03E-17A6-2	R2	135	243	400	150	420
5.0	4.0	24.4	ACS355-03E-24A4-2	R3	219	243	400	150	420
7.5	5.5	31.0	ACS355-03E-31A0-2	R4	252	243	400	150	420
10.0	7.5	46.2	ACS355-03X-46A2-2	R4	380	243	400	150	420
3-phase AC supply, 250 to 800 V DC or 380 to 480 V									
0.5	0.37	1.9	ACS355-03E-01A9-4	R0	22	460	800	250	840
0.75	0.55	2.4	ACS355-03E-02A4-4	R1	28	460	800	250	840
1.0	0.75	3.3	ACS355-03E-03A3-4	R1	36	460	800	250	840
1.5	1.1	4.1	ACS355-03E-04A1-4	R1	43	460	800	250	840
2.0	1.5	5.6	ACS355-03E-05A6-4	R1	60	460	800	250	840
3.0	2.2	7.3	ACS355-03E-07A3-4	R1	75	460	800	250	840
4.0	3.0	8.8	ACS355-03E-08A8-4	R1	91	460	800	250	840
5.0	4.0	12.5	ACS355-03E-12A5-4	R3	119	460	800	250	840
7.5	5.5	15.6	ACS355-03E-15A6-4	R3	153	460	800	250	840
10.0	7.5	23.1	ACS355-03E-23A1-4	R3	232	460	800	250	840
15.0	11.0	31.0	ACS355-03E-31A0-4	R4	316	460	800	250	840
20.0	15.0	38.0	ACS355-03E-38A0-4	R4	388	460	800	250	840
25.0	18.5	44.0	ACS355-03E-44A0-4	R4	460	460	800	250	840

*) This is typical maximum losses of drive with basic control panel running at rated power at rated speed at rated conditions.

**) Operation is started with minimum voltage, but 100% AC current cannot be achieved before voltage is equal or higher than minimum MPPT voltage.

***) Panel open circuit voltage should be dimensioned so that it will never in any conditions exceed this level.

Options

Selecting options

The options shown in the table are available within the ACS355 range. The ordering code, which is shown in the second column,

replaces the XXXX in the type designation. You can order as many options as required, simply by extending the code as necessary.

Options	Ordering code	Description	Model	Availability	
				IP20 drive	IP66/67 drive
Protection class	*)	NEMA 1/UL type 1 (R0, R1, R2)	MUL1-R1	■	–
	*)	NEMA 1/UL type 1 (R3)	MUL1-R3	■	–
	*)	NEMA 1/UL type 1 (R4)	MUL1-R4	■	–
	B063	IP66/IP67/UL type 4X enclosure		–	■
Control panel (choose one option only)	J400	Assistant control panel	ACS-CP-A	□	●
	J404	Basic control panel	ACS-CP-C	□	–
Panel mounting kit	*)	Panel mounting kit	ACS/H-CP-EXT	□	–
	*)	Panel holder mounting kit	OPMP-01	□	–
Potentiometer	J402	Potentiometer	MPOT-01	□	–
Fieldbus (choose one option only)	K451	DeviceNet™	FDNA-01	□	□
	K452	LonWorks®	FLON-01	□	□
	K454	PROFIBUS DP	FPBA-01	□	□
	K457	CANopen®	FCAN-01	□	□
	K458	Modbus RTU	FMBA-01	□	□
	K462	ControlNet™	FCNA-01	□	□
	K466	1 port EtherNet/IP™, Modbus TCP, PROFINET IO	FENA-01	□	□
	K469	EtherCAT®	FECA-01	□	□
	*)	RS-485/Modbus	FRSA-00		
	K470	POWERLINK	FEPL-02	□	□
	K473	1 port EtherNet/IP™, Modbus TCP, PROFINET IO	FENA-11	□	□
	K475	2 port EtherNet/IP™, Modbus TCP, PROFINET IO	FENA-21	□	□
	*)	20 pack PROFIBUS DP for machinery drives	FPBA-01-M	□	□
	*)	20 pack CANopen for machinery drives	FCAN-01-M	□	□
Extension modules (choose one option only)	L502	Speed encoder module	MTAC-01	□	–
	L511	Relay output module	MREL-01	□	–
	G406	Auxiliary power extension module	MPOW-01	□	–
High protection class options	H376	Cable gland kit (IP66/IP67/UL Type 4X)		–	□
	F278	Input switch kit (factory installed variant)		–	□
Pressure compensation	C169	Pressure compensation valve		–	□
Tools	*)	FlashDrop tool	MFDI-01	□	□
	*)	DriveWindow Light	DriveWindow Light	□	□
External options	*)	Input chokes		□	□ ¹⁾
	*)	EMC filters		□	□ ¹⁾
	*)	Braking resistors		□	□ ¹⁾
	*)	Output chokes		□	□ ¹⁾
	N826	High Speed Application		■	■
	N827	Solar pump drive		■	–
	N828	Low ambient start		■	■
	N830	Enhanced sequence programming		■	■

● = Standard
■ = Product variant

□ = Option, external
– = Not available

*) = To be ordered as a separate item.
**) = Available in selected countries.

¹⁾ External options not available in IP66/IP67/UL Type 4X protection class.