ACS150 Competitor comparison

Siemens SINAMICS G110

Mitsubishi FR-S 500

Allen Bradley PowerFlex 4

WEG CFW10

Hitachi X200

Lenze 8400 BaseLine

Main

Yaskawa VS Mini J7

Schneider Altivar 11

Lenze smd

Allen Bradley PowerFlex 4M

Yaskawa J1000

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Yaskawa J1000

Summary Slide

Description

Siemens SINAMICS G110

- Creates low-cost opportunities for optimizing new generations of products and innovative applications
- Smooth and continuous speed control, quiet and with small footprint
- High operational reliability with high service lifetime
- Extremely simple to install and is easily handled/operated
- Linear *V/f* characteristic, quadratic*V/f* characteristic, multipoint characteristic (parameterizable *V/f* characteristic)
- For power range 0.12 to 3 kW
- Analog product variant and USS product variant (RS485) are both available in the following versions:
  - Without EMC filter, with heat sink
  - Integrated EMC filter, class A/B, with heat sink
  - Without EMC filter, with flat heat sink (FSA only)
  - Integrated EMC filter, class B, with flat heat sink (FSA only)
- Applications: Pumps and fans, Auxiliary drives, Conveyor belts, Billboards, Door/gate operating mechanisms, Centrifuges

ABB ACS150

- ACS150 is a component drive for the serial OEM business in basic machinery applications
- Integrated user interface
- Unpowered drive configuration in 2 s
- Straightforward installation and integration
- Fast availability and service
- Scalar control
- For power range 0.37 kW to 4.0 kW
- Applications
  - Fans, pumps, gate control, material handling, conveyors

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Protection class

Siemens SINAMICS G110

- IP20

ABB ACS150

- IP20 UL open (standard)
- NEMA 1 (option)

Ambient specification

Siemens SINAMICS G110

Vibration

- Do not install the inverter in an area where it is likely to be exposed to constant vibration
- Compliance of Mechanical strength according to EN 60721-3-3: Deflection 0.075 mm (10 … 58 Hz), Acceleration 10 m/s2 (58 … 200 Hz)

Shock

- Do not drop the inverter or expose to sudden shock

Temperature

- Operating temperature -10 to +40°C, derating required for some types in range +40°C to +50°C
- Storage temperature -40 to +70 °C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- Up to 1000 m without derating
  - At 4000m rated output current 90%
  - Line voltage up to 2000 m above sea level 100%, at 4000 m above sea level 75%

Acoustic noise (PWM carrier freq.)

- 2…16 kHz (in 2 kHz increments), 8 kHz standard (types ≥ 0.55 require current output derating with > 8kHz switching frequency)

ABB ACS150

Vibration

- Compliance with IEC 60721-3-3 (operation) and ISTA 1A (storage and transportation)

Shock

- Mechanical shocks are not allowed for the drive during operation
- Bump according to IEC 60068-2-29, 25g/1000pcs

Temperature

- Operating temperature -10 to +50 °C, minimum derate after 40 °C (1% per degree)
- Storage temperature –40 °C to +70°C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 0 to 1000m derate 1% per 100m

Acoustic noise

- 4…16 kHz

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Mains connections

Siemens SINAMICS G110

Voltage types and power range

- 1-phase 200 - 240 V ±10%
  - 0.12 to 3 kW

Power factor

- Cos φ ≥ 0.95

Supply frequency

- 47…63 Hz

Supply networks

- Unfiltered variants can be operated on IT line supplies. Frame sizes FSB and FSC can be used on ungrounded supplies, but it is necessary to cut the 'Y' capacitor link.

DC bus connection

- Available. Connection of the DC bus between inverters is only envisaged for very basic applications. Recommendations given which type of terminal crimps should be used.

ABB ACS150

Voltage and power range

- 1-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 380 - 480V +/-10%
  - 0.37 to 4 kW (0.5 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60Hz, tolerance ±5%

Supply networks

- Suitable for IT network. Drive operation in floating (IT) networks possible by disconnecting EMC filter.

DC bus connection

- Not available

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Ratings 1-phase 200V

1-phase 200V		ABB	Siemens	ACS150		Siemens G110		Siemens	ABB
P_N	P_N	ACS150	G110	I_{2N}	I_{2N}	*Rated output current*		G110	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-		A	A	A	A		
kW	hp	01X-	6SL3211-	U_N=200-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16		0xB11-2xx1			0,9	0,9	FSA	
0,25	1/3		0xB12-5xx1			1,7	1,7		
0,37	0,5	2A4-2	0xB13-7xx1	2,4	2,2	2,3	2,3		R0
0,55	0,75		0xB15-5xx1			3,2	3,2	FSA	
0,75	1	04A7-2	0xB17-5xx1	4,7	4,2	3,9	3,2		R1
1,1	1,5	06A7-2	0xB21-1xx1	6,7	6,0	6,0	6,0	FSB	
1,5	2	07A5-2	0xB21-5xx1	7,5	6,8	7,8	6,0		R2
2,2	3	09A8-2	0xB22-2xx1	9,8	8,8	11,0	11,0	FSC	
3	4		0xB23-0xx1			13,6	11,0	FCS	

Siemens SINAMICS G110

Overload ratings

- In cycle time 300 sec: 1.5 x rated output current for 60 s, then 0.85 x rated output current for 240 s

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 200V

3-phase 200V		ABB	Siemens	ACS150		Siemens G110		Siemens	ABB
P_N	P_N	ACS150	G110	I_{2N}	I_{2N}	*Rated output current*		G110	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-		A	A	A	A		
kW	hp	03X-		U_N=200-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	02A4-2		2,4	2,2				R0
0,55	0,75	03A5-2		3,5	3,2				
0,75	1	04A7-2		4,7	4,2				R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2		7,5	6,8				
2,2	3	09A8-2		9,8	8,8				R2

Siemens SINAMICS G110

Overload ratings

In cycle time 300 sec: 1.5 x rated output current for 60 s, then 0.85 x rated output current for 240 s

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

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Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Ratings 3-phase 400V

3-phase 400V		ABB	Siemens	ACS150		Siemens G110		Siemens	ABB
P_N	P_N	ACS150	G110	I_{2N}	I_{2N}	*Rated output current*		G110	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-		A	A	A	A		
kW	hp	03X-		U_N=380-480 V		U_N=380-480 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	01A2-4		1,2	1,1				R0
0,55	0,75	01A9-4		1,9	1,7				
0,75	1	02A4-4		2,4	2,2				R1
1,1	1,5	03A3-4		3,3	3,0				
1,5	2	04A1-4		4,1	3,7				
2,2	3	05A6-4		5,6	5,0				
3	4	07A3-4		7,3	6,6				
4	5	08A8-4		8,8	7,9				

Siemens SINAMICS G110

Overload ratings

- In cycle time 300 sec: 1.5 x rated output current for 60 s, then 0.85 x rated output current for 240 s

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

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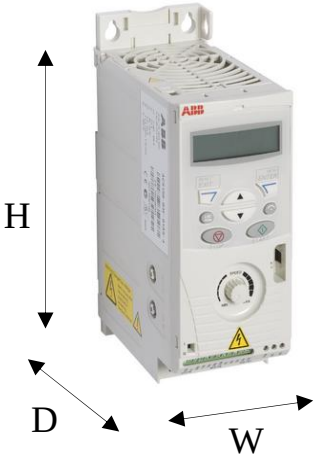
Dimensions 200 V 1-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Siemens G110	ABB ACS150			Siemens G110			Siemens G110	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	01X-	6SL3211-	W	H1	D	W	H	D	Frame	Frame
0,12	0,16		0xB11-2xx1				90	150	116	FSA	
0,25	1/3		0xB12-5xx1								
0,37	0,5	2A4-2	0xB13-7xx1	70	169	142					R0
0,55	0,75		0xB15-5xx1				90	150	131	FSA	
0,75	1	04A7-2	0xB17-5xx1	70	169	142					R1
1,1	1,5	06A7-2	0xB21-1xx1				140	160	142	FSB	
1,5	2	07A5-2	0xB21-5xx1	105							R2
2,2	3	09A8-2	0xB22-2xx1				184	181	152	FSC	
3	4		0xB23-0xx1								

Siemens SINAMICS G110

- The depth of a unit will increase with 8 mm if the Basic operator panel (BOP) is fitted to the unit



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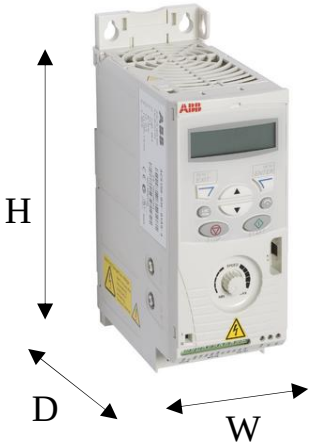
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 1-phase: area, volume, weight

Dimensions 200 V		ABB ACS150	Siemens G110	ABB ACS150			Siemens G110			Siemens G110	ABB ACS150
		Type	Type	1-phase			3-phase				
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	01X-	6SL3211-	area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16		0xB11-2xx1				135	1,6	0,8	FSA	
0,25	1/3		0xB12-5xx1								
0,37	0,5	2A4-2	0xB13-7xx1	118	1,7	1,1					R0
0,55	0,75		0xB15-5xx1				135	1,8	0,9	FSA	
0,75	1	04A7-2	0xB17-5xx1	118	1,7	1,3					R1
1,1	1,5	06A7-2	0xB21-1xx1				224	3,2	1,5	FSB	
1,5	2	07A5-2	0xB21-5xx1	177	2,5	1,5					R2
2,2	3	09A8-2	0xB22-2xx1				333	5,1	2,1	FSC	
3	4		0xB23-0xx1						2,2	FCS	

Dimensions 200 V 3-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Siemens G110	ABB ACS150			Siemens G110			Siemens G110	ACS150
		Type	Type	3-phase			3-phase				
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2									R0
0,55	0,75	03A5-2									
0,75	1	04A7-2		70	169	142					R1
1,1	1,5	06A7-2									
1,5	2	07A5-2									
2,2	3	09A8-2		105							R2



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: area, volume, weight

Dimensions 200 V		ABB ACS150	Siemens G110	ABB ACS150			Siemens G110			Siemens G110	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2				1,1					R0
0,55	0,75	03A5-2									
0,75	1	04A7-2		118	1,7						
1,1	1,5	06A7-2				1,3					R1
1,5	2	07A5-2									
2,2	3	09A8-2		177	2,5	1,5					R2

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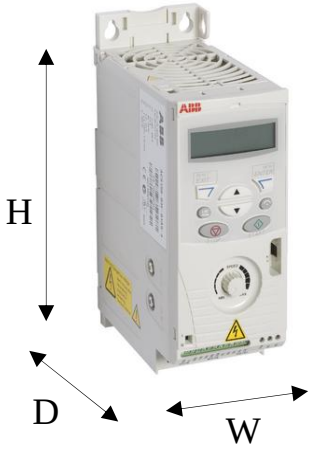
Dimensions 400 V 3-phase: width, height, depth

Dimensions 400 V		ABB ACS150	Siemens G110	ABB ACS150			Siemens G110			Siemens G110	ACS150
		Type	Type								
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4		70	169	142					R0
0,55	0,75	01A9-4									
0,75	1	02A4-4									R1
1,1	1,5	03A3-4									
1,5	2	04A1-4									
2,2	3	05A6-4									
3	4	07A3-4									
4	5	08A8-4									



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Dimensions 400 V 3-phase: area, volume, weight

Dimensions 400 V		ABB ACS150	Siemens G110	ABB ACS150			Siemens G110			Siemens G110	ABB ACS150
		Type	Type								
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4		118	1,7	1,1					R0
0,55	0,75	01A9-4									
0,75	1	02A4-4				1,3					R1
1,1	1,5	03A3-4									
1,5	2	04A1-4									
2,2	3	05A6-4									
3	4	07A3-4									
4	5	08A8-4									

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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DIN rail mounting as standard

Sideways mounting

Installation

Siemens SINAMICS G110

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Optional
Flange	No
Wall (sideways)	No
Heatsinkless	Yes
Side-by-side	Yes (not heatsinkless units)

Free space requirements

Location	*mm*
Above	100
Below	100
Left and right	0 between units (30 mm for heatsinkless units), 15 mm from the cabinet enclosure side

- Operational motor cable lenghts
  - 25 m (FSA filtered 10 m) screened cable
  - 50 m unscreened cable

ABB ACS150

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	80
Below	80
Left and right	0

- Installation with clamps and screws, cabinet support tools available
- Operational motor cable lengths

Frame	Standard	With output chokes
R0	30 m	60 m
R1	50 m	100 m
R2	50 m	100 m

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2nd env. EMC filter as standard

EMC and harmonics

Siemens SINAMICS G110

- **Filters**
  - Variants with integrated filter or unfiltered, specified in product type code
- **Chokes**
  - Line reactors
- **EMC compliant motor cable lengths (shielded cable)**
  - Variants with integrated filter:
    - Category C2 5m
    - Category C3, frame size FSA 10m, FSB and FSC 25m
    - With additional external filter class B:
      - Category C2 25m
      - Category C3 all frame sizes 25m
  - Unfiltered variants
    - The use of unfiltered inverters in an industrial installation is only possible if it forms part of a system which includes power-line filtering at the “system level”
    - With external filter class B with low leakage currents: Category C1 5m
- **THD**
  - Complies with EN 61000-3-2

Rating	Typical Harmonic Current (A)					Typical Harmonic Current (%)					Typical Voltage Distortion		
											Distribution Transformer Rating		
											10kVA	100kVA	1MVA
	3rd	5th	7th	9th	11th	3rd	5th	7th	9th	11th	THD (%)	THD (%)	THD (%)
120W 230V 1AC	1.05	0.9	0.76	0.58	0.57	89	76	64	49	48	0.631	0.063	0.0063
250W 230V 1AC	2.06	1.77	1.50	1.32	1.20	91	78	66	58	53	1.297	0.13	0.013
370W 230V 1AC	2.26	2.26	2.12	1.83	1.56	71	71	66	57	49	1.673	0.167	0.0167
550W 230V 1AC	3.86	3.18	2.44	1.82	1.42	90	74	57	43	33	1.85	0.185	0.0185

ABB ACS150

- **Filters**
  - Inbuilt EMC filter for category C3 (2nd environment) as standard
  - External EMC filter for categories C1, C2 (1st environment) and C3 (2nd environment) as option
- **Chokes**
  - AC input/output chokes as an option
- **EMC compliant motor cable lengths**
  - Category C3 30m (with 4 kHz switching frequency) as standard
  - With external EMC filter and 4 kHz switching frequency
    - 1~ 200 V: C1 10m, C2 and C3 100m (for 0.37 kW unit C1 10m, C2 45m and C3 75m)
    - 3~ 200 V: C2 and C3 30 m
    - 3~ 400 V: C1, C2 and C3 100 m
- **THD**
  - EN61000-3-2 with optional chokes

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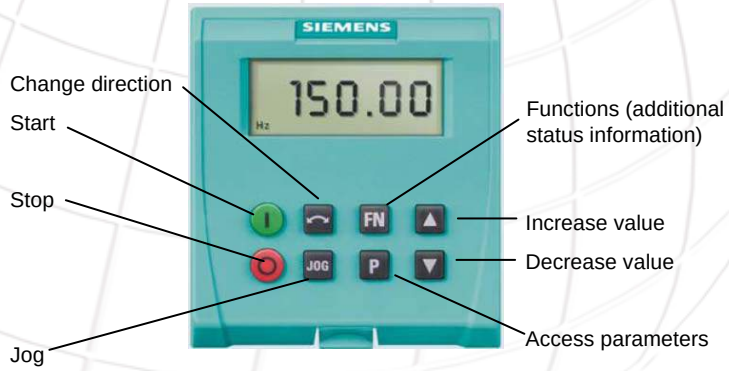
Control location change to keypad from softkey

User interface

Siemens SINAMICS G110

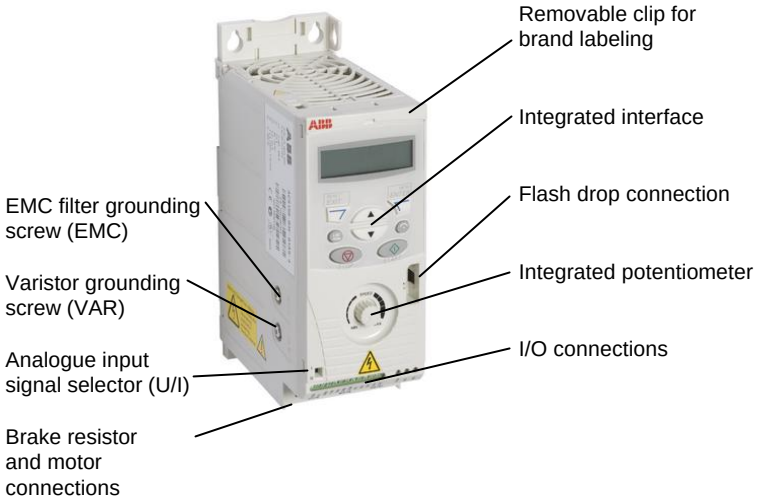
- LED for status information
- Optional BOP (Basic operator panel) with five-digit display
  - Change parameter values, monitor specific parameters, and clone parameters from one inverter to another
  - Can be fitted to and removed from the inverter whilst power is applied
  - To run the inverter (start/stop, setpoint) using the BOP, parameters P0700 (command source, i.e. start/stop, reverse, jog) and P1000 (frequency setpoint) have to be set to 1. Alternatively, P0719 can be set to 11.



- Remote operator panel mounting not possible

ABB ACS150

- Integrated interface
- Integrated potentiometer
- FlashDrop connection



Machine interface

Siemens SINAMICS G110

Type	*Qty.*	*Programmable*
Digital inputs	3	Yes
Analog inputs	1, in Analog variant	Yes (scaleable or for use as 4th DI)
Digital outputs	1 optocoupler output	Yes
Analog outputs	-	

Specialities:

- The USS variant provides USS protocol, which can be used either via the RS232 or via the RS485 interface to commission, parameterize and run the inverter. The USS-RS485 interface is only available on the USS variant and can be directly connected to an inverter network or a USS master such as a PLC. The USS-RS232 interface can be used with both variants but requires the optional 'PC to Inverter Connection Kit'.

ABB ACS150

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	1 (i.e. digital input)	Yes
Relay outputs	1	Yes
Transistor outputs	1	Yes

Specialities:

- Pulse train input

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100% * Phd for braking

Motor control

Siemens SINAMICS G110

- Linear *V/f* characteristic (with parameterizable voltage boost);
- Quadratic*V/f* characteristic;
- Multipoint characteristic (parameterizable *V/f* characteristic)

Braking

- DC braking, compound braking

Output frequency

- 0 … 650 Hz

ABB ACS150

- Scalar control

Braking

- Brake chopper available as standard
  - 100% * Phd for braking

Output frequency

- 500 Hz as maximum output frequency

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Macros and language versions

Siemens SINAMICS G110

- Not available

ABB ACS150

- **Macros**
  - ABB Standard
  - 3-wire
  - Alternate
  - Motor Potentiometer
  - Hand/auto
- **Languages**
  - N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Software features

Siemens SINAMICS G110

- Careful handling of the machine mechanical system due to a skip frequency band in case of resonance, parameterizable ramp up/ramp down times up to 650 s, ramp smoothing, as well as bringing the inverter into circuit on turning motor (flying start)
- Increased installation availability by automatic restart facility following power failure or fault
- Fast current limit (FCL) for trip-free operation in case of sudden load changes
- Programmable *V/f* characteristic (e.g. for synchronous motors)
- Fast DC and compound braking without external braking resistor
- Limitation of DC link voltage by means of the *V*DCmax controller
- Slip compensation, electronic motor potentiometer function and three fixed speed setpoints
- Configurable voltage boost for higher dynamic response when starting and accelerating
- Motor holding brake function to control an external mechanical brake

ABB ACS150

- FlashDrop
- Pulse train input
- Changed parameter menu
- Emergency stop
- Jog function
- Fault Group (Group 4)
- Hardware protection against miss wiring in I/O and supply
- Zero speed delay
- Flux Optimization
- Switching frequency control
- 7 preset speeds
- Application macros
- Flying start
- Critical frequency lock-out
- Max. Freq. 500 Hz

(* = Basic feature in ABB ACS150

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Other advanced features

Siemens SINAMICS G110

- N/A

ABB ACS150

FlashDrop

- Option tool for fast and safe selecting and setting drive parameters without power
- Palm-size 153x53x71mm, light weight 0.4 kg
- Portable and battery chargable
- Keypad with LCD display
- Includes Drive PM (Drive parameter manager) software for PC to create, edit and copy parameter sets for FlashDrop
- Help function available
- Possibility to store 20 user specified parameter macros
- Parameter hiding, Parameter upload and download, Cold drive and Damaged drive parameterization
- Compatible also with ACS150, ACS550 and ACH550 drives

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

PC connectivity and tools

Siemens SINAMICS G110

- STARTER software tool
  - Possible to use with both alaog and USS product variants. The user will require the optional ‘PC to Inverter Connection Kit’ for both variants. In addition the USS variant can also be connected via terminals 8 and 9 to a PC using any RS485/232 interface converter.
  - Provides the user with a graphical interface that provides easy access to the inverter’s parameters via a parameter database or a configuration wizard to guide the user through the correct set-up and configuration procedures
  - Available on the Documentation and PC Tool CD-ROM (orderable as a separate item) or it can be downloaded from the internet

ABB ACS150

- N/A

Hardware options

Siemens SINAMICS G110

- Variant Dependent Options
  - Supplementary filter for Class B operation
  - Low leakage Class B filter
  - Line commutating choke
- Variant Independent Options
  - Basic Operator Panel (BOP)
  - DIN Rail Mounting Kit (frame sizes A and B)
  - PC to inverter connection kit
  - STARTER software commissioning tool
  - Documentation CD
- SINAMICS G110 starter kit in a stackable transport case, for an easy introduction to variable-speed drives:
  - Inverter (0.75 kW) with analog input and integrated EMC filter
  - BOP operator panel
  - PC inverter connection kit
  - Short description, operating instructions, and parameter list (hard copy, in German)
  - STARTER commissioning tool on CD-ROM incl. operating instructions, parameter list, and Getting Started guide
  - Screwdriver

ABB ACS150

- AC input/output chokes
- NEMA 1 kit
- External Category C1 / C2 EMC filter

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Maintenance

Siemens SIMAMICS G110

- Replacement fans not listed available for G110 (for G110 replacement fan tables exist)

ABB ACS150

- **Cooling fan replacement**
  - Very easy to replace
  - Every five years
- **Capacitor reforming**
  - Every two years when stored
- **Available spare parts**
  - Fan

Standards

Siemens SINAMICS G110

Approvals

- CE, UL, cUL, C-tick

Compliance with

- Low Voltage Directive 73/23/EC as amended by Directive 98/68/EC
- ISO 9001

Applicable standards

- EN 50178 Electronic equipment for use in power installations
- EN 60204 - Safety of machinery, electrical equipment of machines
- EN 61800-5-1 - Electrical power drive systems with variable speed – Part 5-1: Requirements regarding safety – electrical, thermal, and energy requirements
- UL508C
- EN 61800-3 EMC product standard for electrical drive systems
- Mechanical strength to EN 60721-3-3

ABB ACS150

Approvals

- CE, UL, cUL, C-tick, GOST-R

Compliance with

- Low Voltage Directive 73/23/EEC with supplements
- Machinery Directive 98/37/EC
- EMC Directive 89/336/EEC with supplements
- Quality assurance system ISO 9001
- Environmental system ISO 14001
- RoHS directive 2002/95/EC with amandments

Applicable standards

- IEC/EN 61800-5-1 - Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
- IEC/EN 60204-1 (1997) - Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
- IEC/EN 60529: 1991 - Degrees of protection provided by enclosures (IP code)
- IEC/EN 61800-3 (2004)- EMC product standard including specific test methods
- UL 508C UL - Standard for Safety, Power Conversion Equipment

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Performance analysis – Autodyne description

Test stand is used to characterize 2,2kW (3hp) heavy duty rated LVAC drives and allow ABB to compare accurate repeatable data against ABB's baseline products (ACS150, ACS350, ACS550 and ACS800). The mechanical portion of the dynamometer consists of a 2,2kW (3hp) 1755 rpm 230VAC/460VAC vector duty motor with encoder (spinner motor) which is connected to the output of the drive under test (DUT). The spinner motor is connected through a in-line torque transducer to a 10 hp 1750 RPM DC motor with encoder. Actual torque and speed information is fed to the dynamometer controller which is run by an IBM desktop computer and flat screen monitor using a Windows™ based proprietary software program controlling electrical power supplied to the DUT and from the DUT to the spinner motor.

Essentially, tests are conducted "out of the box". However, an ID run and a speed regulator autotune are performed, if the drive is so equipped. All drives are tested in sensorless vector mode of operation.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Tested units in performance analysis

Siemens SINAMICS G110

Model: 6SL3211-AB22-2AA0

Drive rating: 200-240V
2.2 kW / 3Hp
11 A

Tester (experienced drive specialist) comments:

- **The drive uses contactor style power connections. Power in on top and out on the bottom.**
- **The BOP is a backlight LCD with start/stop, fwd/rev, Jog, FN, P and Up/Down Arrow keys.**
- **The drive is mounted using slots in both the top and bottom of the drive.**
- **The control terminals are clip type and the smallest of any drive tested thus far.**
- **The Quick Guide does not include instructions for the BOP.**
- **The Quick Access Parameter Menu is easy to locate and use but the end of the commissioning cycle is confusing. At Parameter 3900 you can choose various resets with or without motor calculation or resetting the I/O. 1 is the recommended entry. When entered there isn't any indication how to escape nor is there any sign of motor calculation. Finally, out of desperation the power was cycled.**
- **For such a simple drive the Operating Instructions are 92 pages long and don't contain any parameter list. The separate Parameter List is 102 pages long. The index of the Operating Instructions indicates that fault codes using the BOP are located on page 65 but page 65 doesn't contain any fault codes. The fault codes are only listed in the Parameter List.**
- **The drive tripped on F0001 (Overcurrent) at 754 rpm during the FAIL test and the 240 rpm reference during the torque vs speed test. The drive tripped on F0002 (Overvoltage) during the Speed Accuracy test during the transition to the second load point.**

ABB ACS150

Model: ACS150-03X-07A3-4

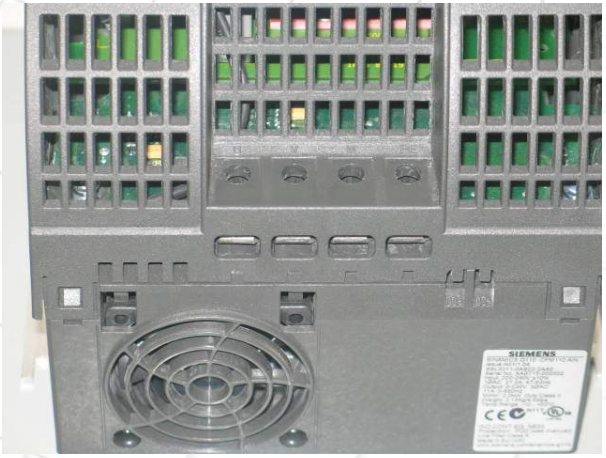
Drive rating: 380-480V
3,0 kW / 4 Hp
7,3 A

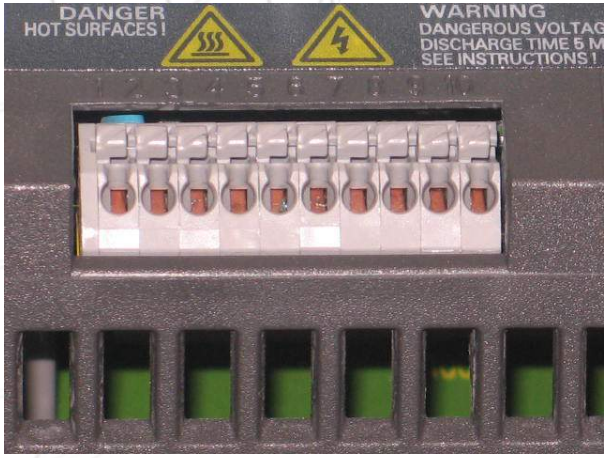
Parameter Settings:

9902 ABB Standard
9905 230V
9906 4.2A
9907 60Hz
9908 1750 RPM
9909 3.0 HP
2101 Torque Boost
2201 Not Selected
2202 1.0 Second
2203 1.0 Second

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Photos of the tested unit



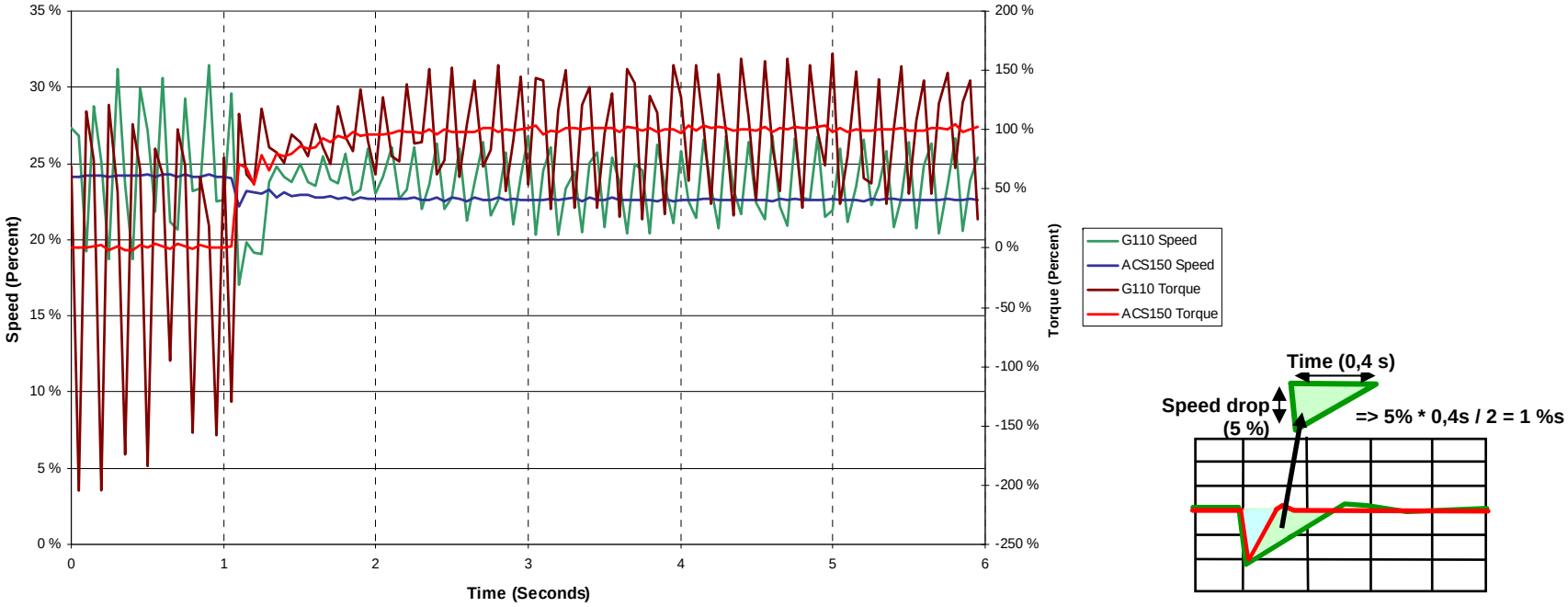


Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Impact load test – Dynamic speed accuracy (stiffness)

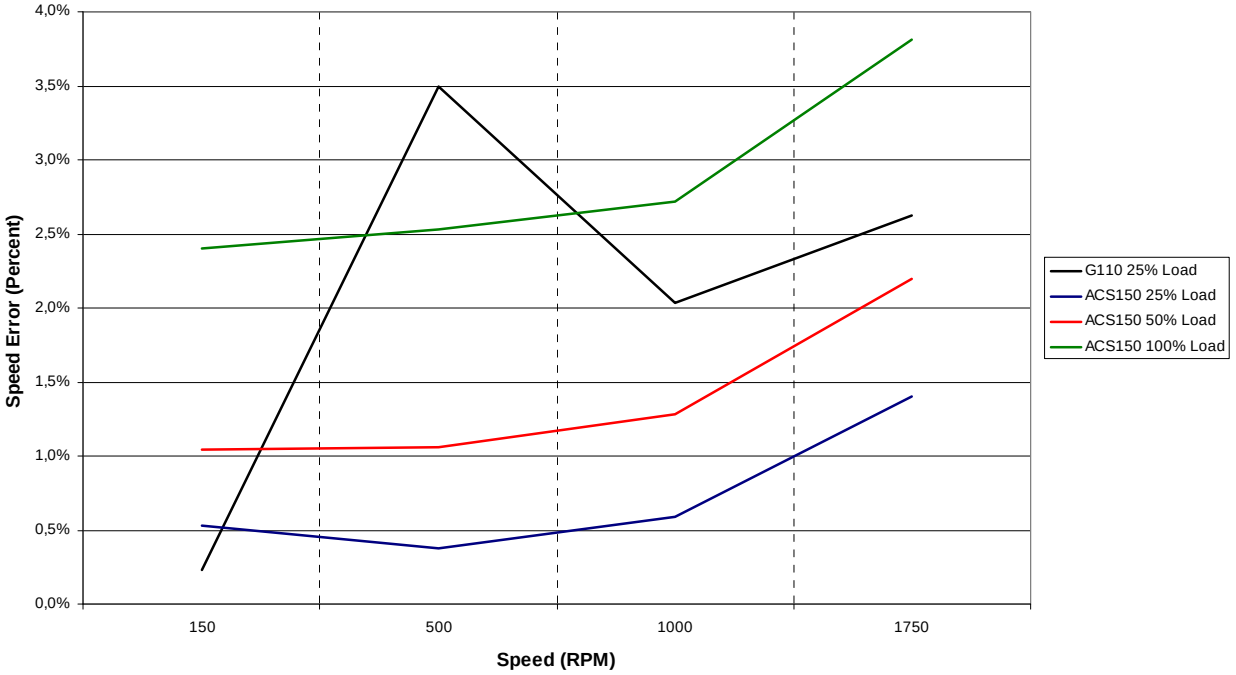
Motor is operated at 25% rated speed and 100% load is applied. Speed and torque are measured over time. Dynamic speed error (stiffness) is speed drop (% of nominal speed) times time of recovery (s) divided by 2. The 25% speed reference data is plotted as this is worst case test for the speed regulator evaluation.



Dynamic speed error depends on speed controller tuning. The smaller the stiffness %s figure the better the drive works in case of disturbances. In ACS150 the speed control default tuning is quite conservative to ensure that controller is stable despite the motor used and its size compared to size of the inverter. Both products handled the 100% impact load at ¼ speed. The G110 has good dynamic speed accuracy despite the amount of speed and torque ripple.

Static speed accuracy

Drive is given speed references of 150, 500, 1000 and 1750 rpm's and loads of 25%, 50% and 100%. The speed error in static situation (constant load and speed) is calculated as a ratio of the average speed error compared to motor nominal speed (1755 rpm), Speed Error [%] = $(n^*-n_{act}) / n_{N(mot)}$. Speed (control) accuracy is essential feature for high quality motor control.



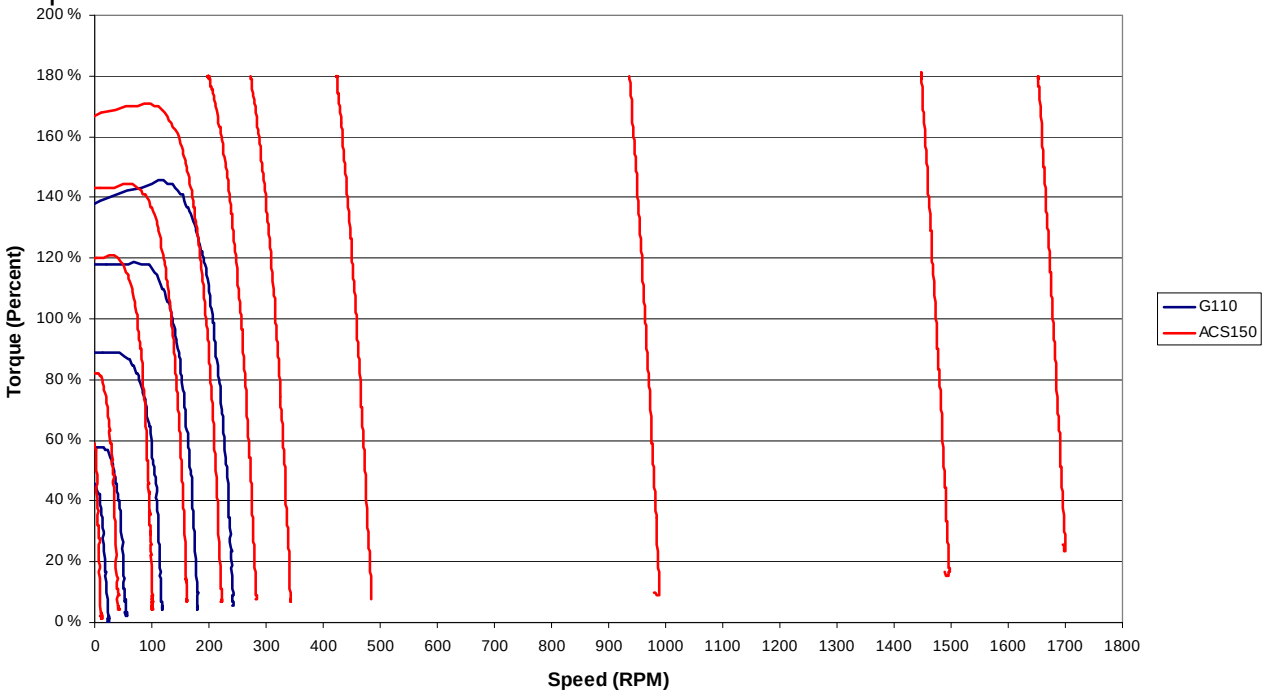
Static speed error depends on the accuracy and quality of measurements (voltage, current, speed estimation). The smaller the error figure and difference between figures at partial and full load points, the better the drive works in applications where good static accuracy is needed (e.g. extruders). Both products showed a comparable range of speed accuracies at each load point although the ACS150 was slightly more consistent.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Maximum torque as a function of speed

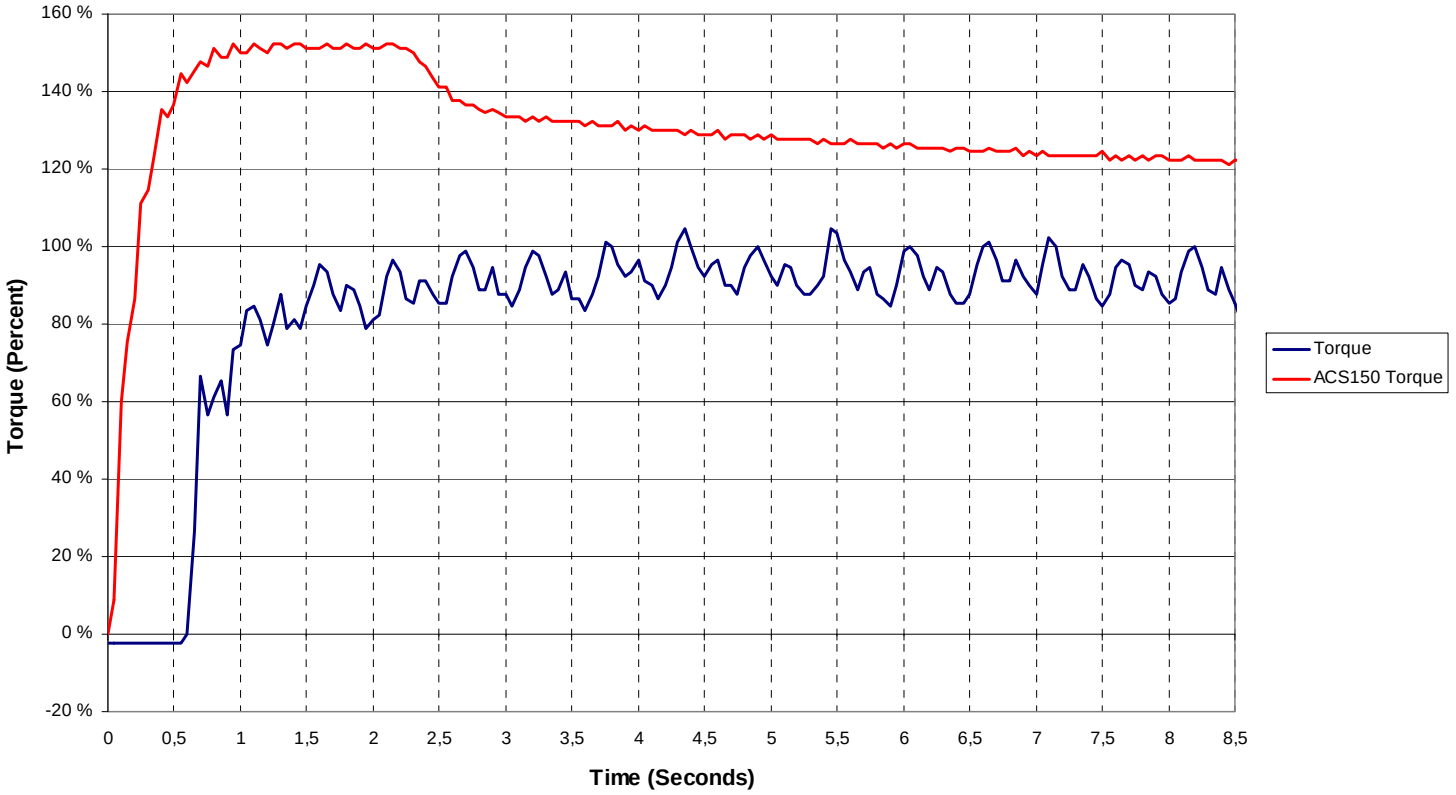
Drive is given speed reference of 30, 60, 120, 180, 240, 300, 360, 500, 1000, 1500 and 1700 rpm's. Load is gradually increased to 180% for 2 seconds, or until the motor stalls. The test describes the drive's speed range. The speed range is defined as the minimum speed the motor can operate from a given base speed and still generate 100% torque.



ACS150 produce approximately 180% torque at each set point over 300 rmp. ACS150 is stable but torque is limited below 300 rmp. G110 gives less torque than ACS150 and was not able to produce torque over 300 rmp?

Maximum starting torque

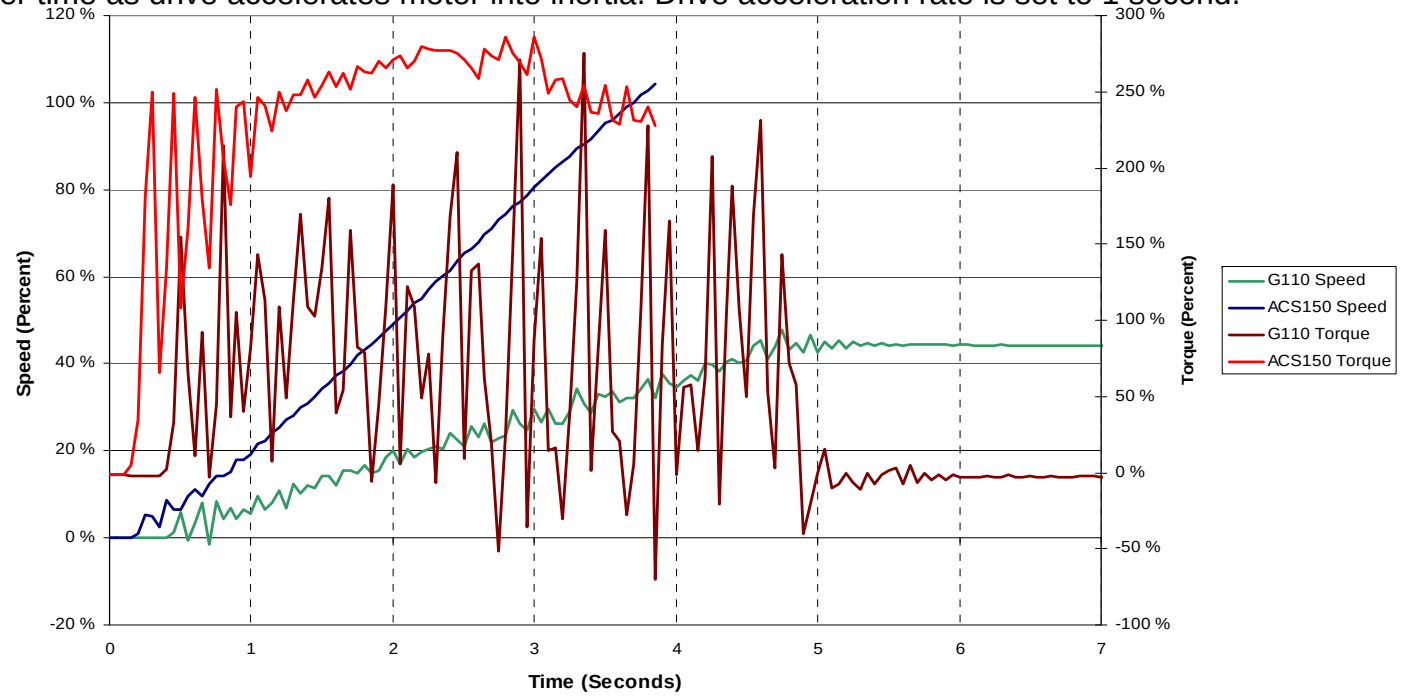
Motor output shaft is locked. Drive is given run command and 1000 rpm speed reference. Torque is measured with respect to time.



The ACS150 ramped to a maximum torque of 150% in approximately 1 seconds. The ACS150 begins to decrease torque because of allowable current limitations below 5 Hz. The G110 was not able to produce adequate starting torque above 90% and exhibited some torque ripple.

Fast acceleration into inertia

Drive is given run command and zero speed reference. Dynamometer inertia simulation program places 22.5 lb-ft^2 (0.95 kgm^2) inertia on motor shaft and then drive is given 100% speed reference. Speed and torque are measured over time as drive accelerates motor into inertia. Drive acceleration rate is set to 1 second.



The ACS150 accelerated the inertia in approximately 3.7 seconds while producing 250% torque. Acceleration was smooth. The G110 did not accelerate the inertia smoothly and produced only 150% torque which extended the acceleration time up to 5.0 seconds. The G110 also produced significant torque ripple during the initial seconds of acceleration and did not reach 100% speed.

Efficiency

Using power analyzer, input power, speed and torque of AC motor are measured at 25%, 50%, 75% and 100% rated motor load. Since the comparison is made by using the same motor at the same operation point the figures reflect the efficiency of the inverter and the additional losses caused in the motor due to the inverter operation. The difference in total efficiency may be remarkable in total energy consumption.

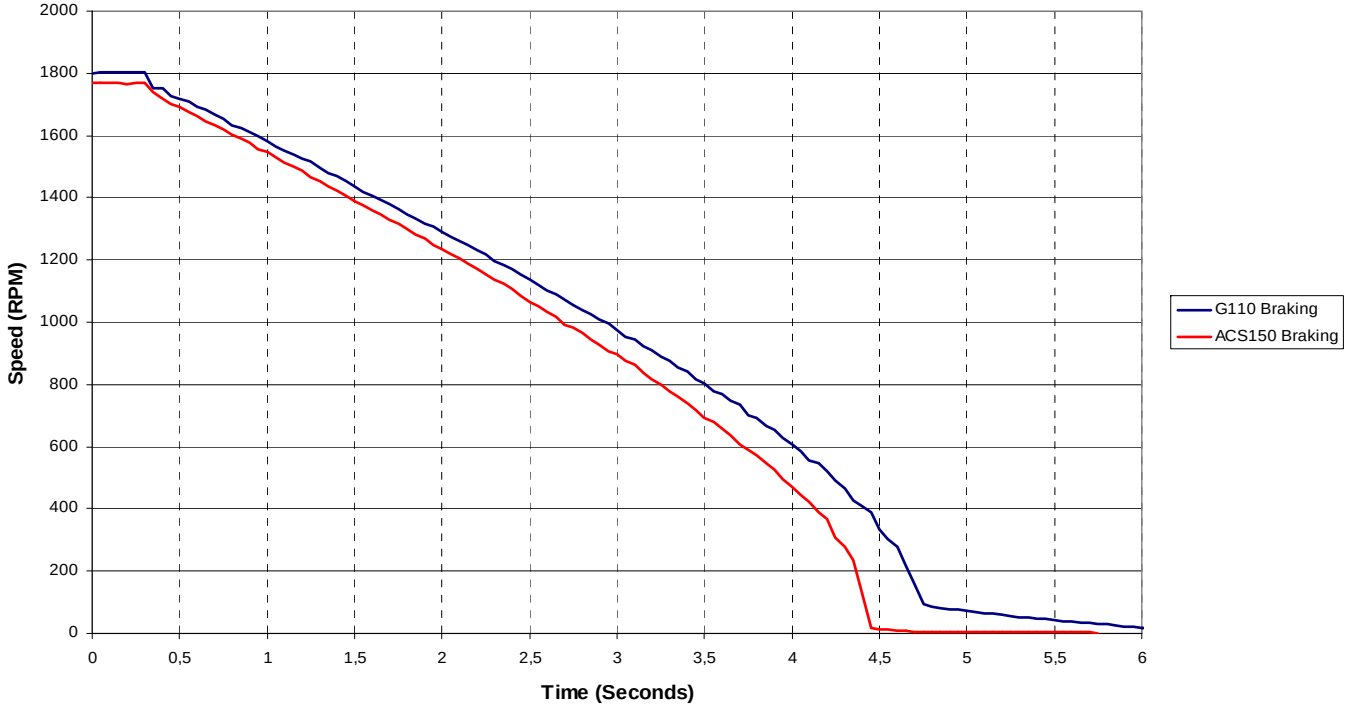
Load (Percent)	Efficiency	
	ACS150	G110
25%	82.3%	N/A
50%	89.0%	N/A
75%	89.3%	N/A
100%	88.5%	N/A

G110's efficiency test data is not available.

.

Overvoltage control

With DUT operating at nominal line voltage and 100% rated speed, the run command will be removed from DUT. Time from the run command being removed until AC motor speed reaches 0 will be measured and recorded. DUT deceleration time will be set to 1 sec. The test measures the ability of drives to decelerate the load with and without flux braking (raising the magnetization level in the motor to convert kinetic energy to motor thermal energy). The shorter the time, the better the overvoltage controller (and flux braking algorithms) of a drive works.



ACS150 decelerated the load in 4.5 seconds and G110 in 6 seconds.

ABB strengths

ACS150 advantages over Siemens SINAMICS G110

NEMA 1 kit option	Pulse train input
3~200 V units	100% * Phd for braking
3~400 V units	500 Hz max. output frequency
Areas of 1~200 V units	Application macros
DIN rail mounting as standard	High functionality software features
Sideways mounting	
2nd env. EMC filter as standard	Cold configuration with FlashDrop
Control location change to keypad from softkey	RoHS compliance

For ACS150 advantages in performance, see the performance test slides

ACS150 Competitor comparison

Siemens SINAMICS G110

Mitsubishi FR-S 500

Allen Bradley PowerFlex 4

WEG CFW10

Hitachi X200

Lenze 8400 BaseLine

Main

Yaskawa VS Mini J7

Schneider Altivar 11

Lenze smd

Allen Bradley PowerFlex 4M

Yaskawa J1000

Summary Slide

- Description
- Protection class
- Ambient specification
- Mains connections
- Ratings 1-phase 200V
- Ratings 3-phase 200V
- Ratings 3-phase 400V
- Dimensions 200 V 1-phase: width, height, depth
- Dimensions 200 V 1-phase: area, volume, weight
- Dimensions 200 V 3-phase: width, height, depth
- Dimensions 200 V 3-phase: area, volume, weight
- Dimensions 400 V 3-phase: width, height, depth
- Dimensions 400 V 3-phase: area, volume, weight
- Installation
- EMC and harmonics
- User interface
- Machine interface
- Motor control
- Macros and language versions

- Software features
- Other advanced features
- PC connectivity and tools
- Hardware options
- Maintenance
- Standards
- Performance analysis – Autodyne description
- Tested units in performance analysis
- Photos of the tested unit
- Impact load test – Dynamic speed accuracy (stiffness)
- Static speed accuracy
- Maximum torque as a function of speed
- Maximum starting torque
- Fast acceleration into inertia
- Efficiency
- Overvoltage control
- ABB strengths

Description

Yaskawa VS Mini J7

- A compact and highly competitive inverter for general use.
- Vector Mode
- V/Hz Mode
- For power range 0.1 kW to 4 kW
- Suggested use:
  - Conveyors
  - Commercial laundry machines
  - Pumps and fans
  - Blowers
  - Food processing machines
  - Air conditioning

ABB ACS150

- ACS150 is a component drive for the serial OEM business in basic machinery applications
- Integrated user interface
- Unpowered drive configuration in 2 s
- Straightforward installation and integration
- Fast availability and service
- Scalar control
- For power range 0.37 kW to 4.0 kW
- Applications
  - Fans, pumps, gate control, material handling, conveyors

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Protection class

Yaskawa VS Mini J7

- Open chassis type IP20

ABB ACS150

- IP20 UL open (standard)
- NEMA 1 (option)

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Ambient specification

Yaskawa VS Mini J7

Vibration

- Up to 1G, at less than 20 Hz
- Up to 0.2G, at 20-50 Hz. No standard mentioned in the manual

Shock

- N/A

Temperature

- Operating temperature -10 to +50 °C
- With EMC filters ambient temperature max. 40°C
- Storage temperature -20 to +60 °C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 1000 m or less. Higher by derating

Acoustic noise (PWM corrier freq.)

- 2,5…10 kHz, step 2,5 kHz

ABB ACS150

Vibration

- Compliance with IEC 60721-3-3 (operation) and ISTA 1A (storage and transportation)

Shock

- Mechanical shocks are not allowed for the drive during operation
- Bump according to IEC 60068-2-29, 25g/1000pcs

Temperature

- Operating temperature -10 to +50 °C, minimum derate after 40 °C (1% per degree)
- Storage temperature –40 °C to +70°C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 0 to 1000m derate 1% per 100m

Acoustic noise

- 4…16 kHz

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Mains connections

Yaskawa VS Mini J7

Voltage types and power range

- 1-phase 230 V –15%/ +10%
  - 0.1 to 1.5 kW (0.13 to 2 hp)
- 3-phase 200 V –15%/ +10%
  - 0.1 to 3.7 kW (0.13 to 5 hp)
- 3-phase 400 V –15%/ +10%
  - 0.2 to 3.7 kW (0.25 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60 Hz, tolerance ±5%

Supply networks

- N/A

DC bus connection

- Not available

ABB ACS150

Voltage and power range

- 1-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 380 - 480V +/-10%
  - 0.37 to 4 kW (0.5 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60Hz, tolerance ±5%

Supply networks

- Suitable for IT network. Drive operation in floating (IT) networks possible by disconnecting EMC filter.

DC bus connection

- Not available

Ratings 1-phase 200V

1-phase 200V		ABB ACS150	VS Mini J7	ABB ACS150		Yaskawa VS Mini J7		Yaskawa VS Mini J7	ABB ACS150
P_N	P_N			I_{2N}	I_{2N}	*Rated output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	CIMR-	A	A	A	A	Frame	
kW	hp	01X-	J7AU	U_N=200-240 V		U_N=200-240 V		names N/A	Frame
0,1	0,13		B0P1			0,8	0,8	F1	
0,2	0,25		B0P2			1,6	1,6		
0,4	0,5	2A4-2	B0P4	2,4	2,2	3,0	3,0	F3	R0
0,55	0,75								
0,75	1	04A7-2	B0P7	4,7	4,2	5,0	5,0	F7	R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	B1P5	7,5	6,8	8,0	8,0	F8	R2
2,2	3	09A8-2		9,8	8,8				

Yaskawa VS Mini J7

Overload ratings

- 150% output current for 60 s

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 200V

3-phase 200V		ABB ACS150	VS Mini J7	ABB ACS150		Yaskawa VS Mini J7		Yaskawa VS Mini J7	ABB ACS150
P_N	P_N			I_{2N}	I_{2N}	*Rated output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	CIMR-	A	A	A	A	Frame	
kW	hp	03X-	J7AU	U_N=206-240 V		U_N=200-230 V		names N/A	Frame
0,1	0,13		20P1			0,8	0,8	F1	
0,2	0,25		20P2			1,6	1,6		
0,4	0,5	02A4-2	20P4	2,4	2,2	3,0	3,0	F2	R0
0,55	0,75	03A5-2		3,5	3,2				
0,75	1	04A7-2	20P7	4,7	4,2	5,0	5,0	F4	R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	21P5	7,5	6,8	8,0	8,0	F7	
2,2	3	09A8-2	22P2	9,8	8,8	11,0	11,0	F8	R2
3	4								
3,7	5		23P7			17,5	17,5	F9	

Yaskawa VS Mini J7

Overload ratings

- 150% output current for 60 s

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 400V

3-phase 400V		ABB ACS150	VS Mini J7	ABB ACS150		Yaskawa VS Mini J7		Yaskawa VS Mini J7	ABB ACS150
P_N	P_N			I_{2N}	I_{2N}	*Rated output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	CIMR-	A	A	A	A	Frame	
kW	hp	03X-	J7AU	U_N=380-480 V		U_N=380-460 V		names N/A	Frame
0,12	0,16								
0,2	0,25		40P2			1,2	1,2	F5	
0,4	0,5	01A2-4	40P4	1,2	1,1	1,8	1,8	F6	R0
0,55	0,75	01A9-4		1,9	1,7				
0,75	1	02A4-4	40P7	2,4	2,2	3,4	3,4	F7	R1
1,1	1,5	03A3-4		3,3	3,0				
1,5	2	04A1-4	41P5	4,1	3,7	4,8	4,8	F8	
2,2	3	05A6-4	42P2	5,6	5,0	5,5	5,5		
3	4	07A3-4		7,3	6,6				
3,7	5	08A8-4	43P7	8,8	7,9	8,6	8,6	F9	

Yaskawa VS Mini J7

Overload ratings

- 150% output current for 60 s

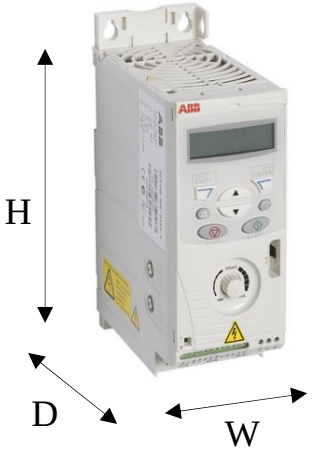
ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Dimensions 200 V 1-phase: width, height, depth

Dimensions 200 V		ABB ACS150	VS Mini J7	ABB ACS150			Yaskawa VS Mini J7			Yaskawa VS Mini J7	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-	CIMR-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Frame	
kW	hp	01X-	J7AU	W	H1	D	W	H	D	names N/A	Frame
0,1	0,13		B0P1				68	128	70	F1	
0,2	0,25		B0P2								
0,4	0,5	2A4-2	B0P4	70	169	142			112	F3	R0
0,55	0,75										
0,75	1	04A7-2	B0P7	70	169	142	108	128	129	F7	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	B1P5	105	169	142	108	128	154	F8	R2
2,2	3	09A8-2									



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 1-phase: area, volume, weight

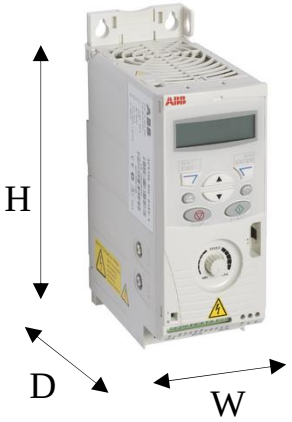
Dimensions 200 V		ABB ACS150	VS Mini J7	ABB ACS150			Yaskawa VS Mini J7			Yaskawa VS Mini J7	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-	CIMR-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)	Frame	
kW	hp	01X-	J7AU	area	volume	weight	area	volume	weight	names N/A	Frame
0,1	0,13		B0P1				87	0,6	0,6	F1	
0,2	0,25		B0P2						0,7		
0,4	0,5	2A4-2	B0P4	118	1,7	1,1		1,0	1,0	F3	R0
0,55	0,75										
0,75	1	04A7-2	B0P7	118	1,7	1,3	138	1,8	1,5	F7	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	B1P5	177	2,5	1,5	138	2,1	1,5	F8	R2
2,2	3	09A8-2									

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: width, height, depth

Dimensions 200 V		ABB ACS150	VS Mini J7	ABB ACS150			Yaskawa VS Mini J7			Yaskawa VS Mini J7	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-	CIMR-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Frame	
kW	hp	03X-	J7AU	W	H1	D	W	H	D	names N/A	Frame
0,1	0,13		20P1				68	128	70	F1	
0,2	0,25		20P2								
0,4	0,5	02A4-2	20P4	70	169	142			102	F2	R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	20P7				68	128	122	F4	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	21P5				108	128	129	F7	
2,2	3	09A8-2	22P2	105					154	F8	R2
3	4										
3,7	5		23P7				140	128	161	F9	



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: area, volume, weight

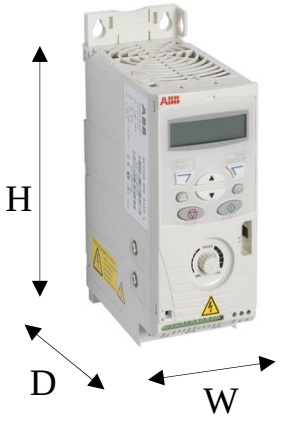
Dimensions 200 V		ABB ACS150	VS Mini J7	ABB ACS150			Yaskawa VS Mini J7			Yaskawa VS Mini J7	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-	CIMR-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)	Frame	
kW	hp	03X-	J7AU	area	volume	weight	area	volume	weight	names N/A	Frame
0,1	0,13		20P1				87	0,6	0,6	F1	
0,2	0,25		20P2								
0,4	0,5	02A4-2	20P4			1,1		0,9	0,9	F2	R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	20P7	118	1,7		87	1,1	1,1	F4	
1,1	1,5	06A7-2				1,3					R1
1,5	2	07A5-2	21P5				138	1,8	1,4	F7	
2,2	3	09A8-2	22P2	177	2,5	1,5		2,1	1,5	F8	R2
3	4										
3,7	5		23P7				179	2,9	2,1	F9	

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: width, height, depth

Dimensions 400 V		ABB ACS150	VS Mini J7	ABB ACS150			Yaskawa VS Mini J7			Yaskawa VS Mini J7	ABB ACS150
		Type	Type								
		ACS150-	CIMR-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	Frame	
kW	hp	03X-	J7AU	W	H1	D	W	H	D	names N/A	Frame
0,12	0,16										
0,2	0,25		40P2				108	128	81	F5	
0,4	0,5	01A2-4	40P4						99	F6	R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	40P7				108	128	129	F7	
1,1	1,5	03A3-4		70	169	142					
1,5	2	04A1-4	41P5				108	128	154	F8	R1
2,2	3	05A6-4	42P2								
3	4	07A3-4									
3,7	5	08A8-4	43P7				140	128	161	F9	



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: area, volume, weight

Dimensions 400 V		ABB ACS150	VS Mini J7	ABB ACS150			Yaskawa VS Mini J7			Yaskawa VS Mini J7	ABB ACS150
		Type	Type								
		ACS150-	CIMR-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)	Frame	
kW	hp	03X-	J7AU	area	volume	weight	area	volume	weight	names N/A	Frame
0,12	0,16										
0,2	0,25		40P2				138	1,1	1,0	F5	
0,4	0,5	01A2-4	40P4			1,1		1,4	1,1	F6	R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	40P7				138	1,8	1,5	F7	
1,1	1,5	03A3-4		118	1,7						
1,5	2	04A1-4	41P5			1,3	138	2,1	1,5	F8	R1
2,2	3	05A6-4	42P2								
3	4	07A3-4									
3,7	5	08A8-4	43P7				179	2,9	2,1	F9	

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

DIN rail mounting as standard

Sideways mounting

Side by side mounting

Installation

Yaskawa VS Mini J7

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Optional
Flange	No
Wall (sideways)	No
Heatsinkless	No
Side-by-side	No

Free space requirements

Location	*mm*
Above	100
Below	100
Left and right	30

- Cable connections made with screw connectors, cable entry from the bottom
- Attached with screws
- Motor lead length should not exceed 50 m

ABB ACS150

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	80
Below	80
Left and right	0

- Installation with clamps and screws, cabinet support tools available
- Operational motor cable lengths

Frame	Standard	With output chokes
R0	30 m	60 m
R1	50 m	100 m
R2	50 m	100 m

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Category C3 EMC filter as standard

EN61000-3-2 with opt. chokes

EMC and harmonics

Yaskawa VS Mini J7

- **Filters**
  - Only the external filter is possible (class B)
  - Emission (conducted) , EN50082-2 (1995), EN55011 (1991) Class B
  - Emission (radiated) EN50081-2 (1993)
  - EN 61800-3:1996, EN61800-3, A11: 2001
  - With EMC filters ambient temperature max. 40°C
- **Chokes**
  - AC/DC chokes as external option (comment: not available through OMRON/Yaskawa, the user has to make them by himself)
- **Motor cable lengths**
  - Screened cable must be used to conform to the EMC standards. Max length is 20 m.
- **THD**
  - N/A

ABB ACS150

- **Filters**
  - Inbuilt EMC filter for category C3 (2nd environment) as standard
  - External EMC filter for categories C1, C2 (1st environment) and C3 (2nd environment) as option
- **Chokes**
  - AC input/output chokes as an option
- **EMC compliant motor cable lengths**
  - Category C3 30m (with 4 kHz switching frequency) as standard
  - With external EMC filter and 4 kHz switching frequency
    - 1~ 200 V: C1 10m, C2 and C3 100m (for 0.37 kW unit C1 10m, C2 45m and C3 75m)
    - 3~ 200 V: C2 and C3 30 m
    - 3~ 400 V: C1, C2 and C3 100 m
- **THD**
  - EN61000-3-2 with optional chokes

User interface

Yaskawa VS Mini J7

- Fixed 7 segment led display with fixed potentiometer as standard
- Remotable as option using the SI-232/J7 (3G3JV-PSI232J) interface and the remote digital operator JVOP144/146 (w/ w/o potentiometer) and extension cable 3G3IV-PCN126/326 (1 or 3 m long)

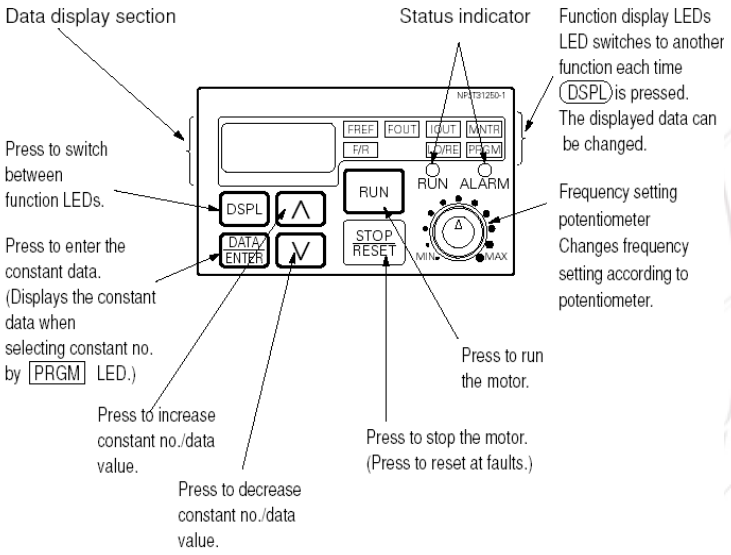
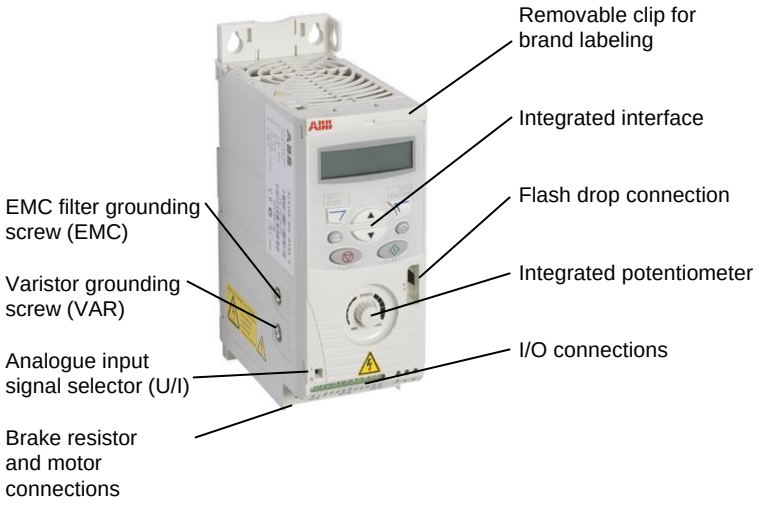


ABB ACS150

- Integrated interface
- Integrated potentiometer
- FlashDrop connection



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Machine interface

Yaskawa VS Mini J7

Type	*Qty.*	*Programmable*
Digital inputs	5	4
Analog inputs	1	Yes
Digital outputs	1 (relay type NO/NC)	Yes
Analog outputs	1	Yes

Specialities:

Protocol	*Standard /Optional*	*Baud rate*	*Notes*
ModBus (RS422 & RS485)	Option	2.4 - 19.2 kbps	RTU port (Up to 32 nodes)

ABB ACS150

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	1 (i.e. digital input)	Yes
Relay outputs	1	Yes
Transistor outputs	1	Yes

Specialities:

- Pulse train input

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

100% * Phd for braking

500 Hz max. output frequency

Motor control

Yaskawa VS Mini J7

- V/Hz Mode (Scalar control)

Braking

- Brake chopper N/A
- Optional braking unit + resistor

Output frequency

- 1.5 – 400 Hz

ABB ACS150

- Scalar control

Braking

- Brake chopper available as standard
  - 100% * Phd for braking

Output frequency

- 500 Hz as maximum output frequency

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Macros and language versions

Yaskawa VS Mini J7

- N/A

ABB ACS150

- **Macros**
  - ABB Standard
  - 3-wire
  - Alternate
  - Motor Potentiometer
  - Hand/auto
- **Languages**
  - N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Software features

Yaskawa VS Mini J7

- DC Injection braking: adjustable amplitude, duration, current limited (*
- Slip compensation (*
- Constant Set-up and initialization (*
- V/f pattern selection (*
- Full-range automatic torque boost (*
- Multi-step speed selection (*
- Jog function (*
- Automatic restart after momentary power loss (*
- Motor overload detection (*
- Soft start characteristics, acceleration /deceleration can be performed in S-curve pattern (*
- Overtorque, overfrequency detection function (*
- Memobus communications

ABB ACS150

- FlashDrop
- Pulse train input
- Changed parameter menu
- Emergency stop
- Jog function
- Fault Group (Group 4)
- Hardware protection against miss wiring in I/O and supply
- Zero speed delay
- Flux Optimization
- Switching frequency control
- 7 preset speeds
- Application macros
- Flying start
- Critical frequency lock-out
- Max. Freq. 500 Hz

(* = Basic feature in ABB ACS150

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Other advanced features

Yaskawa VS Mini J7

- N/A

ABB ACS150

FlashDrop

- Option tool for fast and safe selecting and setting drive parameters without power
- Palm-size 153x53x71mm and light weight 0.4 kg
- Portable and battery chargable
- Keypad with LCD display
- Includes Drive PM (Drive parameter manager) software for PC to create, edit and copy parameter sets for FlashDrop
- Help function available
- Possibility to store 20 user specified parameter macros
- Parameter hiding, Parameter upload and download, Cold drive and Damaged drive parameterization
- Compatible also with ACS150, ACS550 and ACH550 drives

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

PC connectivity and tools

Yaskawa VS Mini J7

- Possible with optional interface SI-232/J7 (3G3JV-PSI232J) and PC cable 3G3IV-PCN329-E

ABB ACS150

- N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Hardware options

Yaskawa VS Mini J7

- EMC Filters
- Remote kit for control panel

ABB ACS150

- AC input/output chokes
- NEMA 1 kit
- External EMC filter for 1st / 2nd environment

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Maintenance

Yaskawa VS Mini J7

- **Cooling fan replacement**
  - Every 2-3 years
- **Smoothing capacitor**
  - Every five years
- **Fuses**
  - Ten years
- **Aluminum capacitors on PCBs**
  - Five years

Preconditions for replacement periods:

- Yearly average of ambient temperature +30 ºC
- Load factor max. 80%
- Operating rate max. 12 h/day

ABB ACS150

- **Cooling fan replacement**
  - Very easy to replace
  - Every five years
- **Capacitor reforming**
  - Every two years when stored
- **Available spare parts**
  - Fan

Standards

Yaskawa VS Mini J7

- **Approvals**
  - CE, UL, cUL
- **Applicable standards**
  - EN 61800-3:1996, EN61800-3, A11: 2001
  - Emission (radiated)
  - EN50081-2 (1993)
  - Emission (conducted)
  - EN50082-2 (1995)
  - EN55011 (1991) Class B

ABB ACS150

- **Approvals**
  - CE, UL, cUL, C-tick, GOST-R
- **Compliance with**
  - Low Voltage Directive 73/23/EEC with supplements
  - Machinery Directive 98/37/EC
  - EMC Directive 89/336/EEC with supplements
  - Quality assurance system ISO 9001
  - Environmental system ISO 14001
  - RoHS directive 2002/95/EC with amandments
- **Applicable standards**
  - IEC/EN 61800-5-1 - Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
  - IEC/EN 60204-1 (1997) - Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
  - IEC/EN 60529: 1991 - Degrees of protection provided by enclosures (IP code)
  - IEC/EN 61800-3 (2004)- EMC product standard including specific test methods
  - UL 508C UL - Standard for Safety, Power Conversion Equipment

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Performance analysis – Autodyne description

Test stand is used to characterize 2,2kW (3hp) heavy duty rated LVAC drives and allow ABB to compare accurate repeatable data against ABB's baseline products (ACS150, ACS350, ACS550 and ACS800). The mechanical portion of the dynamometer consists of a 4,0kW (5hp) 1765 rpm 480VAC vector duty motor with encoder (spinner motor) which is connected to the output of the drive under test (DUT). The spinner motor is connected through a in-line torque transducer to a 10 hp 1750 RPM DC motor with encoder. Actual torque and speed information is fed to the dynamometer controller which is run by an IBM desktop computer and flat screen monitor using a Windows™ based proprietary software program controlling electrical power supplied to the DUT and from the DUT to the spinner motor.

Essentially, tests are conducted "out of the box". However, an ID run and a speed regulator autotune are performed, if the drive is so equipped. All drives are tested in sensorless vector mode of operation.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Tested units in performance analysis

Yaskawa VS Mini J7

Model: CIMR-J7AM43P7

Drive rating: 380-480V
4kW / 5Hp
8,6 A

Tester (experienced drive specialist) comments:

- Non Captive cover screw.
- Feed thru wiring.
- Poor ground terminals.
- .1 min hz. 1.5 default.
- Drive unstable at 500 RPM in all tests.
- Never stalled in Speed/Torque tests.
- Also long Logic UP time.
- Good Torque producer!

ABB ACS150

Model: ACS150-03X-07A3-4

Drive rating: 380-480V
3,0 kW / 4 Hp
7,3 A

Parameter Settings:

9902 ABB Standard

9905 460V

9906 4.2A

9907 60Hz

9908 1765 RPM

9909 3.0 HP

2101 Torque Boost

2201 Not Selected

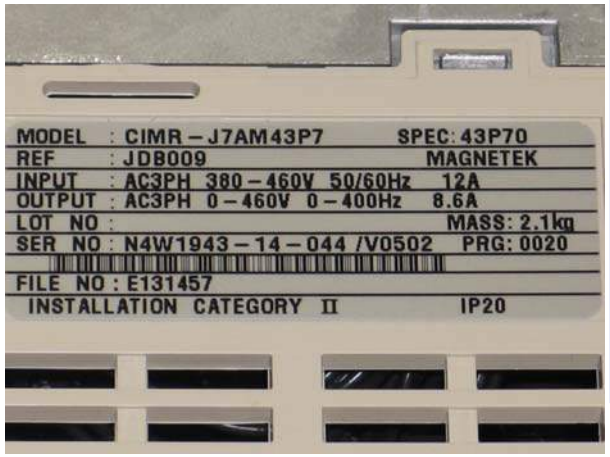
2202 1.0 Second

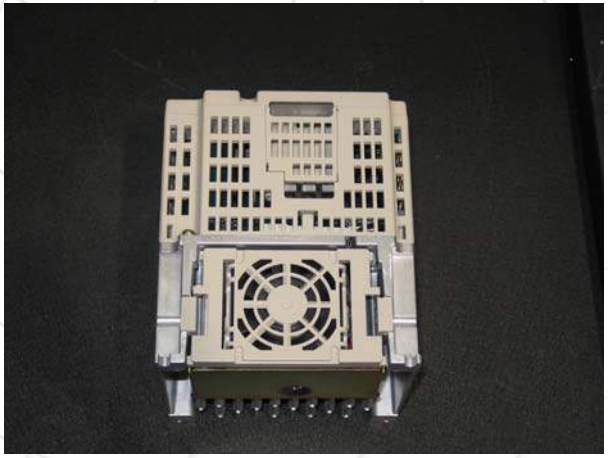
2203 1.0 Second

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Photos of the tested unit



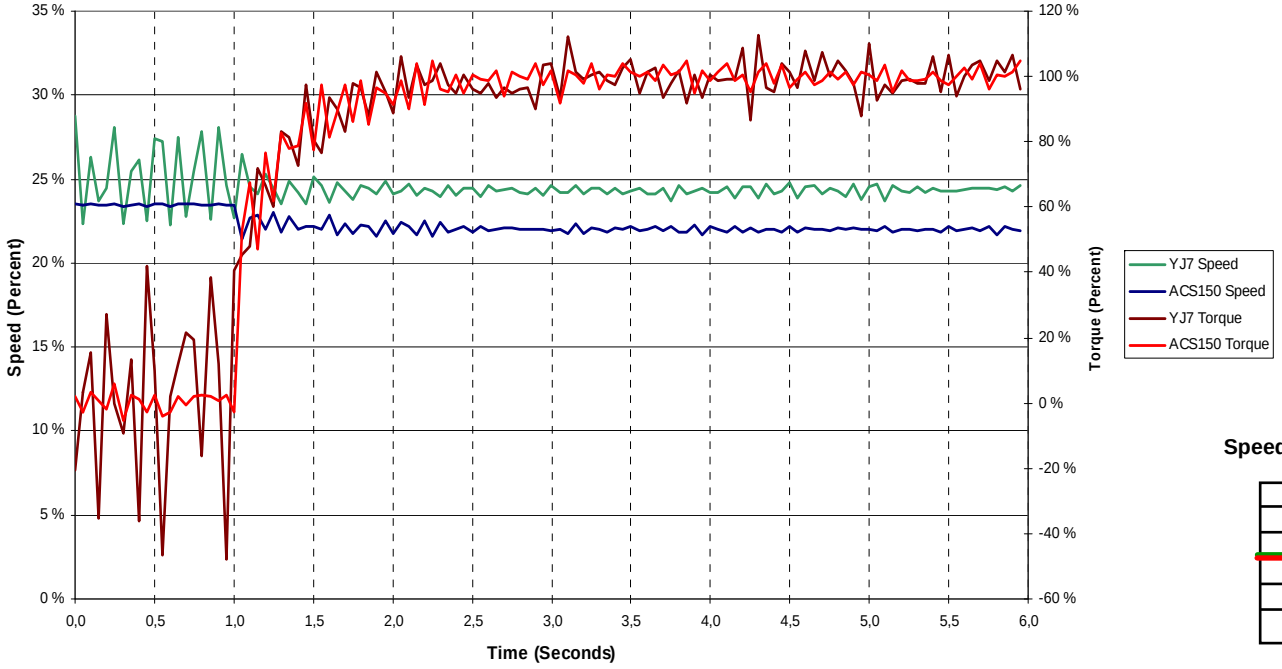


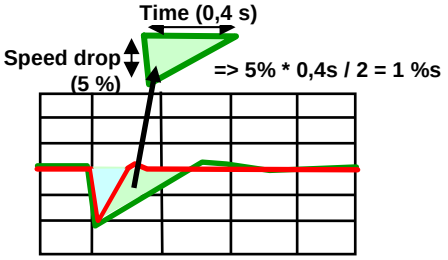
Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Impact load test – Dynamic speed accuracy (stiffness)

Motor is operated at 25% rated speed and 100% load is applied. Speed and torque are measured over time. Dynamic speed error (stiffness) is speed drop (% of nominal speed) times time of recovery (s) divided by 2. The 25% speed reference data is plotted as this is worst case test for the speed regulator evaluation.

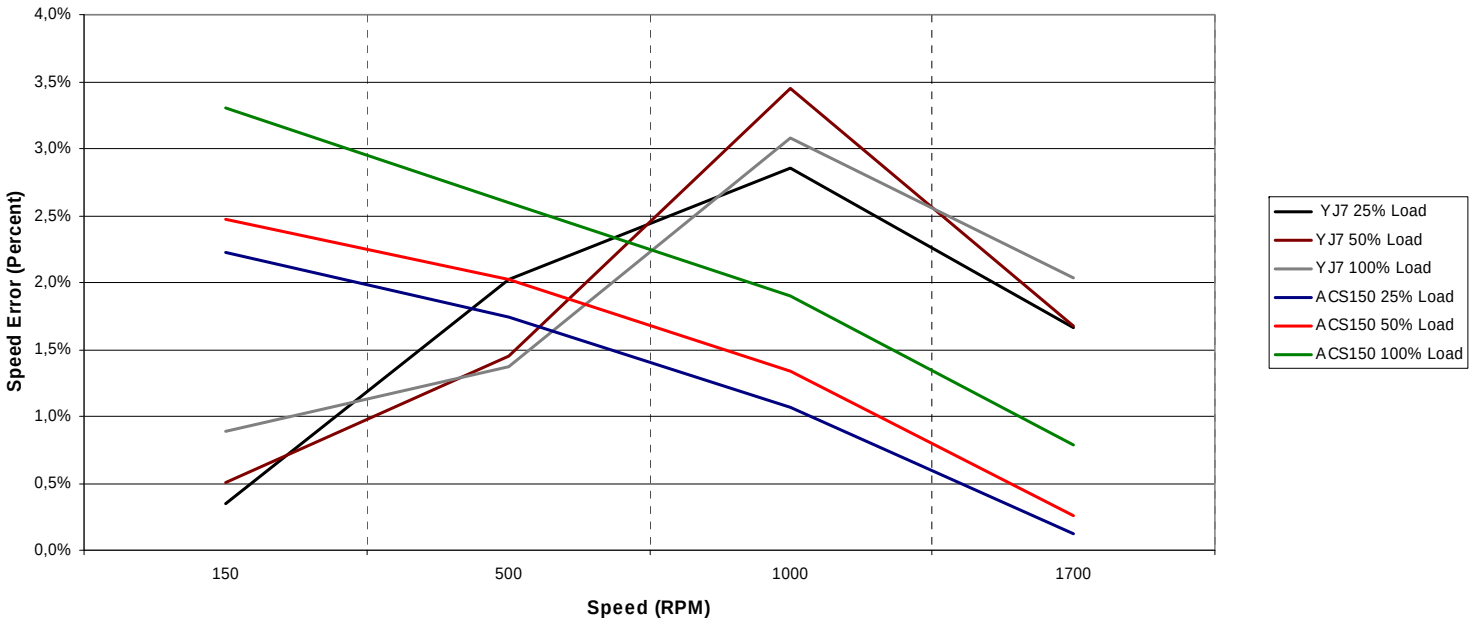




Dynamic speed error depends on speed controller tuning. The smaller the stiffness %s figure the better the drive works in case of disturbances. In ACS150 the speed control default tuning is quite conservative to ensure that controller is stable despite the motor used and its size compared to size of the inverter. Both products handled the 100% impact load at ¼ speed.

Static speed accuracy

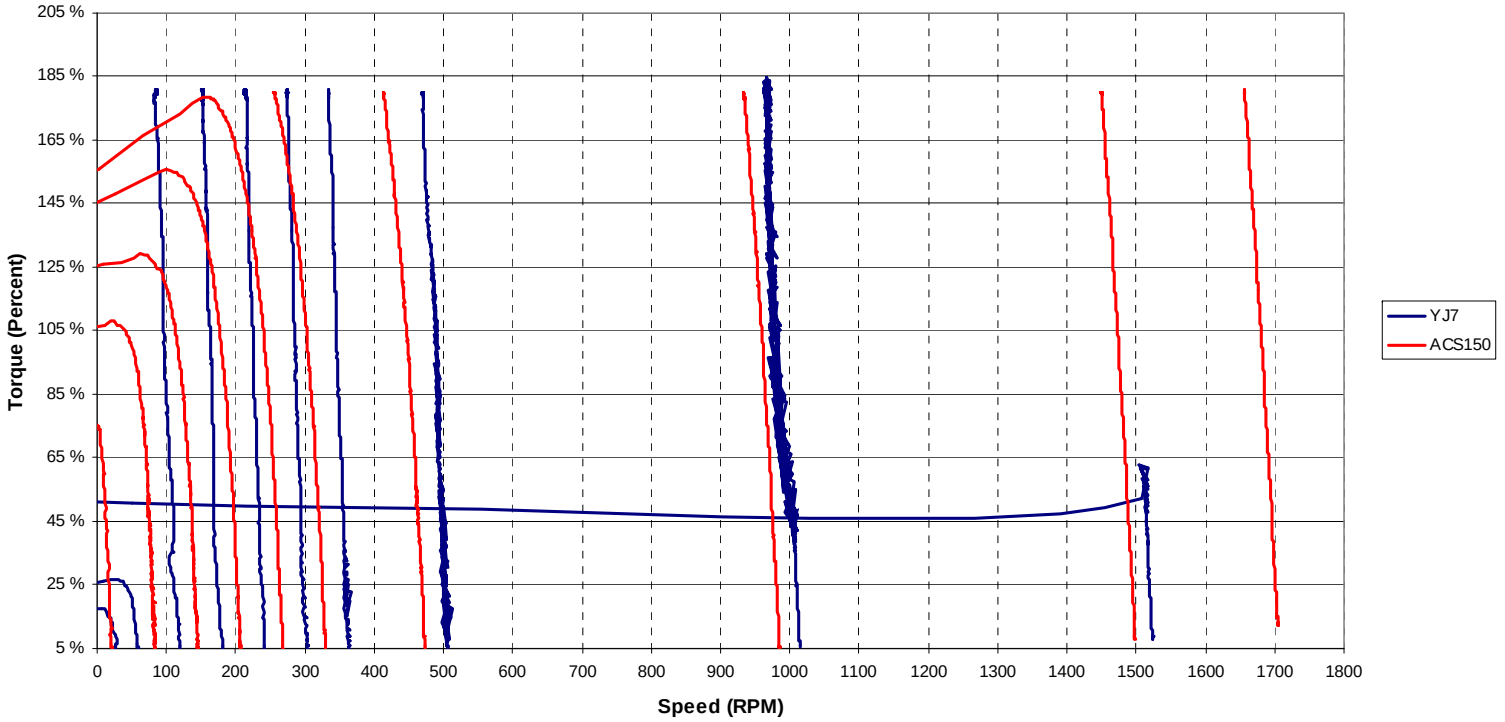
Drive is given speed references of 150, 500, 1000 and 1700 rpm's and loads of 25%, 50% and 100%. The speed error in static situation (constant load and speed) is calculated as a ratio of the average speed error compared to motor nominal speed (1765 rpm), Speed Error [%] = $(n^*-n_{act}) / n_{N(mot)}$. Speed (control) accuracy is essential feature for high quality motor control.



Static speed error depends on the accuracy and quality of measurements (voltage, current, speed estimation). The smaller the error figure and difference between figures at partial and full load points, the better the drive works in applications where good static accuracy is needed (e.g. extruders). Both products showed a comparable range of speed accuracies at each load point although the ACS150 was slightly more consistent at each speed set point.

Maximum torque as a function of speed

Drive is given speed reference of 30, 60, 120, 180, 240, 300, 360, 500, 1000, 1500 and 1700 rpm's. Load is gradually increased to 180% for 2 seconds, or until the motor stalls. The test describes the drive's speed range. The speed range is defined as the minimum speed the motor can operate from a given base speed and still generate 100% torque.



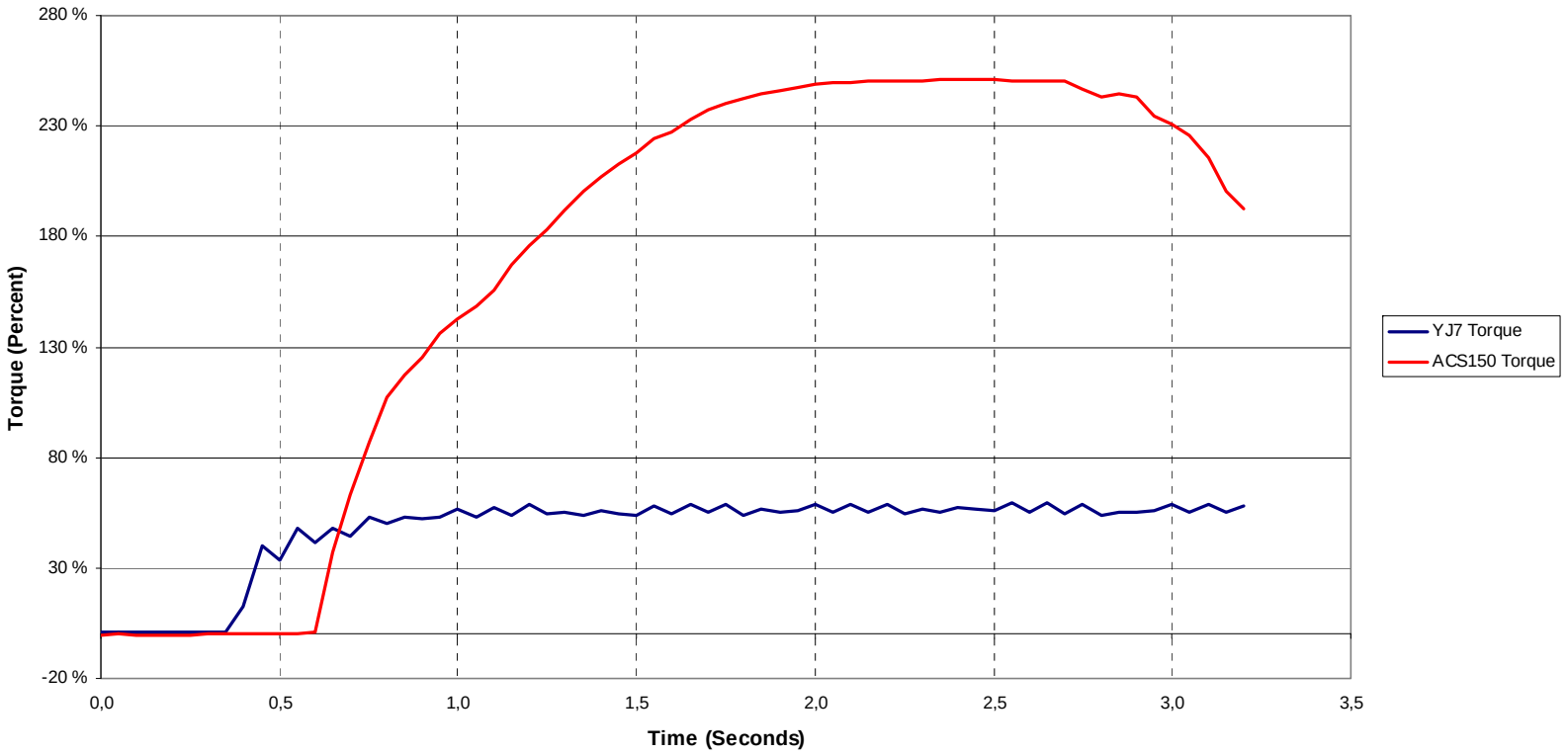
Both products produced approximately 180% torque at 300 to 1000 rpm. The YJ7 was not able to produce torque below 60 rpm and over 1500 rmp.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Maximum starting torque

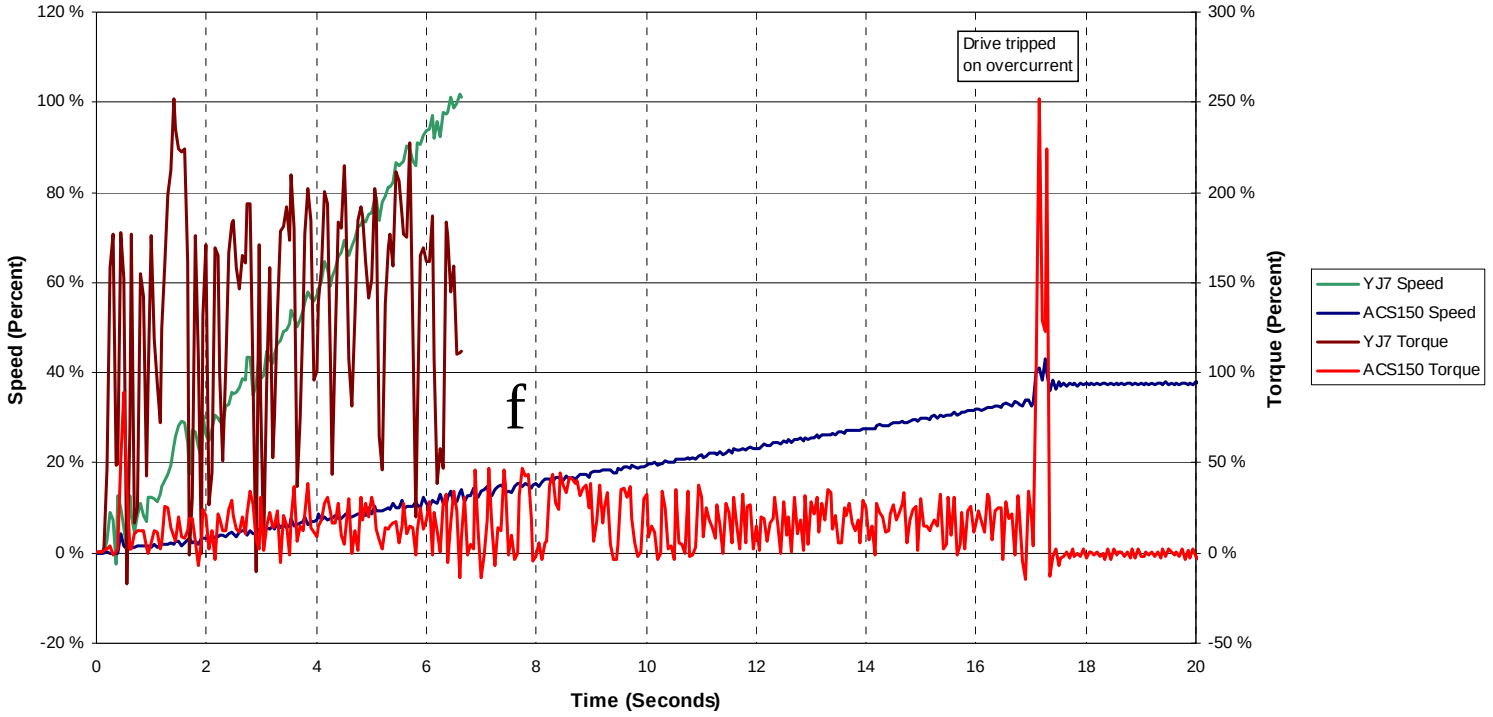
Motor output shaft is locked. Drive is given run command and 1000 rpm speed reference. Torque is measured with respect to time.



The ACS150 ramped to a maximum torque of 250% in approximately 1.25 seconds. The YJ7 was not able to produce adequate starting torque.

Fast acceleration into inertia

Drive is given run command and zero speed reference. Dynamometer inertia simulation program places 22.5 lb-ft^2 (0.95 kgm^2) inertia on motor shaft and then drive is given 100% speed reference. Speed and torque are measured over time as drive accelerates motor into inertia. Drive acceleration rate is set to 1 second.



The YJ7 accelerated the inertia in approximately 7 seconds while producing 150% torque. The ACS150 stop to over current trip.

Efficiency

Using power analyzer, input power, speed and torque of AC motor are measured at 25%, 50%, 75% and 100% rated motor load. Since the comparison is made by using the same motor at the same operation point the figures reflect the efficiency of the inverter and the additional losses caused in the motor due to the inverter operation. The difference in total efficiency may be remarkable in total energy consumption.

Load (Percent)	Efficiency	
	ACS150	YJ7
25%	82.3%	85,5%
50%	89.0%	N/A
75%	89.3%	N/A
100%	88.5%	N/A

The Yaskawa's efficiency test was aborted due to overvoltage trips caused by limited drive current.

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Overvoltage control

With DUT operating at nominal line voltage and 100% rated speed, the run command will be removed from DUT. Time from the run command being removed until AC motor speed reaches 0 will be measured and recorded. DUT deceleration time will be set to 1 sec. The test measures the ability of drives to decelerate the load with and without flux braking (raising the magnetization level in the motor to convert kinetic energy to motor thermal energy). The shorter the time, the better the overvoltage controller (and flux braking algorithms) of a drive works.

No data

ABB strengths

ACS150 advantages over Yaskawa VS Mini J7

NEMA 1 kit option	EN61000-3-2 with opt. chokes
Switching frequency 16 kHz	Pulse train input
Weight of 400 V units	100% * Phd for braking
DIN rail mounting as standard	500 Hz max. output frequency
Sideways mounting	Application macros
Side by side mounting	High functionality software features
Category C3 EMC filter as standard	Cold configuration with FlashDrop
	RoHS compliance

For ACS150 advantages in performance, see the performance test slides

ACS150 Competitor comparison

Siemens SINAMICS G110

Mitsubishi FR-S 500

Allen Bradley PowerFlex 4

WEG CFW10

Hitachi X200

Lenze 8400 BaseLine

Main

Yaskawa VS Mini J7

Schneider Altivar 11

Lenze smd

Allen Bradley PowerFlex 4M

Yaskawa J1000

Summary Slide

Description

Mitsubishi FR-S 500

- The Mitsubishi FR- S 500 claims to provide optimized drive characteristics and environmentally friendly operation with advanced flux vector control and soft PWM control (randomized carrier frequency).
- Simplified installation and maintenance is visualized with easily accessible screw terminals for cable connections and replaceable cooling fans.
- Vector control
- V/Hz Mode
- For power range 0.12 kW to 3.7 kW
- Applications
  - Conveyor belts, chain conveyors, feed belts, transport belts and worm conveyors, saws, milling cutters, grinding and drilling machines, pumps, fans, door drives

ABB ACS150

- ACS150 is a component drive for the serial OEM business in basic machinery applications
- Integrated user interface
- Unpowered drive configuration in 2 s
- Straightforward installation and integration
- Fast availability and service
- Scalar control
- For power range 0.37 kW to 4.0 kW
- Applications
  - Fans, pumps, gate control, material handling, conveyors

Protection class

Mitsubishi FR-S 500

- IP20 (standard)
- IP40 (3-phase 200 V Japanese)

ABB ACS150

- IP20 UL open (standard)
- NEMA 1 (option)

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Ambient specification

Mitsubishi FR-S 500

Vibration

- 5.9 m/s2 or less (Conforming to JIS C 0040).
- 0.6 G: resistance to vibrations from 10 to 55 Hz for 2 hours along all 3 axes

Shock

- 10 G (3 times each in 3 directions)

Temperature

- Nominal ambient temperature is –10°C to +50°C (non-freezing)
- Storage temperature: -20 to +65 °C

Humidity

- Lower than 90 % (non-condensing)

Altitude limitations

- 1000 m or less (without derating). Higher by derating 3% for every extra 500 m (91 %) to 2500 m.

Acoustic noise

- 0,7…14.5 kHz

ABB ACS150

Vibration

- Compliance with IEC 60721-3-3 (operation) and ISTA 1A (storage and transportation)

Shock

- Mechanical shocks are not allowed for the drive during operation
- Bump according to IEC 60068-2-29, 25g/1000pcs

Temperature

- Operating temperature -10 to +50 °C, minimum derate after 40 °C (1% per degree)
- Storage temperature –40 °C to +70°C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 0 to 1000m derate 1% per 100m

Acoustic noise

- 4…16 kHz

Mains connections

Mitsubishi FR-S 500

Voltage types and power range

- 1-phase 220 – 240 V –15%/ +10%
  - 0.2 to 1.5 kW
- 3-phase 380 – 480 V –15%/ +10%
  - 0.4 to 3.7 kW

Power factor

- N/A

Supply frequency

- 50/60 Hz, tolerance ±5%

Supply networks

- The filters are not designed for use in IT networks

DC bus connection

- Not available

ABB ACS150

Voltage and power range

- 1-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 380 - 480V +/-10%
  - 0.37 to 4 kW (0.5 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60Hz, tolerance ±5%

Supply networks

- Suitable for IT network. Drive operation in floating (IT) networks possible by disconnecting EMC filter.

DC bus connection

- Not available

Ratings 1-phase 200V

1-phase 200V		ABB	Mitsubishi	ABB ACS150		Mitsubishi FR-S 520		Mitsubishi	ABB
P_N	P_N	ACS150	FR-S 520	I_{2N}	I_{2N}	*Rated output current*		FR-S 520	ACS150
		Type	Type	40° C	50° C	40° C	50° C	Frame	
		ACS150-	FR-S520S-	A	A	A	A	names	
kW	hp	01X-		U_N=200-240 V		U_N=200-240 V		N/A	Frame
0,12	0,16								
0,2	0,25		0.2K			1,4	1,4	F1	
0,4	0,5	2A4-2	0.4K	2,4	2,2	2,5	2,5	F4	R0
0,55	0,75								
0,75	1	04A7-2	0.75K	4,7	4,2	4,1	4,1	F5	R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	1.5K	7,5	6,8	7,0	7,0	F9	R2
2,2	3	09A8-2		9,8	8,8				

Mitsubishi FR-S 500

Overload ratings

- 150 % for 60 sec.
- 200 % for 0.5 sec.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 200V

3-phase 200V		ABB	Mitsubishi	ABB ACS150		Mitsubishi FR-S 520		Mitsubishi	ABB
P_N	P_N	ACS150	FR-S 520	I_{2N}	I_{2N}	*Rated output current*		FR-S 500	ACS150
		Type	Type	40° C	50° C	40° C	50° C	Frame	
		ACS150-	FR-S520S-	A	A	A	A	names	
kW	hp	03X-		U_N=206-240 V		U_N=200-240 V		N/A	Frame
0,1	0,125		0.1K			0,8	0,8	F1	
0,2	0,25		0.2K			1,4	1,4		
0,4	0,5	02A4-2	0.4K	2,4	2,2	2,5	2,5	F2	R0
0,55	0,75	03A5-2		3,5	3,2				
0,75	1	04A7-2	0.75K	4,7	4,2	4,1	4,1	F3	R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	1.5K	7,5	6,8	7,0	7,0	F7	
2,2	3	09A8-2	2.2K	9,8	8,8	10,0	10,0		R2
3	4								
3,7	5		3.7K			16,5	16,5	F8	

Mitsubishi FR-S 500

Overload ratings

- 150 % for 60 sec.
- 200 % for 0.5 sec.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 400V

3-phase 400V		ABB	Mitsubishi	ABB ACS150		Mitsubishi FR-S 540		Mitsubishi	ABB
P_N	P_N	ACS150	FR-S 540	I_{2N}	I_{2N}	*Rated output current*		FR-S 540	ACS150
		Type	Type	40° C	50° C	40° C	50° C	Frame	
		ACS150-	FR-S540S-	A	A	A	A	names	
kW	hp	03X-		U_N=380-480 V		U_N=380-480 V		N/A	Frame
0,12	0,16								
0,18	0,25								
0,4	0,5	01A2-4	0.4K	1,2	1,1	1,3	1,2	F6	R0
0,55	0,75	01A9-4		1,9	1,7				
0,75	1	02A4-4	0.75K	2,4	2,2	2,5	2,3	F6	R1
1,1	1,5	03A3-4		3,3	3,0				
1,5	2	04A1-4	1.5K	4,1	3,7	4,1	3,7	F7	
2,2	3	05A6-4	2.2K	5,6	5,0	5,8	5,3	F9	
3	4	07A3-4		7,3	6,6				
3,7	5	08A8-4	3.7K	8,8	7,9	8,5	7,7	F10	

Mitsubishi FR-S 500

Overload ratings

- 150 % for 60 sec.
- 200 % for 0.5 sec.

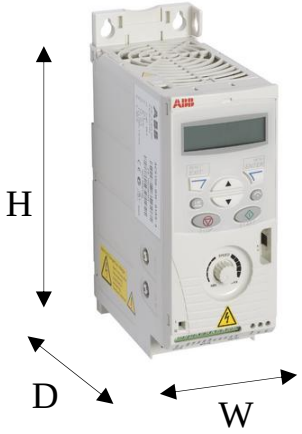
ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Dimensions 200 V 1-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Mitsubishi FR-S 520	ABB ACS150			Mitsubishi FR-S 520			Mitsubishi FR-S 520	ABB ACS150
		Type	Type	1-phase			1-phase			Frame	
		ACS150-	FR-S520S-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	names	
kW	hp	01X-		W	H1	D	W	H	D	N/A	Frame
0,12	0,16										
0,2	0,25		0.2K				68	128	80,5	F1	
0,4	0,5	2A4-2	0.4K	70	169	142			142,5	F4	R0
0,55	0,75										
0,75	1	04A7-2	0.75K	70	169	142	68	128	162,5	F5	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	1.5K	105	169	142	108	128	155,5	F9	R2
2,2	3	09A8-2									



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

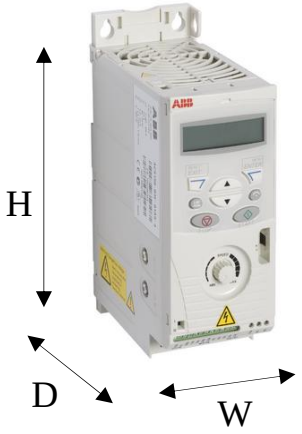
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 1-phase: area, volume, weight

Dimensions 200 V		ABB ACS150	Mitsubishi FR-S 520	ABB ACS150			Mitsubishi FR-S 520			Mitsubishi FR-S 520	ABB ACS150
		Type	Type	1-phase			1-phase			Frame	
		ACS150-	FR-S520S-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)	names	
kW	hp	01X-		area	volume	weight	area	volume	weight	N/A	Frame
0,12	0,16										
0,2	0,25		0.2K				87	0,7	0,6	F1	
0,4	0,5	2A4-2	0.4K	118	1,7	1,1		1,2	0,8	F4	R0
0,55	0,75										
0,75	1	04A7-2	0.75K	118	1,7	1,3	87	1,4	1,0	F5	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	1.5K	177	2,5	1,5	138	2,2	1,5	F9	R2
2,2	3	09A8-2									

Dimensions 200 V 3-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Mitsubishi FR-S 500	ABB ACS150			Mitsubishi FR-S 500			Mitsubishi FR-S 500	ABB ACS150
		Type	Type	3-phase			3-phase			Frame	
		ACS150-	FR-S520S-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	names	
kW	hp	03X-		W	H1	D	W	H	D	N/A	Frame
0,1	0,125		0.1K				68	128	80,5	F1	
0,2	0,25		0.2K								
0,4	0,5	02A4-2	0.4K	70	169	142			112,5	F2	R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	0.75K				68	128	132,5	F3	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	1.5K				108	128	135,5	F7	
2,2	3	09A8-2	2.2K	105		142					R2
3	4										
3,7	5		3.7K				170	128	142,5	F8	



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

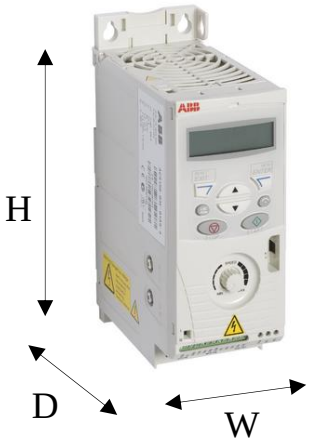
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: area, volume, weight

Dimensions 200 V		ABB ACS150	Mitsubishi FR-S 500	ABB ACS150			Mitsubishi FR-S 500			Mitsubishi FR-S 500	ABB ACS150
		Type	Type	3-phase			3-phase			Frame	
		ACS150-	FR-S520S-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)	names	
kW	hp	03X-		area	volume	weight	area	volume	weight	N/A	Frame
0,1	0,125		0.1K				87	0,7	0,5	F1	
0,2	0,25		0.2K								
0,4	0,5	02A4-2	0.4K			1,1		1,0	0,8	F2	R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	0.75K	118	1,7		87	1,2	0,9	F3	
1,1	1,5	06A7-2				1,3					R1
1,5	2	07A5-2	1.5K				138	1,9	1,5	F7	
2,2	3	09A8-2	2.2K	177	2,5	1,5					R2
3	4										
3,7	5		3.7K				218	3,1	2,1	F8	

Dimensions 400 V 3-phase: width, height, depth

Dimensions 400 V		ABB ACS150	Mitsubishi FR-S 540	ABB ACS150			Mitsubishi FR-S 540			Mitsubishi FR-S 540	ABB ACS150
		Type	Type							Frame	
		ACS150-	FR-S540S-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	names	
kW	hp	03X-		W	H1	D	W	H	D	N/A	Frame
0,12	0,16										
0,18	0,25										
0,4	0,5	01A2-4	0.4K	70	169	142	108	128	129,5	F6	R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	0.75K				108	128	129,5	F6	R1
1,1	1,5	03A3-4									
1,5	2	04A1-4	1.5K				108	128	135,5	F7	
2,2	3	05A6-4	2.2K						155,5	F9	
3	4	07A3-4									
3,7	5	08A8-4	3.7K				108	128	165,5	F10	



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: area, volume, weight

Dimensions 400 V		ABB ACS150	Mitsubishi FR-S 540	ABB ACS150			Mitsubishi FR-S 540			Mitsubishi FR-S 540	ABB ACS150
		Type	Type							Frame	
		ACS150-	FR-S540S-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)	names	
kW	hp	03X-		area	volume	weight	area	volume	weight	N/A	Frame
0,12	0,16										
0,18	0,25										
0,4	0,5	01A2-4	0.4K	118	1,7	1,1	138	1,8	1,5	F6	R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	0.75K				138	1,8	1,5	F6	R1
1,1	1,5	03A3-4				1,3					
1,5	2	04A1-4	1.5K				138	1,9	1,5	F7	
2,2	3	05A6-4	2.2K					2,2	1,6	F9	
3	4	07A3-4									
3,7	5	08A8-4	3.7K				138	2,4	1,7	F10	

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

DIN rail mounting as standard

Sideways mounting

Side by side mounting

Installation

Mitsubishi FR-S 500

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Optional
Flange	No
Wall (sideways)	No
Heatsinkless	No
Side-by-side	No

Free space requirements

Location	*mm*
Above	100
Below	100
Left and right	10 (50)*

* 50 mm is required for 5.5K and 7.5K inverters

- Screws or bolts, fixed screw terminals
- Vertical mounting, horizontal not possible
- Power and control connections allow the cable entry from the bottom
- Motor cable length max. 100 m, when Pr 98, automatic torque boost is selected the max. length is 30 m

ABB ACS150

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	80
Below	80
Left and right	0

- Installation with clamps and screws, cabinet support tools available
- Operational motor cable lengths

Frame	Standard	With output chokes
R0	30 m	60 m
R1	50 m	100 m
R2	50 m	100 m

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

EN 61800-3 compliance

EN61000-3-2 with opt. chokes

EMC and harmonics

Mitsubishi FR-S 500

- **Filters**
  - Manufacturer doesn't guarantee compliance with EMC standards Limits for conducted noise voltages: EN 61800-3
  - EMC standards, Emissions: EN 50081 when using external filters
- **Chokes**
  - AC/DC chokes as option
- **Motor cable lengths**
  - Maximum motor cable lengths according to EMC regulations:
    - Environment 1 (unrestricted distribution): up to 20 m (shielded)
    - Environment 1 (restricted distribution): up to 100 m (shielded)
    - 100A limits of Environment 2: up to 100 m
- **THD**
  - Information not available

ABB ACS150

- **Filters**
  - Inbuilt EMC filter for category C3 (2nd environment) as standard
  - External EMC filter for categories C1, C2 (1st environment) and C3 (2nd environment) as option
- **Chokes**
  - AC input/output chokes as an option
- **EMC compliant motor cable lengths**
  - Category C3 30m (with 4 kHz switching frequency) as standard
  - With external EMC filter and 4 kHz switching frequency
    - 1~ 200 V: C1 10m, C2 and C3 100m (for 0.37 kW unit C1 10m, C2 45m and C3 75m)
    - 3~ 200 V: C2 and C3 30 m
    - 3~ 400 V: C1, C2 and C3 100 m
- **THD**
  - EN61000-3-2 with optional chokes

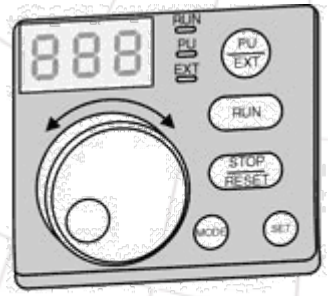
Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

User interface

Mitsubishi FR-S 500

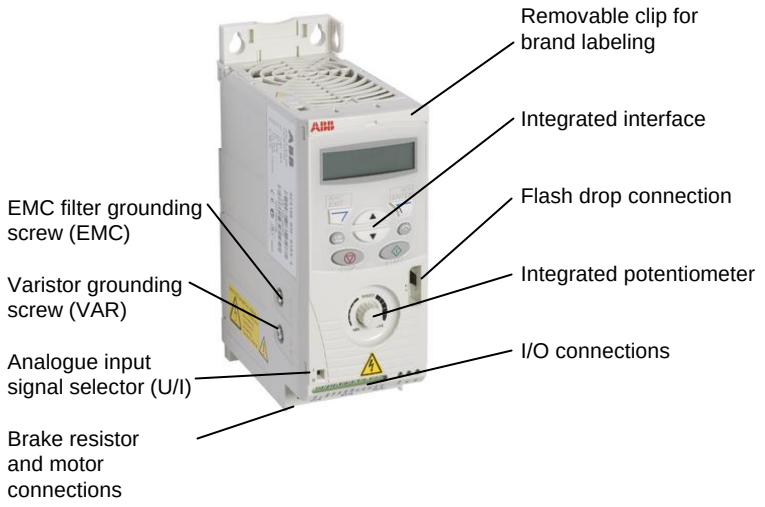
- Integrated control panel
- Dial jog94 w/ 5 buttons
- Optional LCD keypad



Integrated control panel

ABB ACS150

- Integrated interface
- Integrated potentiometer
- FlashDrop connection



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Machine interface

Mitsubishi FR-S 500

Type	*Qty.*	*Programmable*
Digital inputs	5	4
Analog inputs	1	N/A
Relay outputs	1	Yes
Analog outputs	1	No

Specialities:

- N/A

Protocol	*Standard /Optional*	*Baud rate*	*Notes*
RS 485	Standard	4.8 – 19.2 kbit/s	

ABB ACS150

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	1 (i.e. digital input)	Yes
Relay outputs	1	Yes
Transistor outputs	1	Yes

Specialities:

- Pulse train input

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Motor control

Brake chopper as standard

100% * Phd for braking

500 Hz max. output frequency

Mitsubishi FR-S 500

- Vector control
- V/Hz Mode

Braking

- Optional external brake unit

Output frequency

- 0.5 – 120 Hz with vector control
- 0.5 – 120 Hz with V/Hz Mode

ABB ACS150

- Scalar control

Braking

- Brake chopper available as standard
  - 100% * Phd for braking

Output frequency

- 500 Hz as maximum output frequency

Macros and language versions

Mitsubishi FR-S 500

- N/A

ABB ACS150

- **Macros**
  - ABB Standard
  - 3-wire
  - Alternate
  - Motor Potentiometer
  - Hand/auto
- **Languages**
  - N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Software features

Mitsubishi FR-S 500

- Flying start (*
- Torque boost (*
- Inrush current limiter (*
- Acc./Dec. characteristics liner or S-pattern mode selectable (*
- Braking torque: regenerative and DC-braking (*
- JOG operation (*
- Error reset (*
- Multispeed preset (*
- Max. frequency 120 Hz (* (ACS150 500 Hz)
- Optional multilingual parameter unit
- PID controller
- Standard RS-485 communication function
- Maintenance timer function (*
- Second electronic thermal function
- Automatic torque boost function (max. torque 150% at 5 Hz) (* (ACS150 with torque boost on)

(* = Basic feature in ABB ACS150

ABB ACS150

- FlashDrop
- Pulse train input
- Changed parameter menu
- Emergency stop
- Jog function
- Fault Group (Group 4)
- Hardware protection against miss wiring in I/O and supply
- Zero speed delay
- Flux Optimization
- Switching frequency control
- 7 preset speeds
- Application macros
- Flying start
- Critical frequency lock-out
- Max. Freq. 500 Hz

Other advanced features

Mitsubishi FR S-500

The FR-PU07

- An optional parameter unit
- Can be installed on the enclosure or held in hand (Operations can be performed from FR-PU07 by connecting the connection cable (FRCB2) to the PU connector), size 135x83x14 mm
- LCD display with 8 languages
- Parameter setting values of maximum of three inverters can be stored
- Parameter upload and download, help function, parameter hiding by user group function
- A battery pack type (available soon) allows parameter setting and parameter copy without powering on the inverter
- Compatible with FR-S/E/A500, FR-F/E/700

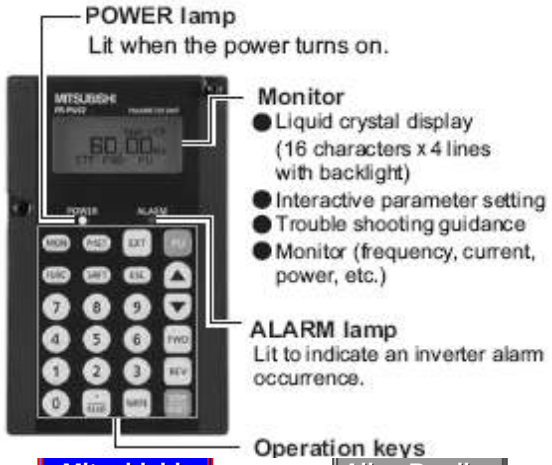

ABB ACS150

FlashDrop

- Option tool for fast and safe selecting and setting drive parameters without power
- Palm-size 153x53x71mm and light weight 0.4 kg
- Portable and battery chargable
- Keypad with LCD display
- Includes Drive PM (Drive parameter manager) software for PC to create, edit and copy parameter sets for FlashDrop
- Help function available
- Possibility to store 20 user specified parameter macros
- Parameter hiding, Parameter upload and download, Cold drive and Damaged drive parameterization
- Compatible also with ACS150, ACS550 and ACH550 drives

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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PC connectivity and tools

Mitsubishi FR-S 500

- Connection between personal computer and inverter established via an RS485 network or directly via an SC-FR PC adapter cable available separately.
- VFD Setup software package
  - MS Windows 3.11, WIN 95/98/XP and 2000 compatible world-wide standardised multi-language parameterisation software
  - Several frequency inverters can be set up, operated, and monitored simultaneously across a network or via a PC or notebook
  - The software package includes functions like system management, parameter settings, display and diagnostics, file management and help

ACS150

- N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Hardware options

Mitsubishi FR-S 500

- EMC Filters
- DC reactors
- AC reactors

ABB ACS150

- AC input/output chokes
- UL Type 1 kit
- External EMC filter for 1st / 2nd environment

Capacitor change not required

Maintenance

Mitsubishi FR-S 500

- Maintenance timer function
- **Cooling fan**
  - Size 60x60 mm. Connected to control electronics board with adapter and mounted to the heatsink with 2 snap fits.
  - Life of the cooling fan bearing 10 000 – 35 000 hours. Cooling fan must be changed every 2 to 3 to years if run constantly.
  - The lifetime of the cooling fans can be extended significantly through a selective ON/OFF control specified by parameter 244.
- **Smoothing capacitors**
  - Changed every 5 years
- Note: There is no cooling fan in the FR-E 520S-0.4 k/0.75 k-EC and FR-E 540-0.4 k/0.75 k-EC.

ABB ACS150

- **Cooling fan replacement**
  - Very easy to replace
  - Every five years
- **Capacitor reforming**
  - Every two years when stored
- **Available spare parts**
  - Fan



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Standards

Mitsubishi FR-S 500

Approvals

- CE, UL, cUL, CSA
- VDE 0100, VDE 0105, VDE 0113
- EN 50178 (Configuration of electrical systems and electrical equipment)
- VBG No. 4
- JIS C 0040

Compliance with

- Low Voltage Directive EN50178
- Quality assurance system ISO 9001
- Environmental system ISO 14001

Applicable standards

- Manufacturer doesn't guarantee compliance with EMC standards Limits for conducted noise voltages: EN61800-3
- EMC standards, Emissions: EN 50081 when using external filters

ABB ACS150

Approvals

- CE, UL, cUL, C-tick, GOST-R

Compliance with

- Low Voltage Directive 73/23/EEC with supplements
- Machinery Directive 98/37/EC
- EMC Directive 89/336/EEC with supplements
- Quality assurance system ISO 9001
- Environmental system ISO 14001
- RoHS directive 2002/95/EC with amandments

Applicable atandards

- IEC/EN 61800-5-1 - Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
- IEC/EN 60204-1 (1997) - Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
- IEC/EN 60529: 1991 - Degrees of protection provided by enclosures (IP code)
- IEC/EN 61800-3 (2004)- EMC product standard including specific test methods
- UL 508C UL - Standard for Safety, Power Conversion Equipment

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Performance analysis – Autodyne description

Test stand is used to characterize 2,2kW (3hp) heavy duty rated LVAC drives and allow ABB to compare accurate repeatable data against ABB's baseline products (ACS150, ACS350, ACS550 and ACS800). The mechanical portion of the dynamometer consists of a 4kW (5hp) 1765 rpm 480VAC vector duty motor with encoder (spinner motor) which is connected to the output of the drive under test (DUT). The spinner motor is connected through a in-line torque transducer to a 10 hp 1750 RPM DC motor with encoder. Actual torque and speed information is fed to the dynamometer controller which is run by an IBM desktop computer and flat screen monitor using a Windows™ based proprietary software program controlling electrical power supplied to the DUT and from the DUT to the spinner motor.

Essentially, tests are conducted "out of the box". However, an ID run and a speed regulator autotune are performed, if the drive is so equipped. All drives are tested in sensorless vector mode of operation.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Tested units in performance analysis

Mitsubishi FR-S 500

Model: FR-S540-3.7K-EC

Drive rating: 380-480V
3,7 kW
8,5 A

Tester (experienced drive specialist) comments:

- **Power Terminal Markings are raised letters on black plastic – unreadable w/o flashlight.**
- **Has Motor terminal sticker that says "Do not connect ac line here".**
- **Access to terminals is good.**
- **Inputs are dual marked L1/R – Outputs are UVW only.**
- **Acc Dec times are reference from 0 to Par 20, not base frequency.**
- **During many tests the drive trips on OV during constant speed. This looks to be harsh current control (back to BJT / Classic days).**
- **This drive will not run at low speeds, either loaded or unloaded. Anything below about 8-9 Hz. saturates the motor and trips the drive on either motor OL or I2T. Could not run Spd/Tq curves because of this. Dropped the boost to zero and ran the spd/tq test ok. The flux current dropped from 5.7 to between 3.4 and 4.4 amps.**
- **Drive is max altitude 1000M w/ no derate for higher altitudes.**
- **It has a low vibration spec and no shock spec.**
- **All inputs are non-programmable fixed function.**
- **0-999 sec. accel and decel.**
- **Brochure indicates OV controller (non-adjustable), but it doesn't do anything.**

ABB ACS150

Model: ACS150-03X-07A3-4

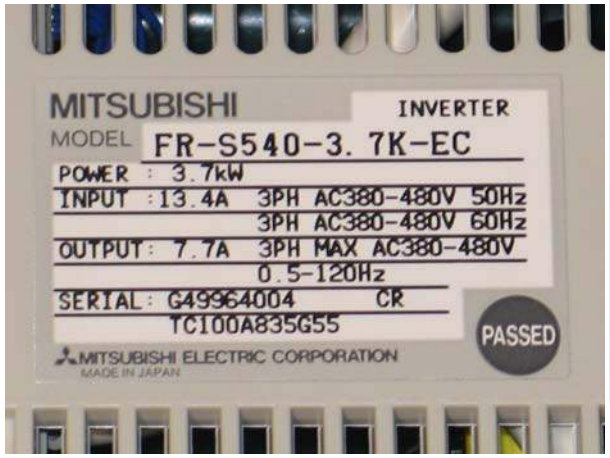
Drive rating: 380-480V
3,0 kW / 4 Hp
7,3 A

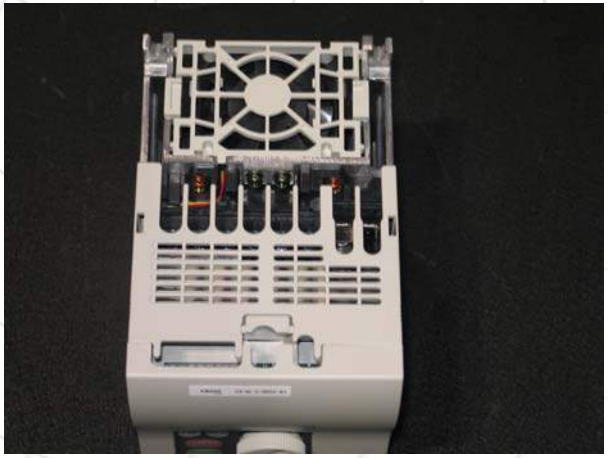
Parameter Settings:

9902 ABB Standard
9905 460V
9906 4.2A
9907 60Hz
9908 1765 RPM
9909 3.0 HP
2101 Torque Boost
2201 Not Selected
2202 1.0 Second
2203 1.0 Second

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Photos of the tested unit





Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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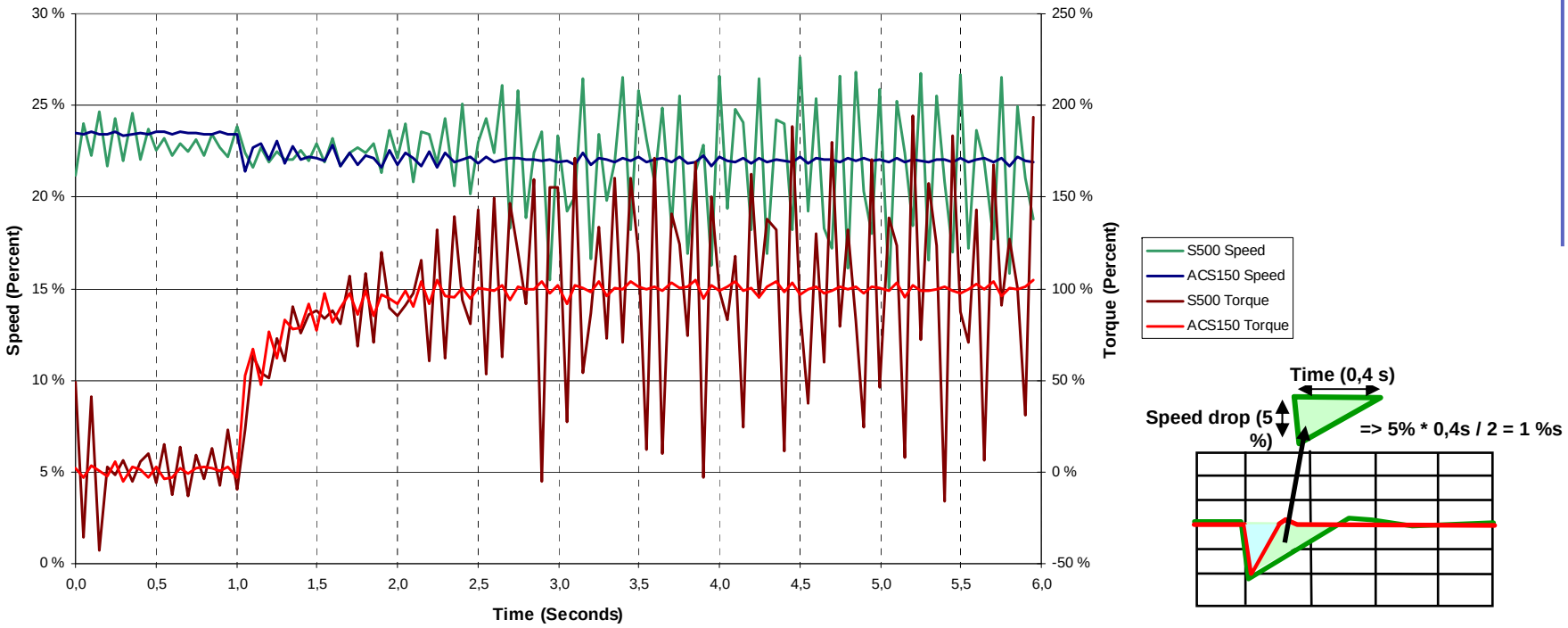
Impact load test – Dynamic speed accuracy (stiffness)

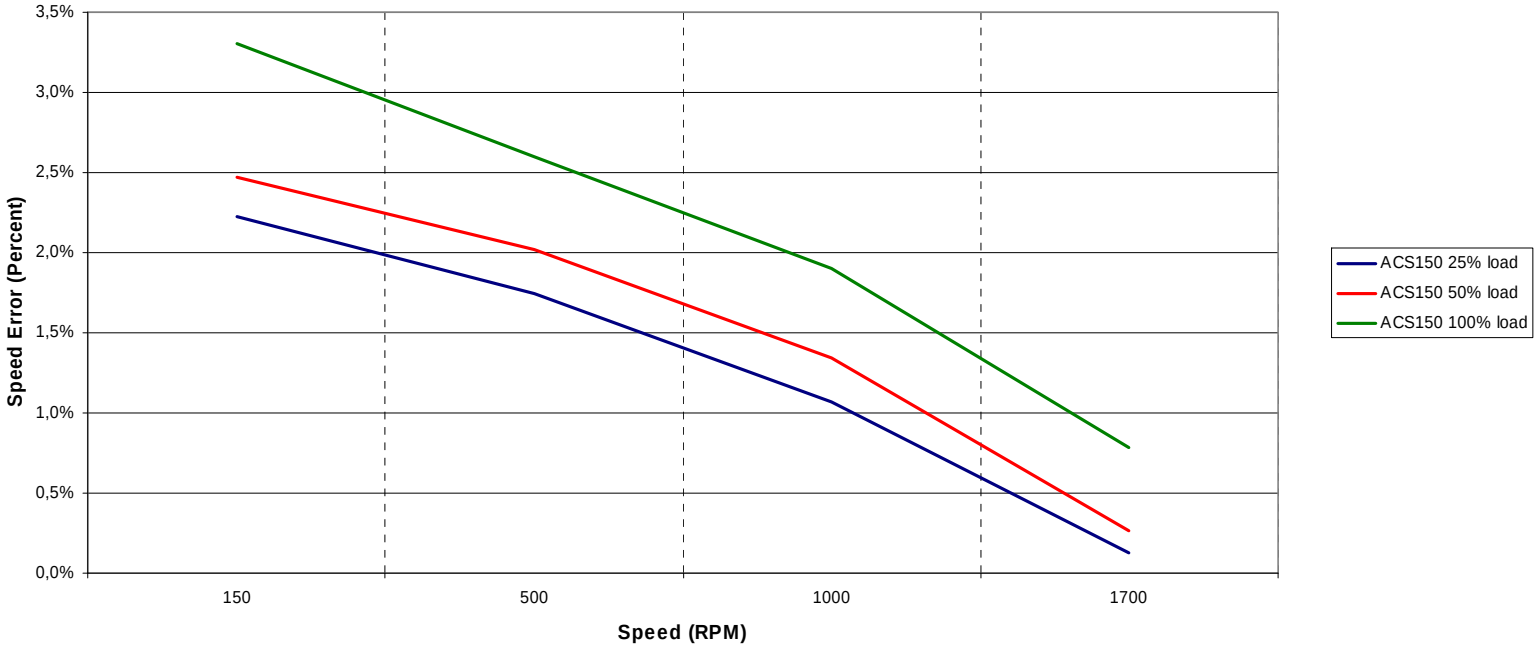
Motor is operated at 25% rated speed and 100% load is applied. Speed and torque are measured over time. Dynamic speed error (stiffness) is speed drop (% of nominal speed) times time of recovery (s) divided by 2. The 25% speed reference data is plotted as this is worst case test for the speed regulator evaluation.



Dynamic speed error depends on speed controller tuning. The smaller the stiffness %s figure the better the drive works in case of disturbances. In ACS150 the speed control default tuning is quite conservative to ensure that controller is stable despite the motor used and its size compared to size of the inverter. Both products handled the 100% impact load at ¼ speed. The S500 has good dynamic speed accuracy despite the amount of speed and torque ripple.

Static speed accuracy

Drive is given speed references of 150, 500, 1000 and 1700 rpm's and loads of 25%, 50% and 100%. The speed error in static situation (constant load and speed) is calculated as a ratio of the average speed error compared to motor nominal speed (1765 rpm), Speed Error [%] = $(n^*-n_{act}) / n_{N(mot)}$. Speed (control) accuracy is essential feature for high quality motor control.



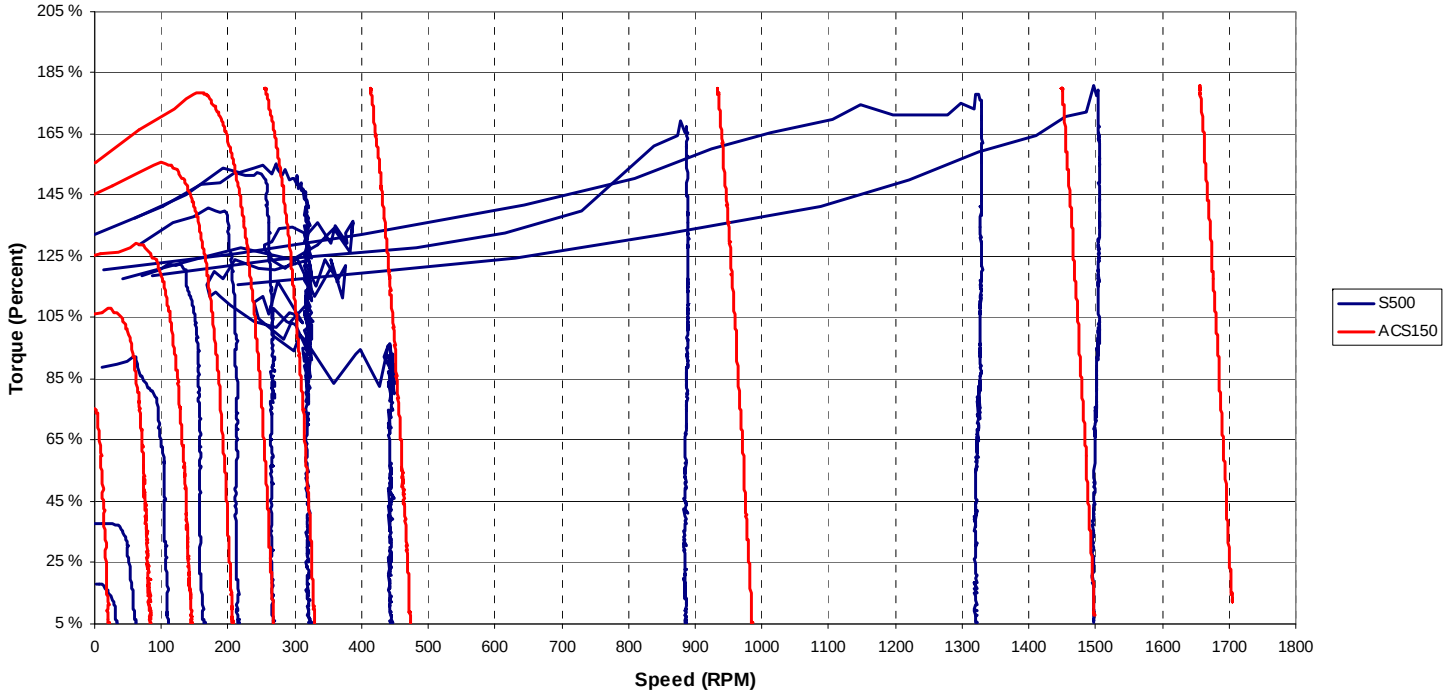
Static speed error depends on the accuracy and quality of measurements (voltage, current, speed estimation). The smaller the error figure and difference between figures at partial and full load points, the better the drive works in applications where good static accuracy is needed (e.g. extruders).
FR-S 500: Test failed. Tester comments: Drive cannot accelerate, unloaded to low frequencies without tripping Estimated lowest is 8-9 Hz.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Maximum torque as a function of speed

Drive is given speed reference of 30, 60, 120, 180, 240, 300, 360, 500, 1000, 1500 and 1700 rpm's. Load is gradually increased to 180% for 2 seconds, or until the motor stalls. The test describes the drive's speed range. The speed range is defined as the minimum speed the motor can operate from a given base speed and still generate 100% torque.



ACS150 produces approximately 180% torque at each set point over 300 rmp and torque is limited below that. S500 is unstable and torque is lower.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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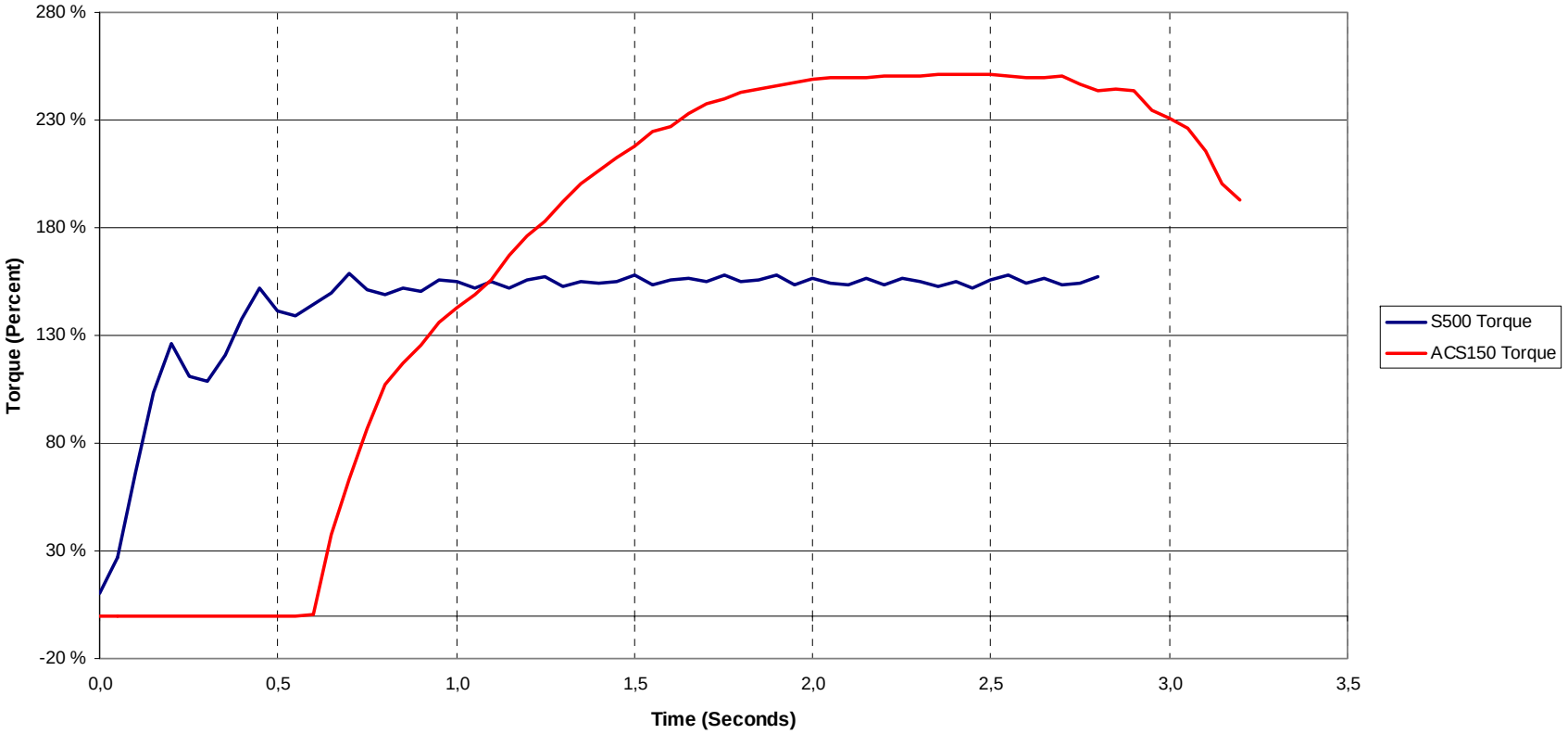
Maximum starting torque

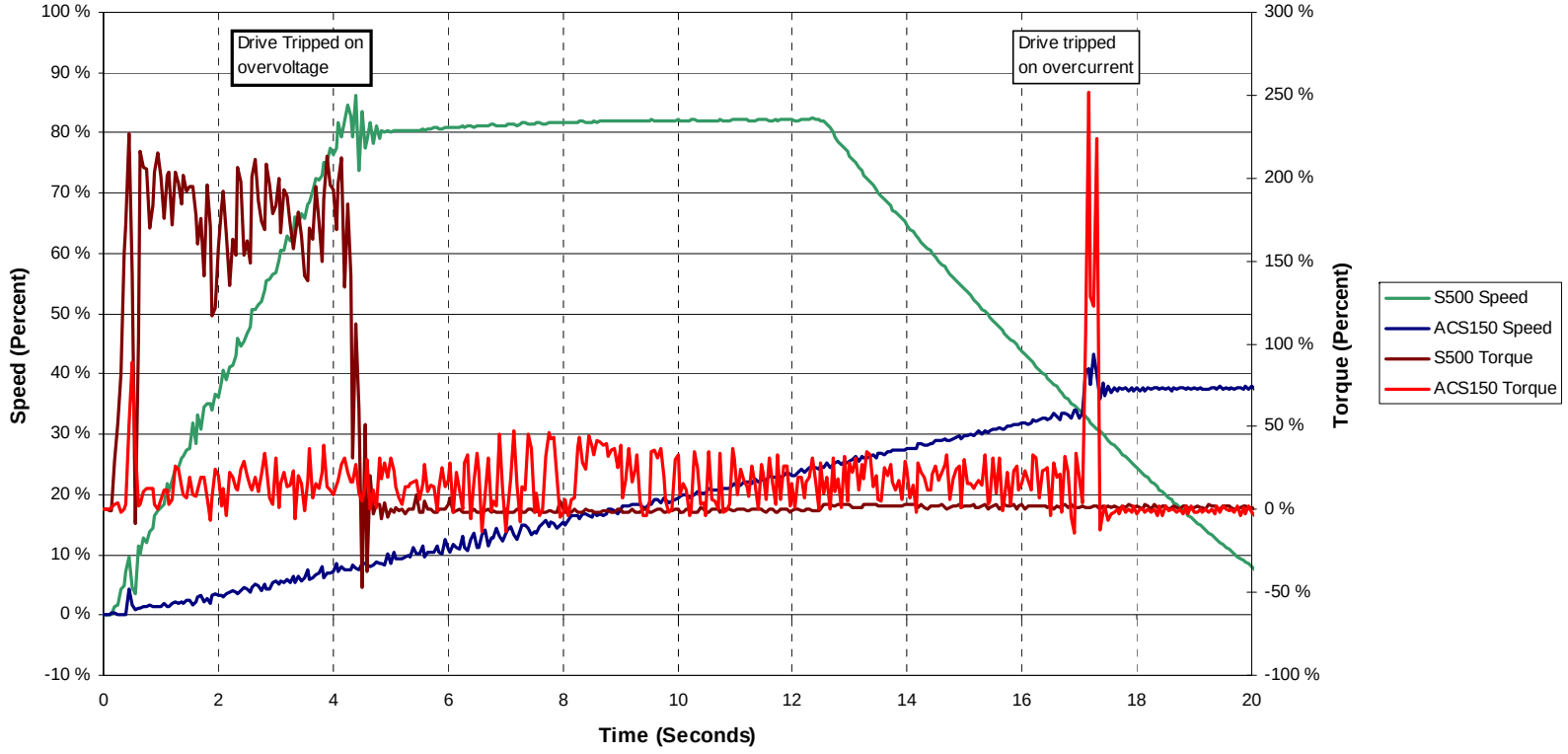
Motor output shaft is locked. Drive is given run command and 1000 rpm speed reference. Torque is measured with respect to time.



The ACS150 ramped to a maximum torque of 250% in approximately 2,0 seconds. S500 torque was only 140%.

Fast acceleration into inertia

Drive is given run command and zero speed reference. Dynamometer inertia simulation program places 22.5 lb-ft^2 (0.95 kgm^2) inertia on motor shaft and then drive is given 100% speed reference. Speed and torque are measured over time as drive accelerates motor into inertia. Drive acceleration rate is set to 1 second.



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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Efficiency

Using power analyzer, input power, speed and torque of AC motor are measured at 25%, 50%, 75% and 100% rated motor load. Since the comparison is made by using the same motor at the same operation point the figures reflect the efficiency of the inverter and the additional losses caused in the motor due to the inverter operation. The difference in total efficiency may be remarkable in total energy consumption.

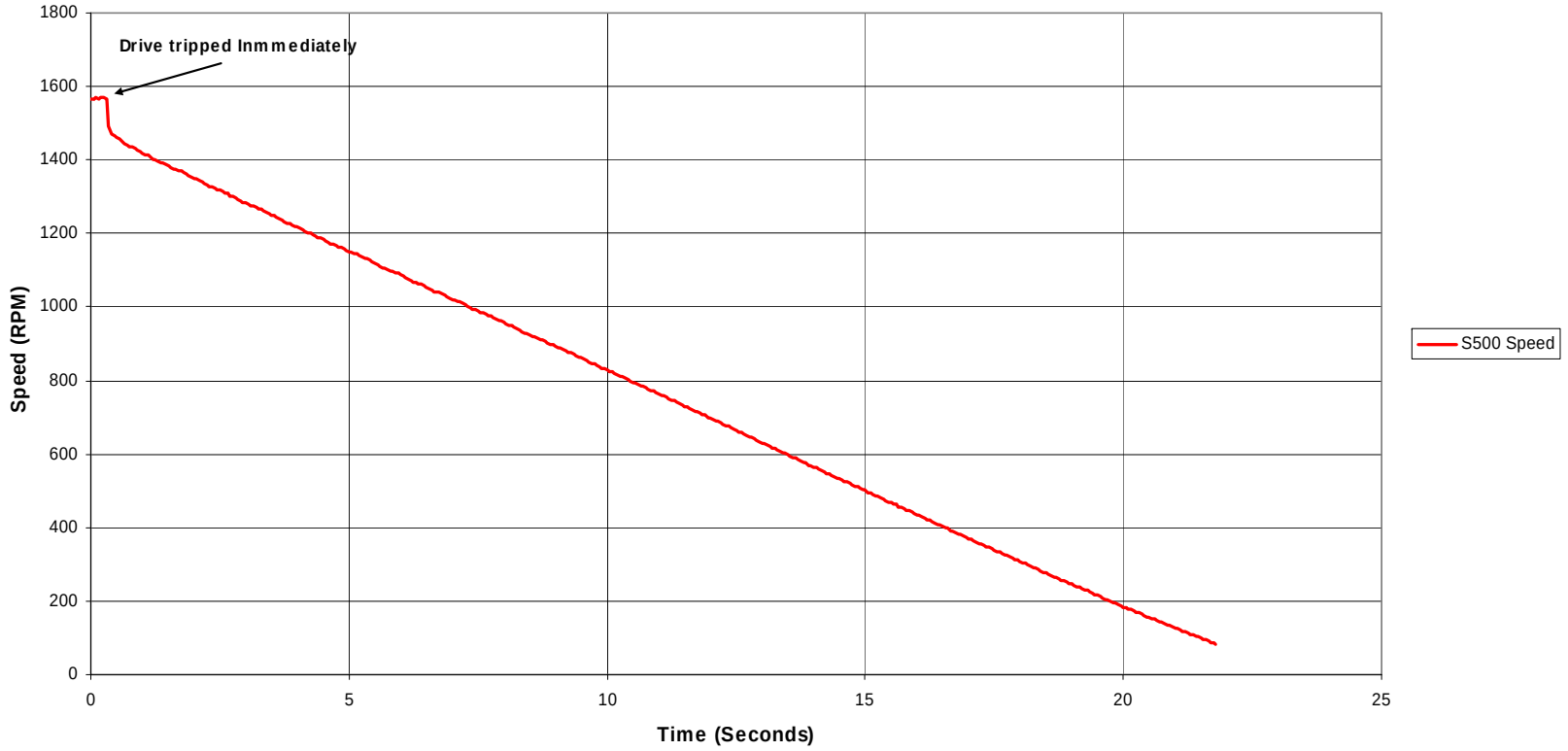
Load (Percent)	Efficiency	
	ACS150	S500
25%	82.3%	85.6%
50%	89.0%	89.2%
75%	89.3%	89.0%
100%	88.5%	88.3%

The test is performed at rated speed with different loads. The efficiencies of both drives were comparable.

.

Overvoltage control

With DUT operating at nominal line voltage and 100% rated speed, the run command will be removed from DUT. Time from the run command being removed until AC motor speed reaches 0 will be measured and recorded. DUT deceleration time will be set to 1 sec. The test measures the ability of drives to decelerate the load with and without flux braking (raising the magnetization level in the motor to convert kinetic energy to motor thermal energy). The shorter the time, the better the overvoltage controller (and flux braking algorithms) of a drive works.



Both drives failed the test and for ACS150 test data is not available.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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ABB strengths

ACS150 advantages over Mitsubishi FR-S 500

NEMA 1 kit option	Pulse train input
Areas of 400 V units	Brake chopper as standard
Volumes of 400 V units	100% * Phd for braking
Weights of 400 V units	500 Hz max. output frequency
DIN rail mounting as standard	Application macros
Sideways mounting	High functionality software features
Side by side mounting	Cold configuration with FlashDrop
EN 61800-3 compliance	Capacitor change not required
EN61000-3-2 with opt. chokes	RoHS compliance

For ACS150 advantages in performance, see the performance test slides

ACS150 Competitor comparison

Siemens SINAMICS G110

Mitsubishi FR-S 500

Allen Bradley PowerFlex 4

WEG CFW10

Hitachi X200

Lenze 8400 BaseLine

Main

Yaskawa VS Mini J7

Schneider Altivar 11

Lenze smd

Allen Bradley PowerFlex 4M

Yaskawa J1000

Summary Slide

Description

Altivar 11

- Designed for maximum simplicity with its immediate starting, user-friendly adjustment and quick wiring - it integrates all the necessary features for use anywhere in the world.
- Sensorless flux vector control with pulse width modulation (PWM) type motor control signal
- For power range 0.18 kW to 2.2 kW
- Applications
  - Conveyors, garage doors, lift doors, automatic parking barriers, check out counters, etc.
  - Grinders, saws, drills, exercise equipment, scrolling displays, retractable hoods, dough mixers, etc.

ABB ACS150

- ACS150 is a component drive for the serial OEM business in basic machinery applications
- Integrated user interface
- Unpowered drive configuration in 2 s
- Straightforward installation and integration
- Fast availability and service
- Scalar control
- For power range 0.37 kW to 4.0 kW
- Applications
  - Fans, pumps, gate control, material handling, conveyors

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Protection class

Altivar 11

- IP 20 (standard)
- UL Type 1 kit as an option

ABB ACS150

- IP20 UL open (standard)
- NEMA 1 (option)

Ambient specification

Altivar 11

Vibration

- Conforming to IEC/EN 60068-2-6:
  - 1.5 mm peak from 3 to 13 Hz
  - 1 gn from 13 to 200 Hz

Shock

- 15 gn for 11 ms conforming to IEC/EN 60068-2-27

Temperature

- -10°C to +40°C , +50°C by removing the protective blanking plate
- +60°C with derating nominal current of the drive by 2.2 % per °C above 50 °C.
- Storage temperature -25 °C to +60 °C.

Humidity

- 5…93 % without condensation or dripping water, conforming to IEC 60068-2-3

Altitude limitations

- 1000 m without derating. Higher derating 1% per additional 100 m.

Acoustic noise

- 2…16 kHz

ABB ACS150

Vibration

- Compliance with IEC 60721-3-3 (operation) and ISTA 1A (storage and transportation)

Shock

- Mechanical shocks are not allowed for the drive during operation
- Bump according to IEC 60068-2-29, 25g/1000pcs

Temperature

- Operating temperature -10 to +50 °C, minimum derate after 40 °C (1% per degree)
- Storage temperature –40 °C to +70°C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 0 to 1000m derate 1% per 100m

Acoustic noise

- 4…16 kHz

Mains connections

Altivar 11

Voltage types and power range

- 1-phase 100 V - 120 V
  - 0.18 kW to 0.75 kW (0.25 to 1 hp)
- 1-phase 200 V - 240 V
  - 0.18 kW to 2.2 kW (0.25 to 3 hp)
- 3-phase 200 V - 230 V
  - 0.18 kW to 2.2 kW (0.25 to 3 hp)

Power factor

- N/A

Supply frequency

- 50/60 Hz, tolerance ±5%

Supply networks

- N/A

ABB ACS150

Voltage types and power range

- 1-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 380 - 480V +/-10%
  - 0.37 to 4 kW (0.5 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60Hz, tolerance ±5%

Supply networks

- Suitable for IT network. Drive operation in floating (IT) networks possible by disconnecting EMC filter.

DC bus connection

- Not available

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Ratings 1-phase 200V

1-phase 200V		ABB	Altivar 11	ABB ACS150		Altivar 11		Altivar 11	ABB
P_N	P_N	ACS150		I_{2N}	I_{2N}	*Rated output*			
		Type		40° C	50° C	40° C	50° C		
		ACS150-	Type	A	A	A	A		
kW	hp	01X-	ATV11HU	UN=200-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,18	0,25		05M2E			1,1	1,1	F1	
0,37	0,5	2A4-2	09M2E	2,4	2,2	2,1	2,1	F2	R0
0,55	0,75		12M2E			3	3	F3	
0,75	1	04A7-2	18M2U	4,7	4,2	3,6	3,6		R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	29M2U	7,5	6,8	6,8	6,8	F4	R2
2,2	3	09A8-2	41M2U	9,8	8,8	9,6	9,6		

Altivar 11

Overload ratings

- 150 % for 60 sec.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 200V

3-phase 200V		ABB ACS150	Altivar 11	ABB ACS150		Altivar 11		Altivar 11	ABB ACS150
P_N	P_N			I_{2N}	I_{2N}	*Rated output*			
		Type	Type	40° C	50° C	40° C	50° C	Frame	
		ACS150-		A	A	A	A	names	
kW	hp	03X-	ATV11HU	UN=206-240 V		U_N=200-240 V		N/A	Frame
0,12	0,16								
0,18	0,25		05M3U			1,6	1,6	F1	
0,37	0,5	02A4-2	09M3U	2,4	2,2	2,4	2,4	F2	R0
0,55	0,75	03A5-2		3,5	3,2				
0,75	1	04A7-2	18M3U	4,7	4,2	4,6	4,6	F3	R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	29M3U	7,5	6,8	7,5	7,5	F4	
2,2	3	09A8-2	41M3U	9,8	8,8	10,6	10,6		R2

Altivar 11

Overload ratings

- 150 % for 60 sec.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 400V

3-phase 400V		ABB ACS150	Altivar 11	ABB ACS150		Altivar 11		Altivar 11	ABB ACS150
P_N	P_N			I_{2N}	I_{2N}	*Rated output*			
		Type	Type	40° C	50° C	40° C	50° C	Frame	
		ACS150-		A	A	A	A	names	
kW	hp	03X-	ATV11HU	U_N=380-480 V		U_N=380-480 V		N/A	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	01A2-4		1,2	1,1				R0
0,55	0,75	01A9-4		1,9	1,7				
0,75	1	02A4-4		2,4	2,2				R1
1,1	1,5	03A3-4		3,3	3,0				
1,5	2	04A1-4		4,1	3,7				
2,2	3	05A6-4		5,6	5,0				
3	4	07A3-4		7,3	6,6				
4	5	08A8-4		8,8	7,9				

N/A

Altivar 11

Overload ratings

- 150 % for 60 sec.

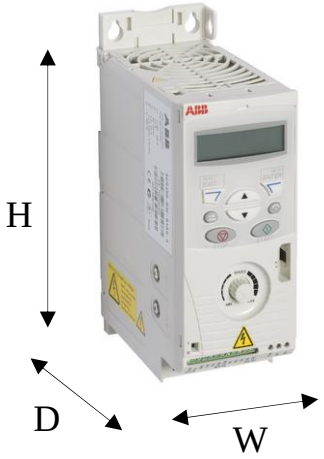
ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Dimensions 200 V 1-phase: width, height, depth

Dimensions 200 V		ACS150	Altivar 11	ABB ACS150			Altivar 11			Altivar 11	ABB ACS150
		Type		1-phase			1-phase				
		ACS150-	Type	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	01X-	ATV11HU	W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25		05M2E						101	F1	
0,37	0,5	2A4-2	09M2E	70	169	142	72	142	125	F2	R0
0,55	0,75		12M2E						138	F3	
0,75	1	04A7-2	18M2U	70	169	142					R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	29M2U	105	169	142	117	142	156	F4	R2
2,2	3	09A8-2	41M2U								



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Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 1-phase: area, volume, weight

Dimensions 200 V		ACS150	Altivar 11	ABB ACS150			Altivar 11			Altivar 11	ABB ACS150
		Type		1-phase			1-phase				
		ACS150-	Type	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	01X-	ATV11HU	area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25		05M2E					1,0	0,7	F1	
0,37	0,5	2A4-2	09M2E	118	1,7	1,1	102	1,3	0,85	F2	R0
0,55	0,75		12M2E					1,4	0,92	F3	
0,75	1	04A7-2	18M2U	118	1,7	1,3					R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	29M2U	177	2,5	1,5	166	2,6	1,6	F4	R2
2,2	3	09A8-2	41M2U								

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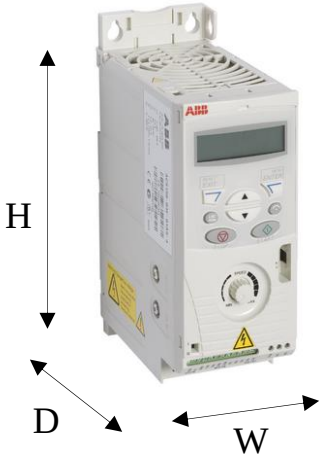
Dimensions 200 V 3-phase: width, height, depth

Dimensions 200 V		ACS150	Altivar 11	ABB ACS150			Altivar 11			Altivar 11	ABB ACS150
		Type	Type	3-phase			3-phase			Frame names	
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-	ATV11HU	W	H1	D	W	H	D	N/A	Frame
0,12	0,16										
0,18	0,25		05M3U				72	142	101	F1	
0,37	0,5	02A4-2	09M3U						125	F2	R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	18M3U	70	169	142	72	147	138	F3	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	29M3U				117	142	156	F4	
2,2	3	09A8-2	41M3U	105		142					R2

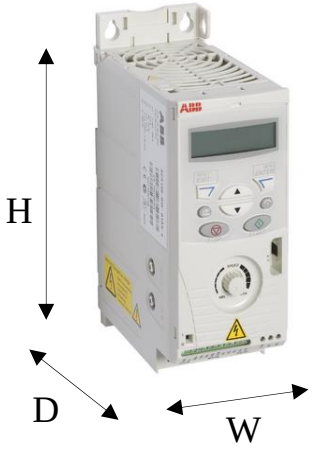


Dimensions 200 V 3-phase: area, volume, weight

Dimensions 200 V		ACS150	Altivar 11	ABB ACS150			Altivar 11			Altivar 11	ABB ACS150
		Type	Type	3-phase			3-phase			Frame names	
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-	ATV11HU	area	volume	weight	area	volume	weight	N/A	Frame
0,12	0,16										
0,18	0,25		05M3U				102	1,0	0,7	F1	
0,37	0,5	02A4-2	09M3U			1,1		1,3	0,85	F2	R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	18M3U	118	1,7		106	1,5	0,95	F3	
1,1	1,5	06A7-2				1,3					R1
1,5	2	07A5-2	29M3U				166	2,6	1,6	F4	
2,2	3	09A8-2	41M3U	177	2,5	1,5					R2

Dimensions 400 V 3-phase: width, height, depth

Dimensions 400 V		ACS150	Altivar 11	ABB ACS150			Altivar 11			Altivar 11	ABB ACS150
		Type								Frame names	
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	N/A	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4		70	169	142	N/A				R0
0,55	0,75	01A9-4									
0,75	1	02A4-4									R1
1,1	1,5	03A3-4									
1,5	2	04A1-4									
2,2	3	05A6-4									
3	4	07A3-4									
4	5	08A8-4									



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: area, volume, weight

Dimensions 400 V		ACS150	Altivar 11	ABB ACS150			Altivar 11			Altivar 11	ABB ACS150
		Type								Frame names	
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	N/A	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4		118	1,7	1,1	N/A				R0
0,55	0,75	01A9-4									
0,75	1	02A4-4				1,3					R1
1,1	1,5	03A3-4									
1,5	2	04A1-4									
2,2	3	05A6-4									
3	4	07A3-4									
4	5	08A8-4									

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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Sideways mounting

Side by side mounting up to 50°C

Installation

Altivar 11

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	No
Heatsinkless	Yes
Side-by-side	Yes, below 40°C

Free space requirements

Location	*mm*
Above	50
Below	50
Left and right	50

- Attached with screws
- Side-by-side mounting only possible below 40°C
- Motor cable lengths
  - 50 m (shielded cable)
  - 100 m (unshielded cable)

ABB ACS150

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	80
Below	80
Left and right	0

- Installation with clamps and screws, cabinet support tools available
- Operational motor cable lengths:

Frame	Standard	With output chokes
R0	30 m	60 m
R1	50 m	100 m
R2	50 m	100 m

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EMC and harmonics

Altivar 11

- **Filters**
  - Built-in EMC Class B filter (Europe)
  - Built-in EMC Class B filter optional (America, Asia)
- **Chokes**
  - Line chokes (option)
- **Motor cable lengths (EN55011, EN55022)**
  - 5 m class B
  - 10 m class A (group 1)
  - With additional EMC filter
    - 20 m class B
    - 50 m class A
  - Comment: In measurements made at ABB Baden-Dättwil Research Center the radiated emissions of ATV11 with internal EMC filter overstep the 1st environment limit at some points with both 2 kHz (min f_{sw}.) and 16 kHz (max. f_{sw}).
- **THD**
  - N/A

ABB ACS150

- **Filters**
  - Inbuilt EMC filter for category C3 (2nd environment) as standard
  - External EMC filter for categories C1, C2 (1st environment) and C3 (2nd environment) as option
- **Chokes**
  - AC input/output chokes as an option
- **EMC compliant motor cable lengths**
  - Category C3 30m (with 4 kHz switching frequency) as standard
  - With external EMC filter and 4 kHz switching frequency
    - 1~ 200 V: C1 10m, C2 and C3 100m (for 0.37 kW unit C1 10m, C2 45m and C3 75m)
    - 3~ 200 V: C2 and C3 30 m
    - 3~ 400 V: C1, C2 and C3 100 m
- **THD**
  - EN61000-3-2 with optional chokes

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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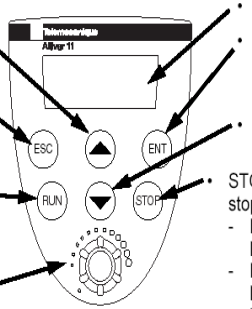
User interface

Altivar 11

- A choice of two different man-machine interfaces:
  - ATV 31H with displays and menu navigation keys
  - ATV 31H-A, Asia range specific functions: Run/Stop buttons and speed potentiometer incorporated on operator panel plus choice of PNP or NPN logic

Functions of the display and the keys

- Returns to the previous menu or parameter, or increases the displayed value
- Exits a menu or parameter, or aborts the displayed value to return to the previous value in the memory
- RUN button: controls motor switch-on in forward operation, if parameter tCC in the FUn menu is configured as LOC
- Reference potentiometer, active if parameter LSr in the FUn menu is configured as LOC

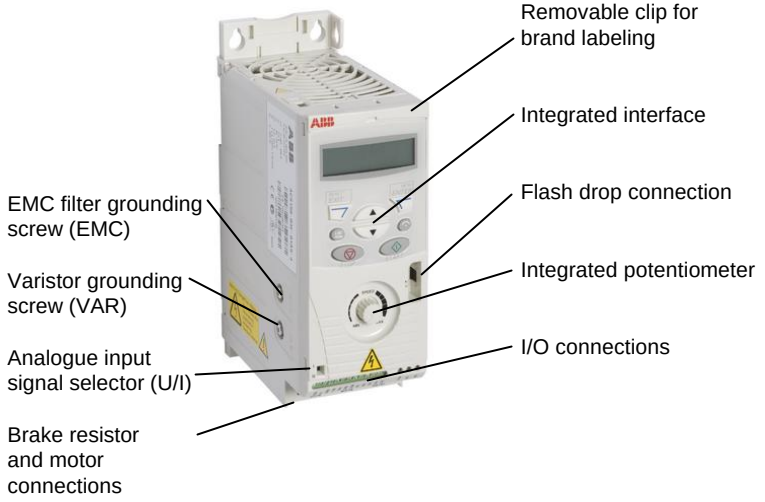


- 3 "7-segment" displays
- Enters a menu or a parameter, or saves the displayed parameter or value
- Goes to the next menu or parameter, or decreases the displayed value
- STOP button: always controls the stopping of the motor.
  - If tCC (FUn menu) is not configured as LOC, it is a freewheel stop.
  - If tCC (FUn menu) is configured as LOC, the stop is on a ramp, but if injection braking is in progress, a freewheel stop takes place.

- Remote operation with IP65 remote terminal for fixing on door of enclosure

ABB ACS150

- Integrated interface
- Integrated potentiometer
- FlashDrop connection



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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Machine interface

Altivar 11

Type	*Qty.*	*Programmable*
Digital inputs	4	N/A
Analog inputs	1	Yes
Pulse train input	N/A	N/A
Relay outputs	1	N/A
Analog outputs	1	N/A

Specialities:

- Negative logic (optional)

Protocol	*Standard/ Optional*	*Baud rate*	*Notes*
Ethernet Modbus through PC Power suite	Option	4800, 9600 or 19200 bps	

ABB ACS150

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	1 (i.e. digital input)	Yes
Relay outputs	1	Yes
Transistor outputs	1	Yes

Specialities:

- Pulse train input

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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100% * Phd for braking

500 Hz max. output frequency

Motor control

Altivar 11

- Sensorless flux vector control with pulse width modulation (PWM) type motor control signal

Braking

- External braking chopper option available
- DC Braking available as standard

Output frequency

- 0 – 200 Hz for vector control

ABB ACS150

- Scalar control

Braking

- Brake chopper available as standard
  - 100% * Phd for braking

Output frequency

- 500 Hz as maximum output frequency

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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Macros and language versions

Altivar 11

- N/A

ABB ACS150

- **Macros**
  - ABB Standard
  - 3-wire
  - Alternate
  - Motor Potentiometer
  - Hand/auto
- **Languages**
  - N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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Software features

Altivar 11

- Adjustment of acceleration and deceleration ramp times and profiles (*
- Adaptation of deceleration ramp, ramp switching (*
- Jog operation, + speed / - speed, save reference (*
- 4 Preset speeds (*
- Brake control (*
- Multi-assignment of logic inputs, positive and negative logic optional (*
- 2-wire / 3-wire control (*
- Automatic d.c. injection (*
- High switching frequency, noise reduction (*
- Fault reset (*
- Drive/Motor thermal protection (*
- Monitoring (*
- Fault relay, unlocking (*
- Automatic catching a spinning load with speed detection (*
- Mixed mode (setting and/or start command)
- Regulator and preset PI, "Manual-Automatic" start with PI
- Traverse control, limit switch management
- Auto tuning (on first power-up, on logic input, on each start command).
- Controlled stop on loss of line supply

(* = Basic feature in ABB ACS150

ABB ACS150

- FlashDrop
- Pulse train input
- Changed parameter menu
- Emergency stop
- Jog function
- Fault Group (Group 4)
- Hardware protection against miss wiring in I/O and supply
- Zero speed delay
- Flux Optimization
- Switching frequency control
- 7 preset speeds
- Application macros
- Flying start
- Critical frequency lock-out
- Max. Freq. 500 Hz

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Other advanced features

Altivar 11

- N/A

ABB ACS150

FlashDrop

- Option tool for fast and safe selecting and setting drive parameters without power
- Palm-size 153x53x71mm and light weight 0.4 kg
- Portable and battery chargable
- Keypad with LCD display
- Includes Drive PM (Drive parameter manager) software for PC to create, edit and copy parameter sets for FlashDrop
- Help function available
- Possibility to store 20 user specified parameter macros
- Parameter hiding, Parameter upload and download, Cold drive and Damaged drive parameterization
- Compatible also with ACS150, ACS550 and ACH550 drives

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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PC connectivity and tools

Altivar 11

- Connects to the 4-way connector under the terminal cover.
- PC connection kit is required for connecting to laptop / PC. (Comprises of: cables, adaptors & RS-232/RS485 convertor.)
- Power*Suite* software available for drive configuration, on CD-ROM
  - In disconnected mode:
    - Preparation and memorization of configuration files: save to hard disk, CD-ROM, floppy disk, etc
    - Printing configurations
    - Exporting to desktop applications
  - In connected mode:
    - Configuration, adjustment, control and monitoring of the drive or starter
    - Transfer and comparison of configuration files between Power*Suite* and the drive or starter
    - Possibility of connecting to an Ethernet network
    - Software available in 5 languages: German, English, Spanish, French and Italian
- Pocket PC connection kit for connecting to Pocket PC (optional)

ABB ACS150

- N/A

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Hardware options

Altivar 11

- Line chokes
- Additional EMC input filters
- UL Type 1 kit
- Braking resistors
- DIN rail mounting
- IP65 remote terminal for fixing on door of enclosure
- Output filters for cable lengths greater than 50mATV 31H…A with local control Run/Stop and speed reference set by a potentiometer
- Drive kit (the drive kit enables you to create bespoke enclosures)

ABB ACS150

- AC input/output chokes
- UL Type 1 kit
- External EMC filter for 1st / 2nd environment

Maintenance

Altivar 11

- No preventive maintenance required
- Check the following regularly:
  - Condition & tightness of connections
  - Temperature and ventilation of surroundings at acceptable level
  - Remove dust from drive
- Service life of fans 3-5 years depending on operating conditions
- Available spare parts:
  - Contact Schneider product support

ABB ACS150

- Cooling fan replacement
  - Very easy to replace
  - Every five years
- Capacitor reforming
  - Every two years when stored

- Available spare parts
  - Fan

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Standards

Altivar 11

Approvals

- CE, UL, CSA, NOM117, C-tick

Applicable standards

- EN50178 (Electronic equipment for use in power installations)
- IEC/EN61000-4-2 level 3
- IEC/EN61000-4-3 level 3
- IEC/EN61000-4-4 level 4
- IEC/EN61000-4-5 level 3 (power access)
- EN61800-3 Environments 1 and 2
- EN55011
- EN55022
- NEC 1999 208 V

ABB ACS150

Approvals

- CE, UL, cUL, C-tick, GOST-R

Compliance with

- Low Voltage Directive 73/23/EEC with supplements
- Machinery Directive 98/37/EC
- EMC Directive 89/336/EEC with supplements
- Quality assurance system ISO 9001
- Environmental system ISO 14001
- RoHS directive 2002/95/EC with amandments

Applicable standards

- IEC/EN 61800-5-1 - Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
- IEC/EN 60204-1 (1997) - Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
- IEC/EN 60529: 1991 - Degrees of protection provided by enclosures (IP code)
- IEC/EN 61800-3 (2004)- EMC product standard including specific test methods
- UL 508C UL - Standard for Safety, Power Conversion Equipment

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Performance analysis – Autodyne description

Test stand is used to characterize 2,2kW (3hp) heavy duty rated LVAC drives and allow ABB to compare accurate repeatable data against ABB's baseline products (ACS150, ACS350, ACS550 and ACS800). The mechanical portion of the dynamometer consists of a 2,2kW (3hp) 1755 rpm 230VAC/460VAC vector duty motor with encoder (spinner motor) which is connected to the output of the drive under test (DUT). The spinner motor is connected through a in-line torque transducer to a 10 hp 1750 RPM DC motor with encoder. Actual torque and speed information is fed to the dynamometer controller which is run by an IBM desktop computer and flat screen monitor using a Windows™ based proprietary software program controlling electrical power supplied to the DUT and from the DUT to the spinner motor.

Essentially, tests are conducted "out of the box". However, an ID run and a speed regulator autotune are performed, if the drive is so equipped. All drives are tested in sensorless vector mode of operation if available.

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Tested units in performance analysis

Schneider Altivar 11

Model: ATV11HU41M2U

Drive rating: 200-240V
2,2kW / 3Hp
9.6 A

Tester (experienced drive specialist) comments:

- **The input and output power connections were contactor style (Top/In and Bottom/Out). Additionally, to gain access to the screw terminals required inserting the screwdriver down a opening approximately 1.25" long. You had to "feel" the screwdriver engage the slot since you couldn't see it.**
- **The default AI1 value is 0 to 5Vdc and requires a parameter change for 0-10Vdc.**
- **The operator panel uses three 7-segment LED's as well as an ESC, Ent and Up/Down arrow keys. The display used codes and required close examination of the user manual to ensure you were accessing the correct parameter.**
- **The drive used standard mounting holes rather than keyholes.**
- **You must enter the motor Cosine phi.**
- **To reset a fault you must cycle power.**
- **Because the drive was powered through a 460/230Vac isolation transformer the harmonic distortion and efficiency test results were erratic and are not provided.**

ABB ACS150

Model: ACS150-03X-07A3-4

Drive rating: 380-480V
3,0 kW / 4 Hp
7,3 A

Parameter Settings:

9902 ABB Standard
9905 230V
9906 4.2A
9907 60Hz
9908 1750 RPM
9909 3.0 HP
2101 Torque Boost
2201 Not Selected
2202 1.0 Second
2203 1.0 Second

Photos of the tested unit

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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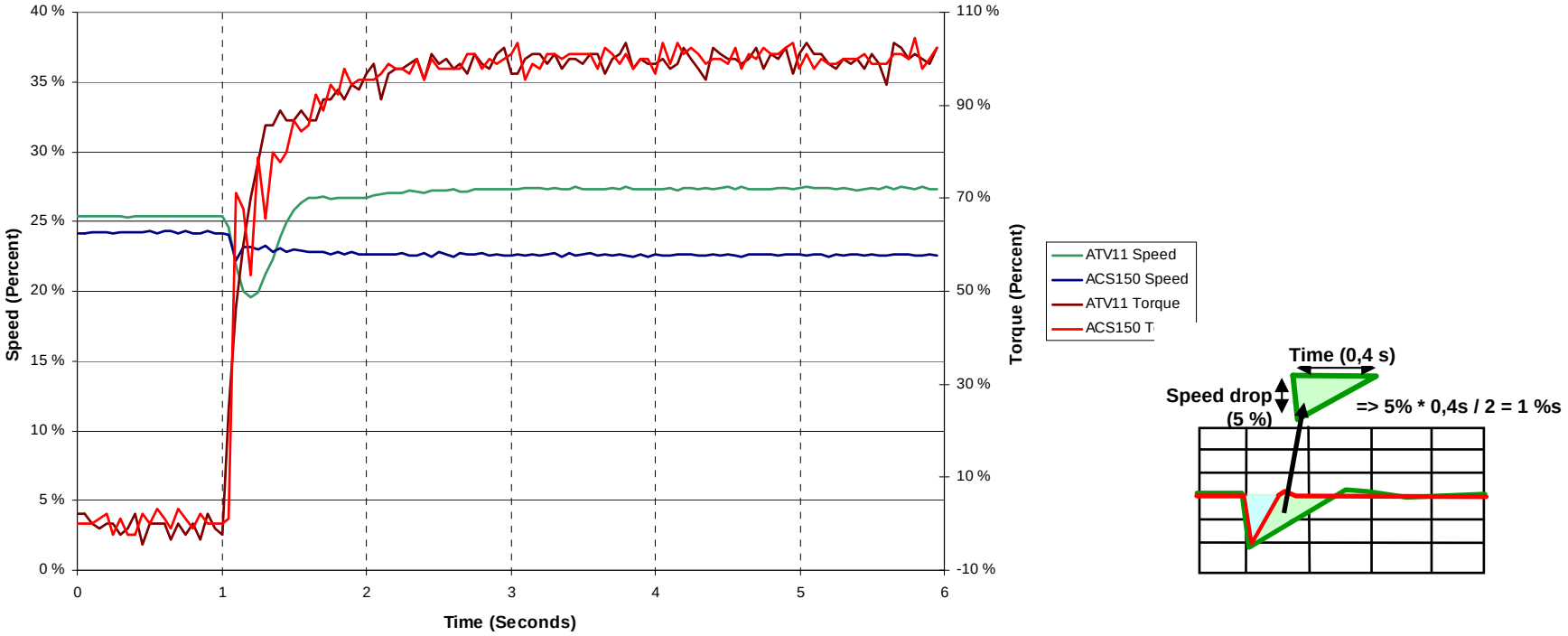
Impact load test – Dynamic speed accuracy (stiffness)

Motor is operated at 25% rated speed and 100% load is applied. Speed and torque are measured over time. Dynamic speed error (stiffness) is speed drop (% of nominal speed) times time of recovery (s) divided by 2. The 25% speed reference data is plotted as this is worst case test for the speed regulator evaluation.



Dynamic speed error depends on speed controller tuning. The smaller the stiffness %s figure the better the drive works in case of disturbances. The ACS150 speed control default tuning is quite conservative to ensure that the controller is stable despite the motor used and its size compared to size of the inverter. The ATV11 has good dynamic speed accuracy despite the amount of speed and torque ripple.

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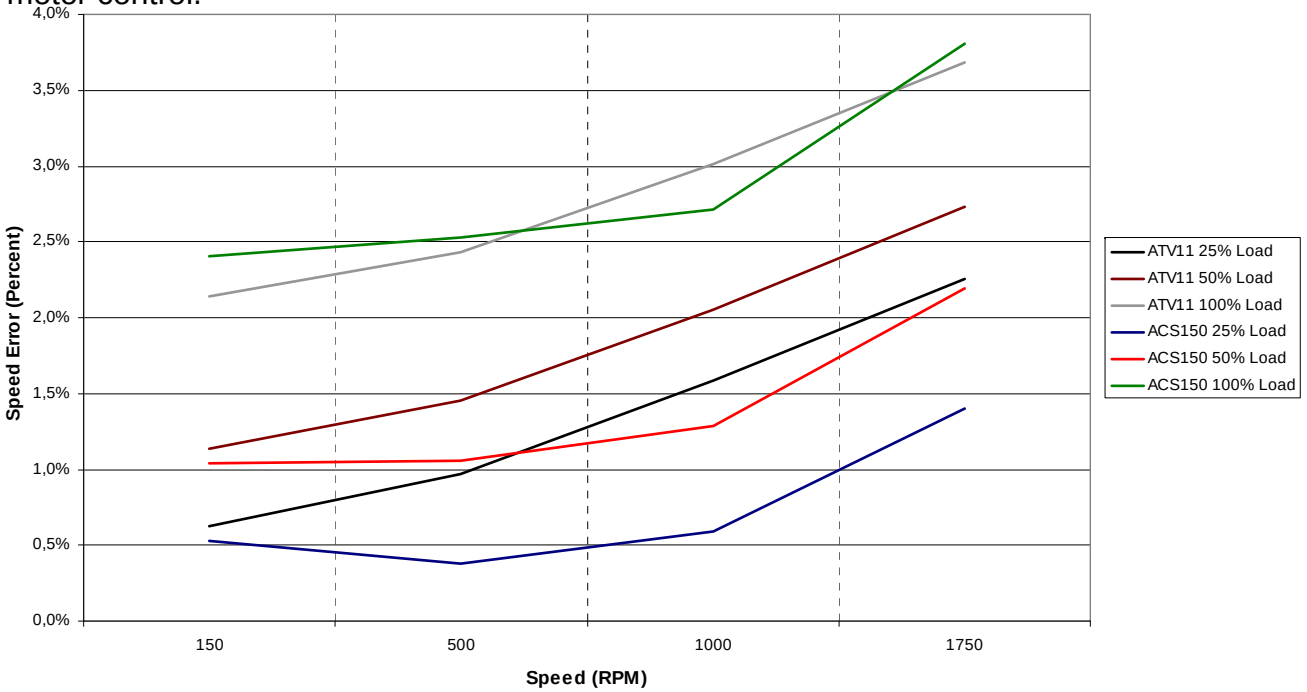
Static speed accuracy

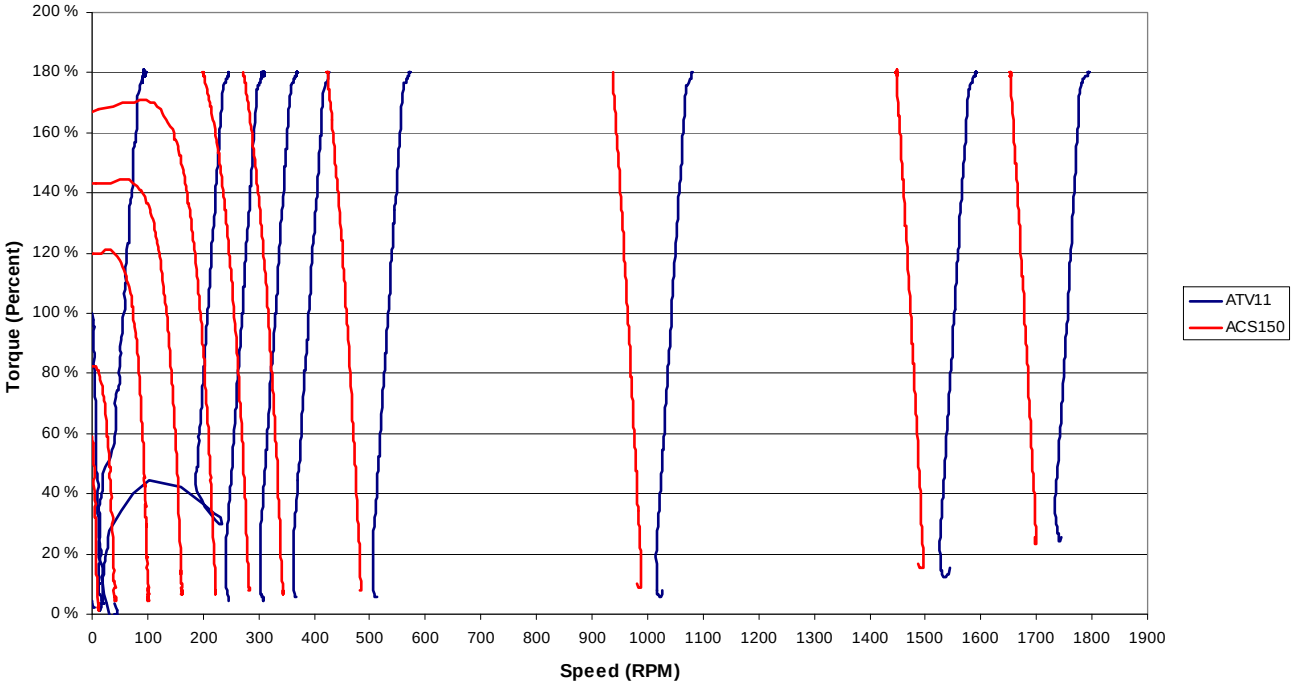
Drive is given speed references of 150, 500, 1000 and 1750 rpm's and loads of 25%, 50% and 100%. The speed error in static situation (constant load and speed) is calculated as a ratio of the average speed error compared to motor nominal speed (1755 rpm), Speed Error [%] = $(n^*-n_{act}) / n_{N(mot)}$. Speed (control) accuracy is essential feature for high quality motor control.



Static speed error depends on the accuracy and quality of measurements (voltage, current, speed estimation). The smaller the error figure and difference between figures at partial and full load points, the better the drive works in applications where good static accuracy is needed (e.g. extruders).

Maximum torque as a function of speed

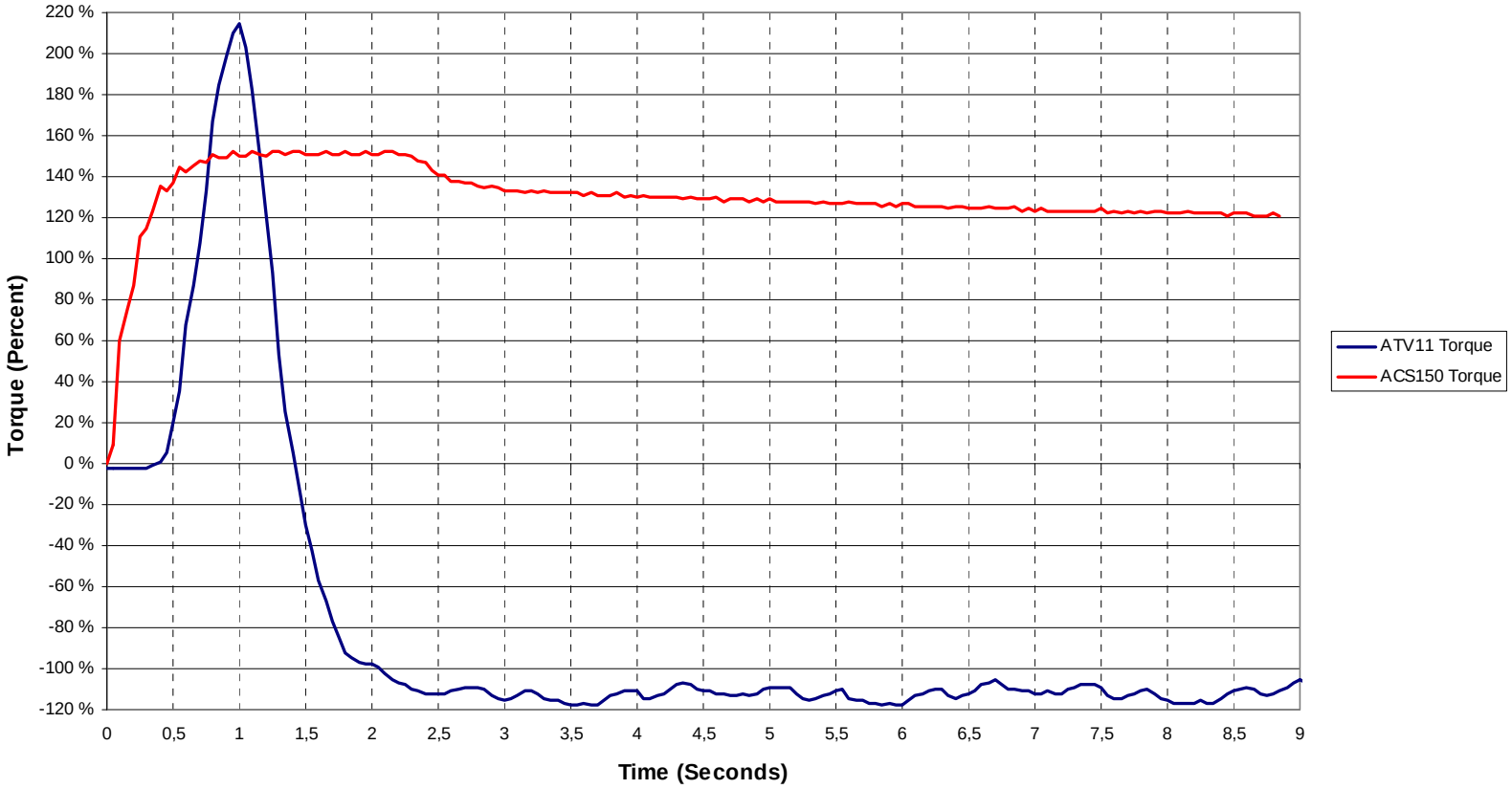
Drive is given speed reference of 30, 60, 120, 180, 240, 300, 360, 500, 1000, 1500 and 1700 rpm's. Load is gradually increased to 180% for 2 seconds, or until the motor stalls. The test describes the drive's speed range. The speed range is defined as the minimum speed the motor can operate from a given base speed and still generate 100% torque.



Both products produced approximately 180% torque at each set point over 300 rmp. ATV11 speed is over compensated and in the low speed unstable. ACS150 is stable but torque is limited below 300 rmp.

Maximum starting torque

Motor output shaft is locked. Drive is given run command and 1000 rpm speed reference. Torque is measured with respect to time.



The ACS150 ramped to a maximum torque of 150% in approximately 1 seconds. ATV11 was not able to produce adequate starting torque longer than 1s.

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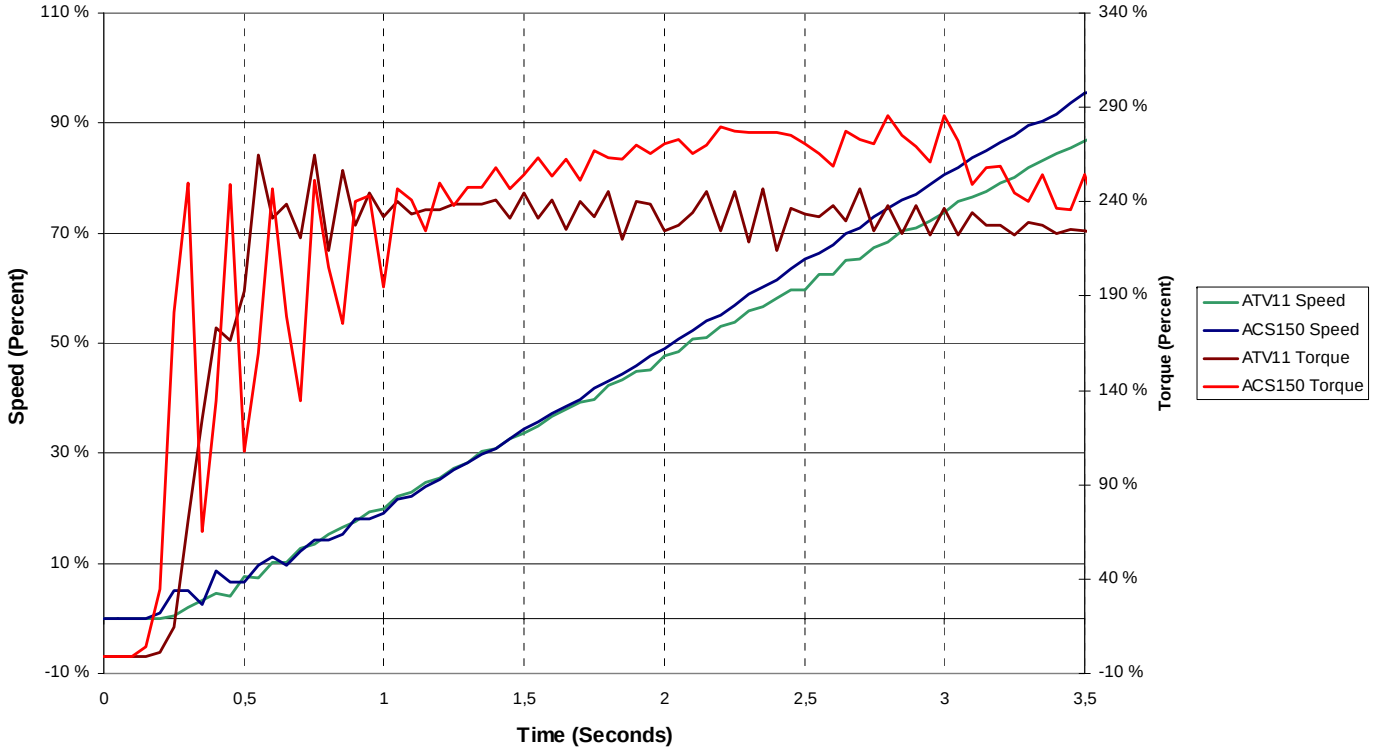
Fast acceleration into inertia

Drive is given run command and zero speed reference. Dynamometer inertia simulation program places 22.5 lb-ft^2 (0.95 kgm^2) inertia on motor shaft and then drive is given 100% speed reference. Speed and torque are measured over time as drive accelerates motor into inertia. Drive acceleration rate is set to 1 second.



The both drivers accelerated the inertia in approximately 3.7 seconds while producing 250% torque.

Efficiency

Using power analyzer, input power, speed and torque of AC motor are measured at 25%, 50%, 75% and 100% rated motor load. Since the comparison is made by using the same motor at the same operation point the figures reflect the efficiency of the inverter and the additional losses caused in the motor due to the inverter operation. The difference in total efficiency may be remarkable in total energy consumption.

Load (Percent)	Efficiency	
	ACS150	ATV11
25%	82.3%	N/A
50%	89.0%	N/A
75%	89.3%	N/A
100%	88.5%	N/A

ATV11's efficiency test data was not available.

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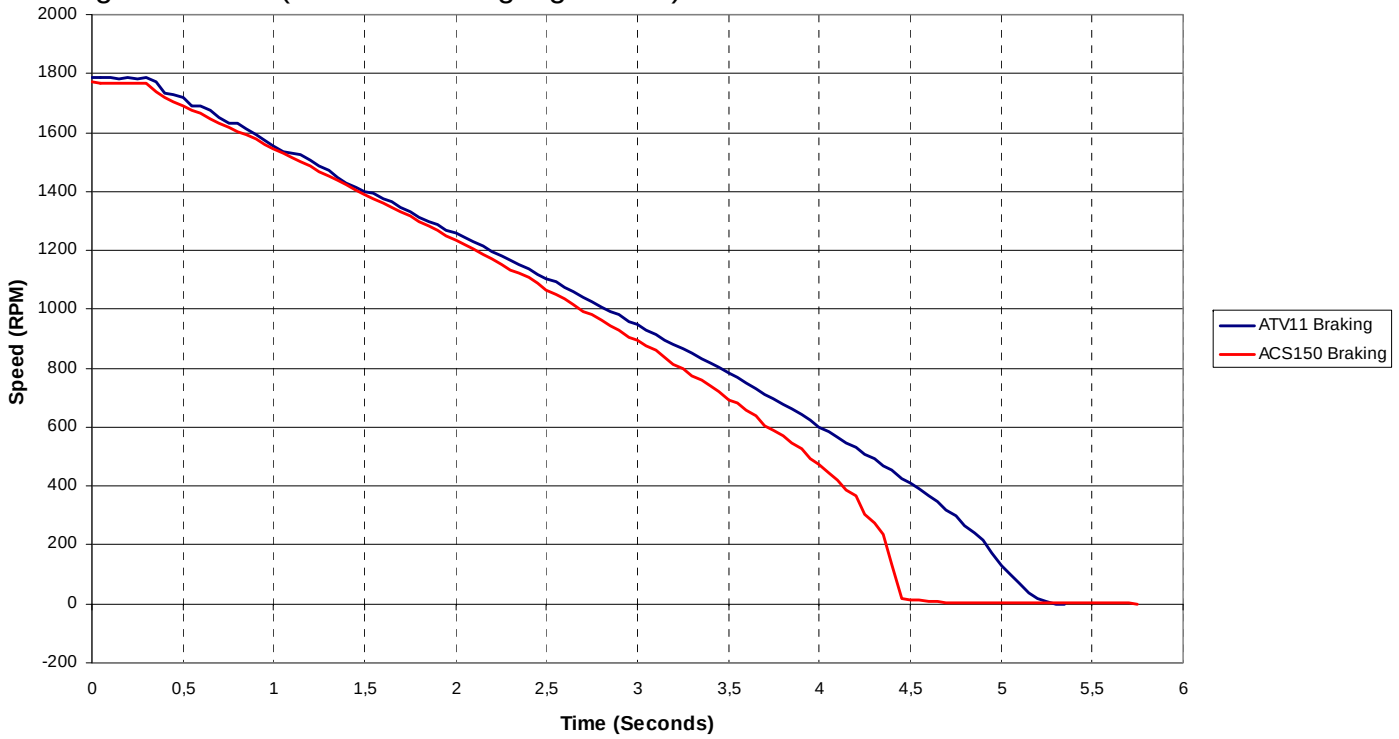
Overvoltage control

With DUT operating at nominal line voltage and 100% rated speed, the run command will be removed from DUT. Time from the run command being removed until AC motor speed reaches 0 will be measured and recorded. DUT deceleration time will be set to 1 sec. The test measures the ability of drives to decelerate the load with and without flux braking (raising the magnetization level in the motor to convert kinetic energy to motor thermal energy). The shorter the time, the better the overvoltage controller (and flux braking algorithms) of a drive works.



The ACS150 was able to decelerate the load to zero within 4,5 seconds. The ATV11 decelerated to zero within 5,3 seconds.

ABB strengths

ACS150 advantages over Altivar 11

3-phase 400 V unit	500 Hz max. output frequency
Sideways mounting	Application macros
Side by side mounting up to 50°C	High functionality software features
EN61000-3-2 with opt. chokes	Cold configuration with FlashDrop
Pulse train input	Easy maintenance
100% * Phd for braking	RoHS compliance

For ACS150 advantages in performance, see the performance test slides

ACS150 Competitor comparison

Siemens SINAMICS G110

Mitsubishi FR-S 500

Allen Bradley PowerFlex 4

WEG CFW10

Hitachi X200

Lenze 8400 BaseLine

Main

Yaskawa VS Mini J7

Schneider Altivar 11

Lenze smd

Allen Bradley PowerFlex 4M

Yaskawa J1000

Summary Slide

Description

PowerFlex 4

- Providing users with powerful motor speed control in a compact, space saving design, the Allen-Bradley PowerFlex 4 AC drive is the smallest and most cost-effective member of the PowerFlex family of drives.
- Available in power ratings from 0.2 to 3.7 kW (0.25 to 5 hp) and in voltage classes of 120, 240 and 480 volts, the PowerFlex 4 is designed to meet global OEM and end-user demands for flexibility, space savings and ease-of-use.
- The PowerFlex 4 is a cost-effective alternative for speed control of applications such as machine tools, fans, pumps and conveyors and material handling systems.
- Sensorless vector control
- V/Hz
- For power range 0.2 kW to 11 kW

ABB ACS150

- ACS150 is a component drive for the serial OEM business in basic machinery applications
- Integrated user interface
- Unpowered drive configuration in 2 s
- Straightforward installation and integration
- Fast availability and service
- Scalar control
- For power range 0.37 kW to 4.0 kW
- Applications
  - Fans, pumps, gate control, material handling, conveyors

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Protection class

PowerFlex 4

- IP 20 Open Type
- IP 30/NEMA 1/UL Type 1 (requires the installation of the PowerFlex 4 IP 30/NEMA 1/UL Type 1 option kit)

ABB ACS150

- IP20 UL open (standard)
- NEMA 1 (option)

Ambient specification

PowerFlex 4

Vibration

- 1G peak, 5 to 2000 Hz (operating)

Shock

- 15G peak for 11ms duration (±1.0ms) (operating)

Temperature

- Open Type, IP20: –10 to +50 °C
- NEMA Type 1, IP30, UL Type 1: –10 to +40 °C

Humidity

- Lower than 95 % (non-condensing)

Altitude limitations

- 1000 m or less. Higher by derating 1% for every extra 100 m

Acoustic noise

- 2…16 kHz

ABB ACS150

Vibration

- Compliance with IEC 60721-3-3 (operation) and ISTA 1A (storage and transportation)

Shock

- Mechanical shocks are not allowed for the drive during operation
- Bump according to IEC 60068-2-29, 25g/1000pcs

Temperature

- Operating temperature -10 to +50 °C, minimum derate after 40 °C (1% per degree)
- Storage temperature –40 °C to +70°C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 0 to 1000m derate 1% per 100m

Acoustic noise

- 4…16 kHz

Mains connections

PowerFlex 4

Voltage types and power range

- 1-phase 100 - 120V ±10%
  - 0.2 to 1.1 kW (0.25 to 1.5 hp)
- 1-phase 200 – 240V ±10%
  - 0.2 to 2.2 kW (0.25 to 3 hp)
- 3-phase 200 - 240V ±10%
  - 0.2 to 3.7 kW (0.25 to 5 hp)
- 3-phase 380 - 480V ±10%
  - 0.4 to 3.7 kW (0.5 to 5 hp)

Power factor

- Efficiency 97.5% (typical)

Supply frequency

- 50/60 Hz

Supply networks

- N/A

DC bus connection

- Not available

ABB ACS150

Voltage and power range

- 1-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 380 - 480V +/-10%
  - 0.37 to 4 kW (0.5 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60Hz, tolerance ±5%

Supply networks

- Suitable for IT network. Drive operation in floating (IT) networks possible by disconnecting EMC filter.

DC bus connection

- Not available

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Ratings 1-phase 200V

1-phase 200V		ABB	PowerFlex 4	ABB ACS150		PowerFlex 4		PowerFlex 4	ABB
P_N	P_N	ACS150		I_{2N}	I_{2N}	*Output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	22A-	A	A	A	A		
kW	hp	01X-		U_N=200-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,18	0,25		A1P4N113			1,4	1,4	A	
0,37	0,5	2A4-2	A2P1N113	2,4	2,2	2,1	2,1		R0
0,55	0,75								
0,75	1	04A7-2	A3P6N113	4,7	4,2	3,6	3,6	A	R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	A6P8N113	7,5	6,8	6,8	6,8	B	R2
2,2	3	09A8-2	A9P6N113	9,8	8,8	9,6	9,6		

PowerFlex 4

Overload ratings

- 150 % for 60 sec.
- 200% for 3 sec.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 200V

3-phase 200V		ABB	PowerFlex 4	ABB ACS150		PowerFlex 4		PowerFlex 4	ABB
P_N	P_N	ACS150		I_{2N}	I_{2N}	*Output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	22A-	A	A	A	A		
kW	hp	03X-		U_N=206-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,18	0,25		B1P5N104			1,5	1,5	A	
0,37	0,5	02A4-2	B2P3N104	2,4	2,2	2,3	2,3		R0
0,55	0,75	03A5-2		3,5	3,2				
0,75	1	04A7-2	B4P5N104	4,7	4,2	4,5	4,5	A	
1,1	1,5	06A7-2		6,7	6,0				R1
1,5	2	07A5-2	B8P0N104	7,5	6,8	8,0	8,0	B	
2,2	3	09A8-2	B012N104	9,8	8,8	12,0	12,0		R2
3	4								
4	5		B017N104			17,5	17,5	B	

PowerFlex 4

Overload ratings

- 150 % for 60 sec.
- 200% for 3 sec.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 400V

3-phase 400V		ABB	PowerFlex 4	ABB ACS150		PowerFlex 4			ABB
P_N	P_N	ACS150		I_{2N}	I_{2N}	*Output current*		PowerFlex 4	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	22A-	A	A	A	A		
kW	hp	03X-		U_N=380-480 V		U_N=380-500 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	01A2-4	D1P4N104	1,2	1,1	1,4	1,4	B	R0
0,55	0,75	01A9-4		1,9	1,7				
0,75	1	02A4-4	D2P3N104	2,4	2,2	2,3	2,3	B	R1
1,1	1,5	03A3-4		3,3	3,0				
1,5	2	04A1-4	D4P0N104	4,1	3,7	4,0	4,0	B	
2,2	3	05A6-4	D6P0N104	5,6	5,0	6,0	6,0		
3	4	07A3-4		7,3	6,6				
4	5	08A8-4	D8P7N104	8,8	7,9	8,7	8,7	B	

PowerFlex 4

Overload ratings

- 150 % for 60 sec.
- 200% for 3 sec.

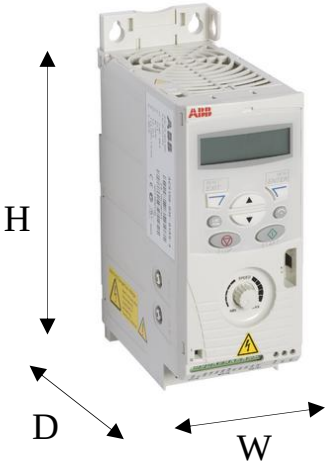
ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Dimensions 200 V 1-phase: width, height, depth

Dimensions 200 V		ABB ACS150	PowerFlex 4	ABB ACS150			PowerFlex 4			PowerFlex 4	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-	22A-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	01X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25		A1P4N113				80	152	136	A	
0,37	0,5	02A4-2	A2P1N113	70	169	142					R0
0,55	0,75										
0,75	1	04A7-2	A3P6N113	70	169	142	80	152	136	A	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	A6P8N113	105			100	213	136	B	R2
2,2	3	09A8-2	A9P6N113								



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Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 1-phase: area, volume, weight

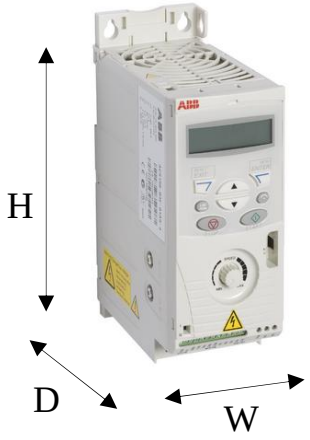
Dimensions 200 V		ABB ACS150	PowerFlex 4	ABB ACS150			PowerFlex 4			PowerFlex 4	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-	22A-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	01X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25		A1P4N113				122	1,7	1,4	A	
0,37	0,5	02A4-2	A2P1N113	118	1,7	1,1					R0
0,55	0,75										
0,75	1	04A7-2	A3P6N113	118	1,7	1,3	122	1,7	1,4	A	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	A6P8N113	177	2,5	1,5	213	2,9	2,2	B	R2
2,2	3	09A8-2	A9P6N113								

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: width, height, depth

Dimensions 200 V		ABB ACS150	PowerFlex 4	ABB ACS150			PowerFlex 4			PowerFlex 4	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-	22A-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25		B1P5N104				80	152	136	A	
0,37	0,5	02A4-2	B2P3N104								R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	B4P5N104	70	169	142	80	152	136	A	
1,1	1,5	06A7-2									R1
1,5	2	07A5-2	B8P0N104				80	152	136	B	
2,2	3	09A8-2	B012N104	105			100	180			R2
3	4										
4	5		B017N104				100	180	136	B	



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Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: area, volume, weight

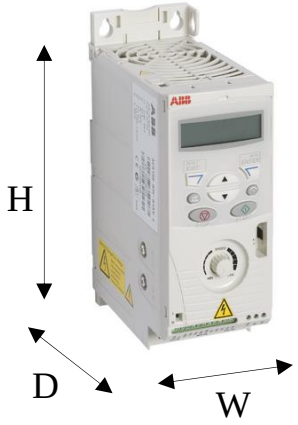
Dimensions 200 V		ABB ACS150	PowerFlex 4	ABB ACS150			PowerFlex 4			PowerFlex 4	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-	22A-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25		B1P5N104				122	1,7	1,4	A	
0,37	0,5	02A4-2	B2P3N104			1,1					R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	B4P5N104	118	1,7		122	1,7	1,4	A	
1,1	1,5	06A7-2				1,3					R1
1,5	2	07A5-2	B8P0N104				122	1,7	1,4	B	
2,2	3	09A8-2	B012N104	177	2,5	1,5	180	2,4	2,2		R2
3	4										
4	5		B017N104				180	2,4	2,2	B	

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: width, height, depth

Dimensions 400 V		ABB ACS150	PowerFlex 4	ABB ACS150			PowerFlex 4			PowerFlex 4	ABB ACS150
		Type	Type								
		ACS150-	22A-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4	D1P4N104	70	169	142	80	185	136	B	R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	D2P3N104				80	185	136	B	R1
1,1	1,5	03A3-4									
1,5	2	04A1-4	D4P0N104				80	185	136	B	
2,2	3	05A6-4	D6P0N104				100	213			
3	4	07A3-4									
4	5	08A8-4	D8P7N104				100	213	136	B	



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: area, volume, weight

Dimensions 400 V		ABB ACS150	PowerFlex 4	ABB ACS150			PowerFlex 4			PowerFlex 4	ABB ACS150
		Type	Type								
		ACS150-	22A-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4	D1P4N104	118	1,7	1,1	148	2,0	1,4	B	R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	D2P3N104			1,3	148	2,0	1,4	B	R1
1,1	1,5	03A3-4									
1,5	2	04A1-4	D4P0N104				148	2,0	1,4	B	
2,2	3	05A6-4	D6P0N104				213	2,9	2,2		
3	4	07A3-4									
4	5	08A8-4	D8P7N104				213	2,9	2,2	B	

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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DIN rail mounting for all units

Sideways mounting

Side by side mounting up to 50°C

Installation

PowerFlex 4

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes (Frame B)
Flange	Optional
Wall (sideways)	No
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	120
Below	120
Left and right	0 for IP20 up to 40°C, 25 mm for > IP20 or 40…50°C

- Operational motor cable lengths

380-480V Ratings	Motor Insulation Rating	Motor Cable Only(1)
	1000 Vp-p	15 meters (49 feet)
	1200 Vp-p	40 meters (131 feet)
	1600 Vp-p	170 meters (558 feet)

ABB ACS150

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	80
Below	80
Left and right	0

- Installation with clamps and screws, cabinet support tools available
- Operational motor cable lengths

Frame	Standard	With output chokes
R0	30 m	60 m
R1	50 m	100 m
R2	50 m	100 m

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EMC and harmonics

PowerFlex 4

- **Filters**
  - Integral filter available on 1~240 V drives
  - External -S and/or -L Type filters for other drive types
- **Chokes**
  - AC/DC chokes as external option
- **EMC compliant motor cable lengths**

Filter Type	EN61800-3 First Environment Restricted Distribution or Second Environment (2)	EN61800-3 First Environment Unrestricted Distribution (3)
Integral	10 meters (33 feet)	1 meter (3 feet)
External - S Type(1)	10 meters (33 feet)	1 meter (3 feet)
External - L Type(1)	100 meters (328 feet)	5 meters (16 feet)

(3) First Environment Unrestricted Distribution installations require a shielded enclosure

- **THD:** EN61000-3-2
  - 0.75 kW 1~& 3~ 240V and 0.4 kW 1~ 240V drives with additional external harmonic mitigation
  - Other drive ratings comply with EN61000-3-2 without additional external mitigation

ABB ACS150

- **Filters**
  - Inbuilt EMC filter for category C3 (2nd environment) as standard
  - External EMC filter for categories C1, C2 (1st environment) and C3 (2nd environment) as option
- **Chokes**
  - AC input/output chokes as an option
- **EMC compliant motor cable lengths**
  - Category C3 30m (with 4 kHz switching frequency) as standard
  - With external EMC filter and 4 kHz switching frequency
    - 1~ 200 V: C1 10m, C2 and C3 100m (for 0.37 kW unit C1 10m, C2 45m and C3 75m)
    - 3~ 200 V: C2 and C3 30 m
    - 3~ 400 V: C1, C2 and C3 100 m
- **THD**
  - EN61000-3-2 with optional chokes

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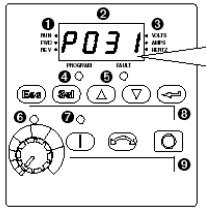
User interface

PowerFlex 4

- Standard integrated keypad
- Integrated potentiometer
- Optional remote and LCD keypad



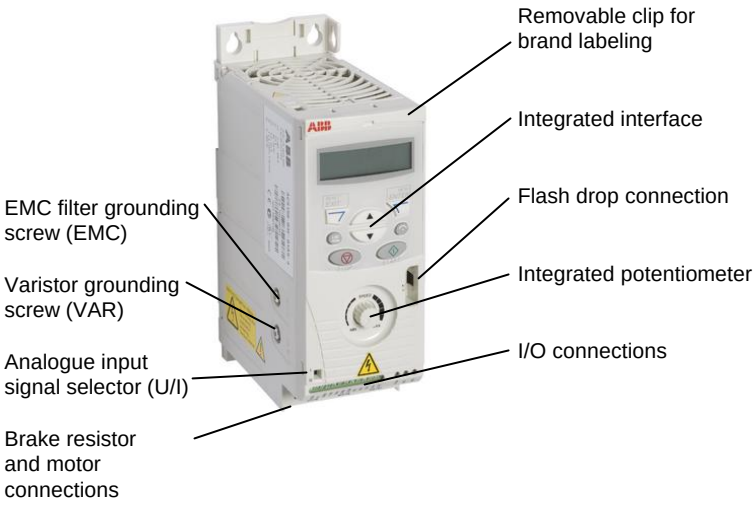
Menu	Description
d	Display Group (View Only) Consists of commonly viewed drive operating conditions.
P	Basic Program Group Consists of most commonly used programmable functions.
A	Advanced Program Group Consists of remaining programmable functions.
F	Fault Designator Consists of list of codes for specific fault conditions. Displayed only when fault is present.

No.	LED	LED State	Description
❶	Run/Direction Status	Steady Red	Indicates drive is running and commanded motor direction.
		Flashing Red	Drive has been commanded to change direction. Indicates actual motor direction while decelerating to zero.
❷	Alphanumeric Display	Steady Red	Indicates parameter number, parameter value, or fault code.
		Flashing Red	Single digit flashing indicates that digit can be edited. All digits flashing indicates a fault condition.
❸	Displayed Units	Steady Red	Indicates the units of the parameter value being displayed.
❹	Program Status	Steady Red	Indicates parameter value can be changed.
❺	Fault Status	Flashing Red	Indicates drive is faulted.
❻	Pot Status	Steady Green	Indicates potentiometer on Integral Keypad is active.
❼	Start Key Status	Steady Green	Indicates Start key on Integral Keypad is active. The Reverse key is also active unless disabled by A095 [Reverse Disable].

No.	Key	Name	Description
❽	Esc	Escape	Back one step in programming menu. Cancel a change to a parameter value and exit Program Mode.
	Sel	Select	Advance one step in programming menu. Select a digit when viewing parameter value.
	▲ ▼	Up Arrow Down Arrow	Scroll through groups and parameters. Increase/decrease the value of a flashing digit.
	↵	Enter	Advance one step in programming menu. Save a change to a parameter value.
❾		Potentiometer	Used to control speed of drive. Default is active. Controlled by parameter P038 [Speed Reference].
		Start	Used to start the drive. Default is active. Controlled by parameter P036 [Start Source].
		Reverse	Used to reverse direction of the drive. Default is active. Controlled by parameters P036 [Start Source] and A095 [Reverse Disable].
		Stop	Used to stop the drive or clear a fault. This key is always active. Controlled by parameter P037 [Stop Mode].

ABB ACS150

- Integrated interface
- Integrated potentiometer
- FlashDrop connection



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Machine interface

PowerFlex 4

Type	*Qty.*	*Programmable*
Digital inputs	7	4
Analog inputs	1	N/A
Pulse train input	N/A	N/A
Relay outputs	1	Yes
Analog outputs	1	N/A

Specialities:

- Unipolar and bipolar analog inputs
- 2 Opto outputs

Protocol	*Standard /Optional*	*Baud rate*	*Notes*
RS485 (DSI)	Integral	N/A	
DeviceNet	Option	N/A	
EtherNet/IP	Option	N/A	
Profibus	Option	N/A	

ABB ACS150

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	1 (i.e. digital input)	Yes
Relay outputs	1	Yes
Transistor outputs	1	Yes

Specialities:

- Pulse train input

100% * Phd for braking for all units

500 Hz max. output frequency

Motor control

PowerFlex 4

- Sensorless vector control
- V/Hz

Braking

- Dynamic Brake Resistor Connection [0.75 kW ratings and higher]
- Internal brake IGBT included with all ratings except No Brake drives

Output frequency

- Output frequency 0…240 Hz (programmable) with vector control.
- Output frequency 0…240 Hz with V/Hz

ABB ACS150

- Scalar control

Braking

- Brake chopper available as standard
  - 100% * Phd for braking

Output frequency

- 500 Hz as maximum output frequency

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Macros and language versions

PowerFlex 4

- N/A

ABB ACS150

- **Macros**
  - ABB Standard
  - 3-wire
  - Alternate
  - Motor Potentiometer
  - Hand/auto
- **Languages**
  - N/A

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Software features

PowerFlex 4

- A flying start (*
- Jog function (*
- 2-wire/3-wire control (*
- Input is programmable (*
- Preset frequencies (*
- DC brake, DC brakeAuto (*
- Torque boost selection (*
- Slip compensation (*
- Auto-reset /Non-resettable (*
- PWM frequency (*
- Multiple programmable stop modes (Ramp, Coast, DC-Brake, Ramp-to-Hold and S-Curve) (*
- Acc./Dec. set up as S-curve (in %)
- Programming and Network solutions

(* = Basic feature in ABB ACS150

ABB ACS150

- FlashDrop
- Pulse train input
- Changed parameter menu
- Emergency stop
- Jog function
- Fault Group (Group 4)
- Hardware protection against miss wiring in I/O and supply
- Zero speed delay
- Flux Optimization
- Switching frequency control
- 7 preset speeds
- Application macros
- Flying start
- Critical frequency lock-out
- Max. Freq. 500 Hz

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Other advanced features

PowerFlex 4

Pocket DriveExplorer for Pocket PC

- Tool to program and maintain Allen-Bradley drives
- Program can be loaded to Pocket PC devices such as Dell Axim's and HP iPAQ's
- Portable with many connection possibilities: Serial, Wi-Fi® and Bluetooth® wireless technology connectivity options
- Clear and big display with possibility to create own texts
- Requires a PC for loading program from a CD (incl. both Pocket PC and Windows CE versions) to the Pocket PC
- Parameter setting, uploading and downloading, Download new firmware to the drive and/or attached peripherals
- Utility tool for disabling editing possibility and limiting to saved connections
- Compatible with PowerFlex® 4, 4M, 40, 40P, 400 (Component Class) drives, PowerFlex® 70, 700, 700H, 700S (Architecture Class) drives, SCANport™ products and select peripherals, SMC Flex™

ABB ACS150

FlashDrop

- Option tool for fast and safe selecting and setting drive parameters without power
- Palm-size 153x53x71mm and light weight 0.4 kg
- Portable and battery chargable
- Keypad with LCD display
- Includes Drive PM (Drive parameter manager) software for PC to create, edit and copy parameter sets for FlashDrop
- Help function available
- Possibility to store 20 user specified parameter macros
- Parameter hiding, Parameter upload and download, Cold drive and Damaged drive parameterization
- Compatible also with ACS150, ACS550 and ACH550 drives

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PC connectivity and tools

PowerFlex 4

- Integral RS-485 communications can be used for programming from a PC. It can also be used in a multi-drop network configuration.
- Converter module provides connectivity to any controller with a DF1 port.Through the use of a Serial Converter Module and DriveExplorer™ or DriveExecutive™ software, programming can be greatly simplified.
- DriveExplorer SoftwareView and modify drive and adapter parameters in a method similar to the file management capability of Microsoft Windows Explorer. Operate the drive via an on-screen Control Bar, which is a tool that allows you to start, stop, and change the speed reference of the drive.
- DriveExecutive Software offers online and offline programming capability.
- DriveTools™ SP is a family of software tools designed for Microsoft® Windows NT v4.0 / 2000 / XP operating systems. These applications provide a Simplified Programming interface for programming, troubleshooting, and maintaining your Allen-Bradley AC and DC drive products.

ABB ACS150

- N/A

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Hardware options

PowerFlex 4

- LCD display mounted
- LCD display handheld
- Remote kit for control panel

ABB ACS150

- AC input/output chokes
- UL Type 1 kit
- External EMC filter for 1st / 2nd environment

Maintenance

PowerFlex 4

- N/A

ABB ACS150

- Cooling fan replacement
  - Very easy to replace
  - Every five years
- Capacitor reforming
  - Every two years when stored
- Available spare parts
  - Fan

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Standards

PowerFlex 4

Approvals

- UL, IEC (Designed to Meet), CE, C-Tick, cUL, CSA

Compliance with

- LV Directive 73/23/EEC
- EMC Directive 89/336/EEC

Applicable standards

- EMC 61800-3
- Low voltage EN60204-1/EN50178
- UL 508C
- CSA 22.2

ABB ACS150

Approvals

- CE, UL, cUL, C-tick, GOST-R

Compliance with

- Low Voltage Directive 73/23/EEC with supplements
- Machinery Directive 98/37/EC
- EMC Directive 89/336/EEC with supplements
- Quality assurance system ISO 9001
- Environmental system ISO 14001
- RoHS directive 2002/95/EC with amandments

Applicable standards

- IEC/EN 61800-5-1 - Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
- IEC/EN 60204-1 (1997) - Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
- IEC/EN 60529: 1991 - Degrees of protection provided by enclosures (IP code)
- IEC/EN 61800-3 (2004)- EMC product standard including specific test methods
- UL 508C UL - Standard for Safety, Power Conversion Equipment

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Performance analysis – Autodyne description

Test stand is used to characterize 2,2kW (3hp) heavy duty rated LVAC drives and allow ABB to compare accurate repeatable data against ABB's baseline products (ACS150, ACS350, ACS550 and ACS800). The mechanical portion of the dynamometer consists of a 2,2kW (3hp) 1755 rpm 230VAC/460VAC vector duty motor with encoder (spinner motor) which is connected to the output of the drive under test (DUT). The spinner motor is connected through a in-line torque transducer to a 10 hp 1750 RPM DC motor with encoder. Actual torque and speed information is fed to the dynamometer controller which is run by an IBM desktop computer and flat screen monitor using a Windows™ based proprietary software program controlling electrical power supplied to the DUT and from the DUT to the spinner motor.

Essentially, tests are conducted "out of the box". However, an ID run and a speed regulator autotune are performed, if the drive is so equipped. All drives are tested in sensorless vector mode of operation.

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Tested units in performance analysis

Allen-Bradley POWERFLEX 4

Model: 22A-A9P6N113

Drive rating: 200-240V
2.2 kW / 3Hp
9.6 A

Tester (experienced drive specialist) comments:

- Wiring power terminals is much easier because of grey plastic and easy to see saddle clamps. Depth of wire insertion is obvious and stripping guide is impressed into plastic cover.
- Factory jumper for coast stop input, like Danfoss
- No tie point for control cables
- Drive is V/Hz. only. No Sensorless vector setting.
- Motor would not rotate. Factory default DC Boost is too high at 5% of base voltage (23V). I reduced it to zero to rotate the motor. Par A084. It's the only note in the "common problems" table for "no Rotation" besides "Miswiring". Must happen a lot.
- "Improper boost setting at initial start-up."
- Drive trips on F005 Overvoltage on Overvoltage test and Harmonics test. No results are available. Speed Accuracy Test is missing some data for the same reason.
- Very sensitive to bus overvoltage due to speed and current.
- Relatively poor speed/torque characteristics without boost.

ABB ACS150

Model: ACS150-03X-07A3-4

Drive rating: 380-480V
3,0 kW / 4 Hp
7,3 A

Parameter Settings:

9902 ABB Standard

9905 230V

9906 4.2A

9907 60Hz

9908 1750 RPM

9909 3.0 HP

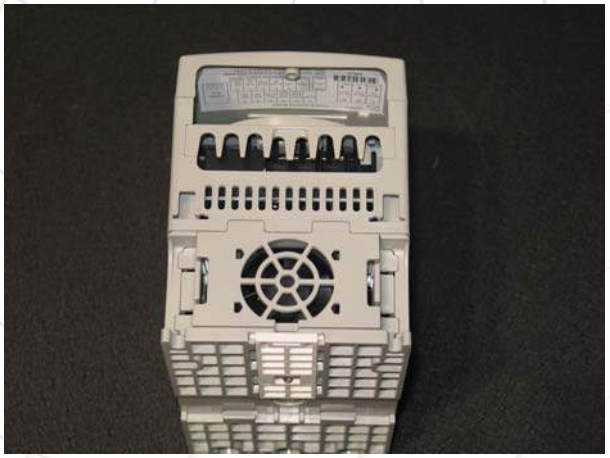
2101 Torque Boost

2201 Not Selected

2202 1.0 Second

2203 1.0 Second

Photos of the tested unit



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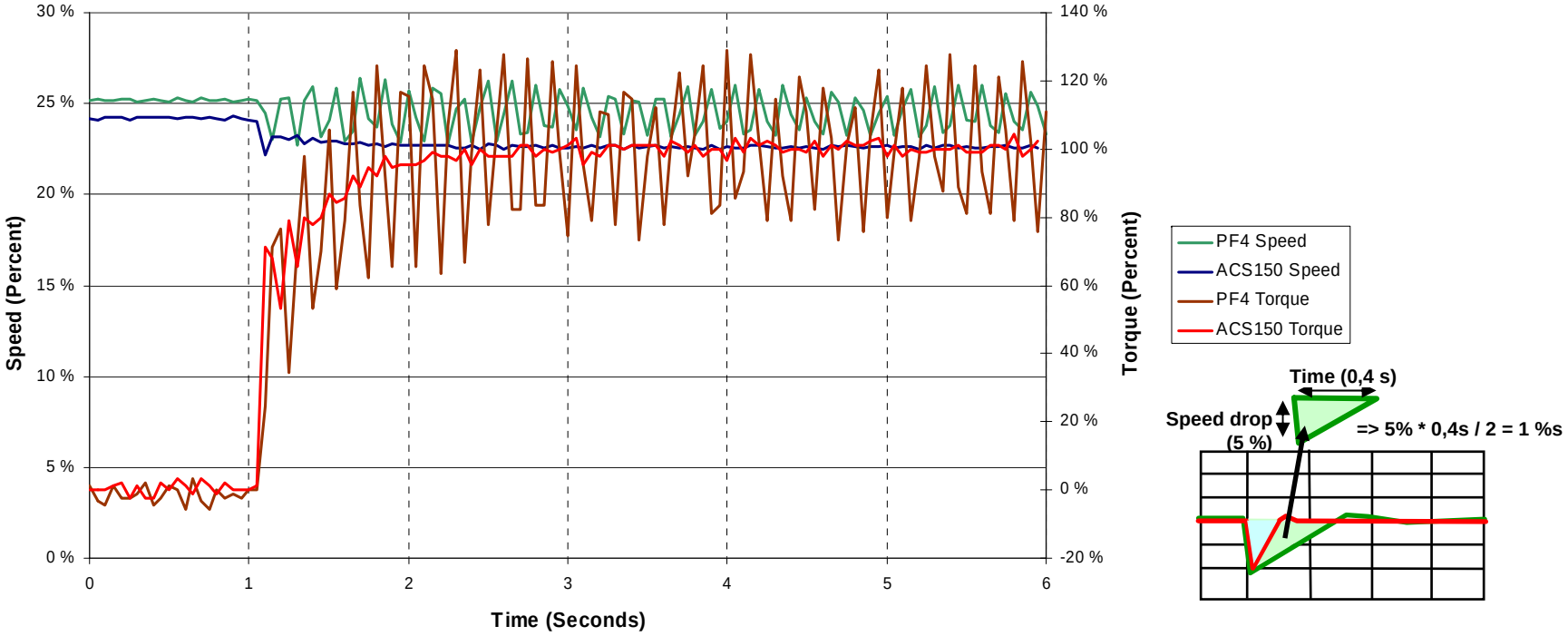
Impact load test – Dynamic speed accuracy (stiffness)

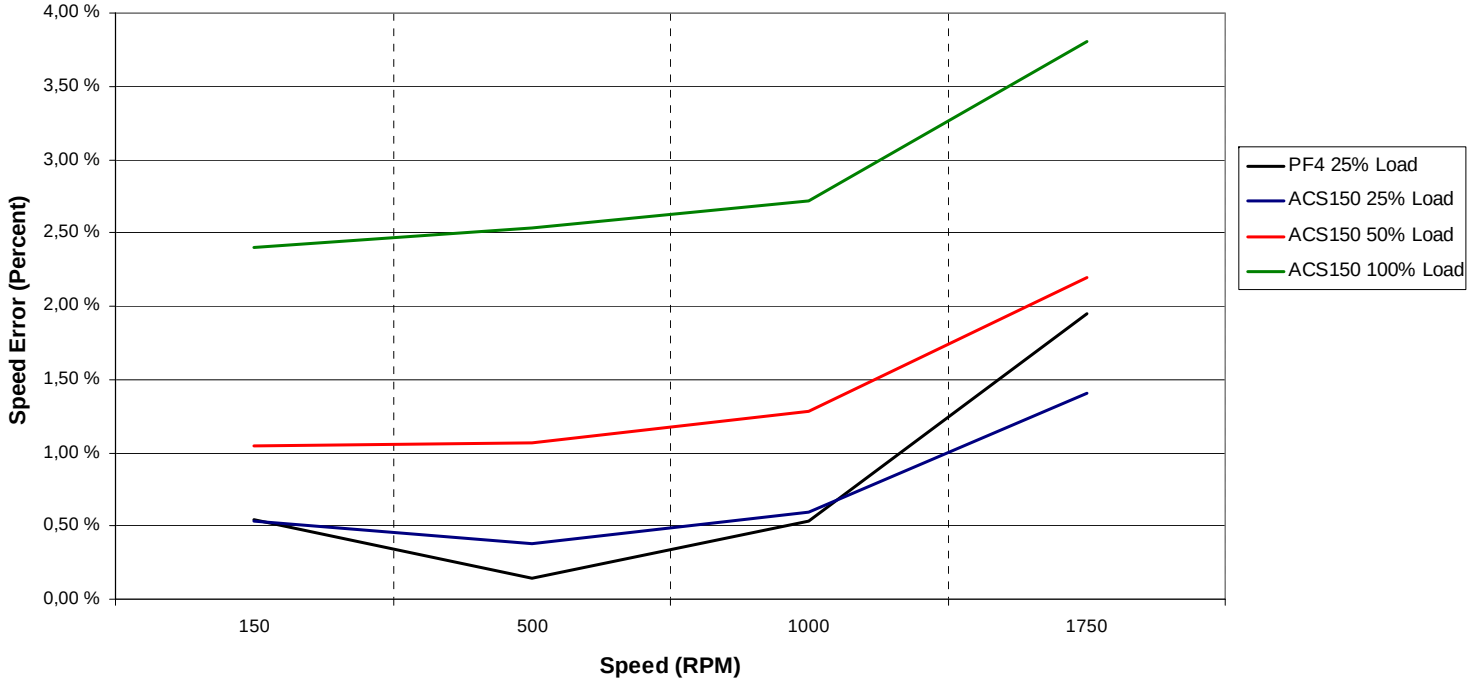
Motor is operated at 25% rated speed and 100% load is applied. Speed and torque are measured over time. Dynamic speed error (stiffness) is speed drop (% of nominal speed) times time of recovery (s) divided by 2. The 25% speed reference data is plotted as this is worst case test for the speed regulator evaluation.



Dynamic speed error depends on speed controller tuning. The smaller the stiffness %s figure the better the drive works in case of disturbances. In ACS150 the speed control default tuning is quite conservative to ensure that controller is stable despite the motor used and its size compared to size of the inverter. Both products handled the 100% impact load at ¼ speed. The PF4 has good dynamic speed accuracy despite the amount of speed and torque ripple.

Static speed accuracy

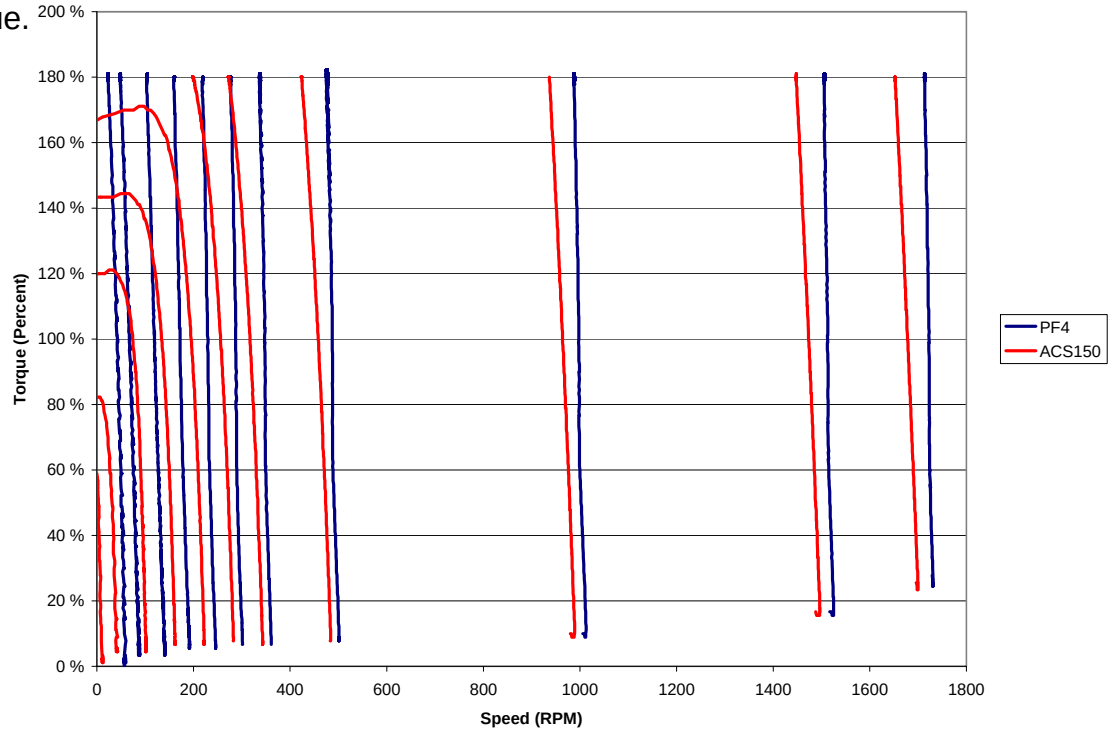
Drive is given speed references of 150, 500, 1000 and 1750 rpm's and loads of 25%, 50% and 100%. The speed error in static situation (constant load and speed) is calculated as a ratio of the average speed error compared to motor nominal speed (1755 rpm), Speed Error [%] = $(n^*-n_{act}) / n_{N(mot)}$. Speed (control) accuracy is essential feature for high quality motor control.



Static speed error depends on the accuracy and quality of measurements (voltage, current, speed estimation). The smaller the error figure and difference between figures at partial and full load points, the better the drive works in applications where good static accuracy is needed (e.g. extruders). Both products showed a comparable range of speed accuracies at each load point.

Maximum torque as a function of speed

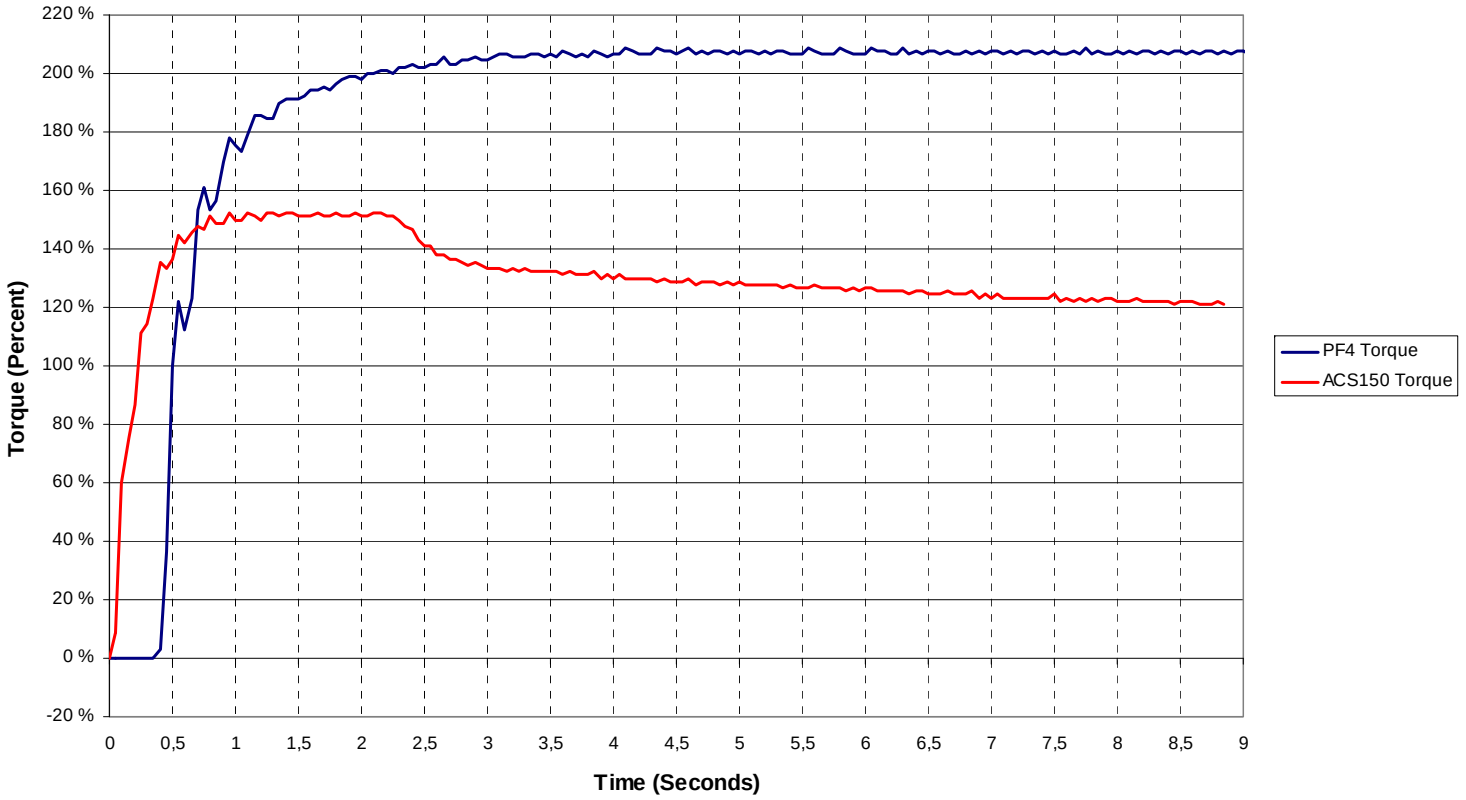
Drive is given speed reference of 30, 60, 120, 180, 240, 300, 360, 500, 1000, 1500 and 1700 rpm's. Load is gradually increased to 180% for 2 seconds, or until the motor stalls. The test describes the drive's speed range. The speed range is defined as the minimum speed the motor can operate from a given base speed and still generate 100% torque.



Both products produced approximately 180% torque at each set point over 300 rmp. ACS150 is stable but torque is limited below 300 rmp . FP4 can produce 180% even in the low speed.

Maximum starting torque

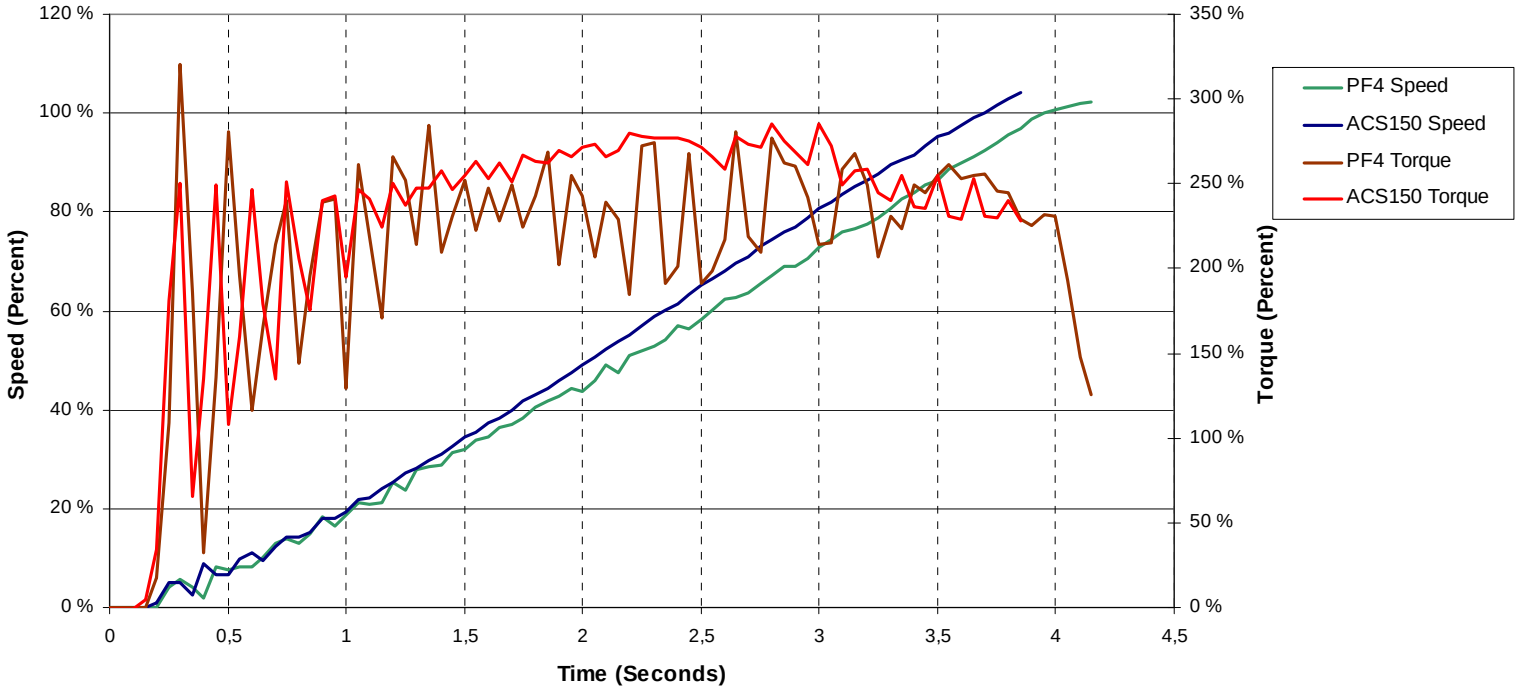
Motor output shaft is locked. Drive is given run command and 1000 rpm speed reference. Torque is measured with respect to time.



The ACS150 ramped to a maximum torque of 150% in approximately 1 second. ACS150 reduces torque to nominal after 2 s due to current limiting. PF4 produces torque of 200% in 2 seconds.

Fast acceleration into inertia

Drive is given run command and zero speed reference. Dynamometer inertia simulation program places 22.5 lb-ft^2 (0.95 kgm^2) inertia on motor shaft and then drive is given 100% speed reference. Speed and torque are measured over time as drive accelerates motor into inertia. Drive acceleration rate is set to 1 second.



The both drives accelerated the inertia in approximately 4 seconds while producing 250% torque. Acceleration was smooth.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Efficiency

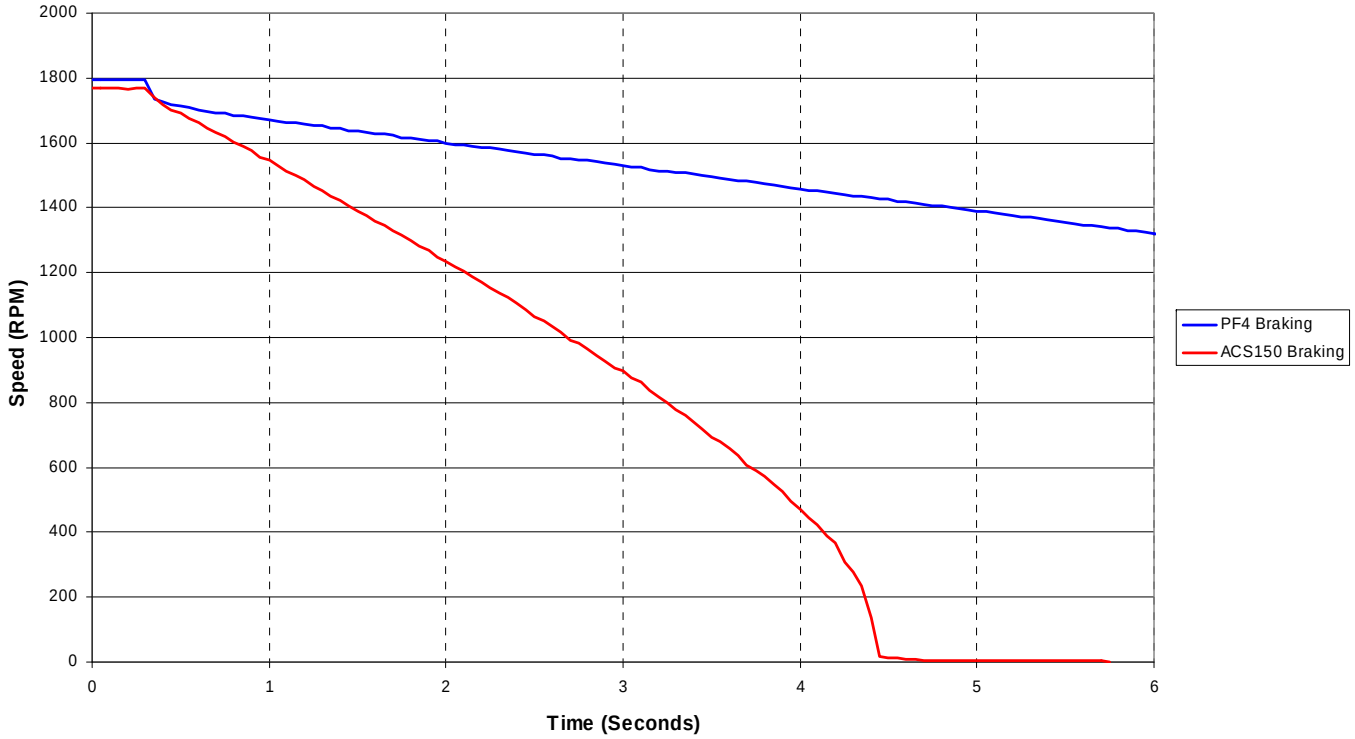
Using power analyzer, input power, speed and torque of AC motor are measured at 25%, 50%, 75% and 100% rated motor load. Since the comparison is made by using the same motor at the same operation point the figures reflect the efficiency of the inverter and the additional losses caused in the motor due to the inverter operation. The difference in total efficiency may be remarkable in total energy consumption.

Load (Percent)	Efficiency	
	ACS150	PF4
25%	82.3%	82.1%
50%	89.0%	88.4%
75%	89.3%	88.4%
100%	88.5%	89.6%

The test is performed at rated speed with different loads. The efficiencies of both drives were comparable at all load points.

Overvoltage control

With DUT operating at nominal line voltage and 100% rated speed, the run command will be removed from DUT. Time from the run command being removed until AC motor speed reaches 0 will be measured and recorded. DUT deceleration time will be set to 1 sec. The test measures the ability of drives to decelerate the load with and without flux braking (raising the magnetization level in the motor to convert kinetic energy to motor thermal energy). The shorter the time, the better the overvoltage controller (and flux braking algorithms) of a drive works.



ACS150 decelerated the load in 4.5 seconds and PF4 took much longer time.

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ABB strengths

ACS150 advantages over PowerFlex 4

Weight of all units	500 Hz max. output frequency
Areas of 400 V units	Application macros
Volumes of 400 V units	High functionality software features
DIN rail mounting for all units	Cold configuration with FlashDrop
Sideways mounting	Easy maintenance
Side by side mounting up to 50°C	RoHS compliance
Pulse train input	
100% * Phd for braking for all units	

For ACS150 advantages in performance, see the performance test slides

ACS150 Competitor comparison

Siemens SINAMICS G110

Mitsubishi FR-S 500

Allen Bradley PowerFlex 4

WEG CFW10

Hitachi X200

Lenze 8400 BaseLine

Main

Yaskawa VS Mini J7

Schneider Altivar 11

Lenze smd

Allen Bradley PowerFlex 4M

Yaskawa J1000

Summary Slide

Description

Lenze smd

- By cutting out non-essential features, the Lenze smd range of frequency inverters brings new economy to 25% of the inverter market. In many application areas such as conveying, leisure, horticultural and agricultural machinery, sophisticated features such as fieldbus communications and vector control are not needed. The smd inverters omit these features and concentrate on down-to-earth value. Despite low prices, smd inverters still offer all the features needed in simple applications.
- Compact design
- Innovative EPM memory chip
- Quick installation
- Quick commissioning
- Scalar control
- For power range 0.18 kW to 11 kW

ABB ACS150

- ACS150 is a component drive for the serial OEM business in basic machinery applications
- Integrated user interface
- Unpowered drive configuration in 2 s
- Straightforward installation and integration
- Fast availability and service
- Scalar control
- For power range 0.37 kW to 4.0 kW
- Applications
  - Fans, pumps, gate control, material handling, conveyors

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Protection class

Lenze smd

- IP 20

ABB ACS150

- IP20 UL open (standard)
- NEMA 1 (option)

Ambient specification

Operating temp. from -10°C

Relative humidity up to 95%

Switching frequency up to 16 kHz

Lenze smd

Vibration

- Acceleration stability up to 0.7g (Germanischer Lloyd, general conditions)

Shock

- N/A

Temperature

- Operation: 0°C to +55°C, derate after 40°C with 2,5% / °C
- Storage -20°C to +70°C
- Transportation -25°C to +70°C

Humidity

- Lower than 85% (non-condensing)

Altitude limitations

- 0–4000 m. The rated output current should be derated by 5%/1000 m above sea level.

Acoustic noise

- Compliant with EN 61800-3 including A11 noise immunity.
- 4…10 kHz

ABB ACS150

Vibration

- Compliance with IEC 60721-3-3 (operation) and ISTA 1A (storage and transportation)

Shock

- Mechanical shocks are not allowed for the drive during operation
- Bump according to IEC 60068-2-29, 25g/1000pcs

Temperature

- Operating temperature -10 to +50 °C, minimum derate after 40 °C (1% per degree)
- Storage temperature –40 °C to +70°C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 0 to 1000m derate 1% per 100m

Acoustic noise

- 4…16 kHz

Mains connections

Lenze smd

Voltage types and power range

- 1-phase 180 - 264 V ± 0%
  - 0.25 to 2.2 kW
- 3-phase 180 - 264 V ± 0%
  - 0.37 to 15 kW
- 3-phase 400 - 480 V ± 0%
  - 0.37 to 22 kW

Power factor

- N/A

Supply frequency

- 50/60 Hz

Supply networks

- Operation in public supply networks (Limitation of harmonic currents according to EN 61000 3 2)

DC bus connection

- Not available

ABB ACS150

Voltage and power range

- 1-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 380 - 480V +/-10%
  - 0.37 to 4 kW (0.5 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60Hz, tolerance ±5%

Supply networks

- Suitable for IT network. Drive operation in floating (IT) networks possible by disconnecting EMC filter.

DC bus connection

- Not available

Ratings 1-phase 200V

1-phase 200V		ABB ACS150	Lenze smd	ACS150		Lenze smd		Lenze smd	ABB ACS150
P_N	P_N			I_{2N}	I_{2N}	*Rated output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	ESMD	A	A	A	A		
kW	hp	01X-		U_N=200-240 V		U_N=180-264 V		Frame	Frame
0,12	0,16								
0,25	1/3		251X2SFA			1,7	1,3	A5	
0,37	0,5	2A4-2	371X2SFA	2,4	2,2	2,4	1,8		R0
0,55	0,75		551X2SFA			3	2,3	A6	
0,75	1	04A7-2	751X2SFA	4,7	4,2	4,0	3,0		R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	152X2SFA	7,5	6,8	7,0	5,3	B5	R2
2,2	3	09A8-2	222X2SFA	9,8	8,8	9,5	7,1	B6	

Lenze smd

Overload ratings

- 150 % for 60 sec.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 200V

3-phase 200V		ABB ACS150	Lenze smd	ACS150		Lenze smd		Lenze smd	ABB ACS150
P_N	P_N			I_{2N}	I_{2N}	*Rated output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	ESMD	A	A	A	A		
kW	hp	03X-		U_N=200-240 V		U_N=180-264 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	02A4-2	371X2TXA	2,4	2,2	2,4	1,8	A5	R0
0,55	0,75	03A5-2		3,5	3,2				
0,75	1	04A7-2	751X2TXA	4,7	4,2	4,2	3,2	A6	R1
1,1	1,5	06A7-2	112X2TXA	6,7	6,0	6,0	4,5	A7	
1,5	2	07A5-2	152X2TXA	7,5	6,8	7,0	5,3		
2,2	3	09A8-2	222X2TXA	9,8	8,8	9,6	7,2	B6	R2
3	4		302X2TXA			12,0	9,0	B2	
4	5		402X2TXA			15,2	11,4		
5,5	7,5		552L2TXA			22	16,5	C1	
7,5	10		752L2TXA			28	21,0		
11	15		113L2TXA			42	31,5	D1	
15	20		153L2TXA			54	40,5		

Lenze smd

Overload ratings

- 150 % for 60 sec.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 400V

3-phase 400V		ABB ACS150	Lenze smd	ACS150		Lenze smd		Lenze smd	ABB ACS150
P_N	P_N			I_{2N}	I_{2N}	*Rated output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	ESMD	A	A	A	A		
kW	hp	03X-		U_N=380-480 V		U_N=320-550 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	01A2-4	371L4TXA	1,2	1,1	1,3	1,0	A1	R0
0,55	0,75	01A9-4		1,9	1,7				
0,75	1	02A4-4	751L4TXA	2,4	2,2	2,5	1,9	A2	R1
1,1	1,5	03A3-4	112L4TXA	3,3	3,0	3,6	2,7	A3	
1,5	2	04A1-4	152L4TXA	4,1	3,7	4,1	3,1	B1	
2,2	3	05A6-4	222L4TXA	5,6	5,0	5,8	4,4		
3	4	07A3-4	302L4TXA	7,3	6,6	7,6	5,7	B2	
4	5	08A8-4	402L4TXA	8,8	7,9	9,4	7,1		
5,5	7,5		552L4TXA			12,6	9,5		
7,5	10		752L4TXA			16,1	12,1	C1	
11	15		113L4TXA			24	18,0	D1	
15	20		153L4TXA			31	23,3		
18,5	25		183L4TXA			39	29,3		
22	30		223L4TXA			46	34,5		

Lenze smd

Overload ratings

- 150 % for 60 sec.

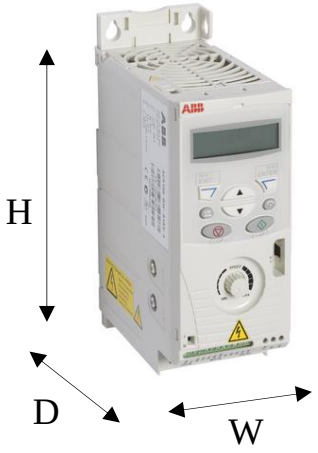
ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Dimensions 200 V 1-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Lenze smd	ABB ACS150			Lenze smd			Lenze smd	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-	ESMD	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	01X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,25	1/3		251X2SFA								
0,37	0,5	2A4-2	371X2SFA	70	169	142	74	146	83	A5	R0
0,55	0,75		551X2SFA								
0,75	1	04A7-2	751X2SFA	70	169	142			92	A6	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	152X2SFA	105			95	146	124	B5	R2
2,2	3	09A8-2	222X2SFA						140	B6	



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Dimensions 200 V 1-phase: area, volume, weight

Dimensions 200 V		ABB ACS150	Lenze smd	ABB ACS150			Lenze smd			Lenze smd	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-	ESMD	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	01X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,25	1/3		251X2SFA								
0,37	0,5	2A4-2	371X2SFA	118	1,7	1,1	108	0,9	0.5	A5	R0
0,55	0,75		551X2SFA					1,0	0.6	A6	
0,75	1	04A7-2	751X2SFA	118	1,7	1,3					R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	152X2SFA	177	2,5	1,5	139	1,7	1.4	B5	R2
2,2	3	09A8-2	222X2SFA					1,9	1.4	B6	

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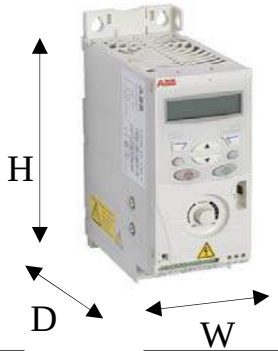
Dimensions 200 V 3-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Lenze smd	ABB ACS150			Lenze smd			Lenze smd	ACS150
		Type	Type	3-phase			3-phase				
		ACS150-	ESMD	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2	371X2TXA	70	169	142	74	146	83	A5	R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	751X2TXA				74	146	92	A6	R1
1,1	1,5	06A7-2	112X2TXA						141	A7	
1,5	2	07A5-2	152X2TXA								
2,2	3	09A8-2	222X2TXA	105			95		140	B6	R2
3	4		302X2TXA						171	B2	
4	5		402X2TXA								
5,5	7,5		552L2TXA				128	197	182	C1	
7,5	10		752L2TXA								
11	15		113L2TXA				170	248	203	D1	
15	20		153L2TXA								



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Dimensions 200 V 3-phase: area, volume, weight

Dimensions 200 V		ABB ACS150	Lenze smd	ABB ACS150			Lenze smd			Lenze smd	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-	ESMD	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2	371X2TXA			1,1	108	0,9	0,5	A5	R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	751X2TXA	118	1,7			1,0	0,6	A6	
1,1	1,5	06A7-2	112X2TXA			1,3	108	1,5	1,2	A7	R1
1,5	2	07A5-2	152X2TXA								
2,2	3	09A8-2	222X2TXA	177	2,5	1,5		1,9	1,4	B6	R2
3	4		302X2TXA				139	2,4	1,9	B2	
4	5		402X2TXA						1,7		
5,5	7,5		552L2TXA				252	4,6	3,2	C1	
7,5	10		752L2TXA								
11	15		113L2TXA				422	8,6	6,4	D1	
15	20		153L2TXA								

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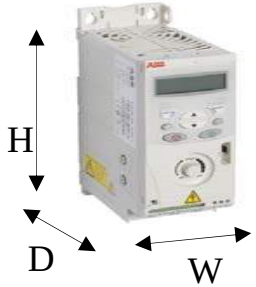
Dimensions 400 V 3-phase: width, height, depth

Dimensions 400 V		ABB ACS150	Lenze smd	ABB ACS150			Lenze smd			Lenze smd	ACS150
		Type	Type								
		ACS150-	ESMD	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4	371L4TXA	70	169	142	74	146	100	A1	R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	751L4TXA				74	146	120	A2	R1
1,1	1,5	03A3-4	112L4TXA						146	A3	
1,5	2	04A1-4	152L4TXA				95		133	B1	
2,2	3	05A6-4	222L4TXA								
3	4	07A3-4	302L4TXA						171	B2	
4	5	08A8-4	402L4TXA								
5,5	7,5		552L4TXA								
7,5	10		752L4TXA				128	197	182	C1	
11	15		113L4TXA				170	248	203	D1	
15	20		153L4TXA								
18,5	25		183L4TXA								
22	30		223L4TXA								



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Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: area, volume, weight

Dimensions 400 V		ABB ACS150	Lenze smd	ABB ACS150			Lenze smd			Lenze smd	ABB ACS150
		Type	Type								
		ACS150-	ESMD	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4	371L4TXA	118	1,7	1,1	108	1,1	0,6	A1	R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	751L4TXA			1,3	108	1,3	0,8	A2	R1
1,1	1,5	03A3-4	112L4TXA					1,6	1,0	A3	
1,5	2	04A1-4	152L4TXA				139	1,8	1,4	B1	
2,2	3	05A6-4	222L4TXA								
3	4	07A3-4	302L4TXA					2,4	1,7	B2	
4	5	08A8-4	402L4TXA						1,8		
5,5	7,5		552L4TXA								
7,5	10		752L4TXA				252	4,6	3,2	C1	
11	15		113L4TXA				422	8,6	3,2	D1	
15	20		153L4TXA						6,4		
18,5	25		183L4TXA								
22	30		223L4TXA								

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DIN rail mounting as standard

Sideways mounting

Side by side mounting

Installation

Lenze smd

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Option
Flange	No
Wall (sideways)	No
Heatsinkless	No
Side-by-side	No

Free space requirements

Location	*mm*
Above	100
Below	100
Left and right	3

- Attached with screws
- Motor cable lengths
  - 50 m (shielded cable)
  - 100 m (unshielded cable)

ABB ACS150

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	80
Below	80
Left and right	0

- Installation with clamps and screws, cabinet support tools available
- Operational motor cable lengths

Frame	Standard	With output chokes
R0	30 m	60 m
R1	50 m	100 m
R2	50 m	100 m

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EMC and harmonics

Lenze smd

- **Filters**
  - Compliant with EN 61800-3/A11
- **Chokes**
  - N/A
- **Motor cable lengths**
  - Compliance with limit value class A according to EN 55011 if installed in a control cabinet with the appropriate smd footprint filter and the motor cable length does not exceed 10 m
- **THD**
  - Compliance with EN61000-3-2 requirements
    - < 0.5 kW with mains choke
    - 0.5…1 kW with active filter
    - > 1 kW without additional measures

ABB ACS150

- **Filters**
  - Inbuilt EMC filter for category C3 (2nd environment) as standard
  - External EMC filter for categories C1, C2 (1st environment) and C3 (2nd environment) as option
- **Chokes**
  - AC input/output chokes as an option
- **EMC compliant motor cable lengths**
  - Category C3 30m (with 4 kHz switching frequency) as standard
  - With external EMC filter and 4 kHz switching frequency
    - 1~ 200 V: C1 10m, C2 and C3 100m (for 0.37 kW unit C1 10m, C2 45m and C3 75m)
    - 3~ 200 V: C2 and C3 30 m
    - 3~ 400 V: C1, C2 and C3 100 m
- **THD**
  - EN61000-3-2 with optional chokes

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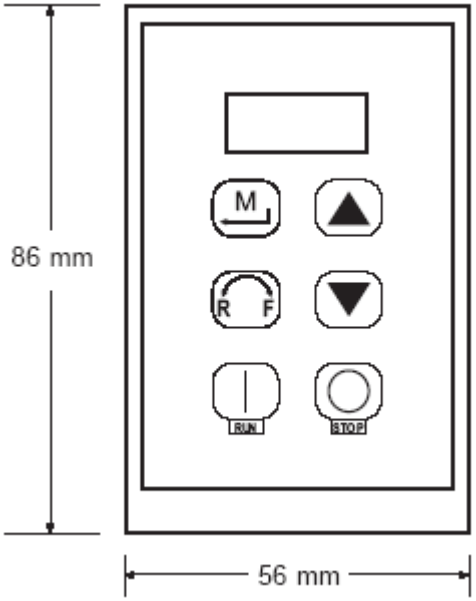
User interface

Lenze smd

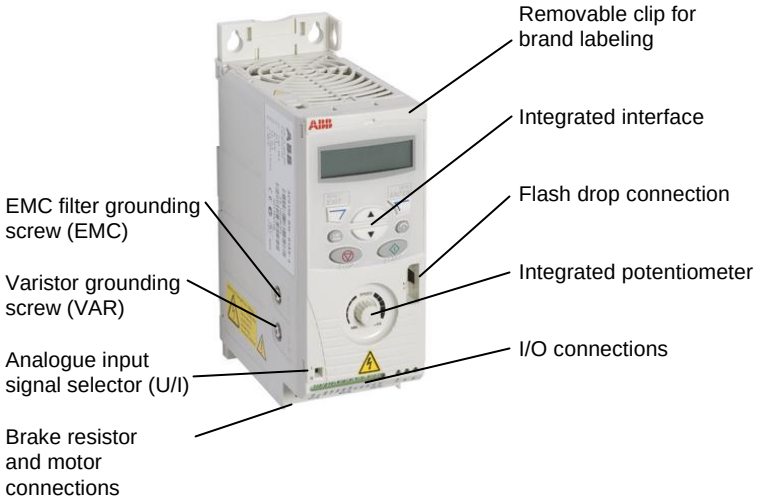
- Integrated keypad



- Remote IP65 keypads

ABB ACS150

- Integrated interface
- Integrated potentiometer
- FlashDrop connection



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Machine interface

Lenze smd

Type	*Qty.*	*Programmable*
Digital inputs	3 (+1 fixed start/stop input)	Yes
Analog inputs	1	Yes
Pulse train input	N/A	N/A
Relay outputs	1	Yes
Digital output	1	Yes
Analog outputs	1	Yes

Specialities:

- N/A

Protocol	*Standard /Optional*	*Baud rate*	*Notes*
RS232 & RS485	Standard	N/A	N/A

ABB ACS150

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	1 (i.e. digital input)	Yes
Relay outputs	1	Yes
Transistor outputs	1	Yes

Specialities:

- Pulse train input

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100% * Phd for braking

500 Hz max. output frequency

Motor control

Lenze smd

- Scalar control

Braking

- N/A

Output frequency

- 0–240 Hz with scalar control

ABB ACS150

- Scalar control

Braking

- Brake chopper available as standard
  - 100% * Phd for braking

Output frequency

- 500 Hz as maximum output frequency

Macros and language versions

Lenze smd

- N/A

ABB ACS150

- Macros
  - ABB Standard
  - 3-wire
  - Alternate
  - Motor Potentiometer
  - Hand/auto
- Languages
  - N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Software features

Lenze smd

- Electronic motor potentiometer (*
- Setpoint selection using UP/DOWN keys (*
- DC brake (*
- $I^2 * t$ motor protection (*
- Three fixed jog speeds (*
- Fault reset through input signal or automatically with adjustable delay (*
- Diagnostics and display functions (elapsed time/power on time meter, fault history buffer, fault messages) (*
- Variable current limits (*
- V/f characteristic, liner and square-law (*
- Switching frequency control (*
- Input freely programmable (*
- Output relay freely programmable (*
- Max. frequency 240 Hz (* (ACS150 500 Hz)
- Copying of settings with integrated memory chip (* (ACS150 FlashDrop)

(* = Basic feature in ABB ACS150

ABB ACS150

- FlashDrop
- Pulse train input
- Changed parameter menu
- Emergency stop
- Jog function
- Fault Group (Group 4)
- Hardware protection against miss wiring in I/O and supply
- Zero speed delay
- Flux Optimization
- Switching frequency control
- 7 preset speeds
- Application macros
- Flying start
- Critical frequency lock-out
- Max. Freq. 500 Hz

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Other advanced features

Lenze smd

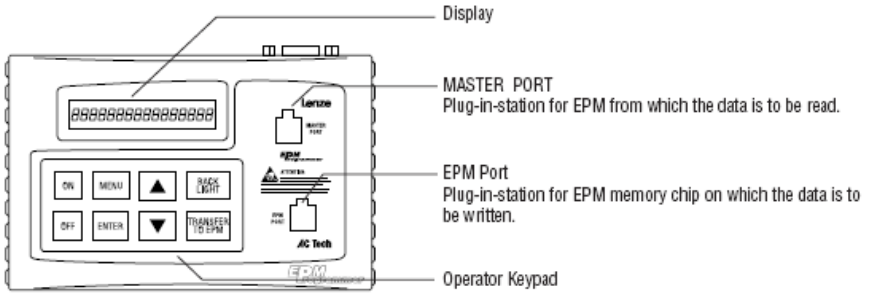
EPM, Electronic Programmable Memory

- For programming, storing, archive the drive's parameter configuration, and simplifying initial setup
- Uses a small size EPM memory chip (as standard in the drive) that plugs directly into the drives fascia; can be inserted to a unpowered drive
- The EPM chip needs to stay in the drive
- Three ways to program the EPM
  - With the SMVector integrated keypad
  - Programming in a Microsoft WindowsTM environment with Techlink
  - Programming with a portable EPM programmer - option having a 16-character text LCD display
    - EPM inserted into the programmer ⇨ parameters copied to EPM ⇨ EPM plugged into the drive
    - Battery chargable, can also be used woth 6 VDC/300 mA external power supply
    - Size 105x155x76 mm, weight 1.3 kg
    - Memory for storing up to 120 user specified parameter files
    - Possibility to set a password
    - Languages: EN, DE, FR, IT and ES
- Compatible with several Lenze and AC Tech inverter drive controllers (TMD/TML, SMD) and new SimpleServo products; operation and functionality may differ

ABB ACS150

FlashDrop

- Option tool for fast and safe selecting and setting drive parameters without power
- Palm-size 153x53x71mm and light weight 0.4 kg
- Portable and battery chargable
- Keypad with LCD display
- Includes Drive PM (Drive parameter manager) software for PC to create, edit and copy parameter sets for FlashDrop
- Help function available
- Possibility to store 20 user specified parameter macros
- Parameter hiding, Parameter upload and download, Cold drive and Damaged drive parameterization
- Compatible also with ACS150, ACS550 and ACH550 drives



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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PC connectivity and tools

Lenze smd

- Global Drive Control -software

ABB ACS150

- N/A

Hardware options

Lenze smd

- Dynamic braking units
- DIN rail maounting option
- Remote IP65 keypads
- EMC filters
- EPM programmer
- EPM memory chip

ABB ACS150

- AC input/output chokes
- UL Type 1 kit
- External EMC filter for 1st / 2nd environment

Maintenance

Lenze smd

- N/A

ABB ACS150

- Cooling fan replacement
  - Very easy to replace
  - Every five years
- Capacitor reforming
  - Every two years when stored
- Available spare parts
  - Fan

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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Standards

Lenze smd

Approvals

- CE

Compliance with

- Low Voltage Directive (73/23/EEC)
- EMC Directive (89/336/CEE)

Applicable standards

- Noise emission:
  - Limit value class A to EN 55011 (if installed with appropriate smd footprint filter and the motor cable length does not exceed 10 m)
- EN 50081-2: 1993
- Noise immunity: EN 61000-6-2: 1999
- UL 508C: Underwriters Laboratories - Power Conversion Equipment

ABB ACS150

Approvals

- CE, UL, cUL, C-tick, GOST-R

Compliance with

- Low Voltage Directive 73/23/EEC with supplements
- Machinery Directive 98/37/EC
- EMC Directive 89/336/EEC with supplements
- Quality assurance system ISO 9001
- Environmental system ISO 14001
- RoHS directive 2002/95/EC with amandments

Applicable standards

- IEC/EN 61800-5-1 - Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
- IEC/EN 60204-1 (1997) - Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
- IEC/EN 60529: 1991 - Degrees of protection provided by enclosures (IP code)
- IEC/EN 61800-3 (2004)- EMC product standard including specific test methods
- UL 508C UL - Standard for Safety, Power Conversion Equipment

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ABB strengths

ACS150 advantages over Lenze smd

NEMA 1 kit option	100% * Phd for braking
Operating temp. from -10°C	500 Hz max. output frequency
Relative humidity up to 95%	Application macros
Switching frequency up to 16 kHz	High functionality software features
DIN rail mounting as standard	Cold configuration with FlashDrop
Sideways mounting	Easy maintenance
Side by side mounting	RoHS compliance
Integrated potentiometer	
Pulse train input	

For ACS150 advantages in performance, see the performance test slides

ACS150 Competitor comparison

Siemens SINAMICS G110

Mitsubishi FR-S 500

Allen Bradley PowerFlex 4

WEG CFW10

Hitachi X200

Lenze 8400 BaseLine

Main

Yaskawa VS Mini J7

Schneider Altivar 11

Lenze smd

Allen Bradley PowerFlex 4M

Yaskawa J1000

Summary Slide

Description

WEG CFW10

- WEG Digital CFW-10 VFD Series is anoffspring of the very successful CFW-08Plus. In addition to a very small, easilymounted package, simplified keypad and bright LED readout, complete diagnostics and fully program mable I/O, the CFW-10 controls three phase AC motors with a single phase 120V AC input voltage will produce three phase 230V to drive motors up to 1HD and single phase 230V AC will produce three phase 230V to drive motors up to 3HP. Increased flexibility and decreased costs are achieved by eliminating the need for a set-up transformer to operate three phase 230V AC motors when only single phase 115V is available. The CFW-10 is an economical solution to many industrial and commercial applications.
- Applications
  - Centrifugal pumps, process pumps, fans / exhausts, stirrers / mixers, extruding machines, rollouttables, driers, rotating filters, cutting machines, conveyors

ABB ACS150

- ACS150 is a component drive for the serial OEM business in basic machinery applications
- Integrated user interface
- Unpowered drive configuration in 2 s
- Straightforward installation and integration
- Fast availability and service
- Scalar control
- For power range 0.37 kW to 4.0 kW
- Applications
  - Fans, pumps, gate control, material handling, conveyors

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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Protection class

WEG CFW10

- IP 20

ABB ACS150

- IP20 UL open (standard)
- NEMA 1 (option)

Operating temp. from -10°C

Ambient specification

WEG CFW10

Vibration

- Avoid exposure to excessive vibration

Shock

- N/A

Temperature

- 0...122ºF (0 ... 50 °C)

Humidity

- 5 ... 90% non condensing

Altitude limitations

- 0...3300ft (1000 m) up to (4000 m) with 10%/1000m output current de-rating

Acoustic noise

- 2.5 - 15 kHz adjustable switching frequency

ABB ACS150

Vibration

- Compliance with IEC 60721-3-3 (operation) and ISTA 1A (storage and transportation)

Shock

- Mechanical shocks are not allowed for the drive during operation
- Bump according to IEC 60068-2-29, 25g/1000pcs

Temperature

- Operating temperature -10 to +50 °C, minimum derate after 40 °C (1% per degree)
- Storage temperature –40 °C to +70°C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 0 to 1000m derate 1% per 100m

Acoustic noise

- 4…16 kHz

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Mains connections

WEG CFW10

Voltage and power range

- 1-phase 110 - 127 V +10% / -15%
  - 0.18 to 0.75 kW (0.25 to 1 hp)
- 1-phase 200 - 240 V +10% / -15%
  - 0.18 to 2.20 kW (0.25 to 3 hp)

Power factor

- Displacement factor > 0.98

Supply frequency

- 50 / 60 Hz +/- 2 Hz (48 - 62 Hz)

Supply networks

- This product is specifically designed for use in industrial low voltage power supply networks (public networks) that not supply residential buildings

DC bus connection

- Not available

ABB ACS150

Voltage and power range

- 1-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 380 - 480V +/-10%
  - 0.37 to 4 kW (0.5 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60Hz, tolerance ±5%

Supply networks

- Suitable for IT network. Drive operation in floating (IT) networks possible by disconnecting EMC filter.

DC bus connection

- Not available

Ratings 1-phase 200V

1-phase 200V		ABB	CFW10	ACS150		WEG CFW10		CFW10	ABB
P_N	P_N	ACS150		I_{2N}	I_{2N}	*Rated output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	CFW100	A	A	A	A		
kW	hp	01X-		U_N=200-240 V		U_N=180-264 V		Frame	Frame
0,12	0,16								
0,18	0,25		016S2024ESZ			1,6	1,6	1	
0,37	0,5	2A4-2	026S2024ESZ	2,4	2,2	2,6	2,6		R0
0,55	0,75								
0,75	1	04A7-2	040S2024ESZ	4,7	4,2	4,0	4,0	2	R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	073S2024PSZ	7,5	6,8	7,3	7,3	2	R2
2,2	3	09A8-2	100S2024PSZ	9,8	8,8	10,0	10,0	3	

WEG CFW10

Overload capacity

- 150% during 60 sec. every 10 min. (1.5 x In - Rated Current)

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min

(+40 °C and +50 °C ambient)

- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 200V

3-phase 200V		ABB	CFW10	ACS150		WEG CFW10		CFW10	ABB
P_N	P_N	ACS150		I_{2N}	I_{2N}	*Rated output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-		A	A	A	A		
kW	hp	03X-		U_N=200-240 V		U_N=180-264 V		Frame names	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	02A4-2		2,4	2,2				R0
0,55	0,75	03A5-2		3,5	3,2				
0,75	1	04A7-2		4,7	4,2				R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2		7,5	6,8				
2,2	3	09A8-2		9,8	8,8				R2

WEG CFW10

Overload capacity

- 150% during 60 sec. every 10 min.
  (1.5 x In - Rated Current)

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min

(+40 °C and +50 °C ambient)

- 1.8 x short-time overload, 2 sec.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Ratings 3-phase 400V

3-phase 400V		ABB ACS150	CFW10	ACS150		WEG CFW10		CFW10	ABB ACS150
P_N	P_N			I_{2N}	I_{2N}	*Rated output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-		A	A	A	A		
kW	hp	03X-		U_N=380-480 V		U_N=320-550 V		Frame names	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	01A2-4		1,2	1,1				R0
0,55	0,75	01A9-4		1,9	1,7				
0,75	1	02A4-4		2,4	2,2				R1
1,1	1,5	03A3-4		3,3	3,0				
1,5	2	04A1-4		4,1	3,7				
2,2	3	05A6-4		5,6	5,0				
3	4	07A3-4		7,3	6,6				
4	5	08A8-4		8,8	7,9				

WEG CFW10

Overload capacity

- 150% during 60 sec. every 10 min. (1.5 x In - Rated Current)

ABB ACS150

Overload ratings

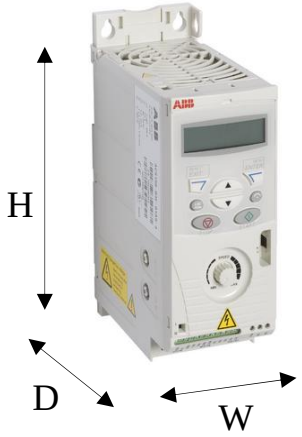
- 1.5 x long time overload, 1min/10min

(+40 °C and +50 °C ambient)

- 1.8 x short-time overload, 2 sec.

Dimensions 200 V 1-phase: width, height, depth

Dimensions 200 V		ABB ACS150	CFW10	ABB ACS150			WEG CFW10			WEG CFW10	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	01X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25		016S2024ESZ				95	132	121	1	
0,37	0,5	2A4-2	026S2024ESZ	70	169	142					R0
0,55	0,75										
0,75	1	04A7-2	040S2024ESZ	70	169	142	95	132	121	1	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	073S2024PSZ	105			115	161	122	2	R2
2,2	3	09A8-2	100S2024PSZ					191		3	



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 1-phase: area, volume, weight

Dimensions 200 V		ABB ACS150	CFW10	ABB ACS150			WEG CFW10			WEG CFW10	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	01X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25		016S2024ESZ				125	1,5	0,9	1	
0,37	0,5	2A4-2	026S2024ESZ	118	1,7	1,1					R0
0,55	0,75										
0,75	1	04A7-2	040S2024ESZ	118	1,7	1,3	125	1,5	0,9	1	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	073S2024PSZ	177	2,5	1,5	185	2,3	1,5	2	R2
2,2	3	09A8-2	100S2024PSZ				220	2,7	1,8	3	

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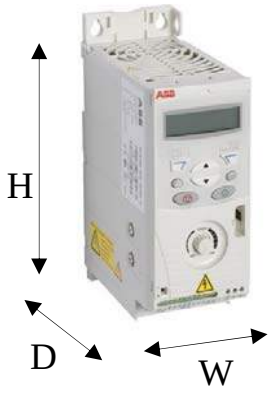
Dimensions 200 V 3-phase: width, height, depth

Dimensions 200 V		ABB ACS150	CFW10	ABB ACS150			WEG CFW10			WEG CFW10	ACS150
		Type	Type	3-phase			3-phase				
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame names	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2									R0
0,55	0,75	03A5-2									
0,75	1	04A7-2		70	169	142					R1
1,1	1,5	06A7-2									
1,5	2	07A5-2									
2,2	3	09A8-2		105							R2



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Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: area, volume, weight

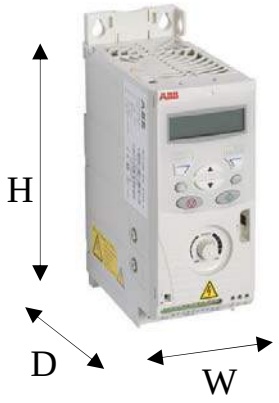
Dimensions 200 V		ABB ACS150	CFW10	ABB ACS150			WEG CFW10			WEG CFW10	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame names	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2				1,1					R0
0,55	0,75	03A5-2									
0,75	1	04A7-2		118	1,7						
1,1	1,5	06A7-2				1,3					R1
1,5	2	07A5-2									
2,2	3	09A8-2		177	2,5	1,5					R2

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: width, height, depth

Dimensions 400 V		ABB ACS150	CFW10	ABB ACS150			WEG CFW10			WEG CFW10	ACS150
		Type	Type								
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame names	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4		70	169	142					R0
0,55	0,75	01A9-4									
0,75	1	02A4-4									R1
1,1	1,5	03A3-4									
1,5	2	04A1-4									
2,2	3	05A6-4									
3	4	07A3-4									
4	5	08A8-4									



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Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: area, volume, weight

Dimensions 400 V		ABB ACS150	CFW10	ABB ACS150			WEG CFW10			WEG CFW10	ABB ACS150
		Type	Type								
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame names	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4		118	1,7	1,1					R0
0,55	0,75	01A9-4									
0,75	1	02A4-4				1,3					R1
1,1	1,5	03A3-4									
1,5	2	04A1-4									
2,2	3	05A6-4									
3	4	07A3-4									
4	5	08A8-4									

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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Installation

WEG CFW10

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	No
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	30
Below	50
Left and right	0

ABB ACS150

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	80
Below	80
Left and right	0

- Installation with clamps and screws, cabinet support tools available
- Operational motor cable lengths

Frame	Standard	With output chokes
R0	30 m	60 m
R1	50 m	100 m
R2	50 m	100 m

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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EMC and harmonics

WEG CFW10

- **Filters**
  - Capacitive filters are already installed inside the CFW-10
  - Optional external EMC filters for EMC class A1, A2 and B
- **Chokes**
  - Optional line reactors
  - Optional load rectors
- **EMC compliant motor cable lenghts**

Model	Class A1	Class A2	Class B	Filter
CFW100040S1112ESZ	30 m	50 m	5 m	
CFW100073S2024PSZ	30 m	50 m	5 m	Footprint
	25 m	40 m	5 m	Standard
CFW100100S2024PSZ	30 m	40 m	5 m	Footprint
	30 m	50 m	3 m	Standard

- **THD**
  - N/A

ABB ACS150

- **Filters**
  - Inbuilt EMC filter for category C3 (2nd environment) as standard
  - External EMC filter for categories C1, C2 (1st environment) and C3 (2nd environment) as option
- **Chokes**
  - AC input/output chokes as an option
- **EMC compliant motor cable lengths**
  - Category C3 30m (with 4 kHz switching frequency) as standard
  - With external EMC filter and 4 kHz switching frequency
    - 1~ 200 V: C1 10m, C2 and C3 100m (for 0.37 kW unit C1 10m, C2 45m and C3 75m)
    - 3~ 200 V: C2 and C3 30 m
    - 3~ 400 V: C1, C2 and C3 100 m
- **THD**
  - EN61000-3-2 with optional chokes

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

User interface

WEG CFW10

- KEYPAD (HMI) with 7 segment displays (LED's)
- Programming
  - Start/Stop, (General functions programming)
- Commands
  - Start/Stop
  - Frequency Increases
  - Decreases Speed
- Monitoring (reading)
  - Output Frequency (Hz)
  - DC Link Voltage (VDC)
  - Speed proportional value (Ex: tt/min)
  - Heat sink temperature
  - Output Current (Amps)
  - Output Voltage (Volts)
  - Last Fault Messages

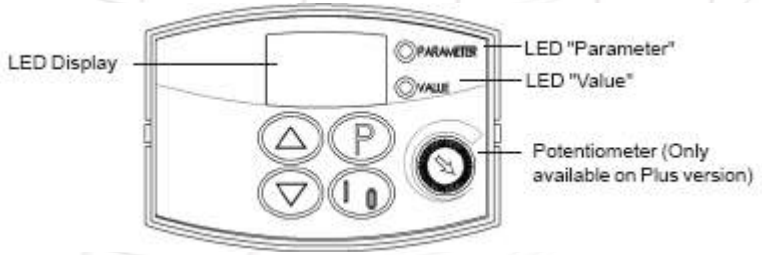
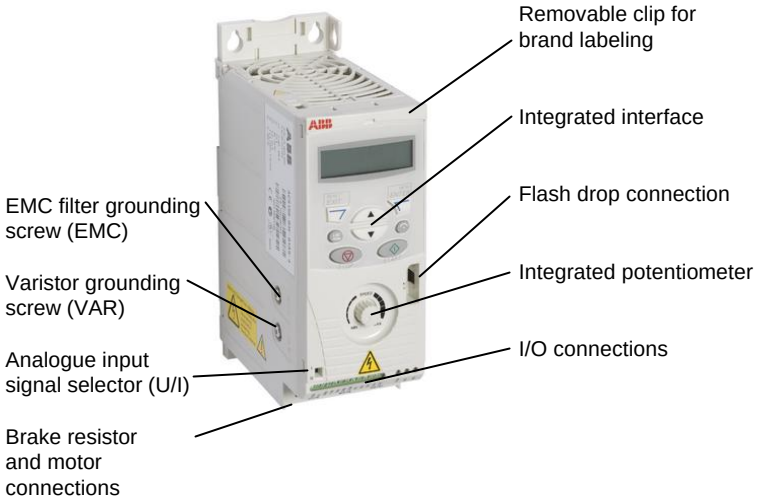


ABB ACS150

- Integrated interface
- Integrated potentiometer
- FlashDrop connection



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Machine interface

WEG CFW10

Type	*Qty.*	*Programmable*
Digital inputs	4	Yes
Analog inputs	1	Yes
Pulse train input	-	-
Relay outputs	1	Yes

Specialities:

- Control board Clean and Plus versions
  - The analog input AI1 and the relay output are not available on Clean version
  - Function 2 configuration is not possible on Clean version
  - Plus version still has a potentiometer for speed setting

ABB ACS150

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	1 (i.e. digital input)	Yes
Relay outputs	1	Yes
Transistor outputs	1	Yes

Specialities:

- Pulse train input

100% * Phd for braking

500 Hz max. output frequency

Motor control

WEG CFW10

- Sinusoidal PWM modulation (Space Vector Modulation),
- Linear V/F or quadratic V/F

Braking

- Braking resistor connection (only for the models 7.3 and 10.0A/200-240V and 4.0A/110-127V)
- Rheostatic braking (7.3A/200-240V, 10.0A/200-240V and 4.0A/110-127V) option

Output frequency

- 0 - 300 Hz

ABB ACS150

- Scalar control

Braking

- Brake chopper available as standard
  - 100% * Phd for braking

Output frequency

- 500 Hz as maximum output frequency

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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Macros and language versions

WEG CFW10

- **Macros**
  - Read-Only Parameters
    - Variables that can be viewed on the display, but can not be changed by the user
  - Regulation Parameters
    - Programmable values that can be used by the CFW-10 functions
  - Configuration Parameters
    - Define the inverter characteristics, the functions to be executed, as well as the input/output functions of the control board
  - Motor Parameters
    - Data about the applied motor: data indicated on the motor nameplate and those obtained during the running of the self-tuning routine
  - Special Function Parameters
    - Parameters related to special functions
- **Languages**
  - Portugese, English, Spanish

ABB ACS150

- **Macros**
  - ABB Standard
  - 3-wire
  - Alternate
  - Motor Potentiometer
  - Hand/auto
- **Languages**
  - N/A

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Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Software features

WEG CFW10

- Password to protect VFD Programming (*
- Fault Auto-diagnosis and automatic reset (*
- Motor Slip compensation (V/F mode) (*
- Manual and automatic torque boost (I x R) (*
- Linear and “S” independent acceleration ranp, two sets of ramps (*
- JOG function (*
- DC braking (*
- Multi-Speed function (up to 8 pre programmable speeds) (*
- Forward/Reverse Speed Selection via DI (*
- Local/Remote Reference Selection via DI

(* = Basic feature in ABB ACS150

ABB ACS150

- FlashDrop
- Pulse train input
- Changed parameter menu
- Emergency stop
- Jog function
- Fault Group (Group 4)
- Hardware protection against miss wiring in I/O and supply
- Zero speed delay
- Flux Optimization
- Switching frequency control
- 7 preset speeds
- Application macros
- Flying start
- Critical frequency lock-out
- Max. Freq. 500 Hz

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Other advanced features

WEG CFW10

ABB ACS150

FlashDrop

- Option tool for fast and safe selecting and setting drive parameters without power
- Palm-size 153x53x71mm, light weight 0.4 kg
- Portable and battery chargable
- Keypad with LCD display
- Includes Drive PM (Drive parameter manager) software for PC to create, edit and copy parameter sets for FlashDrop
- Help function available
- Possibility to store 20 user specified parameter macros
- Parameter hiding, Parameter upload and download, Cold drive and Damaged drive parameterization
- Compatible also with ACS150, ACS550 and ACH550 drives

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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PC connectivity and tools

WEG CFW10

- N/A

ABB ACS150

- N/A

Hardware options

WEG CFW10

- RFI Filters
- Line Reactor
- Load Reactor
- Rheostatic Braking

ABB ACS150

- AC input/output chokes
- NEMA 1 kit
- External EMC filter for 1st / 2nd environment

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Maintenance

WEG CFW10

- To avoid operation problems caused by harsh ambient conditions, such as high temperature, moisture, dirt, vibration or premature ageing of the components, periodic inspections of the inverter and installations are recommended
- It is recommended to change the fans after 40.000 operation hours

ABB ACS150

- **Cooling fan replacement**
  - Very easy to replace
  - Every five years
- **Capacitor reforming**
  - Every two years when stored
- **Available spare parts**
  - Fan

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Standards

WEG CFW10

Approvals

- CE, IEC 146, UL 508 C

Compliance with

- Low Voltage Directive 73/23/EEC including amandement 83/68/EEC
- EMC Directive 89/336/EEC including amandement 92/31/EEC and 93/68/EEC

Applicable standards

- Safety:
  - EN 50178 (1997) Electronic equipment for use in power installations
  - EN 60204-1 (1997) Safety of machinery Electrical equipment of machines – Part 1: General requirements
- EMC:
  - IEC/EN 61800-3 (1996) and amandement A11 (2000) – Adjustable speed electrical power drive systems – Part 3: EMC product standard including test methods

ABB ACS150

Approvals

- CE, UL, cUL, C-tick, GOST-R

Compliance with

- Low Voltage Directive 73/23/EEC with supplements
- Machinery Directive 98/37/EC
- EMC Directive 89/336/EEC with supplements
- Quality assurance system ISO 9001
- Environmental system ISO 14001
- RoHS directive 2002/95/EC with amandments

Applicable standards

- IEC/EN 61800-5-1 - Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
- IEC/EN 60204-1 (1997) - Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
- IEC/EN 60529: 1991 - Degrees of protection provided by enclosures (IP code)
- IEC/EN 61800-3 (2004)- EMC product standard including specific test methods
- UL 508C UL - Standard for Safety, Power Conversion Equipment

Performance analysis – Autodyne description

Test stand is used to characterize 2,2kW (3hp) heavy duty rated LVAC drives and allow ABB to compare accurate repeatable data against ABB's baseline products (ACS150, ACS350, ACS550 and ACS800). The mechanical portion of the dynamometer consists of a 2,2kW (3hp) 1755 rpm 230VAC/460VAC vector duty motor with encoder (spinner motor) which is connected to the output of the drive under test (DUT). The spinner motor is connected through a in-line torque transducer to a 10 hp 1750 RPM DC motor with encoder. Actual torque and speed information is fed to the dynamometer controller which is run by an IBM desktop computer and flat screen monitor using a Windows™ based proprietary software program controlling electrical power supplied to the DUT and from the DUT to the spinner motor.

Essentially, tests are conducted "out of the box". However, an ID run and a speed regulator autotune are performed, if the drive is so equipped. All drives are tested in sensorless vector mode of operation.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Tested units in performance analysis

WEG CFW10

Model: USCFW100100S2024ESZ

Drive rating: 200-240V
2.2 kW / 3Hp
10 A

Tester (experienced drive specialist) comments:

- **The Operator Panel uses three 7-segment LED's, UP/Down arrows, Parameter button and Start/Stop button. The Start/stop button didn't always work and programming the drive was difficult because no parameter prefix was displayed. Parameter P000 in the manual is 000 on the display. When changing a parameter number or value you must be careful to observe which LED is illuminated (Parameter or Value).**
- **No +24Vdc power supply for sourcing DI's. Requires an external power supply. Even though the drive was wired correctly, the voltage to the DI's was verified the drive would not start in remote.**
- **Mounting slots in the top and bottom of the drive are provided instead of holes or keyholes.**
- **The default min frequency is 3 Hz.**
- **Parameter scrolling is tedious since the display is to the hundredths place .xx and does not speed up nor move the cursor to the tens or hundreds position.**
- **The drive powers up with all parameters in "read only". You must set a parameter to permit adjustment. Cycling power resets this parameter requiring you to re-enter the value to permit parameter adjustment.**
- **The drive faulted on E00 (Overcurrent) during the Fast Accel Into Load test, Impact Load test during the second speed reference, Maximum Torque test, Torque vs Speed at the 500 rpm speed reference and Speed Accuracy test. The drive also faulted on E01 (Overvoltage) during the Overvoltage Control test.**

ABB ACS150

Model: ACS150-03X-07A3-4

Drive rating: 380-480V
3,0 kW / 4 Hp
7,3 A

Parameter Settings:

9902 ABB Standard

9905 230V

9906 4.2A

9907 60Hz

9908 1750 RPM

9909 3.0 HP

2101 Torque Boost

2201 Not Selected

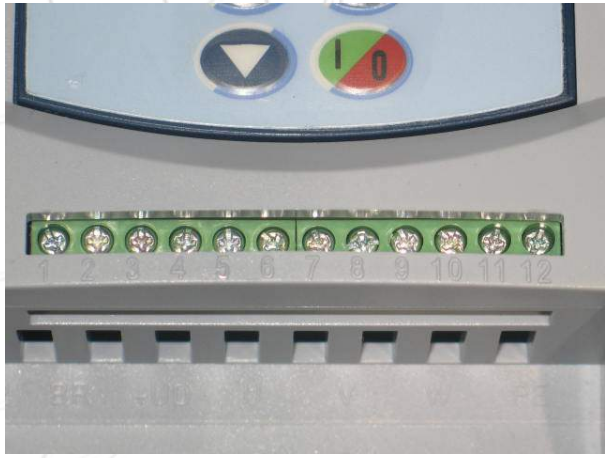
2202 1.0 Second

2203 1.0 Second

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Photos of the tested unit



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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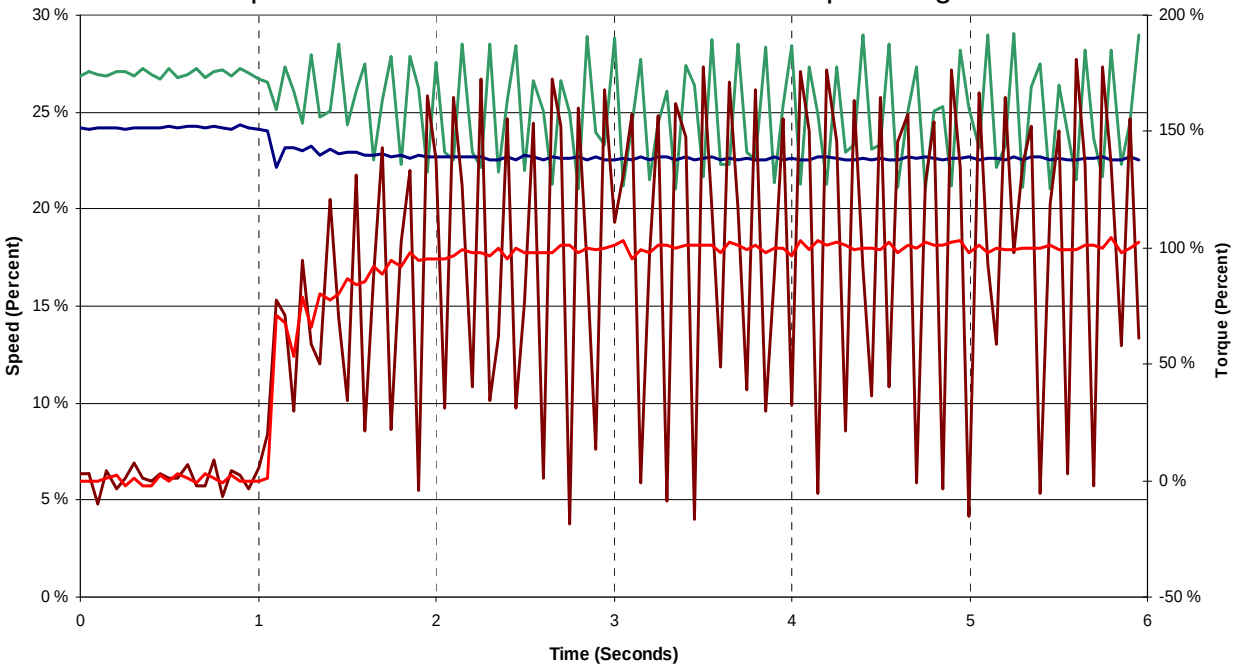
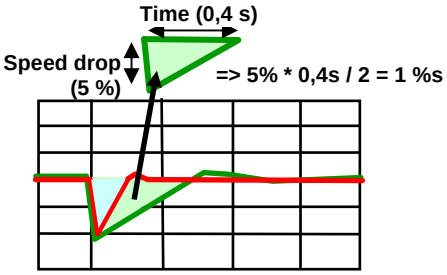
Impact load test – Dynamic speed accuracy (stiffness)

Motor is operated at 25% rated speed and 100% load is applied. Speed and torque are measured over time. Dynamic speed error (stiffness) is speed drop (% of nominal speed) times time of recovery (s) divided by 2. The 25% speed reference data is plotted as this is worst case test for the speed regulator evaluation.

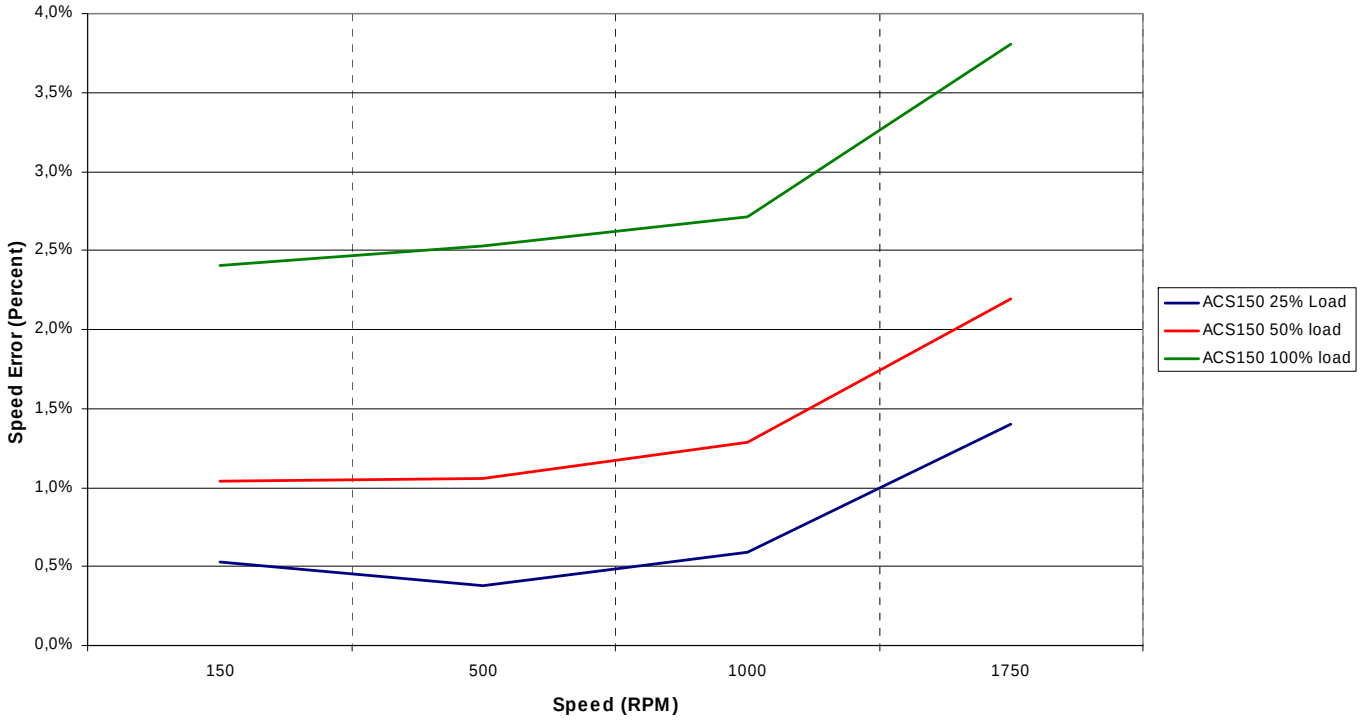




Dynamic speed error depends on speed controller tuning. The smaller the stiffness %s figure the better the drive works in case of disturbances. In ACS150 the speed control default tuning is quite conservative to ensure that controller is stable despite the motor used and its size compared to size of the inverter. Both products handled the 100% impact load at ¼ speed. The WEG has good dynamic speed accuracy despite the amount of speed and torque ripple.

Static speed accuracy

Drive is given speed references of 150, 500, 1000 and 1700 rpm's and loads of 25%, 50% and 100%. The speed error in static situation (constant load and speed) is calculated as a ratio of the average speed error compared to motor nominal speed (1755 rpm), Speed Error [%] = $(n^*-n_{act}) / n_{N(mot)}$. Speed (control) accuracy is essential feature for high quality motor control.



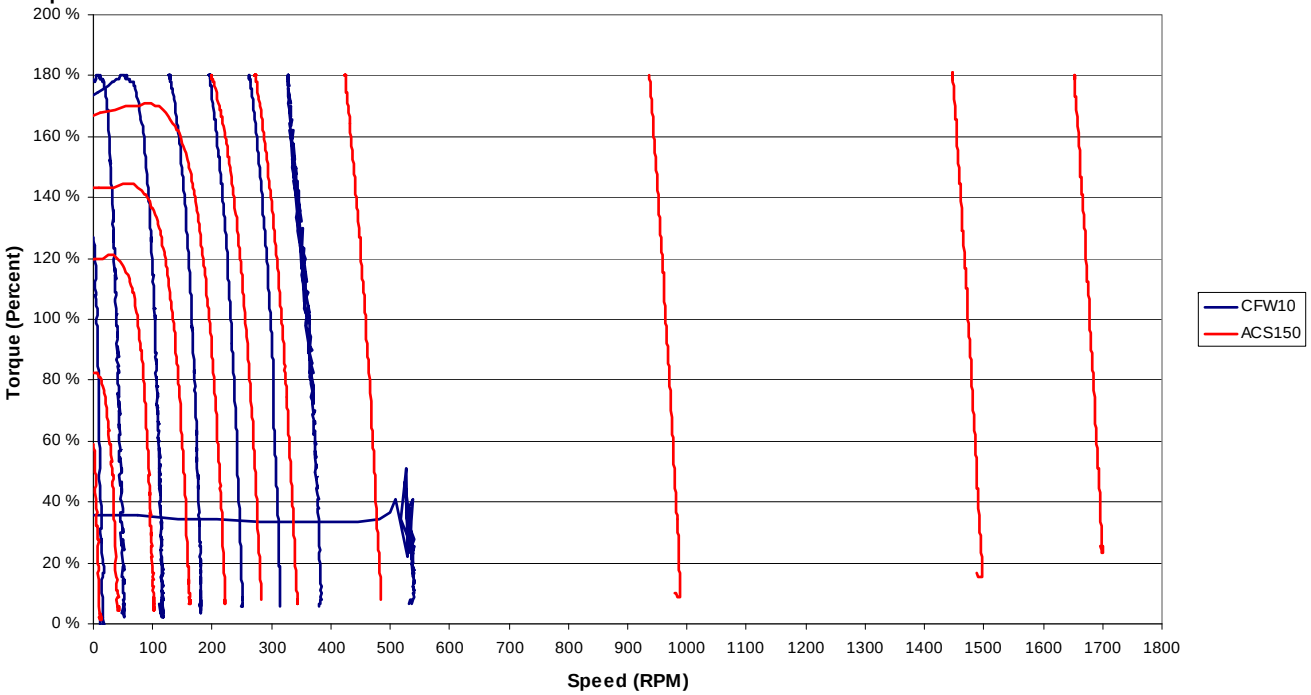
Static speed error depends on the accuracy and quality of measurements (voltage, current, speed estimation). The smaller the error figure and difference between figures at partial and full load points, the better the drive works in applications where good static accuracy is needed (e.g. extruders).

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Maximum torque as a function of speed

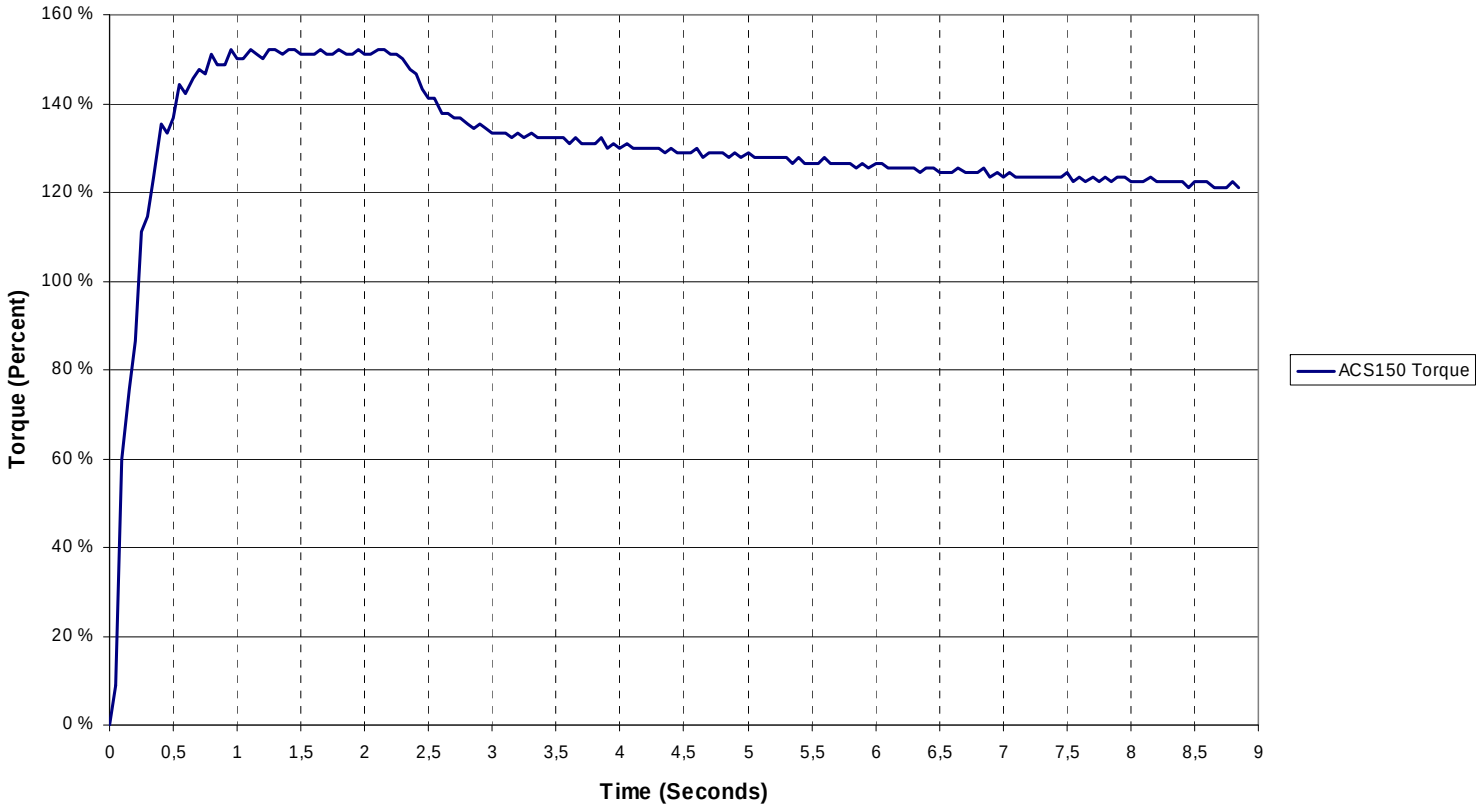
Drive is given speed reference of 30, 60, 120, 180, 240, 300, 360, 500, 1000, 1500 and 1700 rpm's. Load is gradually increased to 180% for 2 seconds, or until the motor stalls. The test describes the drive's speed range. The speed range is defined as the minimum speed the motor can operate from a given base speed and still generate 100% torque.



Both products produced approximately 180% torque at each set point except the ACS150 produced only 80% at 60 rpm and 60% at 30 rpm. The WEG was not able to produce torque above 500 rpm.

Maximum starting torque

Motor output shaft is locked. Drive is given run command and 1000 rpm speed reference. Torque is measured with respect to time.



CFW10: Test failed.

The ACS150 can reach 150% torque within 1s. The ACS150 reduces torque to nominal value after 2 s due to current limiting.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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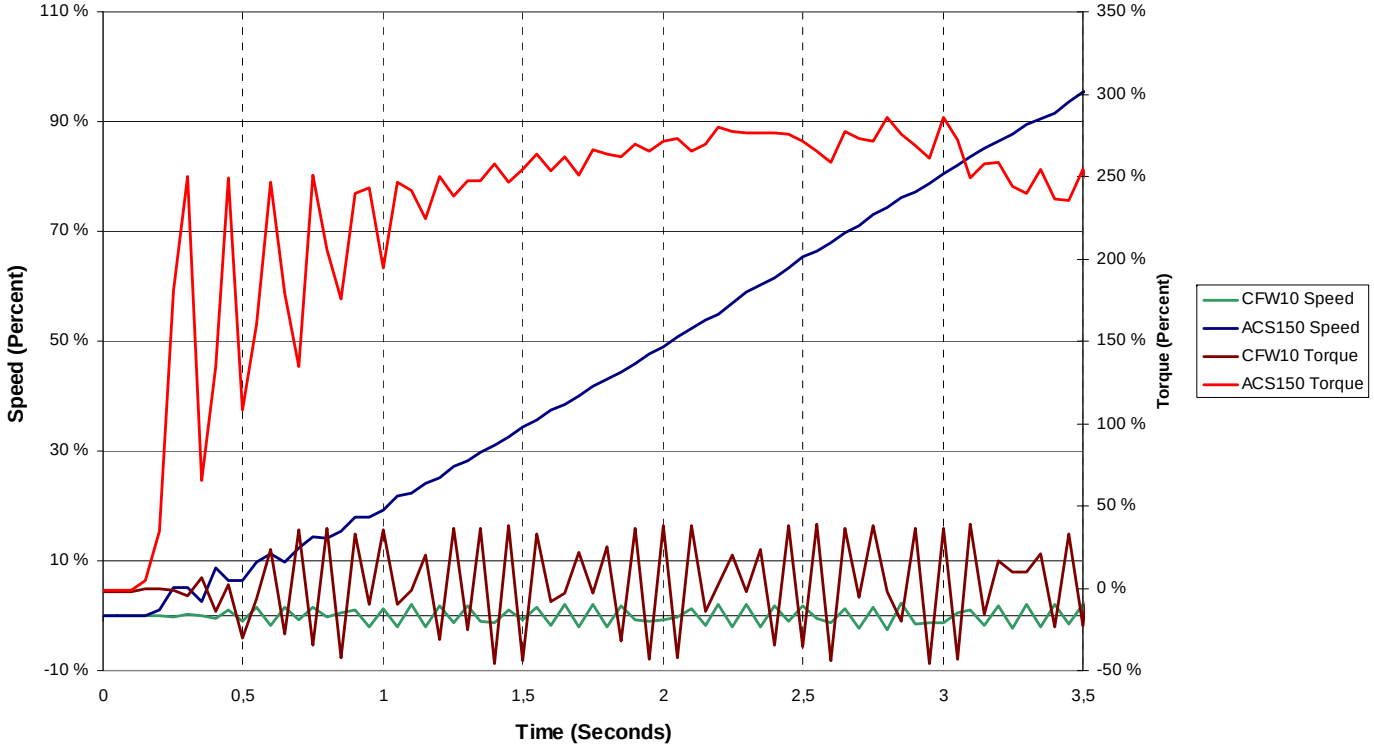
Fast acceleration into inertia

Drive is given run command and zero speed reference. Dynamometer inertia simulation program places 22.5 lb-ft^2 (0.95 kgm^2) inertia on motor shaft and then drive is given 100% speed reference. Speed and torque are measured over time as drive accelerates motor into inertia. Drive acceleration rate is set to 1 second.



The ACS150 accelerated the inertia in approximately 3.5 seconds while producing 250% torque. Acceleration was smooth. The WEG did not accelerate the inertia smoothly nor produce adequate starting torque at all?

Efficiency

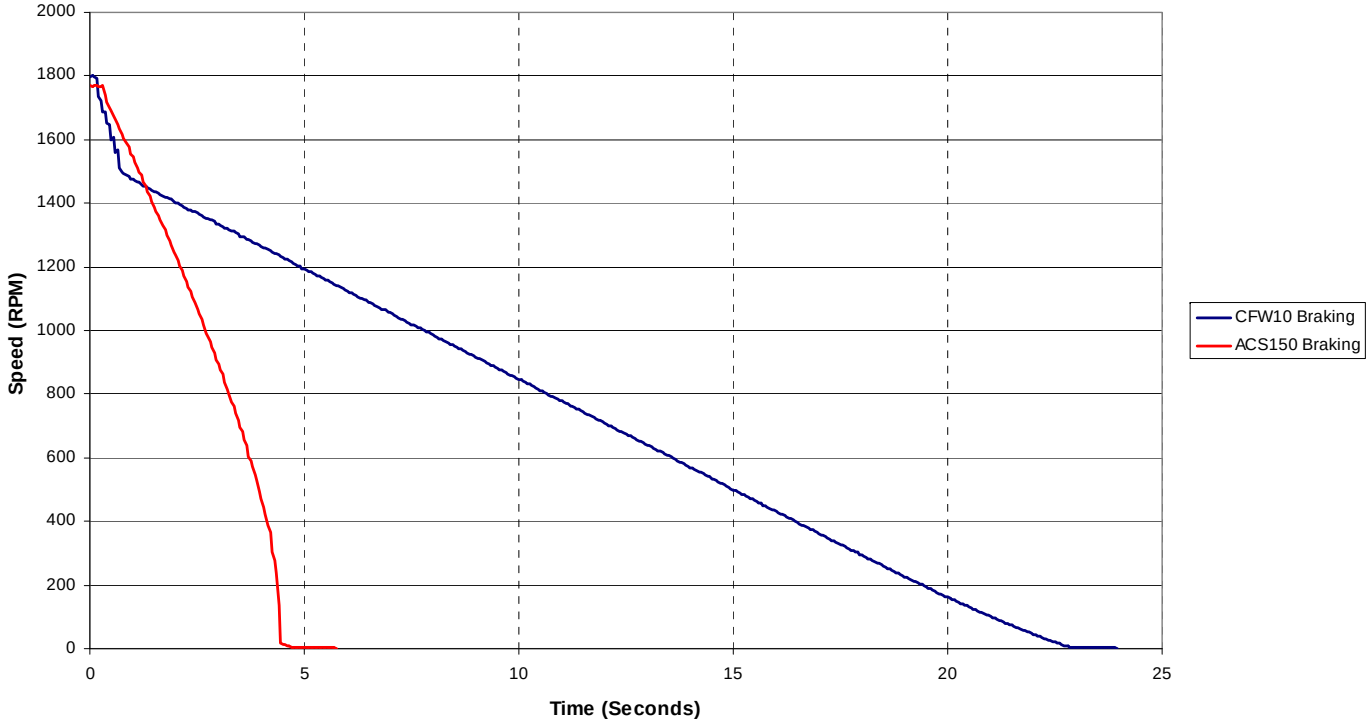
Using power analyzer, input power, speed and torque of AC motor are measured at 25%, 50%, 75% and 100% rated motor load. Since the comparison is made by using the same motor at the same operation point the figures reflect the efficiency of the inverter and the additional losses caused in the motor due to the inverter operation. The difference in total efficiency may be remarkable in total energy consumption.

Load (Percent)	Efficiency	
	ACS150	CFW10
25%	82.3%	N/A
50%	89.0%	N/A
75%	89.3%	N/A
100%	88.5%	N/A

CFW10's efficiency test data is not available.

Overvoltage control

With DUT operating at nominal line voltage and 100% rated speed, the run command will be removed from DUT. Time from the run command being removed until AC motor speed reaches 0 will be measured and recorded. DUT deceleration time will be set to 1 sec. The test measures the ability of drives to decelerate the load with and without flux braking (raising the magnetization level in the motor to convert kinetic energy to motor thermal energy). The shorter the time, the better the overvoltage controller (and flux braking algorithms) of a drive works.



ACS150 decelerated the load to zero within 4.5 seconds and WEG within 23 seconds.

ABB strengths

ACS150 advantages over WEG CFW10

NEMA 1 kit option	100% * Phd for braking
Operating temp. from -10°C	500 Hz max. output frequency
3-phase 200 V and 400 V units	Application macros
Areas of 1-phase 200 V units	High functionality software features
DIN rail mounting	Cold configuration with FlashDrop
EN61000-3-2 with opt. chokes	Easy maintenance
Potentiometer as standard	RoHS compliance
Pulse train input	

For ACS150 advantages in performance, see the performance test slides

ACS150 Competitor comparison

Siemens SINAMICS G110

Mitsubishi FR-S 500

Allen Bradley PowerFlex 4

WEG CFW10

Hitachi X200

Lenze 8400 BaseLine

Main

Yaskawa VS Mini J7

Schneider Altivar 11

Lenze smd

Allen Bradley PowerFlex 4M

Yaskawa J1000

Summary Slide

Description

PowerFlex 4M

- The Allen-Bradley® PowerFlex® 4M AC drive is the smallest and most cost effective member of the PowerFlex® family of drives providing users with powerful motor speed control in a compact, space saving design
- Meets the demands of global OEMs and end users who require
  - Space savings and easy-to-use AC drives
  - Application flexibility
  - Feed-through wiring
  - Ease-of-programming
- Scalar control (Volts per Hertz)
- For power range 0.2 kW to 11 kW
- Applications
  - No special applications mentioned

ABB ACS150

- ACS150 is a component drive for the serial OEM business in basic machinery applications
- Integrated user interface
- Unpowered drive configuration in 2 s
- Straightforward installation and integration
- Fast availability and service
- Scalar control
- For power range 0.37 kW to 4.0 kW
- Applications
  - Fans, pumps, gate control, material handling, conveyors

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Protection class

PowerFlex 4M

- IP 20, NEMA/UL Type Open

ABB ACS150

- IP20 UL open (standard)
- NEMA 1 (option)

Ambient specification

PowerFlex 4M

Vibration

- 1G peak, 5 to 2000 Hz (operating)

Shock

- 15G peak for 11ms duration (±1.0ms) (operating)

Temperature

- Operating temperature –10 to +50 °C, in side-by-side mounting –10 to +40 °C
- Storage temperature –40 to +85 °C

Humidity

- Lower than 95 % (non-condensing)

Altitude limitations

- 1000 m or less

Acoustic noise

- 2…10 kHz

ABB ACS150

Vibration

- Compliance with IEC 60721-3-3 (operation) and ISTA 1A (storage and transportation)

Shock

- Mechanical shocks are not allowed for the drive during operation
- Bump according to IEC 60068-2-29, 25g/1000pcs

Temperature

- Operating temperature -10 to +50 °C, minimum derate after 40 °C (1% per degree)
- Storage temperature –40 °C to +70°C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 0 to 1000m derate 1% per 100m

Acoustic noise

- 4…16 kHz

Mains connections

PowerFlex 4M

Voltage types and power range

- 1-phase 100 - 120V ±10%
  - 0.2 to 1.1 kW (0.25 to 1.5 hp)
- 1-phase 200 - 240V ± 10%
  - 0.2 to 2.2 kW (0.25 to 3 hp)
- 3-phase 200 - 240V ± 10%
  - 0.2 to 7.5 kW (0.25 to 10 hp)
- 3-phase 380 - 480V ± 10%
  - 0.4 to 11 kW (0.5 to 15 hp)

Power factor

- Efficiency (typical) 97.5%

Supply frequency

- 47 - 63 Hz

Supply networks

- Removable MOV to ground ensures reliable operation with ungrounded or resistive distribution systems

DC bus connection

- Available for frame size C (power ratings ≥ 5.5 kW)

ABB ACS150

Voltage and power range

- 1-phase 200 - 240V ± 10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 200 - 240V ± 10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 380 - 480V ± 10%
  - 0.37 to 4 kW (0.5 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60Hz, tolerance ±5%

Supply networks

- Suitable for IT network. Drive operation in floating (IT) networks possible by disconnecting EMC filter.

DC bus connection

- Not available

Ratings 1-phase 200V

1-phase 200V		ABB	PowerFlex	ABB ACS150		PowerFlex 4M		PowerFlex	ABB
P_N	P_N	ACS150	4M	I_{2N}	I_{2N}	*Output current*		4M	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	22F-	A	A	A	A		
kW	hp	01X-		U_N=200-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,2	0,25		A1P6N113			1,6	1,6	A	
0,4	0,5	2A4-2	A2P5N113	2,4	2,2	2,5	2,5		R0
0,55	0,75								
0,75	1	04A7-2	A4P2N113	4,7	4,2	4,2	4,2	A	R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	A8P0N113	7,5	6,8	8,0	8,0	B	R2
2,2	3	09A8-2	A011N113	9,8	8,8	11,0	11,0		

PowerFlex 4M

Overload ratings

- 150% for 60 seconds
- 200 % for 3 seconds

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 200V

3-phase 200V		ABB	PowerFlex	ABB ACS150		PowerFlex 4M		PowerFlex	ABB
P_N	P_N	ACS150	4M	I_{2N}	I_{2N}	*Output current*		4M	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	22F-	A	A	A	A		
kW	hp	03X-		U_N=206-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,2	0,25		B1P6N103			1,6	1,6	A	
0,4	0,5	02A4-2	B2P5N103	2,4	2,2	2,5	2,5		R0
0,55	0,75	03A5-2		3,5	3,2				
0,75	1	04A7-2	B4P2N103	4,7	4,2	4,2	4,2	A	R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	B8P0N103	7,5	6,8	8,0	8,0	A	
2,2	3	09A8-2	B012N103	9,8	8,8	12,0	12,0	B	R2
3	4								
3,7	5		B017N103			17,5	17,5	B	
5,5	7,5		B025N104			25,0	25,0	C	
7,5	10		B033N104			33,0	33,0		

PowerFlex 4M

Overload ratings

- 150% for 60 seconds
- 200 % for 3 seconds

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 400V

3-phase 400V		ABB	PowerFlex	ABB ACS150		PowerFlex 4M		PowerFlex	ABB
P_N	P_N	ACS150	4M	I_{2N}	I_{2N}	*Output current*		4M	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	22F-	A	A	A	A		
kW	hp	03X-		U_N=380-480 V		U_N=380-480 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,4	0,5	01A2-4	D1P5N103	1,2	1,1	1,5	1,5	A	R0
0,55	0,75	01A9-4		1,9	1,7				
0,75	1	02A4-4	D2P5N103	2,4	2,2	2,5	2,5	A	R1
1,1	1,5	03A3-4		3,3	3,0				
1,5	2	04A1-4	D4P2N103	4,1	3,7	4,2	4,2	B	
2,2	3	05A6-4	D6P0N103	5,6	5,0	6,0	6,0		
3	4	07A3-4		7,3	6,6				
3,7	5	08A8-4	D8P7N103	8,8	7,9	8,7	8,7	B	
5,5	7,5		D013N104			13	13	C	
7,5	10		D018N104			18	18		
11	15		D024N104			24	24		

PowerFlex 4M

Overload ratings

- 150% for 60 seconds
- 200 % for 3 seconds

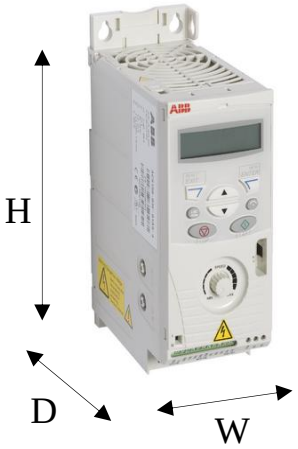
ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Dimensions 200 V 1-phase: width, height, depth

Dimensions 200 V		ABB ACS150	PowerFlex 4M	ABB ACS150			PowerFlex 4M			PowerFlex 4M	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-	22F-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	01X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,2	0,25		A1P6N113				72	174	136	A	
0,4	0,5	02A4-2	A2P5N113	70	169	142					R0
0,55	0,75										
0,75	1	04A7-2	A4P2N113	70	169	142	72	174	136	A	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	A8P0N113	105			100	174	136	B	R2
2,2	3	09A8-2	A011N113								



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 1-phase: area, volume, weight

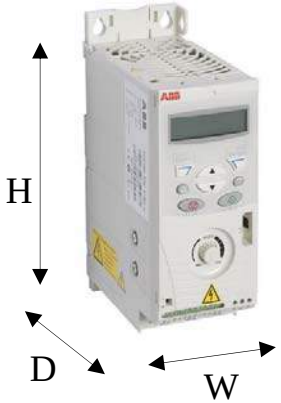
Dimensions 200 V		ABB ACS150	PowerFlex 4M	ABB ACS150			PowerFlex 4M			PowerFlex 4M	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-	22F-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	01X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,2	0,25		A1P6N113				125	1,7	1,6	A	
0,4	0,5	02A4-2	A2P5N113	118	1,7	1,1					R0
0,55	0,75										
0,75	1	04A7-2	A4P2N113	118	1,7	1,3	125	1,7	1,6	A	R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	A8P0N113	177	2,5	1,5	174	2,4	2,1	B	R2
2,2	3	09A8-2	A011N113								

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: width, height, depth

Dimensions 200 V		ABB ACS150	PowerFlex 4M	ABB ACS150			PowerFlex 4M			PowerFlex 4M	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-	22F-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,2	0,25		B1P6N103				72	174	136	A	
0,4	0,5	02A4-2	B2P5N103								R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	B4P2N103	70	169	142	72	174	136	A	
1,1	1,5	06A7-2									R1
1,5	2	07A5-2	B8P0N103				72	174	136	A	
2,2	3	09A8-2	B012N103	105			100	174	136	B	R2
3	4										R2
3,7	5		B017N103				100	174	136	B	
5,5	7,5		B025N104				130	260	180	C	
7,5	10		B033N104								



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: area, volume, weight

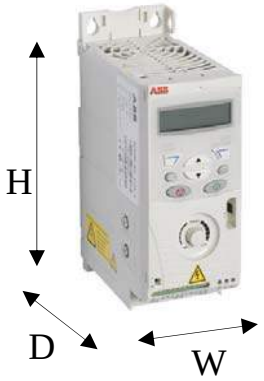
Dimensions 200 V		ABB ACS150	PowerFlex 4M	ABB ACS150			PowerFlex 4M			PowerFlex 4M	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-	22F-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,2	0,25		B1P6N103				125	1,7	1,6	A	
0,4	0,5	02A4-2	B2P5N103			1,1					R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	B4P2N103	118	1,7		125	1,7	1,6	A	
1,1	1,5	06A7-2				1,3					R1
1,5	2	07A5-2	B8P0N103				125	1,7	1,6	A	
2,2	3	09A8-2	B012N103	177	2,5	1,5	174	2,4	2,1	B	R2
3	4										
3,7	5		B017N103				174	2,4	2,1	B	
5,5	7,5		B025N104				338	6,1	4,8	C	
7,5	10		B033N104								

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: width, height, depth

Dimensions 400 V		ABB ACS150	PowerFlex 4M	ABB ACS150			PowerFlex 4M			PowerFlex 4M	ABB ACS150
		Type	Type								
		ACS150-	22F-	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,4	0,5	01A2-4	D1P5N103	70	169	142	72	174	136	A	R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	D2P5N103				72	174	136	A	R1
1,1	1,5	03A3-4									
1,5	2	04A1-4	D4P2N103				100	174	136	B	
2,2	3	05A6-4	D6P0N103								
3	4	07A3-4									
3,7	5	08A8-4	D8P7N103				100	174	136	B	
5,5	7,5		D013N104				130	260	180	C	
7,5	10		D018N104								
11	15		D024N104								



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: area, volume, weight

Dimensions 400 V		ABB ACS150	PowerFlex 4M	ABB ACS150			PowerFlex 4M			PowerFlex 4M	ABB ACS150
		Type	Type								
		ACS150-	22F-	(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,4	0,5	01A2-4	D1P5N103	118	1,7	1,1	125	1,7	1,6	A	R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	D2P5N103			1,3	125	1,7	1,6	A	R1
1,1	1,5	03A3-4									
1,5	2	04A1-4	D4P2N103				174	2,4	2,1	B	
2,2	3	05A6-4	D6P0N103								
3	4	07A3-4									
3,7	5	08A8-4	D8P7N103				174	2,4	2,1	B	
5,5	7,5		D013N104				338	6,1	4,8	C	
7,5	10		D018N104								
11	15		D024N104								

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

DIN rail mounting for all units

Sideways mounting

Side-by-side up to +50°C

Installation

PowerFlex 4M

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes (Frames A and B)
Flange	No
Wall (sideways)	No
Heatsinkless	No
Side-by-side	Yes (Up to +40°C)

Free space requirements

Location	*mm*
Above	76,2
Below	76,2
Left and right	0 up +40°C, 25 mm up to +50°C

- Operational motor cable lengths, for 380-480 V ratings

Motor insulation rating	Motor cable
1000 Vp-p	15 m
1200 Vp-p	40 m
1600 Vp-p	170 m

  - Longer cable lenghts can be achieved by installing devices on the output of the drive

ABB ACS150

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	80
Below	80
Left and right	0

- Installation with clamps and screws, cabinet support tools available
- Operational motor cable lengths

Frame	Standard	With output chokes
R0	30 m	60 m
R1	50 m	100 m
R2	50 m	100 m

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

EMC and harmonics

PowerFlex 4M

- **Filters**
  - Integral EMC filter available on 240V 1-phase and 480V 3-phase drives
  - External - S Type and/or -L Type EMC filters available for other drive types
- **Chokes**
  - Input chokes as external option
- **EMC compliant motor cable lengths**

Filter Type	EN61800-3 Second Environment (2)	EN61800-3 First Environment Restricted Distribution (2)	EN61800-3 First Environment Unrestricted Distribution (3)
Integral, 240V	5 meters (16 feet)	5 meters (16 feet)	1 meter (3 feet)
Integral, 480V	10 meters (33 feet)	–	–
External - S Type(1)	5 meters (16 feet)	5 meters (16 feet)	1 meter (3 feet)
External - L Type(1)	100 meters (328 feet)	100 meters (328 feet)	25 meters (82 feet)

(1) Refer to Appendix B for details on optional external filters.
(2) Equivalent to EN55011 Class A.
(3) Equivalent to EN55011 Class B.

- **THD:** EN61000-3-2
  - 0.75 kW 1~& 3~ 240V and 0.4 kW 1~ 240V drives with additional external harmonic mitigation
  - Other drive ratings comply with EN61000-3-2 without additional external mitigation

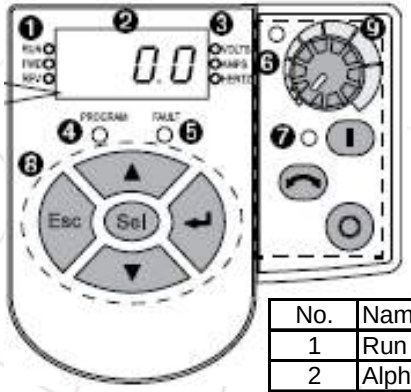
ABB ACS150

- **Filters**
  - Inbuilt EMC filter for category C3 (2nd environment) as standard
  - External EMC filter for categories C1, C2 (1st environment) and C3 (2nd environment) as option
- **Chokes**
  - AC input/output chokes as an option
- **EMC compliant motor cable lengths**
  - Category C3 30m (with 4 kHz switching frequency) as standard
  - With external EMC filter and 4 kHz switching frequency
    - 1~ 200 V: C1 10m, C2 and C3 100m (for 0.37 kW unit C1 10m, C2 45m and C3 75m)
    - 3~ 200 V: C2 and C3 30 m
    - 3~ 400 V: C1, C2 and C3 100 m
- **THD**
  - EN61000-3-2 with optional chokes

User interface

PowerFlex 4M

- Standard integral keypad
- Integrated potentiometer

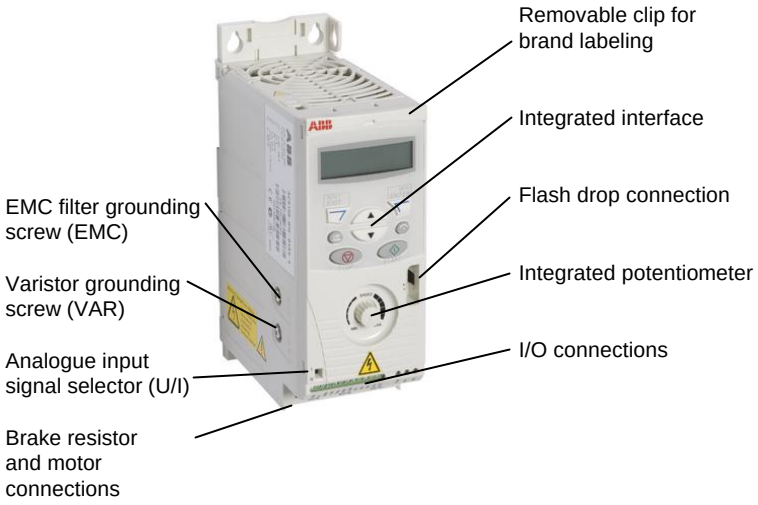


No.	Name
1	Run / Direction status
2	Alphanumeric Display
3	Displayed units
4	Program status
5	Fault status
6	Potentiometer status
7	Start key status
8	Escape, Select, Up /Down arrows, Enter
9	Speed potentiometer with buttons Start, Reverse and Stop

- Optional remote LCD keypads
  - For panel mounting: 22-HIM-C2 (cable 2,9 m) and 22-HIM-C2S (cable 2 m), IP66 / NEMA 4X/12
  - Handheld keypad: 22-HIM-A3 (separate option for panel mount available), IP30 / NEMA Type 1

ABB ACS150

- Integrated interface
- Integrated potentiometer
- FlashDrop connection



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Machine interface

PowerFlex 4M

Type	*Qty.*	*Programmable*
Digital inputs	5	2
Analog inputs	2 (Only one can be used at a time)	No
Pulse train input	No	
Relay outputs	1	Yes
Transistor outputs	No	

Specialities:

- Serial communication

Protocol	*Standard/Optional*	*Baud rate*
RS485 (DSI)	Integral	Information N/A
BACnet MS/TP RS485	Option	Information N/A
ControlNet	Option	Information N/A
DeviceNet	Option	Information N/A
EtherNet/IP	Option	Information N/A
Profibus DP	Option	Information N/A

- Use of a fieldbus module requires a DSI External Communication Kit (sold as option)

ABB ACS150

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	1 (i.e. digital input)	Yes
Relay outputs	1	Yes
Transistor outputs	1	Yes

Specialities:

- Pulse train input

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Brake chopper in all units

500 Hz max. output frequency

Motor control

PowerFlex 4M

- Volts per Hertz

Braking

- Internal IGBT for dynamic braking available in 5.5 to 11 kW drives
  - Optional resistors, rated for 5% duty cycle

Output frequency

  - 400 Hz as maximum output frequency

ABB ACS150

- Scalar control

Braking

- Brake chopper available as standard
  - 100% * Phd for braking

Output frequency

- 500 Hz as maximum output frequency

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Macros and language versions

PowerFlex 4M

- **Macros**
  - Not available
- **Languages**
  - Not available

ABB ACS150

- **Macros**
  - ABB Standard
  - 3-wire
  - Alternate
  - Motor Potentiometer
  - Hand/auto
- **Languages**
  - N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Software features

PowerFlex 4M

- Drive automatically provides auto boost (IR compensation) and slip compensation
- A relay pre-charge limits inrush current

(* = Basic feature in ABB ACS150

ABB ACS150

- FlashDrop
- Pulse train input
- Changed parameter menu
- Emergency stop
- Jog function
- Fault Group (Group 4)
- Hardware protection against miss wiring in I/O and supply
- Zero speed delay
- Flux Optimization
- Switching frequency control
- 7 preset speeds
- Application macros
- Flying start
- Critical frequency lock-out
- Max. Freq. 500 Hz

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Other advanced features

PowerFlex 4M

DSI Wireless Interface Module (WIM)

- Provides a wireless communication interface between a Pocket PC, laptop computer or desktop computer equipped with Bluetooth® wireless technology, and any Allen-Bradley® product supporting the DSI™ protocol

ABB ACS150

FlashDrop

- Option tool for fast and safe selecting and setting drive parameters without power
- Palm-size 153x53x71mm and light weight 0.4 kg
- Portable and battery chargable
- Keypad with LCD display
- Includes Drive PM (Drive parameter manager) software for PC to create, edit and copy parameter sets for FlashDrop
- Help function available
- Possibility to store 20 user specified parameter macros
- Parameter hiding, Parameter upload and download, Cold drive and Damaged drive parameterization
- Compatible also with ACS150, ACS550 and ACH550 drives

PC connectivity and tools

PowerFlex 4M

- Connection
  - Integral RS-485 communications to PC
  - A Serial Converter Module provides connectivity to any controller with a DF1 port
- DriveExplorer Software
  - View and modify drive and adapter parameters as in Microsoft Windows Explorer.
  - Operate the drive via an on-screen Control Bar: start, stop, and speed reference
  - Save, restore and print parameter information
  - Compare current parameters with factory defaults or previously saved parameter values
  - Edit, upload and download parameters
- DriveExecutive Software
  - Online and offline programming capability
  - In-grid and dialog-based parameter editing
  - Immediate visual indication of drive and communication status when viewing online drive
  - Integrated HTML Help architecture

ABB ACS150

- N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Hardware options

PowerFlex 4M

- Dynamic Brake Resistors
- Input Line Reactors
- EMC Filters

Human Interface Module Option Kits and Accessories

Description	Cat. No.
Remote (Panel Mount) LCD Display, Digital Speed Control, CopyCat Capable. IP66 (NEMA/UL Type 4X/12) Indoor Use Only. Includes 2.0 meter cable.	22-HIM-C2S *
Remote Handheld, LCD Display, Full Numeric Keypad, Digital Speed Control, CopyCat Capable. IP30 (NEMA/UL Type 1). Includes 1.0 meter cable. Panel mount with optional Bezel Kit.	22-HIM-A3
Remote Handheld, Wireless Interface Module with Bluetooth® Technology. IP30 (NEMA/UL Type 1). Panel Mount with optional Bezel Kit.	22-WIM-N1
Remote (Panel Mount), Wireless Interface Module with Bluetooth Technology. IP66 (NEMA/UL Type 4X/12) Indoor Use Only.	22-WIM-N4S
Bezel Kit. Panel Mount for LCD Display, Remote Handheld Unit. IP30 (NEMA/UL Type 1). Includes a 22-RJ45CBL-C20 cable.	22-HIM-B1
DSI HIM Cable (DSI HIM to RJ45 cable)	
1.0 Meter (3.3 Feet)	22-HIM-H10
2.9 Meter (9.51 Feet)	22-HIM-H30

* The 22-HIM-C2S is smaller than the 22-HIM-C2 and cannot be used as a direct replacement.

Communication Option Kits

Description	Cat. No.
Serial Converter Module (RS485 to RS232) Provides serial communication via DF1 protocol for use with DriveExplorer and DriveExecutive™ software. Includes DSI to RS232 serial converter, 1203-SFC serial cable, 22-RJ45CBL-C20 cable, and DriveExplorer Lite CD.	22-SCM-232
Serial Cable 2.0 meter with a locking low profile connector. Connects the serial converter to a 9-pin sub-miniature D female computer connector.	1203-SFC
Serial Null Modem Adapter Use when connecting the serial converter to DriveExplorer on a handheld PC.	1203-SNM
Universal Serial Bus™ (USB) Converter includes 2m USB, 20-HIM-H10 & 22-HIM-H10 Cables	1203-USB
DSI Cable 2.0 meter RJ45 to RJ45 cable, male to male connectors.	22-RJ45CBL-C20
Splitter Cable RJ45 one to two port splitter cable.	AK-U0-RJ45-SC1
Terminating Resistors 120 Ohm resistor embedded in an RJ45 connector (2 pieces).	AK-U0-RJ45-TR1
Terminal Block RJ45 two position terminal block (6 pieces) with two 120 Ohm terminating resistors (loose).	AK-U0-RJ45-TB2P
DSI External Communications Kit External mounting kit for 22-COMM Communication Adapters.	22-XCOMM-DC-BASE
External Comms Power Supply Optional 100…240V ac Power Supply for External DSI Communications Kit.	20-XCOMM-AC-PS1
BACnet® MS/TP RS485 Communication Adapter ‡	22-COMM-B
ControlNet™ Communication Adapter ‡	22-COMM-C
DeviceNet™ Communication Adapter ‡	22-COMM-D
EtherNet/IP™ Communication Adapter ‡	22-COMM-E
PROFIBUS™ DP Communication Adapter ‡	22-COMM-P
Compact I/O Module (3 Channel)	1769-SM2

‡ PowerFlex 4M drives require External DSI Communication Kits. Communication Adapters cannot be drive mounted.

ABB ACS150

- AC input/output chokes
- UL Type 1 kit
- External EMC filter for 1st / 2nd environment

Maintenance

PowerFlex 4M

- Industrial control equipment should be inspected periodically. Inspection intervals should be based on environmental/operating conditions, and adjusted as indicated by experience. An initial inspection within 3 to 4 months after installation is suggested.

ABB ACS150

- Cooling fan replacement
  - Very easy to replace
  - Every five years
- Capacitor reforming
  - Every two years when stored
- Available spare parts
  - Fan

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Standards

PowerFlex 4M

Approvals

- UL, CE, CSA, C-Tick

Compliance with

- EMC Directive 89/336

Applicable standards

- LV: EN 50178, EN 60204
- EMC: EN 61800-3, EN 50081-1, EN 50082-2

ABB ACS150

Approvals

- CE, UL, cUL, C-tick, GOST-R

Compliance with

- Low Voltage Directive 73/23/EEC with supplements
- Machinery Directive 98/37/EC
- EMC Directive 89/336/EEC with supplements
- Quality assurance system ISO 9001
- Environmental system ISO 14001
- RoHS directive 2002/95/EC with amandments

Applicable standards

- IEC/EN 61800-5-1 - Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
- IEC/EN 60204-1 (1997) - Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
- IEC/EN 60529: 1991 - Degrees of protection provided by enclosures (IP code)
- IEC/EN 61800-3 (2004)- EMC product standard including specific test methods
- UL 508C UL - Standard for Safety, Power Conversion Equipment

ABB strengths

ACS150 advantages over PowerFlex 4M

NEMA 1 option	Pulse train input
Switching frequency up to 16 kHz	Brake chopper in all units
Weight of all units	500 Hz max. output frequency
Areas of 400 V units	Application macros
Sideways mounting	High functionality software features
DIN rail mounting for all units	Cold configuration with FlashDrop
Sideways mounting	Clear maintenance instructions
Side-by-side up to +50°C	RoHS compliance

For ACS150 advantages in performance, see the performance test slides.

ACS150 Competitor comparison

Siemens SINAMICS G110

Mitsubishi FR-S 500

Allen Bradley PowerFlex 4

WEG CFW10

Hitachi X200

Lenze 8400 BaseLine

Main

Yaskawa VS Mini J7

Schneider Altivar 11

Lenze smd

Allen Bradley PowerFlex 4M

Yaskawa J1000

Summary Slide

Description

Hitachi X200

- The economic drive solution for applications up to 7.5 kW. X200 frequency inverters are suitable for pump and fan applications as well as for common tasks in machine construction.
- The standard "Safe Stop" function according to EN954-1 class 3 provides additional functionality and cost effectiveness. With the integrated EMC filter the inverter fullfills EN61800-3 standard and is complying with standards like CE, UL, cUL, c-Tick and RoHS.
- Applications
  pump and fan applications, common tasks in machine construction

ABB ACS150

- ACS150 is a component drive for the serial OEM business in basic machinery applications
- Integrated user interface
- Unpowered drive configuration in 2 s
- Straightforward installation and integration
- Fast availability and service
- Scalar control
- For power range 0.37 kW to 4.0 kW
- Applications
  - Fans, pumps, gate control, material handling, conveyors

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Protection class

Hitachi X200

- IP 20

ABB ACS150

- IP20 UL open (standard)
- NEMA 1 (option)

Ambient specification

Hitachi X200

Vibration

- 5.9 m/s2 10…55 Hz /

Shock

- na

Temperature

- -10 to +50 °C (carrier derating required for ambient temperature higher than 40 °C), no freezing

Humidity

- 20 … 90 % humidity (non condensing)

Altitude limitations

- altitude 1000 m or less

Acoustic noise

- 2.0kHz to 12kHz

ABB ACS150

Vibration

- Compliance with IEC 60721-3-3 (operation) and ISTA 1A (storage and transportation)

Shock

- Mechanical shocks are not allowed for the drive during operation
- Bump according to IEC 60068-2-29, 25g/1000pcs

Temperature

- Operating temperature -10 to +50 °C, minimum derate after 40 °C (1% per degree)
- Storage temperature –40 °C to +70°C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 0 to 1000m derate 1% per 100m

Acoustic noise

- 4…16 kHz

Mains connections

Hitachi X200

Voltage types and power range

- 1-phase 200 - 240 V +10 %, -15 %
  - 0.2 kW to 2.2 kW
- 3-phase 200 - 240V +10 %, -15 %
  - 0.2 kW to 2.2 kW
- 3-phase 380 - 480 V +10 %, -15 %
  - 0.4 kW to 7.5 kW

Power factor

- Optional reactor for improving power factor

Supply frequency

- 50/60 Hz ±5 %

Supply networks

- N/A

ABB ACS150

Voltage types and power range

- 1-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 380 - 480V +/-10%
  - 0.37 to 4 kW (0.5 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60Hz, tolerance ±5%

Supply networks

- Suitable for IT network. Drive operation in floating (IT) networks possible by disconnecting EMC filter.

DC bus connection

- Not available

Ratings 1-phase 200V

1-phase 200V		ABB		ACS150		Hitachi X200			ABB
P_N	P_N	ACS150	Hitachi X200	I_{2N}	I_{2N}	*Rated output current*		Hitachi X200	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-		A	A	A	A		
kW	hp	01X-		U_N=200-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,25	1/3								
0,37	0,5	2A4-2		2,4	2,2				R0
0,55	0,75		005SFEF			3,0			
0,75	1	04A7-2	007SFEF	4,7	4,2	4,0			R1
1,1	1,5	06A7-2	011SFEF	6,7	6,0	5,0			
1,5	2	07A5-2	015SFEF	7,5	6,8	7,1			R2
2,2	3	09A8-2	022SFEF	9,8	8,8	10,0			
3	4								

Hitachi X200

Overload ratings

- 150 % for 60 sec.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 200V

3-phase 200V		ABB		ACS150		Hitachi X200			ABB
P_N	P_N	ACS150	Hitachi X200	I_{2N}	I_{2N}	*Rated output current*		Hitachi X200	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-		A	A	A	A		
kW	hp	03X-		U_N=200-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	02A4-2		2,4	2,2				R0
0,55	0,75	03A5-2		3,5	3,2				
0,75	1	04A7-2	007NFU	4,7	4,2	4,0			R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2	015NFU	7,5	6,8	7,1			
2,2	3	09A8-2	022NFU	9,8	8,8	10,0			R2
3	4								
4	5								

Hitachi X200

Overload ratings

- 150 % for 60 sec.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 400V

3-phase 400V		ABB		ACS150		Hitachi X200			ABB
P_N	P_N	ACS150	Hitachi X200	I_{2N}	I_{2N}	*Rated output current*		Hitachi X200	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-		A	A	A	A		
kW	hp	03X-		U_N=380-480 V		U_N=380-480 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	01A2-4		1,2	1,1				R0
0,55	0,75	01A9-4		1,9	1,7				
0,75	1	02A4-4	007HFEF	2,4	2,2	3,3			R1
1,1	1,5	03A3-4		3,3	3,0				
1,5	2	04A1-4	015HFEF	4,1	3,7	5,0			
2,2	3	05A6-4	022HFEF	5,6	5,0	7,0			
3	4	07A3-4	030HFEF	7,3	6,6	10,0			
4	5	08A8-4	040HFEF	8,8	7,9	11,0			

Hitachi X200

Overload ratings

- 150 % for 60 sec.

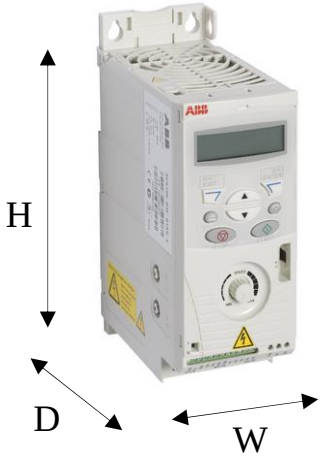
ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Dimensions 200 V 1-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Hitachi X200	ABB ACS150			Hitachi X200			Hitachi X200	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	01X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,25	1/3										
0,37	0,5	2A4-2		70	169	142					R0
0,55	0,75		005SFEF				110	176	126		
0,75	1	04A7-2	007SFEF	70	169	142	110	176	126		R1
1,1	1,5	06A7-2	011SFEF				110	189	155		
1,5	2	07A5-2	015SFEF	105			110	189	155		R2
2,2	3	09A8-2	022SFEF				110	189	155		
3	4										



Dimensions 200 V 1-phase: area, volume, weight

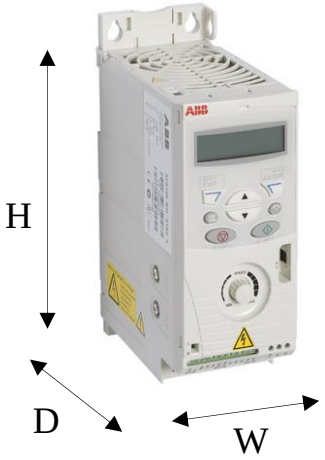
Dimensions 200 V		ABB ACS150	Hitachi X200	ABB ACS150			Hitachi X200			Hitachi X200	ABB ACS150
		Type	Type	1-phase			3-phase				
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	01X-	6SL3211-	area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,25	1/3										
0,37	0,5	2A4-2		118	1,7	1,1					R0
0,55	0,75		005SFEF				222	2	1,5		
0,75	1	04A7-2	007SFEF	118	1,7	1,3	222	2	1,5		R1
1,1	1,5	06A7-2	011SFEF				293	3	2,4		
1,5	2	07A5-2	015SFEF	177	2,5	1,5	293	3	2,4		R2
2,2	3	09A8-2	022SFEF				293	3	2,5		
3	4										

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Hitachi X200	ABB ACS150			Hitachi X200			Hitachi X200	ACS150
		Type	Type	3-phase			3-phase				
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2									R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	007NFU	70	169	142	110	176	126		R1
1,1	1,5	06A7-2									
1,5	2	07A5-2	015NFU				110	189	155		
2,2	3	09A8-2	022NFU	105			110	189	155		R2
3	4										
4	5										

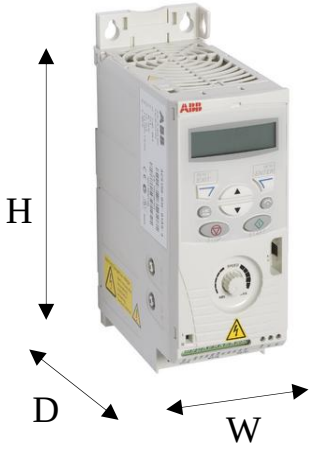


Dimensions 200 V 3-phase: area, volume, weight

Dimensions 200 V		ABB ACS150	Hitachi X200	ABB ACS150			Hitachi X200			Hitachi X200	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2				1,1					R0
0,55	0,75	03A5-2	007NFU								
0,75	1	04A7-2		118	1,7		222	2	1,5		R1
1,1	1,5	06A7-2	015NFU			1,3					
1,5	2	07A5-2	022NFU				293	3	2,4		
2,2	3	09A8-2		177	2,5	1,5	293	3	2,5		R2
3	4										
4	5										

Dimensions 400 V 3-phase: width, height, depth

Dimensions 400 V		ABB ACS150	Hitachi X200	ABB ACS150			Hitachi X200			Hitachi X200	ACS150
		Type	Type								
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4		70	169	142					R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	007HFEF				110	189	155		R1
1,1	1,5	03A3-4									
1,5	2	04A1-4	015HFEF				110	189	155		
2,2	3	05A6-4	022HFEF				110	189	155		
3	4	07A3-4	030HFEF				110	189	155		
4	5	08A8-4	040HFEF				110	189	155		



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: area, volume, weight

Dimensions 400 V		ABB ACS150	Hitachi X200	ABB ACS150			Hitachi X200			Hitachi X200	ABB ACS150
		Type	Type								
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4		118	1,7	1,1					R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	007HFEF			1,3	293	3	2,3		R1
1,1	1,5	03A3-4									
1,5	2	04A1-4	015HFEF				293	3	2,4		
2,2	3	05A6-4	022HFEF				293	3	2,4		
3	4	07A3-4	030HFEF				293	3	2,4		
4	5	08A8-4	040HFEF				293	3	2,4		

Sideways mounting

Side by side mounting up to 50°C

Installation

Hitachi X200

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	No
Flange	No
Wall (sideways)	No
Heatsinkless	Yes
Side-by-side	Yes (derating)

Free space requirements

Location	*mm*
Above	100
Below	100
Left and right	50

- Attached with screws
- Side-by-side mounting possible with derating
- Motor cable lengths
  - Shielded wire (screened cable) is required for motor wiring, and the length must be less than 5 meters.

ABB ACS150

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	80
Below	80
Left and right	0

- Installation with clamps and screws, cabinet support tools available
- Operational motor cable lengths:

Frame	Standard	With output chokes
R0	30 m	60 m
R1	50 m	100 m
R2	50 m	100 m

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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EMC and harmonics

Hitachi X200

- **Filters**
  - EN61800-3 category C1 filter (EU 200 V class)
  - EN61800-3 category C2 filter (EU 400 V class)
- **Chokes**
  - DC link choke as option
  - Output and input side AC reactor as option
- **Motor cable lengths**
  - Shielded wire (screened cable) is required for motor wiring, and the length must be less than 5 meters (EMC recommendations)
- **THD**
  - N/A

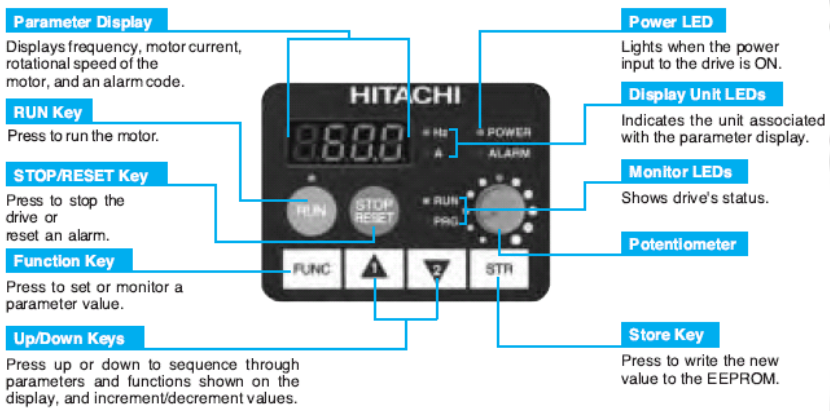
ABB ACS150

- **Filters**
  - Inbuilt EMC filter for category C3 (2nd environment) as standard
  - External EMC filter for categories C1, C2 (1st environment) and C3 (2nd environment) as option
- **Chokes**
  - AC input/output chokes as an option
- **EMC compliant motor cable lengths**
  - Category C3 30m (with 4 kHz switching frequency) as standard
  - With external EMC filter and 4 kHz switching frequency
    - 1~ 200 V: C1 10m, C2 and C3 100m (for 0.37 kW unit C1 10m, C2 45m and C3 75m)
    - 3~ 200 V: C2 and C3 30 m
    - 3~ 400 V: C1, C2 and C3 100 m
- **THD**
  - EN61000-3-2 with optional chokes

User interface

Hitachi X200

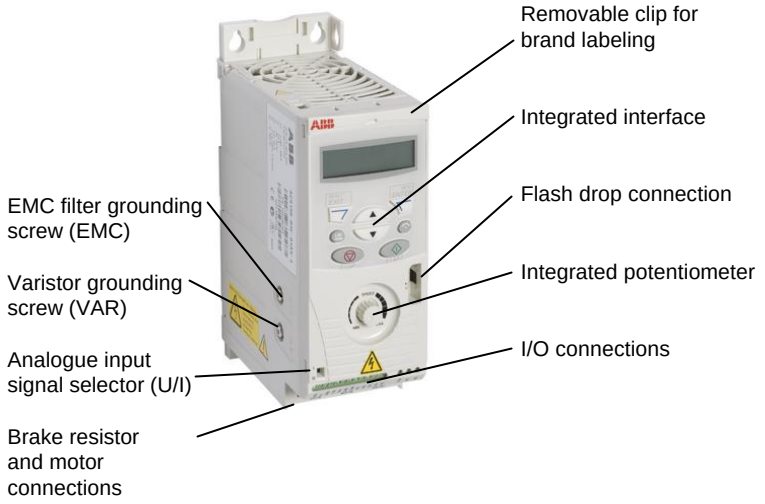
- The digital operator can also be detached and used for remote-control.



- Options: Remote operator, copy unit, cable for digital operator

ABB ACS150

- Integrated interface
- Integrated potentiometer
- FlashDrop connection



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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Machine interface

Hitachi X200

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	N/A	N/A
Relay outputs	3	Yes
Analog outputs	1	N/A

Specialities:

- RS485 interface with Modbus RTU on board
- Network options: Profibus, CanOpen

ABB ACS150

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	1 (i.e. digital input)	Yes
Relay outputs	1	Yes
Transistor outputs	1	Yes

Specialities:

- Pulse train input

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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100% * Phd for braking

500 Hz max. output frequency

Motor control

Hitachi X200

- V/f control, V/f variable (constant torque, reduced torque)

Braking

- DC braking
- Optional mechanical brake for some applications

Output frequency

- 0.5 … 400 Hz

ABB ACS150

- Scalar control

Braking

- Brake chopper available as standard
  - 100% * Phd for braking

Output frequency

- 500 Hz as maximum output frequency

Macros and language versions

Hitachi X200

- **Functions groups**
  - “D” Monitoring functions
  - “F” Main profile parameters
  - “A” Standard functions
  - “B” Fine tuning functions
  - “C” Intelligent terminal functions
  - “H” Motor constant functions
  - “P” DeviceNet functions
  - “E” Error codes
- **Languages**
  - N/A

ABB ACS150

- **Macros**
  - ABB Standard
  - 3-wire
  - Alternate
  - Motor Potentiometer
  - Hand/auto
- **Languages**
  - N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Software features

Hitachi X200

- Pure analog monitor output
- Low load detection
- External thermistor terminal (PYC)
- Cooling-fan on/off
- Instantaneous power failure recovery
- Second motor setting
- 3-wire control
- Analog input selection
- Second acceleration/deceleration setting
- Jogging
- Auto-carrier frequency reduction
- Unattended start protection (USP)
- Analog input wire-break detection

(* = Basic feature in ABB ACS150

ABB ACS150

- FlashDrop
- Pulse train input
- Changed parameter menu
- Emergency stop
- Jog function
- Fault Group (Group 4)
- Hardware protection against miss wiring in I/O and supply
- Zero speed delay
- Flux Optimization
- Switching frequency control
- 7 preset speeds
- Application macros
- Flying start
- Critical frequency lock-out
- Max. Freq. 500 Hz

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Other advanced features

Hitachi X200

- Remote operator
- Copy unit
- Cable for digital operator
- Reactor for improving power factor
- Noise filter
- ProDrive Software

ABB ACS150

FlashDrop

- Option tool for fast and safe selecting and setting drive parameters without power
- Palm-size 153x53x71mm and light weight 0.4 kg
- Portable and battery chargable
- Keypad with LCD display
- Includes Drive PM (Drive parameter manager) software for PC to create, edit and copy parameter sets for FlashDrop
- Help function available
- Possibility to store 20 user specified parameter macros
- Parameter hiding, Parameter upload and download, Cold drive and Damaged drive parameterization
- Compatible also with ACS150, ACS550 and ACH550 drives

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

PC connectivity and tools

Hitachi X200

- ProDrive Software

ABB ACS150

- N/A

Hardware options

Hitachi X200

- Remote operator
- Copy unit
- Cable for digital operator
- Reactor for improving power factor
- Noise filter

ABB ACS150

- AC input/output chokes
- UL Type 1 kit
- External EMC filter for 1st / 2nd environment

Maintenance

Hitachi X200

- Monthly and yearly inspection chart
- Capacitor Life Curves
- Available spare parts
  - Fan
  - Case

ABB ACS150

- Cooling fan replacement
  - Very easy to replace
  - Every five years
- Capacitor reforming
  - Every two years when stored

- Available spare parts
  - Fan



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Standards

Hitachi X200

Approvals

- CE, UL, cUL, c-Tick and RoHS

Compliance with

- European Low Voltage Directive
- EMC directive (89/336/EEC)

Applicable standards

- EN61800-3
- EN954-1 class 3

ABB ACS150

Approvals

- CE, UL, cUL, C-tick, GOST-R

Compliance with

- Low Voltage Directive 73/23/EEC with supplements
- Machinery Directive 98/37/EC
- EMC Directive 89/336/EEC with supplements
- Quality assurance system ISO 9001
- Environmental system ISO 14001
- RoHS directive 2002/95/EC with amandments

Applicable standards

- IEC/EN 61800-5-1 - Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
- IEC/EN 60204-1 (1997) - Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
- IEC/EN 60529: 1991 - Degrees of protection provided by enclosures (IP code)
- IEC/EN 61800-3 (2004)- EMC product standard including specific test methods
- UL 508C UL - Standard for Safety, Power Conversion Equipment

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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ABB strengths

ACS150 advantages over Hitachi X200

NEMA1 options	500 Hz max. output frequency
Sideways mounting	Application macros
Side by side mounting up to 50°C	High functionality software features
EN61000-3-2 with opt. chokes	
Pulse train input	Cold configuration with FlashDrop
100% * Phd for braking	Easy maintenance

For ACS150 advantages in performance, see the performance test slides

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

ACS150 Competitor comparison

Siemens SINAMICS G110

Mitsubishi FR-S 500

Allen Bradley PowerFlex 4

WEG CFW10

Hitachi X200

Lenze 8400 BaseLine

Main

Yaskawa VS Mini J7

Schneider Altivar 11

Lenze smd

Allen Bradley PowerFlex 4M

Yaskawa J1000

Summary Slide

Description

Yaskawa J1000

- Ultra small body and side-by-side installation helps you to design and set up a more compact control panel.
- Easily setup parameter and get the application running immediately. The verify function makes it easy to check those parameters changed from their default values.
- The standard products are compliant with RoHS (EU's Restriction of Hazardous Substances). Adopts the Swing PWM method that suppresses the electromagnetic noise to eliminate harsh noise
- Applications
  - Compact fan, Compact pumps including Feed and Hydraulic Pumps, Compact Transport Equipment including the Conveyor, Auto Shutter/Automatic Door, Food & Beverage Machinery, Agricultural Machinery, Health Equipment, Compact Elevating Device, Rotator Machine including the Agitator, Centrifuge, and Polishing Machine .

ABB ACS150

- ACS150 is a component drive for the serial OEM business in basic machinery applications
- Integrated user interface
- Unpowered drive configuration in 2 s
- Straightforward installation and integration
- Fast availability and service
- Scalar control
- For power range 0.37 kW to 4.0 kW
- Applications
  - Fans, pumps, gate control, material handling, conveyors

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Protection class

Yaskawa J1000

- IP20 open-chassis
- NEMA Type 1 enclosure (option)

ABB ACS150

- IP20 UL open (standard)
- NEMA 1 (option)

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Ambient specification

Yaskawa J1000

Vibration

- na

Shock

- 10 to less than 20 Hz (9.8 m/s2) max., 20 to 55 Hz (5.9 m/s2) max.

Temperature

- −10°C to +50°C (open chassis), −10°C to +40°C (NEMA Type 1)
- Storage temperature −20°C to +60°C (short-term temperature during transportation)

Humidity

- 95 RH% or less (no condensation)

Altitude limitations

- Up to 1000 meters

Acoustic noise

- Carrier Frequency 2 kHz (user-set, up to 15 kHz possible).
- J1000 uses Yaskawa's Swing PWM function to suppress electromagnetic and audible motor noise

ABB ACS150

Vibration

- Compliance with IEC 60721-3-3 (operation) and ISTA 1A (storage and transportation)

Shock

- Mechanical shocks are not allowed for the drive during operation
- Bump according to IEC 60068-2-29, 25g/1000pcs

Temperature

- Operating temperature -10 to +50 °C, minimum derate after 40 °C (1% per degree)
- Storage temperature –40 °C to +70°C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 0 to 1000m derate 1% per 100m

Acoustic noise

- 4…16 kHz

Mains connections

Yaskawa J1000

Voltage types and power range

- 1-Phase 100 V class (available soon)
  - 0.1 to 1.1 kW
- 1-phase 200 to 240 V
  - 0.1 to 2.2 kW
- 3-phase 200 to 240 V
  - 0.1 to 5.5 kW
- 3-phase 380 to 480 V
  - 0.2 to 5.5 kW

Power factor

- N/A

Supply frequency

- 50/60 Hz

Supply networks

- N/A

ABB ACS150

Voltage types and power range

- 1-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 380 - 480V +/-10%
  - 0.37 to 4 kW (0.5 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60Hz, tolerance ±5%

Supply networks

- Suitable for IT network. Drive operation in floating (IT) networks possible by disconnecting EMC filter.

DC bus connection

- Not available

Ratings 1-phase 200V

1-phase 200V		ABB	Yaskawa	ACS150		Yaskawa J1000		Yaskawa	ABB
P_N	P_N	ACS150	J1000	I_{2N}	I_{2N}	*Rated output current*		J1000	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	CIMR-JABA	A	A	A	A		
kW	hp	01X-	normal duty	U_N=200-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,25	1/3								
0,37	0,5	2A4-2		2,4	2,2				R0
0,55	0,75								
0,75	1	04A7-2	0003	4,7	4,2	3,5	3,5	1	R1
1,1	1,5	06A7-2	0006	6,7	6,0	6,0	6,0	2	
1,5	2	07A5-2		7,5	6,8				R2
2,2	3	09A8-2	0010	9,8	8,8	9,6	9,6	2	
3	4								

Yaskawa J1000

Overload ratings

- Normal duty rating: 120% of rated output current for 60 s.
- Heavy duty rating: 150% of rated output current for 60 s.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 200V

3-phase 200V		ABB	Yaskawa	ACS150		Yaskawa J1000		Yaskawa	ABB
P_N	P_N	ACS150	J1000	I_{2N}	I_{2N}	*Rated output current*		J1000	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	CIMR-JA2A	A	A	A	A		
kW	hp	03X-	normal duty	U_N=200-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	02A4-2		2,4	2,2				R0
0,55	0,75	03A5-2		3,5	3,2				
0,75	1	04A7-2	0004	4,7	4,2	3,5	3,5	1	R1
1,1	1,5	06A7-2	0006	6,7	6,0	6,0	6,0	1	
1,5	2	07A5-2	0008	7,5	6,8	8,0	8,0	2	
2,2	3	09A8-2	0010	9,8	8,8	9,6	9,6	2	R2
3	4								
4	5								

Yaskawa J1000

Overload ratings

- Normal duty rating: 120% of rated output current for 60 s.
- Heavy duty rating: 150% of rated output current for 60 s.

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 400V

3-phase 400V		ABB	Yaskawa	ACS150		Yaskawa J1000		Yaskawa	ABB
P_N	P_N	ACS150	J1000	I_{2N}	I_{2N}	*Rated output current*		J1000	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-	CIMR-JA4A	A	A	A	A		
kW	hp	03X-	normal duty	U_N=380-480 V		U_N=380-480 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	01A2-4		1,2	1,1				R0
0,55	0,75	01A9-4		1,9	1,7				
0,75	1	02A4-4	0002	2,4	2,2	2,1	2,1	2	R1
1,1	1,5	03A3-4		3,3	3,0				
1,5	2	04A1-4	0004	4,1	3,7	4,1	4,1	2	
2,2	3	05A6-4	0005	5,6	5,0	5,4	5,4	2	
3	4	07A3-4	0007	7,3	6,6	6,9	6,9	2	
4	5	08A8-4		8,8	7,9				

Yaskawa J1000

Overload ratings

- Normal duty rating: 120% of rated output current for 60 s.
- Heavy duty rating: 150% of rated output current for 60 s.

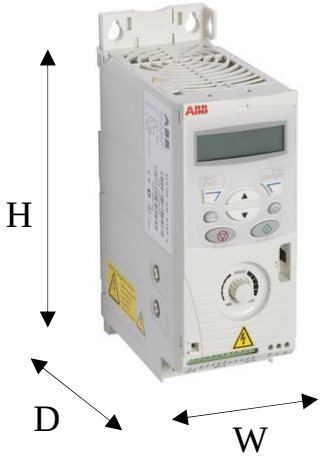
ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Dimensions 200 V 1-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Yaskawa J1000	ABB ACS150			Yaskawa J1000			Yaskawa J1000	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-	CIMR-JABA	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	01X-	normal duty	W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,25	1/3										
0,37	0,5	2A4-2		70	169	142					R0
0,55	0,75										
0,75	1	04A7-2	0003	70	169	142	68	128	78	1	R1
1,1	1,5	06A7-2	0006				108	128	129	2	
1,5	2	07A5-2		105							R2
2,2	3	09A8-2	0010							2	
3	4										



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 1-phase: area, volume, weight

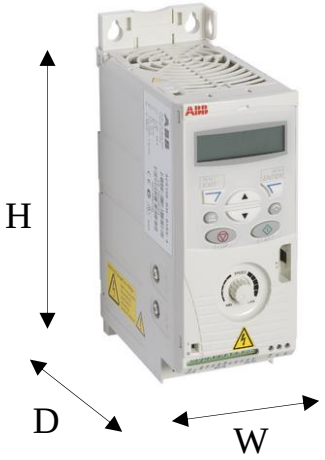
Dimensions 200 V		ABB ACS150	Yaskawa J1000	ABB ACS150			Yaskawa J1000			Yaskawa J1000	ABB ACS150
		Type	Type	1-phase			3-phase				
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	01X-	6SL3211-	area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,25	1/3										
0,37	0,5	2A4-2		118	1,7	1,1					R0
0,55	0,75										
0,75	1	04A7-2	0003	118	1,7	1,3	87	0,7	1,0	1	R1
1,1	1,5	06A7-2	0006				138	1,8	1,7	2	
1,5	2	07A5-2		177	2,5	1,5					R2
2,2	3	09A8-2	0010						1,8	2	
3	4										

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Yaskawa J1000	ABB ACS150			Yaskawa J1000			Yaskawa J1000	ACS150
		Type	Type	3-phase			3-phase				
		ACS150-	CIMR-JA2A	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-	normal duty	W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2		70	169	142					R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	0004				68	128	78	1	R1
1,1	1,5	06A7-2	0006							1	
1,5	2	07A5-2	0008				108	128	129	2	
2,2	3	09A8-2	0010	105						2	R2
3	4										
4	5										



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

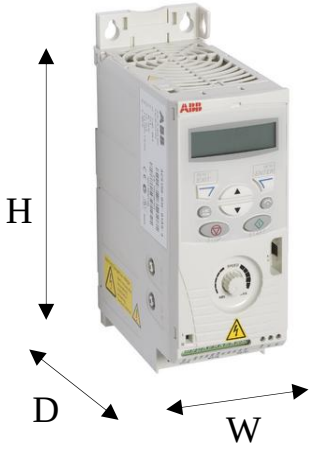
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: area, volume, weight

Dimensions 200 V		ABB ACS150	Yaskawa J1000	ABB ACS150			Yaskawa J1000			Yaskawa J1000	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2				1,1					R0
0,55	0,75	03A5-2									
0,75	1	04A7-2	0004	118	1,7		87	1	0,9	1	R1
1,1	1,5	06A7-2	0006			1,3			1,1	1	
1,5	2	07A5-2	0008				138	1,8	1,7	2	
2,2	3	09A8-2	0010	177	2,5	1,5			1,7	2	R2
3	4										
4	5										

Dimensions 400 V 3-phase: width, height, depth

Dimensions 400 V		ABB ACS150	Yaskawa J1000	ABB ACS150			Yaskawa J1000			Yaskawa J1000	ACS150
		Type	Type								
		ACS150-	CIMR-JA4A	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-	normal duty	W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4		70	169	142					R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	0002				108	128	129	2	R1
1,1	1,5	03A3-4									
1,5	2	04A1-4	0004							2	
2,2	3	05A6-4	0005							2	
3	4	07A3-4	0007							2	
4	5	08A8-4									



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: area, volume, weight

Dimensions 400 V		ABB ACS150	Yaskawa J1000	ABB ACS150			Yaskawa J1000			Yaskawa J1000	ABB ACS150
		Type	Type								
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4				1,1					R0
0,55	0,75	01A9-4									
0,75	1	02A4-4	0002						1,2	2	
1,1	1,5	03A3-4		118	1,7		138	1,8			
1,5	2	04A1-4	0004			1,3			1,7	2	R1
2,2	3	05A6-4	0005						1,7	2	
3	4	07A3-4	0007						1,7	2	
4	5	08A8-4									

Sideways mounting

Side by side mounting up to 50°C

Installation

Yaskawa J1000

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	No
Heatsinkless	Yes
Side-by-side	Yes, 2 mm gap (30 mm gap to wall)

Free space requirements

Location	*mm*
Above	100
Below	100
Left and right	2

- Motor cable lengths
  - Max. 50 m (max. 15 kHz))
  - Max. 100 m (max. 5 kHz)
  - Min. 100 m (max 2 kHz)

ABB ACS150

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	80
Below	80
Left and right	0

- Installation with clamps and screws, cabinet support tools available
- Operational motor cable lengths:

Frame	Standard	With output chokes
R0	30 m	60 m
R1	50 m	100 m
R2	50 m	100 m

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

EMC and harmonics

Yaskawa J1000

- **Filters**
  - Built-in EMC filter (option)
    - Available with a noise filter to meet European standards
  - Input side capacitor-type noise filter option
  - Input noise filter option
  - Output noise filter option
- **Chokes**
  - DC choke (option)
- **Motor cable lengths**
  - na
- **THD**
  - N/A

ABB ACS150

- **Filters**
  - Inbuilt EMC filter for category C3 (2nd environment) as standard
  - External EMC filter for categories C1, C2 (1st environment) and C3 (2nd environment) as option
- **Chokes**
  - AC input/output chokes as an option
- **EMC compliant motor cable lengths**
  - Category C3 30m (with 4 kHz switching frequency) as standard
  - With external EMC filter and 4 kHz switching frequency
    - 1~ 200 V: C1 10m, C2 and C3 100m (for 0.37 kW unit C1 10m, C2 45m and C3 75m)
    - 3~ 200 V: C2 and C3 30 m
    - 3~ 400 V: C1, C2 and C3 100 m
- **THD**
  - EN61000-3-2 with optional chokes

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

User interface

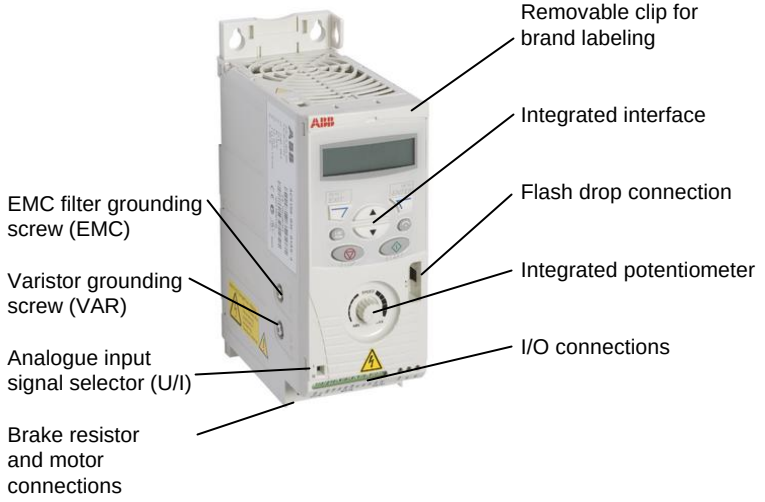
Yaskawa J1000

- LED operator option

- Potentiometer option unit

ABB ACS150

- Integrated interface
- Integrated potentiometer
- FlashDrop connection



Machine interface

Yaskawa J1000

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	3	Yes
Pulse train input	-	-
Digital outputs	2	Yes
Analog outputs	3	Yes

ABB ACS150

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	1 (i.e. digital input)	Yes
Relay outputs	1	Yes
Transistor outputs	1	Yes

Specialities:

- Pulse train input

Protocol	*Standard/ Optional*	*Baud rate*	*Notes*
MEMOBUS/Modbus Communications	Option		

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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100% * Phd for braking

500 Hz max. output frequency

Motor control

Yaskawa J1000

- V/f Control

Braking

- Braking Resistor, Braking Resistor Unit option

Output frequency

- Max. 400 Hz (user-set)

ABB ACS150

- Scalar control

Braking

- Brake chopper available as standard
  - 100% * Phd for braking

Output frequency

- 500 Hz as maximum output frequency

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Macros and language versions

Yaskawa J1000

- N/A

ABB ACS150

- **Macros**
  - ABB Standard
  - 3-wire
  - Alternate
  - Motor Potentiometer
  - Hand/auto
- **Languages**
  - N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Software features

Yaskawa J1000

- DC Injection braking at start
- Speed search
- Switch between accel/decel times
- S-Curve time
- Stopping method selection
- Run command selection
- Speed reference selection
- Multi-function Input
- Multi-function output
- Frequency reference upper/lower limits
- Multi-step speed
- Frequency jump
- Frequency reference hold
- Local/ remote

(* = Basic feature in ABB ACS150

ABB ACS150

- FlashDrop
- Pulse train input
- Changed parameter menu
- Emergency stop
- Jog function
- Fault Group (Group 4)
- Hardware protection against miss wiring in I/O and supply
- Zero speed delay
- Flux Optimization
- Switching frequency control
- 7 preset speeds
- Application macros
- Flying start
- Critical frequency lock-out
- Max. Freq. 500 Hz

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Other advanced features

Yaskawa J1000

- Yaskawa's USB copy unit is available for applications with multiple drives requiring the same parameter settings. Use the copy unit to load parameters from the drive at the factory and edit them later on a PC. Useful for backing up parameter settings and easier than carrying around a laptop.

ABB ACS150

FlashDrop

- Option tool for fast and safe selecting and setting drive parameters without power
- Palm-size 153x53x71mm and light weight 0.4 kg
- Portable and battery chargable
- Keypad with LCD display
- Includes Drive PM (Drive parameter manager) software for PC to create, edit and copy parameter sets for FlashDrop
- Help function available
- Possibility to store 20 user specified parameter macros
- Parameter hiding, Parameter upload and download, Cold drive and Damaged drive parameterization
- Compatible also with ACS150, ACS550 and ACH550 drives

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

PC connectivity and tools

Yaskawa J1000

- DriveWizard Plus makes it possible to operate the drive and perform maintenance using a PC. Edit parameters, access all monitors, create customized operation sequences, and observe drive performance with the oscilloscope function.

ABB ACS150

- N/A

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Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Hardware options

Yaskawa J1000

- Circuit breaker
- Ground fault interruptor
- Magnetic contactor
- Surge protector
- DC reactor
- AC reactor
- Zero phase reactor
- Fuse / fuse holder
- Capacitor-type noise filter
- Input noise filter
- Output noise filter
- Isolator
- Braking resistor
- Braking resistor unit
- Potentiometer option unit
- RS-232C interface
- USB copy unit
- Remote LED operator
- Support tools cable
- Remote interface extension cable
- RS-422/485 MEMOBUS interface
- Frequency meter, current meter
- Frequency setting potentiometer (2 kΩ)
- Frequency meter scaling resistor (20 kΩ)
- Frequency reference setting potentiometer
- Output voltage meter
- NEMA 1 kit
- Attachment for external heatsink
- DIN rail attachment

ABB ACS150

- AC input/output chokes
- UL Type 1 kit
- External EMC filter for 1st / 2nd environment

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Maintenance

Yaskawa J1000

- Yaskawa drives have a built-in maintenance timer that keeps track of component performance, including capacitors, softcharge circuitry, IGBTs, and the cooling fan. This ensures maximum performance life of the drive.
- The cooling fan is also designed for quick replacement: both detachable and easily accessible from the top of the drive.

ABB ACS150

- Cooling fan replacement
  - Very easy to replace
  - Every five years
- Capacitor reforming
  - Every two years when stored
- Available spare parts
  - Fan

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Standards

Yaskawa J1000

Approvals

- CE, cUL, RoHS

Compliance with

- ISO9001
- ISO14001
- JQA-0422 (quality system)
- JQA-EM0498 (environmental system)

Applicable standards

- UL508C (safety standard)

ABB ACS150

Approvals

- CE, UL, cUL, C-tick, GOST-R

Compliance with

- Low Voltage Directive 73/23/EEC with supplements
- Machinery Directive 98/37/EC
- EMC Directive 89/336/EEC with supplements
- Quality assurance system ISO 9001
- Environmental system ISO 14001
- RoHS directive 2002/95/EC with amandments

Applicable standards

- IEC/EN 61800-5-1 - Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
- IEC/EN 60204-1 (1997) - Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
- IEC/EN 60529: 1991 - Degrees of protection provided by enclosures (IP code)
- IEC/EN 61800-3 (2004)- EMC product standard including specific test methods
- UL 508C UL - Standard for Safety, Power Conversion Equipment

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Performance analysis – Autodyne description

Test stand is used to characterize 2,2kW (3hp) heavy duty rated LVAC drives and allow ABB to compare accurate repeatable data against ABB's baseline products (ACS150, ACS350, ACS550 and ACS800). The mechanical portion of the dynamometer consists of a 2,2kW (3hp) 1755 rpm 230VAC/460VAC vector duty motor with encoder (spinner motor) which is connected to the output of the drive under test (DUT). The spinner motor is connected through a in-line torque transducer to a 10 hp 1750 RPM DC motor with encoder. Actual torque and speed information is fed to the dynamometer controller which is run by an IBM desktop computer and flat screen monitor using a Windows™ based proprietary software program controlling electrical power supplied to the DUT and from the DUT to the spinner motor.

Essentially, tests are conducted "out of the box". However, an ID run and a speed regulator autotune are performed, if the drive is so equipped. All drives are tested in sensorless vector mode of operation.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Tested units in performance analysis

Yaskawa J1000

Model: CIMR-JA4A007BAA

Drive rating: 380-480V
3,0 kW
6,9 A

Tester (experienced drive specialist) comments:

- Ground wires extremely difficult to land stranded wire. Must use a ring lung. Location of ground screws requires removal of conduit plate.
- Drive was not easy to mount because of not using keyholes.
- Sink/source switch on control board extremely small and hard to see switch position. Must use a flashlight to provide enough light to see switch position. Switches throw very small and hard to tell if it's in the correct position.
- Control terminal screws very small.
- Brochure and ad indicates side-by-side mounting. User Manual indicates that side clearance for single drive is 30mm. For multiple drives side clearance required is 2 mm but de-rating must be taken be considered.
- No quick start parameter access
- Operator Panel uses Five 7 segment LED's along with Run/Stop button, Loc/Rem button, UP/Down arrow buttons, Enter, Escape and Reset and is fairly easy to use once you understand the parameter structure.
- Drive is V/Hz only.

ABB ACS150

Model: ACS150-03X-07A3-4

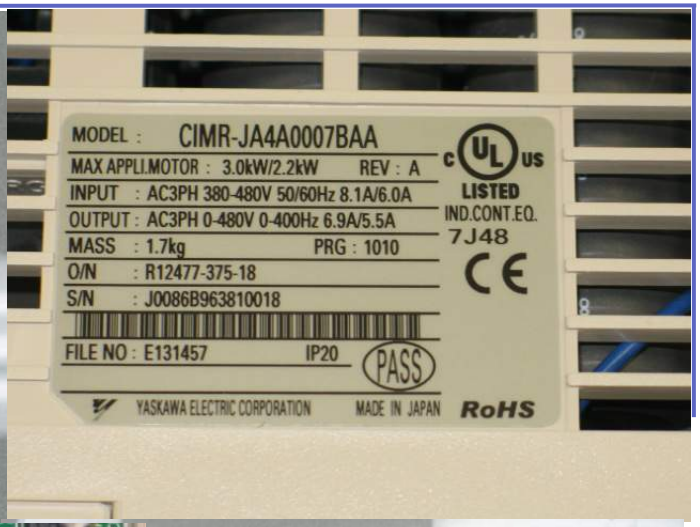
Drive rating: 380-480V
3,0 kW / 4 Hp
7,3 A

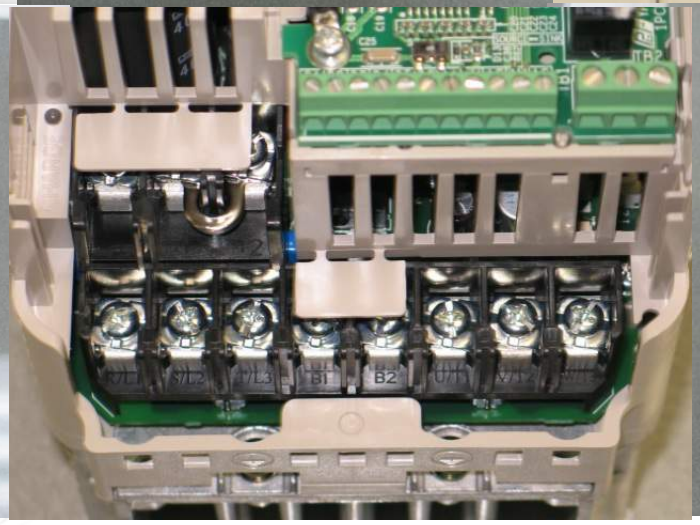
Parameter Settings:

9902 ABB Standard
9905 230V
9906 4.2A
9907 60Hz
9908 1750 RPM
9909 3.0 HP
2101 Torque Boost
2201 Not Selected
2202 1.0 Second
2203 1.0 Second

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Photos of the tested unit



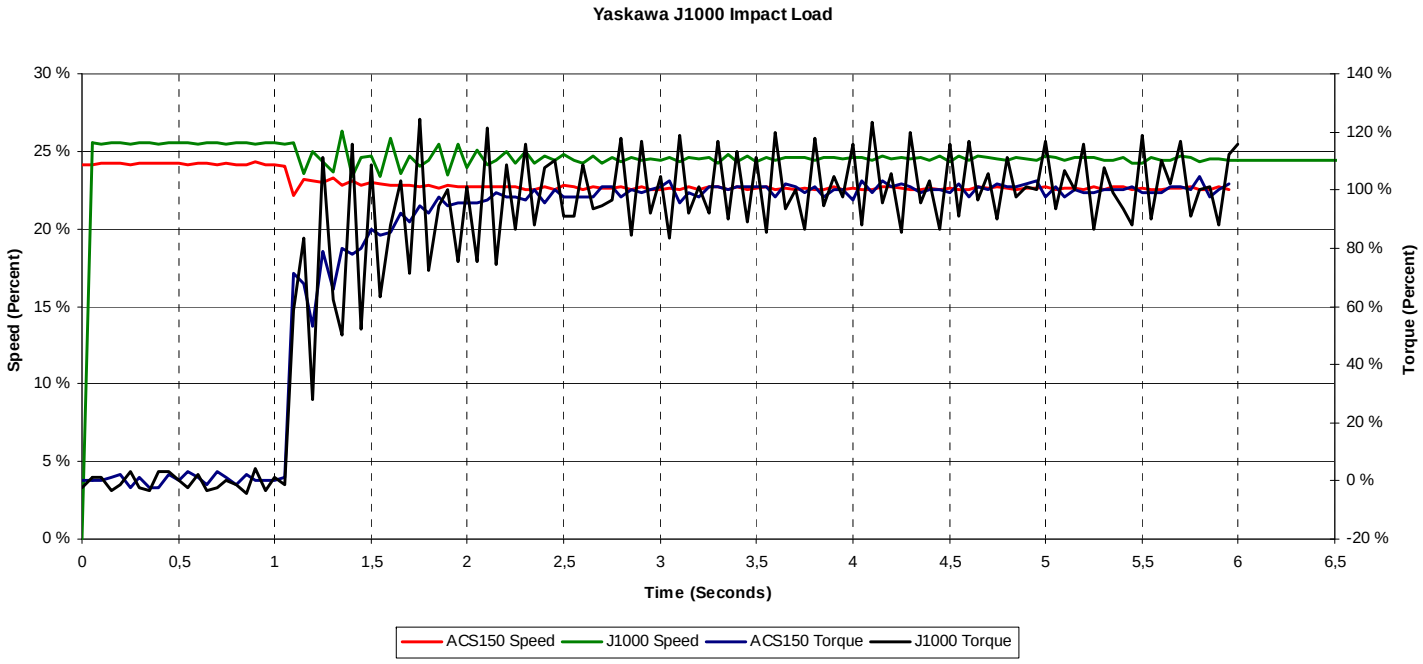


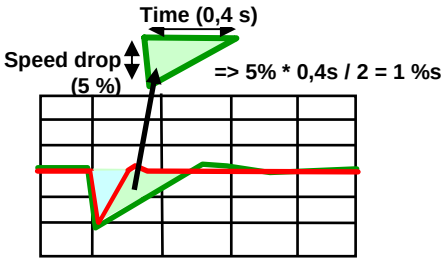
Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Impact load test – Dynamic speed accuracy (stiffness)

Motor is operated at 25% rated speed and 100% load is applied. Speed and torque are measured over time. Dynamic speed error (stiffness) is speed drop (% of nominal speed) times time of recovery (s) divided by 2. The 25% speed reference data is plotted as this is worst case test for the speed regulator evaluation.





Dynamic speed error depends on speed controller tuning. The smaller the stiffness %s figure the better the drive works in case of disturbances. The ACS150 speed control default tuning is quite conservative to ensure that the controller is stable despite the motor used and its size compared to size of the inverter. J1000 has good dynamic speed accuracy despite the torque ripple.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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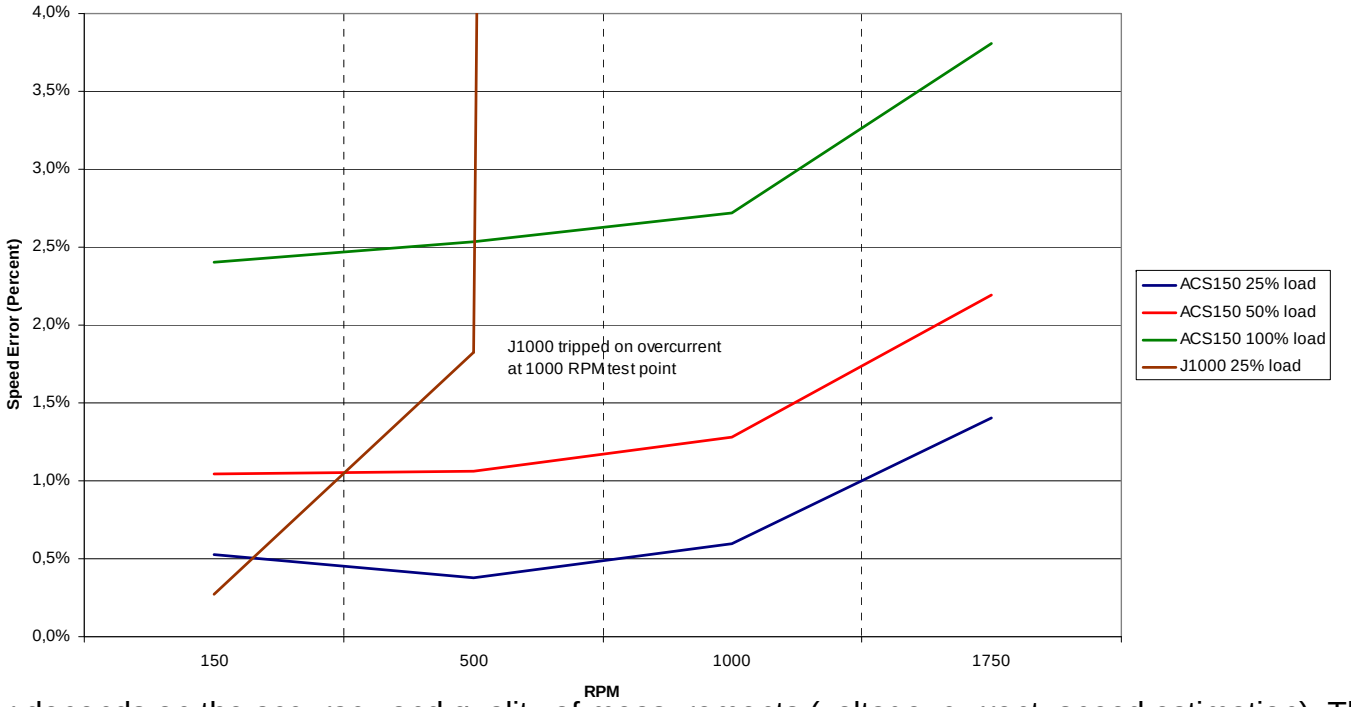
Static speed accuracy

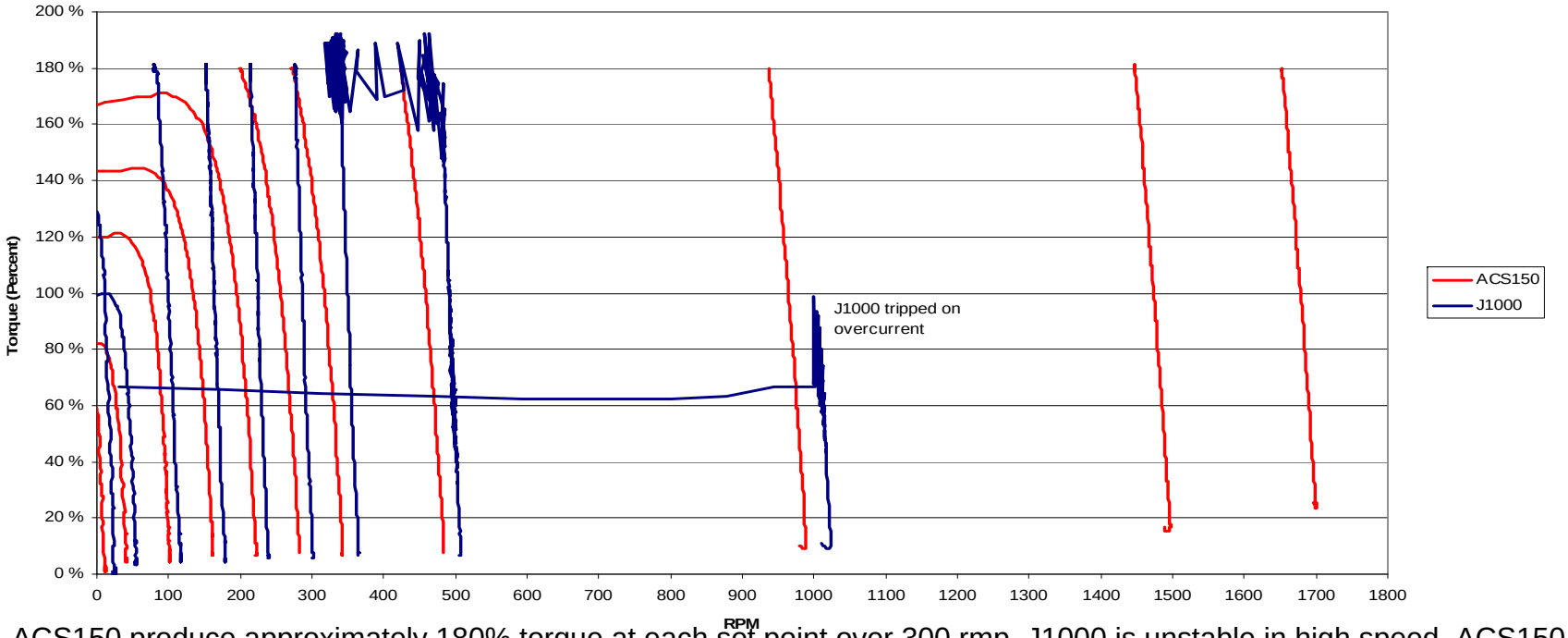
Drive is given speed references of 150, 500, 1000 and 1750 rpm's and loads of 25%, 50% and 100%. The speed error in static situation (constant load and speed) is calculated as a ratio of the average speed error compared to motor nominal speed (1755 rpm), Speed Error [%] = $(n^*-n_{act}) / n_{N(mot)}$. Speed (control) accuracy is essential feature for high quality motor control.



Static speed error depends on the accuracy and quality of measurements (voltage, current, speed estimation). The smaller the error figure and difference between figures at partial and full load points, the better the drive works in applications where good static accuracy is needed (e.g. extruders). J1000 static speed error rises at loading and trimmed on over current?

Maximum torque as a function of speed

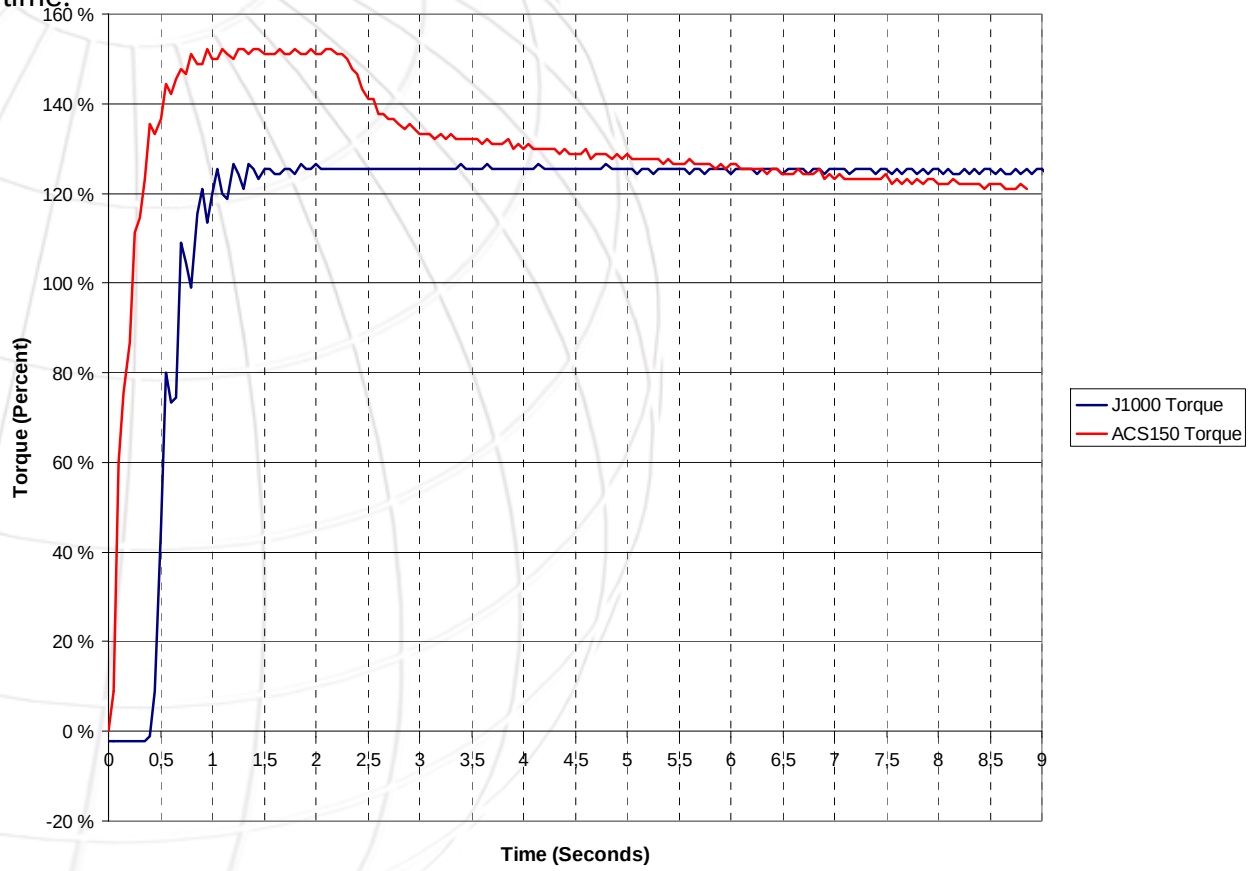
Drive is given speed reference of 30, 60, 120, 180, 240, 300, 360, 500, 1000, 1500 and 1700 rpm's. Load is gradually increased to 180% for 2 seconds, or until the motor stalls. The test describes the drive's speed range. The speed range is defined as the minimum speed the motor can operate from a given base speed and still generate 100% torque.



ACS150 produce approximately 180% torque at each set point over 300 rmp. J1000 is unstable in high speed. ACS150 is stable but torque is limited below 300 rmp. J1000 can maintain 180% torque at 120 to 360 rmp.

Maximum starting torque

Motor output shaft is locked. Drive is given run command and 1000 rpm speed reference. Torque is measured with respect to time.

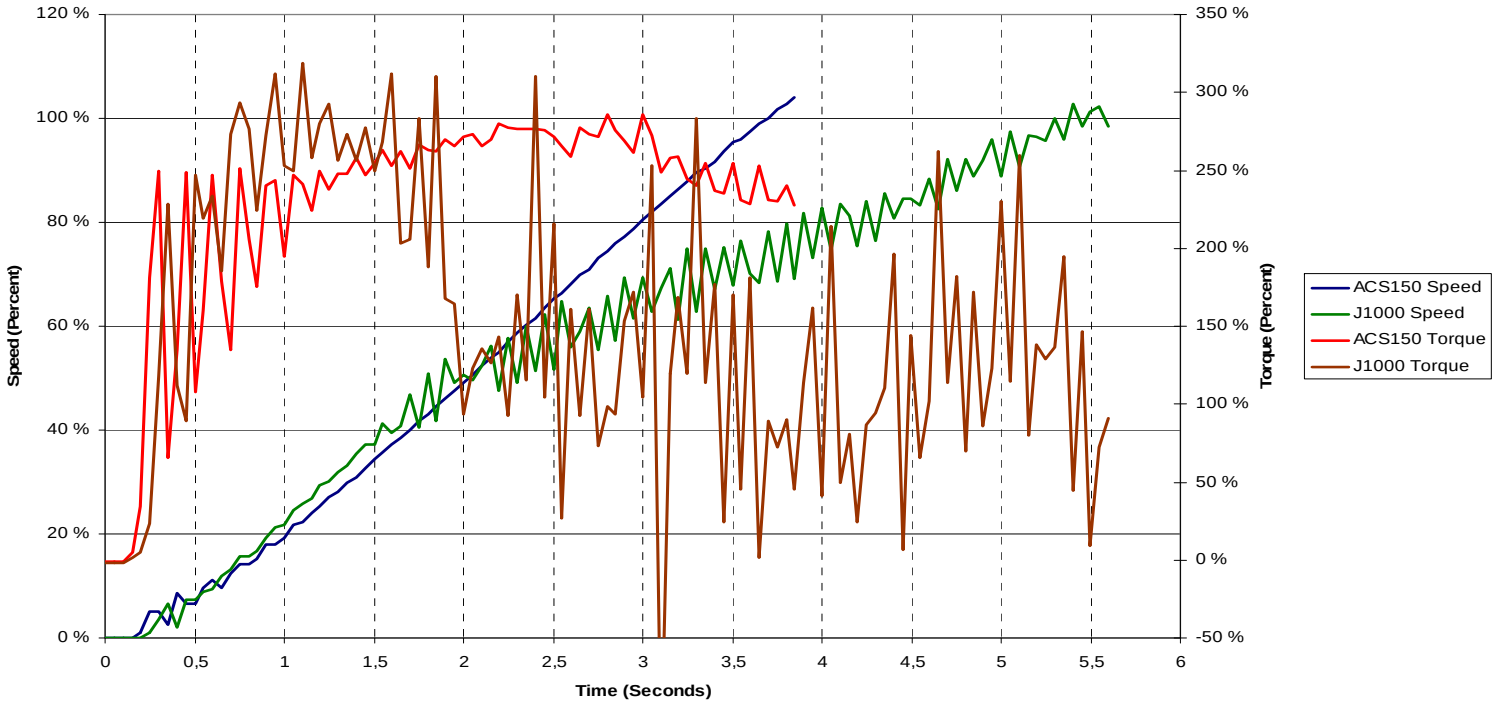


Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Fast acceleration into inertia

Drive is given run command and zero speed reference. Dynamometer inertia simulation program places 22.5 lb-ft^2 (0.95 kgm^2) inertia on motor shaft and then drive is given 100% speed reference. Speed and torque are measured over time as drive accelerates motor into inertia. Drive acceleration rate is set to 1 second.



J1000 torque is dropping after 2 s including ripple in speed and torque. Acceleration time is increased to 5.5 s.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

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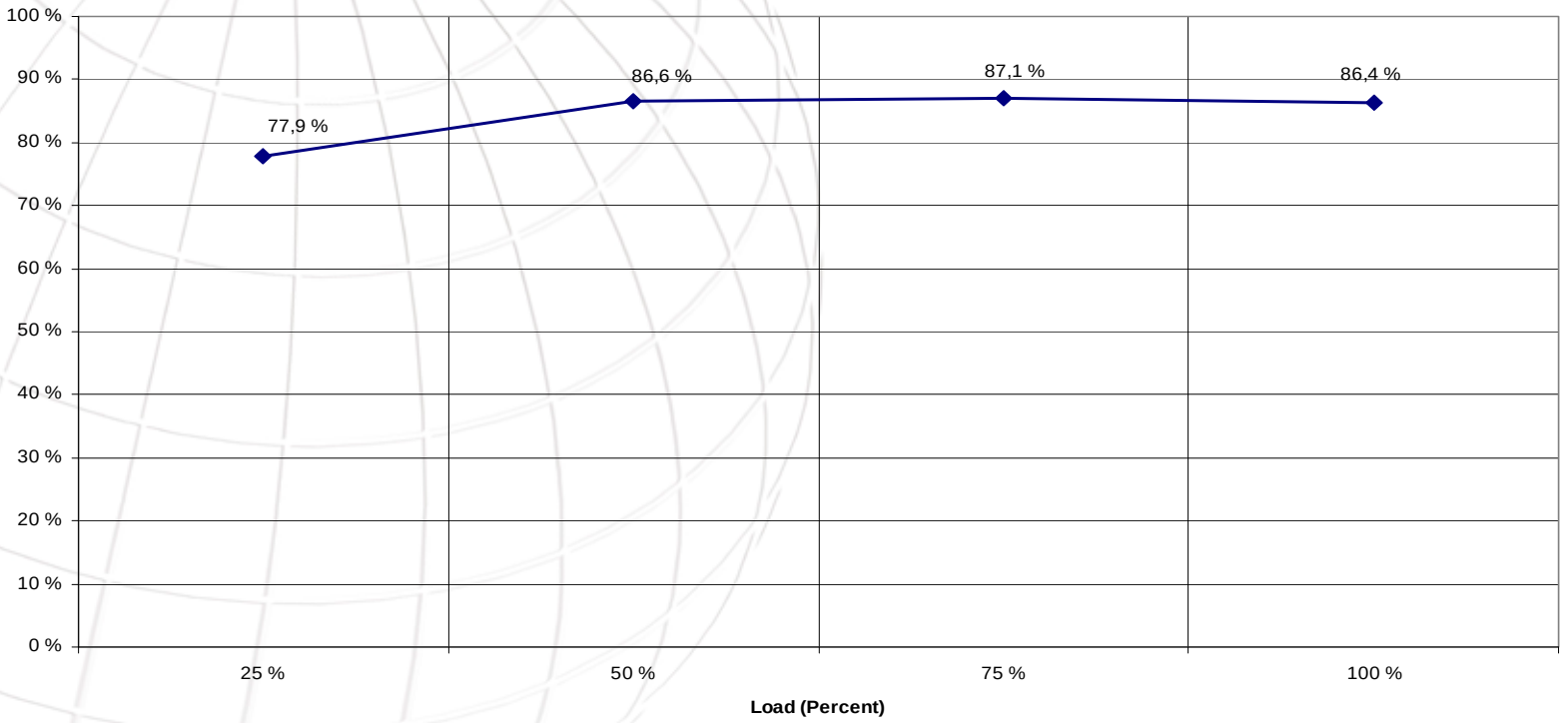
Efficiency

Using power analyzer, input power, speed and torque of AC motor are measured at 25%, 50%, 75% and 100% rated motor load. Since the comparison is made by using the same motor at the same operation point the figures reflect the efficiency of the inverter and the additional losses caused in the motor due to the inverter operation. The difference in total efficiency may be remarkable in total energy consumption.



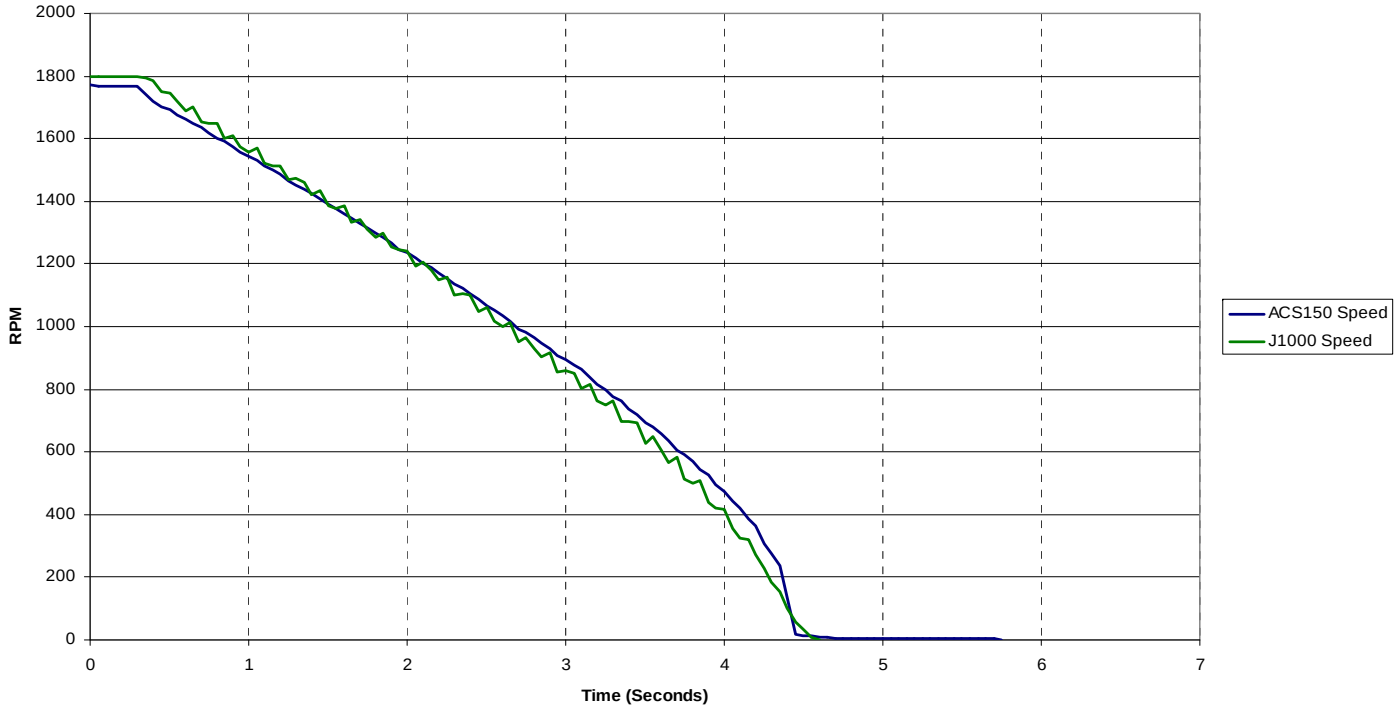
ACS150 efficiency is better compared to J1000. Over 88% at loading 50 to 100%.

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Overvoltage control

With DUT operating at nominal line voltage and 100% rated speed, the run command will be removed from DUT. Time from the run command being removed until AC motor speed reaches 0 will be measured and recorded. DUT deceleration time will be set to 1 sec. The test measures the ability of drives to decelerate the load with and without flux braking (raising the magnetization level in the motor to convert kinetic energy to motor thermal energy). The shorter the time, the better the overvoltage controller (and flux braking algorithms) of a drive works.



Both ACS150 and J1000 were able to decelerate the load to zero within 4,5 seconds.

ABB strengths

ACS150 advantages over Yaskawa J1000

Sideways mounting	500 Hz max. output frequency
Side by side mounting up to 50°C	Application macros
EN61000-3-2 with opt. chokes	High functionality software features
Pulse train input	Cold configuration with FlashDrop
100% * Phd for braking	Easy maintenance

For ACS150 advantages in performance, see the performance test slides

ACS150 Competitor comparison

Siemens SINAMICS G110

Mitsubishi FR-S 500

Allen Bradley PowerFlex 4

WEG CFW10

Hitachi X200

Lenze 8400 BaseLine

Main

Yaskawa VS Mini J7

Schneider Altivar 11

Lenze smd

Allen Bradley PowerFlex 4M

Yaskawa J1000

Summary Slide

Description

Lenze 8400

- The new 8400 Inverter Drives have been designed for consistent process optimisation – throughout all phases of the value-added chain.
- The functionality and drive behaviour of the 8400 series (BaseLine, StateLine and HighLine) develop consistently from one to the next which makes your selection process simple.
- Modifications at a later date are no problem.
- The inverters are supplied in full including integrated shield connections.
- Applications
  - **8400 BaseLine - for continuous motion,** conveyor drives, pumps, fans or ventilators

ABB ACS150

- ACS150 is a component drive for the serial OEM business in basic machinery applications
- Integrated user interface
- Unpowered drive configuration in 2 s
- Straightforward installation and integration
- Fast availability and service
- Scalar control
- For power range 0.37 kW to 4.0 kW
- Applications
  - Fans, pumps, gate control, material handling, conveyors

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Protection class

Lenze 8400

- IP 20

ABB ACS150

- IP20 UL open (standard)
- NEMA 1 (option)

Ambient specification

Lenze 8400

Vibration

- EN 61800-5-1:
  - 10 ... 57 Hz: ±0.075 mm amplitude
  - 57 ... 150 Hz: 1.0g

Shock

- na

Temperature

- Operation: -10 °C … +55 °C
- Storage: -25 °C ... +60 °C
- Transport: -25 °C ... +70 °C
- Output current derating: above +45 °C by 2.5%/°C

Humidity

- na

Altitude limitations

- 0 ... 4000 m amsl
- Rated output current derating Above 1000 m amsl by 5%/1000 m

Acoustic noise

- Noise emission EN 61800-3

ABB ACS150

Vibration

- Compliance with IEC 60721-3-3 (operation) and ISTA 1A (storage and transportation)

Shock

- Mechanical shocks are not allowed for the drive during operation
- Bump according to IEC 60068-2-29, 25g/1000pcs

Temperature

- Operating temperature -10 to +50 °C, minimum derate after 40 °C (1% per degree)
- Storage temperature –40 °C to +70°C

Humidity

- Lower than 95% (non-condensing)

Altitude limitations

- 0 to 1000m derate 1% per 100m

Acoustic noise

- 4…16 kHz

Mains connections

Lenze 8400

Voltage types and power range

- 1-ph 180 - 264 V +/- 0%
  - 0.25 to 2.2 kW
- 3-ph 320 - 550 V +/- 0%
  - 0.37 to 5.5 kW

Power factor

- N/A

Supply frequency

- 45 Hz -0% … 65 Hz +0%

Supply networks

- Data N/A

ABB ACS150

Voltage types and power range

- 1-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 200 - 240V +/-10%
  - 0.37 to 2.2 kW (0.5 to 3 hp)
- 3-phase 380 - 480V +/-10%
  - 0.37 to 4 kW (0.5 to 5 hp)

Power factor

- Displacement power factor 0.98

Supply frequency

- 50/60Hz, tolerance ±5%

Supply networks

- Suitable for IT network. Drive operation in floating (IT) networks possible by disconnecting EMC filter.

DC bus connection

- Not available

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
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Ratings 1-phase 200V

1-phase 200V		ABB		ACS150		Lenze 8400			ABB
P_N	P_N	ACS150	Lenze 8400	I_{2N}	I_{2N}	*Rated output current*		Lenze 8400	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-		A	A	A	A		
kW	hp	01X-		U_N=200-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,25	1/3								
0,37	0,5	2A4-2		2,4	2,2				R0
0,55	0,75		5512			3,0	2,6		
0,75	1	04A7-2	7512	4,7	4,2	4,0	3,5		R1
1,1	1,5	06A7-2	1122	6,7	6,0	5,5	4,8		
1,5	2	07A5-2	1522	7,5	6,8	7,0	6,1		R2
2,2	3	09A8-2	2222	9,8	8,8	9,5	8,3		

Lenze 8400

Overload ratings

- 180 % overload current (3 s)

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Ratings 3-phase 200V

3-phase 200V		ABB		ACS150		Lenze 8400			ABB
P_N	P_N	ACS150	Lenze 8400	I_{2N}	I_{2N}	*Rated output current*		Lenze 8400	ACS150
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-		A	A	A	A		
kW	hp	03X-		U_N=200-240 V		U_N=200-240 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	02A4-2		2,4	2,2				R0
0,55	0,75	03A5-2		3,5	3,2				
0,75	1	04A7-2		4,7	4,2				R1
1,1	1,5	06A7-2		6,7	6,0				
1,5	2	07A5-2		7,5	6,8				
2,2	3	09A8-2		9,8	8,8				R2

Lenze 8400

Overload ratings

- 180 % overload current (3 s)

ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Note: Lenze 8400 3-phase 200V not available

Ratings 3-phase 400V

3-phase 400V		ABB ACS150	Lenze 8400	ACS150		Lenze 8400		Lenze 8400	ABB ACS150
P_N	P_N			I_{2N}	I_{2N}	*Rated output current*			
		Type	Type	40° C	50° C	40° C	50° C		
		ACS150-		A	A	A	A		
kW	hp	03X-		U_N=380-480 V		U_N=380-480 V		Frame	Frame
0,12	0,16								
0,18	0,25								
0,37	0,5	01A2-4		1,2	1,1				R0
0,55	0,75	01A9-4	5514	1,9	1,7	1,8	1,6		
0,75	1	02A4-4	7514	2,4	2,2	2,4	2,1		R1
1,1	1,5	03A3-4	1124	3,3	3,0	3,2	2,8		
1,5	2	04A1-4	1524	4,1	3,7	3,9	3,4		
2,2	3	05A6-4	2224	5,6	5,0	5,1	4,5		
3	4	07A3-4	3024	7,3	6,6	7,3	6,4		
4	5	08A8-4	4024	8,8	7,9	9,5	8,3		

Lenze 8400

Overload ratings

- 180 % overload current (3 s)

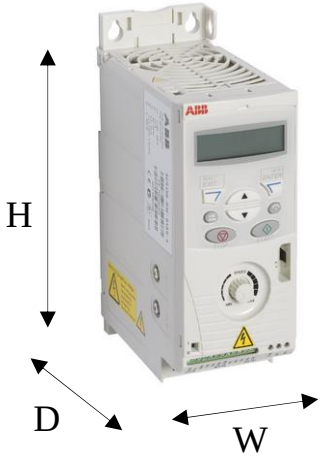
ABB ACS150

Overload ratings

- 1.5 x long time overload, 1min/10min (+40 °C and +50 °C ambient)
- 1.8 x short-time overload, 2 sec.

Dimensions 200 V 1-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Lenze 8400	ABB ACS150			Lenze 8400			Lenze 8400	ABB ACS150
		Type	Type	1-phase			1-phase				
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	01X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,25	1/3										
0,37	0,5	2A4-2		70	169	142					R0
0,55	0,75		5512				70	194	162		
0,75	1	04A7-2	7512	70	169	142					R1
1,1	1,5	06A7-2	1122				70	194	190		
1,5	2	07A5-2	1522	105			70	224	190		R2
2,2	3	09A8-2	2222				70	224	190		



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 1-phase: area, volume, weight

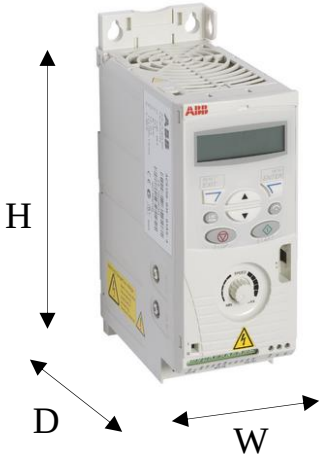
Dimensions 200 V		ABB ACS150	Lenze 8400	ABB ACS150			Lenze 8400			Lenze 8400	ABB ACS150
		Type	Type	1-phase			3-phase				
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	01X-	6SL3211-	area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,25	1/3										
0,37	0,5	2A4-2		118	1,7	1,1					R0
0,55	0,75		5512				136	2	na		
0,75	1	04A7-2	7512	118	1,7	1,3			na		R1
1,1	1,5	06A7-2	1122				136	2	na		
1,5	2	07A5-2	1522	177	2,5	1,5	157	3	na		R2
2,2	3	09A8-2	2222				157	3	na		

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: width, height, depth

Dimensions 200 V		ABB ACS150	Lenze 8400	ABB ACS150			Lenze 8400			Lenze 8400	ACS150
		Type	Type	3-phase			3-phase				
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2									R0
0,55	0,75	03A5-2									
0,75	1	04A7-2		70	169	142					R1
1,1	1,5	06A7-2									
1,5	2	07A5-2									
2,2	3	09A8-2		105							R2



Note: Lenze 8400 3-phase 200V not available

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 200 V 3-phase: area, volume, weight

Dimensions 200 V		ABB ACS150	Lenze 8400	ABB ACS150			Lenze 8400			Lenze 8400	ABB ACS150
		Type	Type	3-phase			3-phase				
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	02A4-2				1,1					R0
0,55	0,75	03A5-2									
0,75	1	04A7-2		118	1,7						R1
1,1	1,5	06A7-2				1,3					
1,5	2	07A5-2									
2,2	3	09A8-2		177	2,5	1,5					R2

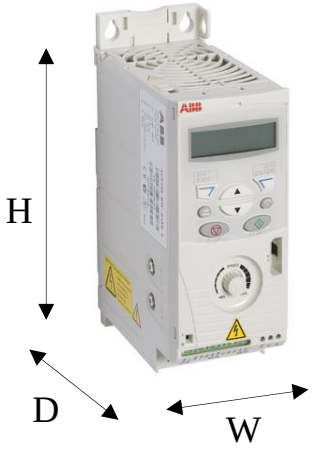
Note: Lenze 8400 3-phase 200V not available

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: width, height, depth

Dimensions 400 V		ABB ACS150	Lenze 8400	ABB ACS150			Lenze 8400			Lenze 8400	ACS150
		Type	Type								
		ACS150-		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)		
kW	hp	03X-		W	H1	D	W	H	D	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4		70	169	142					R0
0,55	0,75	01A9-4	5514				70	194	162		
0,75	1	02A4-4	7514								R1
1,1	1,5	03A3-4	1124				70	194	190		
1,5	2	04A1-4	1524								
2,2	3	05A6-4	2224				70	244	190		
3	4	07A3-4	3024				140	304	198		
4	5	08A8-4	4024								



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Dimensions 400 V 3-phase: area, volume, weight

Dimensions 400 V		ABB ACS150	Lenze 8400	ABB ACS150			Lenze 8400			Lenze 8400	ABB ACS150
		Type	Type								
		ACS150-		(cm^2)	(l)	(kg)	(cm^2)	(l)	(kg)		
kW	hp	03X-		area	volume	weight	area	volume	weight	Frame	Frame
0,12	0,16										
0,18	0,25										
0,37	0,5	01A2-4		118	1,7	1,1					R0
0,55	0,75	01A9-4	5514				136	2	na		
0,75	1	02A4-4	7514			1,3			na		R1
1,1	1,5	03A3-4	1124				136	2	na		
1,5	2	04A1-4	1524						na		
2,2	3	05A6-4	2224				157	3	na		
3	4	07A3-4	3024				213	8	na		
4	5	08A8-4	4024						na		

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Sideways mounting

Side by side mounting up to 50°C

Installation

Lenze 8400

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	No
Flange	Yes (up to 2.2 kW)
Wall (sideways)	No
Heatsinkless	Yes (up to 2.2 kW)
Side-by-side	na

Free space requirements

Location	*mm*
Above	na
Below	na
Left and right	na

- Motor cable lengths
  - 50 m (shielded cable)
  - 100 m (unshielded cable)

ABB ACS150

Mounting method	*Availability*
Wall (back)	Yes
DIN rail	Yes
Flange	No
Wall (sideways)	Yes
Heatsinkless	No
Side-by-side	Yes

Free space requirements

Location	*mm*
Above	80
Below	80
Left and right	0

- Installation with clamps and screws, cabinet support tools available
- Operational motor cable lengths:

Frame	Standard	With output chokes
R0	30 m	60 m
R1	50 m	100 m
R2	50 m	100 m

EMC and harmonics

Lenze 8400

- **Filters**
  - External LL RFI filters (Low Leakage): category C1 (option)
  - External SD RFI filter (Short Distance): category C1, category C2 (option)
  - External LD RFI filter (Long Distance): category C1, category C2 (option)
- **Chokes**
  - Mains chokes (option)
- **EMC compliant motor cable lengths**
  - External LL RFI filters: category C1 for 5 m shielded motor cable
  - External SD RFI filter: category C1 for 25 m shielded motor cable, category C2 for 50 m shielded motor cable
  - External LD RFI filter: category C1 for 50 m shielded motor cable, category C2 for 100 m shielded motor cable
- **THD**
  - N/A

ABB ACS150

- **Filters**
  - Inbuilt EMC filter for category C3 (2nd environment) as standard
  - External EMC filter for categories C1, C2 (1st environment) and C3 (2nd environment) as option
- **Chokes**
  - AC input/output chokes as an option
- **EMC compliant motor cable lengths**
  - Category C3 30m (with 4 kHz switching frequency) as standard
  - With external EMC filter and 4 kHz switching frequency
    - 1~ 200 V: C1 10m, C2 and C3 100m (for 0.37 kW unit C1 10m, C2 45m and C3 75m)
    - 3~ 200 V: C2 and C3 30 m
    - 3~ 400 V: C1, C2 and C3 100 m
- **THD**
  - EN61000-3-2 with optional chokes

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

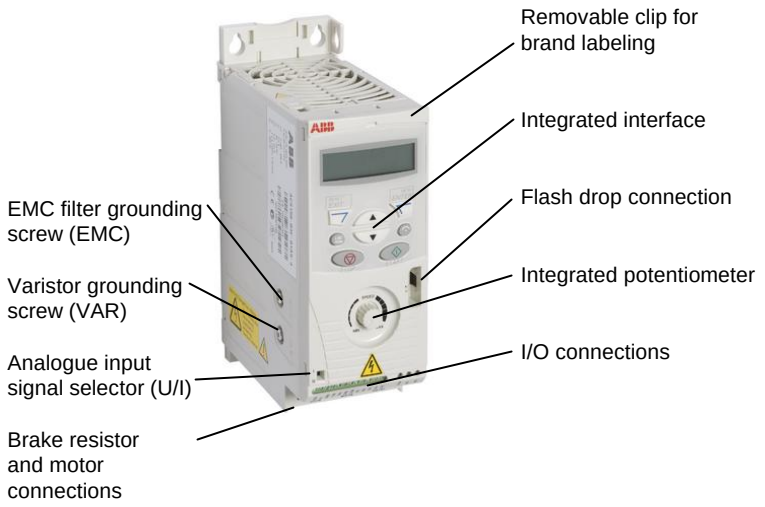
User interface

Lenze 8400

- Memory module for quick commissioning and easy service

ABB ACS150

- Integrated interface
- Integrated potentiometer
- FlashDrop connection



Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Machine interface

Lenze 8400

Type	*Qty.*	*Programmable*
Digital inputs	4	Yes
Analog inputs	1	Yes
Pulse train input	-	-
Relay inputs/outputs	1	Yes
Transistor outputs	-	-
Analog outputs	0	Yes

ABB ACS150

Type	*Qty.*	*Programmable*
Digital inputs	5	Yes
Analog inputs	2	Yes
Pulse train input	1 (i.e. digital input)	Yes
Relay outputs	1	Yes
Transistor outputs	1	Yes

Specialities:

- Pulse train input

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

100% * Phd for braking

500 Hz max. output frequency

Motor control

Lenze 8400

- V/f control without encoder (linear or square-law)
- Sensorless vector control (torque/speed)

Braking

- Brake chopper integrated (400 V types)
- Brake resistor external (400 V types)

Output frequency

- Max 500 Hz

ABB ACS150

- Scalar control

Braking

- Brake chopper available as standard
  - 100% * Phd for braking

Output frequency

- 500 Hz as maximum output frequency

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Macros and language versions

Lenze 8400

- Macros na
- Languages
  - German, English, French

ABB ACS150

- **Macros**
  - ABB Standard
  - 3-wire
  - Alternate
  - Motor Potentiometer
  - Hand/auto
- **Languages**
  - N/A

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Software features

Lenze 8400

- Application-oriented commissioning (predefined application)
- Freely assignable user menu
- Data logger
- DC brake function
- Flying restart circuit
- S-ramps for smooth acceleration
- 3 fixed frequencies (BaseLine)

(* = Basic feature in ABB ACS150

ABB ACS150

- FlashDrop
- Pulse train input
- Changed parameter menu
- Emergency stop
- Jog function
- Fault Group (Group 4)
- Hardware protection against miss wiring in I/O and supply
- Zero speed delay
- Flux Optimization
- Switching frequency control
- 7 preset speeds
- Application macros
- Flying start
- Critical frequency lock-out
- Max. Freq. 500 Hz

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Other advanced features

Lenze 8400

- L-force diagnostic interface for diagnostics and parameter setting, even during operation

ABB ACS150

FlashDrop

- Option tool for fast and safe selecting and setting drive parameters without power
- Palm-size 153x53x71mm and light weight 0.4 kg
- Portable and battery chargable
- Keypad with LCD display
- Includes Drive PM (Drive parameter manager) software for PC to create, edit and copy parameter sets for FlashDrop
- Help function available
- Possibility to store 20 user specified parameter macros
- Parameter hiding, Parameter upload and download, Cold drive and Damaged drive parameterization
- Compatible also with ACS150, ACS550 and ACH550 drives

PC connectivity and tools

Lenze 8400

- USB connection with USB system bus adapter
- Diagnostic interface
  - USB connection with diagnostic adapter

ABB ACS150

- N/A

Hardware options

Lenze 8400

- Brake resistors
- Mains chokes
- RFI filter
- 24 V power supply units
- Brake switch
- Connecting cables for USB diagnostic adapters

ABB ACS150

- AC input/output chokes
- UL Type 1 kit
- External EMC filter for 1st / 2nd environment

Maintenance

Lenze 8400

- Diagnostics and parameter setting using remote maintenance make for quick and cost-effective service all over the world. A memory module, integrated shield connections and pluggable terminals mean that drives can be replaced quickly and easily, thereby reducing machine downtimes.

ABB ACS150

- Cooling fan replacement
  - Very easy to replace
  - Every five years
- Capacitor reforming
  - Every two years when stored

- Available spare parts
  - Fan

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine

Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

Standards

Lenze 8400

Approvals

- CE, UL 508C, RoHS

Compliance with

- Low-Voltage Directive (2006/95/EC)
- Power Conversion Equipment (file no. 132659)
- ISO 14001
- Applicable standards
  - EN 61800-3
  - EN 61800-5-1

ABB ACS150

Approvals

- CE, UL, cUL, C-tick, GOST-R

Compliance with

- Low Voltage Directive 73/23/EEC with supplements
- Machinery Directive 98/37/EC
- EMC Directive 89/336/EEC with supplements
- Quality assurance system ISO 9001
- Environmental system ISO 14001
- RoHS directive 2002/95/EC with amandments

Applicable standards

- IEC/EN 61800-5-1 - Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
- IEC/EN 60204-1 (1997) - Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
- IEC/EN 60529: 1991 - Degrees of protection provided by enclosures (IP code)
- IEC/EN 61800-3 (2004)- EMC product standard including specific test methods
- UL 508C UL - Standard for Safety, Power Conversion Equipment

Siemens SINAMICS G110 | Mitsubishi FR-S 500 | Allen Bradley PowerFlex 4 | WEG CFW10 | Hitachi X200 | Lenze 8400 BaseLine
Main | Yaskawa VS Mini J7 | Schneider Altivar 11 | Lenze smd | Allen Bradley PowerFlex 4M | Yaskawa J1000

ABB strengths

ACS150 advantages over Lenze 8400

3-phase 400 V unit	500 Hz max. output frequency
Sideways mounting	Application macros
Side by side mounting up to 50°C	High functionality software features
EN61000-3-2 with opt. chokes	Cold configuration with FlashDrop
Pulse train input	Easy maintenance
100% * Phd for braking	RoHS compliance

For ACS150 advantages in performance, see the performance test slides