

ACS 200 Series
Adjustable Frequency AC Drives
for speed control of 0.75 to 7.5 HP
AC motors

Product Bulletin

ACS200-02C

ABB AC Drives

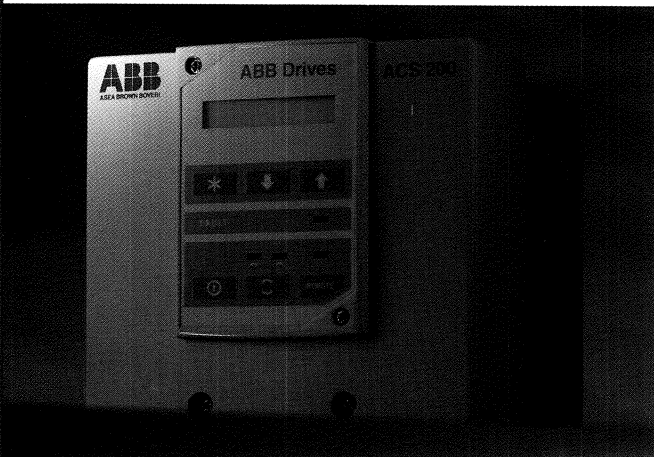


ABB Drives





ACS 200 Series AC DRIVES

OVERVIEW

The ACS 200 series is a microprocessor based Pulse Width Modulated (PWM) adjustable frequency AC drive. The ACS 200 drive takes advantage of sophisticated microprocessor control and advanced IGBT power switching technology to deliver high-performance control of AC motors for a wide range of industrial applications.

The ACS 200 is small in size, yet designed for reliability and long life by keeping the critical temperatures in the drive low, even at a high 122°F (50°C) ambient temperature.

With drives ranging from 0.75 to 7.5 HP, the ACS 200 series features a universal alphanumeric interface that

“speaks” to the operator in plain English phrases, greatly simplifying set-up, operation, and fault diagnosis. The ACS 200 is also programmable in eight other languages.

Each ACS 200 drive comes equipped with a keypad panel that can be used on the drive cover, or remote mounted, and can be used to copy all drive parameters from one drive to another.

The ACS 200 series can handle the most demanding industrial applications in an efficient, dependable, and economical manner.

FEATURES

STANDARD FEATURES

- UL Listed
- 16 Character Multi-lingual Alphanumeric Display
 - For:
 - Output Frequency
 - Speed (RPM)
 - Motor Current
 - Output Voltage
 - Operating Hours
 - Parameter Data
 - Fault Text
- Removable Keypad Operator Panel
- Panel can copy parameters from one drive to another
- One (1) Analog Input
- Five (5) Programmable Digital Inputs
- One (1) Programmable Analog Output
- One Form C Relay Output for FAULT indication
- Input Speed Signals
 - Current 0(4)-20 mA
 - Voltage 0(2)-10 VDC
- Start/Stop
 - 2 Wire (Dry Contact Closure)
 - 3 Wire (Momentary Dry Contacts)
 - Application Of Input Power
- Protection Circuits
 - Over Current
 - Short Circuit
 - Ground Fault
 - Over Voltage
 - Under Voltage
 - Over Temperature
 - Motor Overload (I^2t)
- Electronic Reverse
- DC Injection Braking
- Auto Restart-Customer Selectable and Adjustable
- Two (2) Independently Adjustable Accel and Decel Ramps
- Linear Or “S” Curve Accel/Decel Ramps
- Ramp Or Coast To A Stop
- Programmable Maximum Frequency To 500 Hz
- Three (3) Preset Speeds
- Two (2) Critical Frequency Lockout Points
- V/Hz Shape
 - Linear
 - Squared
 - Optimum
- Start Functions
 - Ramp
 - Flying Start
 - Automatic Torque Boost
- IR Compensation - Manual or Automatic
- Internal Braking Chopper



Input Connection

- ## Motor Connection

- ## External Control Connections

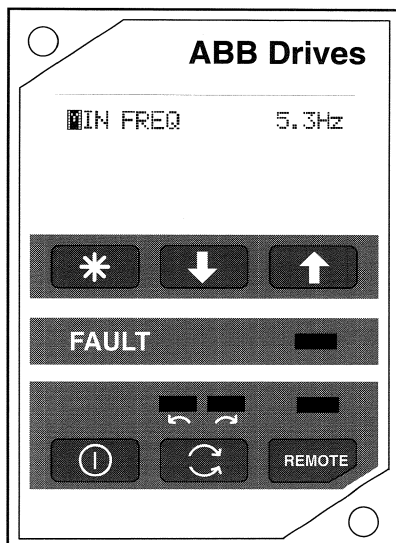
- Specifications are subject to change without notice. Consult factory when specifications are critical.

DRIVE FEATURES - OPERATOR INTERFACE

■ Keypad Control Panel

The ACS 200 has a highly readable 16 character liquid crystal display (LCD) for programming and display of operating information and fault messages. The ACS 200 presents this information in "plain" English (no codes) (or 8 other user-selected languages, including: French, Spanish, German, Italian, Swedish, Finnish, Danish and Dutch).

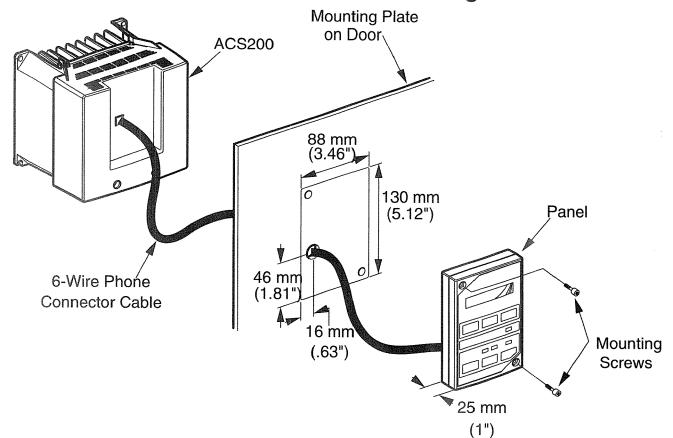
ACS 200 drives are equipped with an easily recognizable six (6) button digital keypad, which allows error-free programming, data input, and operator interface via the front face of the drive. A local/remote button allows easy selection between Local Keypad operation and Remote (external) operation.



The keypad panel also has four LED's for clear indication of Remote, Direction, and Fault status, as well as Stop indication.

The Keypad Panel can be mounted up to 10 feet (3 meters) away from the drive for panel mounting or

hand held operation. When panel mounted, the optional gasket provides NEMA 4 rating.

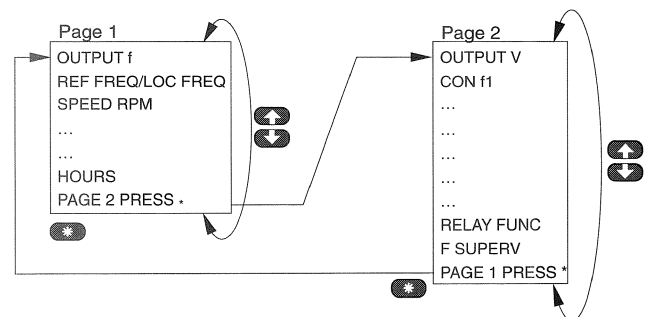


The Keypad Panel also acts as a parameter copy unit that allows the parameters to be copied from one drive to another.

■ Parameters Organized into Pages

The parameters in the ACS 200 are organized into two "pages" to simplify programming. Page one contains the most commonly changed parameters, including motor information, accel and decel times, maximum frequency, and operating information displays.

Page two contains more advanced parameters, such as preset speeds, critical frequency points, and reference scaling to name a few.



■ Easily configurable Digital Inputs

Five (5) digital inputs are configurable for three different control schemes, including 2-wire start, 3-wire start/stop, and start forward/start reverse. The digital inputs are also used for preset speed selection and selection of different accel/decel ramps.

DRIVE FEATURES

DRIVE FEATURES - POWER

■ Current Limit Circuit and 225% O.C. Trip

The ACS 200's fast acting current limit circuitry and 225% overcurrent trip level allows the ACS 200 to operate as a "tripless" drive. The current limit circuit dynamically controls motor current and prevents excessive motor current from unduly tripping the drive.

■ IGBT Power Electronics

The ACS 200 uses the latest IGBT (Insulated Gate Bi-Polar Transistor) power switching devices. These fast response IGBT's allow "tripless" operation enabling 100% motor load capability at a motor's rated load. This minimizes the derating requirements of the motor. In addition, audible motor noise is significantly reduced, which means the ACS 200 can be used in applications where low noise levels are essential. Other significant advantages of this technology are:

- The inherently fast switching rates of the ACS 200 result in smoother motor control when compared to switching rates below 1 kHz. In addition, they minimize the derating requirements of the AC motor at nominal speed while assuring reliable and safe shut-downs during fault conditions.
- Minimal switching losses of IGBT's result in better efficiency, and the ability for the NEMA 1 drive to operate up to 122°F (50°C).
- Minimal gate currents are achieved for the control of large motor currents. This minimizes the power of the gate circuits and allows lower power supply requirements; resulting in greater commonality of spare parts.

DRIVE FEATURES - PROTECTION

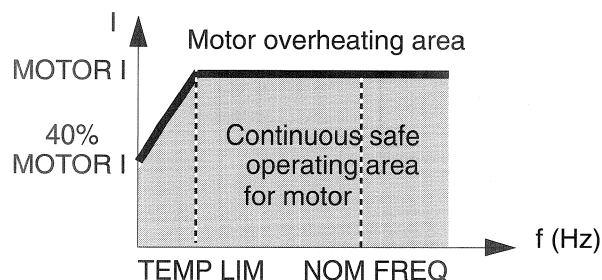
■ Integral Protection Circuits

The ACS 200 was designed to protect the drive and motor from the hazards of continuous service in the most demanding of applications. Built-in protection circuits include the following:

- Overcurrent trip limit - 225%
- Slow current regulation limit -150% (120% for ACS201-4P1-1)
- Overvoltage trip limit -135%
- Undervoltage trip limit -65%
- Over temperature protection - YES
- Short Circuit Protected - YES
- Ground fault protection - YES
- Microprocessor protection - YES
- Motor Thermal Protection (I^2t) - UL Approved

■ Thermal Motor Overload Protection

Motor Thermal Protection (I^2t) is provided as standard in ACS 200 drives. The I^2t protection is designed to emulate a NEMA Class 20 thermal overload relay, but with enhanced features to protect motors even at low speeds by decreasing the allowable operating current. This is necessary as the motor's cooling fan becomes less efficient at low speeds.



The operation curve can be customized to protect motors with any constant torque speed range.

UL Approved.

■ NEMA 1 Enclosures

The ACS 200 is available in NEMA 1 ventilated enclosure, incorporating a rugged die cast back. A drip shield can be installed to cover the top vents in the cover. The ACS 200 drives can also be chassis mounted for OEM applications, or for inclusion in site-specific enclosures.

DRIVE FEATURES - CONTROL

■ Acceleration/Deceleration Rates

The ACS 200 provides two individually controlled, selectable sets of acceleration/deceleration rates from 0.1 to 1800 seconds.

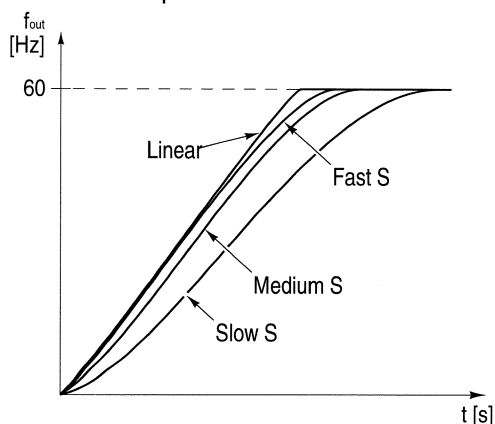
Min. theoretical time - 120 Hz/0.1 seconds

Max. theoretical time - 120 Hz/1800 seconds

Switching between the two accel/decel rates may be controlled via a program designated digital input.

• Linear or "S" Curve Ramping

The ACS 200 also offers selection of the shape of the acceleration/deceleration ramp curves; linear and 3 different S-curves. The Linear selection is suitable for drives requiring steady acceleration/deceleration and/or slow ramps. S-curve ramps are ideal for conveyors carrying fragile loads or other applications where a smooth transition is required when changing from one speed to another.



The "S" curves available are:

- Slow S - Suitable for ramp times <1 second.
- Medium S - Suitable for ramp times <1.5 seconds.
- Fast S - Suitable for ramp times up to 15 seconds.

■ Analog Inputs

The ACS 200 has one analog input as standard which can operate from 0-10 VDC or 0-20 mA or from a potentiometer. The analog input can then be altered by activating the following parameters:

• Analog Input Min/Max Settings

The Analog Input Minimum setting operates as an input offset, allowing settings of 0V/0mA or 2V/4mA to be the input signal required to begin accelerating from minimum speed. An automatic offset adjustment allows the user to

input the minimum analog input setting and scale the drive so it will not start to accelerate from zero speed until the offset input signal is exceeded.

The Analog Input Max setting is the analog input signal corresponding to the maximum signal that will be applied. This may be set such that 10V/20mA is the full speed, or an automatic gain setting may be used, such that the user inputs the maximum speed signal and it scales the drive output so that full speed is achieved at this point.

• Analog Input Inversion

The analog input signal can be inverted so that the minimum analog input signal can correspond to the maximum reference and the maximum analog input signal can correspond to the minimum reference.

• Joystick Reference

Joystick reference is a standard feature that allows both the speed and direction to be controlled from an analog reference. The mid-point of the reference is zero speed. As the reference is increased, the speed increases in the forward direction. As the reference is decreased from the mid-point, the speed increases in the reverse direction.

• Motor Operated Potentiometer (MOP)

The ACS 200 can be configured to allow two of the digital inputs to be used to increase and decrease the frequency reference. When this mode is selected, DI3 is used to increase the reference, and DI4 is used to decrease the reference.

• Keypad

The ACS 200 keypad can also be used for the frequency reference.

• Reference Scaling

The external reference can be independently scaled, so that the minimum and maximum analog input can correspond to a frequency other than the minimum and maximum frequency.

This is very useful, for example, if you want to apply the same 0 - 10 VDC reference to two or more drives, and want one drive to operate from 0 to 60 Hz and the other to operate from 0 to 53 Hz.

DRIVE FEATURES - CONTROL (cont'd)

■ Analog Output

The analog output signal is 0(4) to 20mA and can be proportional to output frequency, output current, or the reference frequency.

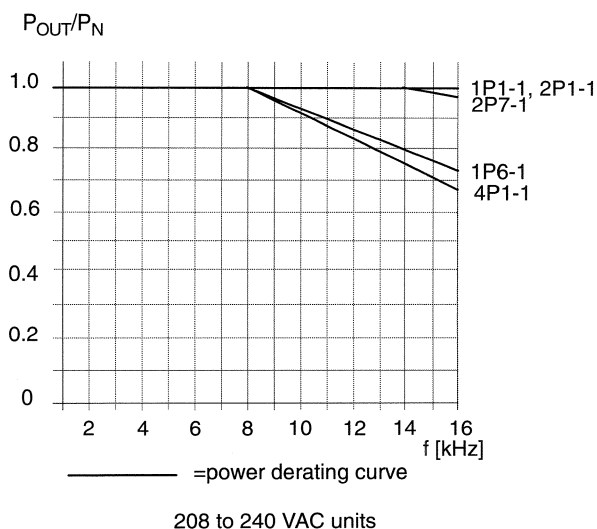
■ Auto Restarts

The ACS 200 Drive can automatically restart after a fault by selecting the following parameters:

- Number of Trials - 0 to 10 restart attempts can be specified.
- Overvoltage, Undervoltage, Overcurrent, loss of reference and drive trip. Normal operation is restored after the fault condition has been corrected. However, if the fault is not cleared, the drive stops.

■ Carrier Frequency

By utilizing IGBT's, the ACS 200 drive employs high switching frequencies, so the motor current is practically sinusoidal. Audible motor noise can also be minimized by choosing a switching frequency up to 16kHz in the ACS 200. These frequencies can be adjusted or changed to best fit the application. When raising the switching frequency above 8 kHz, the switching losses in the drive will increase. Derating may be necessary, depending on the application. See the power derating curves below:



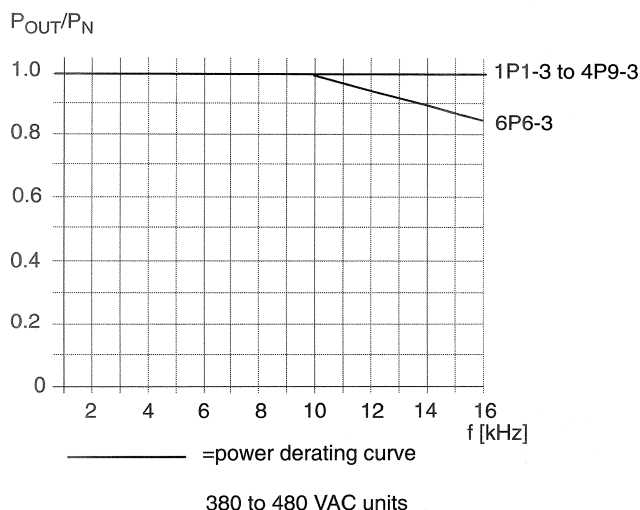
■ Critical Frequency Lockouts

For applications where it may be necessary to avoid specific frequencies due to mechanical resonance problems in the driven equipment, the ACS 200, with its Critical Frequency Lockout Function, makes it possible to set-up two different frequency ranges which will be avoided during operation of the drive.

Each critical frequency setting allows the user to set low and high critical frequency limits. If the speed reference signal requires the ACS 200 to operate within this critical frequency range, the critical frequency lockout function will keep the ACS 200 operating at the low or high critical frequency limit until the reference is out of the critical frequency range, at which time the output frequency will ramp through the critical frequency range at the set accel or decel ramp.

■ Dynamic Braking Chopper

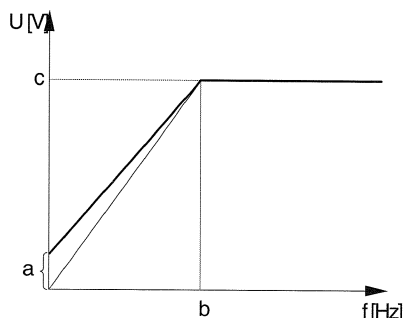
The ACS 200 comes standard with a built-in dynamic braking chopper. The dynamic braking chopper allows the ACS 200 to bring the motor to a rapid stop, by dissipating the regenerated energy in an optional resistor.



DRIVE FEATURES - CONTROL (cont'd)

■ IR Compensation

A complete set of parameters is included in the ACS 200 which allows for extra torque to be applied at speeds between 0.1 Hz and the set field weakening point (Programmable Range).



This provides for higher voltage at low speeds anytime during operation (not just at initial start-up; i.e. start function with torque boost). In Automatic, the IR Compensation voltage is set automatically as a function of effective motor current. In Manual, both the IR-Comp Voltage and IR-Comp Range are adjustable.

■ Parameter Lock

Prevents unauthorized persons from altering the parameters of the ACS 200 by locking out the keypad.

■ Preset Speeds

The ACS 200 allows for three (3) programmable preset speeds to be selected from the digital inputs. This capability is valuable in a wide range of industrial applications.

■ Relay Output

One programmable Form C contact is available. Using parameters 226 (Relay Function) and 227 (Frequency Supervision), the function of the relay can be changed. The available functions are:

- Fault
- Power
- Current Limit
- > Frequency Limit
- < Frequency Limit
- Motor is running forward
- Motor is running
- Motor overtemperature trip
- Under panel control (LOCAL)
- None
- Fault (inverted)

When one of the frequency limits are selected, parameter 227 (Frequency Supervision) is used to set the frequency for the relay to trigger on.

■ Start Functions

Various Start control alternatives are accommodated by the design of the ACS 200, all aimed at increasing efficiency of operation.

Motor starting torque of 150% of the rated torque can be achieved by selecting Start with torque boost. This avoids oversizing of the drive and guarantees reliable starting of even the heaviest loads. (Note - The ACS 200 is designed to operate NEMA design B motors with a ratio of breakdown torque to rated torque of 2.6 to 2.9.)

A Flying Start function allows the ACS 200 to match its output frequency to the rotational speed of a spinning motor. The ACS 200 is able to smoothly resume operation without forcing the motor to zero speed before accelerating.

■ Stop Functions

The stop function of the ACS 200 can be set to coast, ramp, or DC brake.

When set to coast, the power to the motor will stop immediately when a stop command is given, allowing the motor to coast to a stop.

When set to ramp, the ACS 200 will ramp the output frequency to zero at the set decel ramp.

DC Injection Braking applies DC to the motor when a stop command is given.

■ V/Hz (volts per hertz) Shape Control

This parameter allows for the setting of the voltage to frequency relationship in the region below the Field Weakening Point. Two settings are available which are intended to minimize noise, motor losses, and to maximize efficiency:

- **Linear** - The voltage of the motor changes linearly with frequency, for use in Constant Torque applications.
- **Squared** - The motor voltage changes with the square of the speed, for centrifugal loads such as pumps and fans.
- **Optimum** - The motor voltage is automatically controlled to minimize motor current. This setting is suitable for a single motor constant torque drive system with slow changes in system load. Considering the energy saving nature of this function, it is also appropriate in lightly loaded applications.

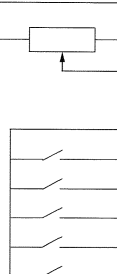
TECHNICAL DATA


■ Control Connections

The ACS 200 drive can be controlled from its digital control panel or from external control devices. External control devices are connected to Terminal Block X1.

All parameters are set from the control panel. The following figure shows input and output signals of the Control Interface Card and their Connections to the Terminal Block X1.

Terminal X1		Function			Comments
1	REF	Output Reference 10 VDC, Max. 10 mA			Remote Potentiometer Reference Voltage
2	GND				
3	AI +	Frequency Reference 0 – 10 V (Ri = 200 KΩ) or 0 – 20 mA or 4 – 20 mA (Ri = 200 Ω)			Remote Speed Reference
4	GND				
5	+24V	Auxiliary voltage output 24 V DC, Max. 100 mA			
6	DI1	START	START	START FORWARD	Digital Inputs
7	DI2	STOP	REVERSE	START REVERSE	
8	DI3	REVERSE	PRESET SPEED	PRESET SPEED	Functions According to S1 Setting
9	DI4	PRESET SPEED	PRESET SPEED	PRESET SPEED	
10	DI5	PRESET SPEED	ACC/DEC 2	ACC/DEC 2	
11	AO +	Analog Current Output 0 – 20 mA or 4 – 20 mA into 500 Ω max			Programmable Analog Output
12	GND				



13	RO1		Relay Output, Fault Indication	Max switching voltage 300 VDC/250 VAC Max switching current 8 A/24 VDC, 0.4 A/250 VDC Max switching power 2000 VA/250 VAC Max continuous current 2A
14	RO2			
15	RO3			

Control connections are galvanically isolated from the input power but not from chassis ground.

Shielded cable should be used on all connections to terminals X1:1 thru X1:12.

PARAMETER LISTING

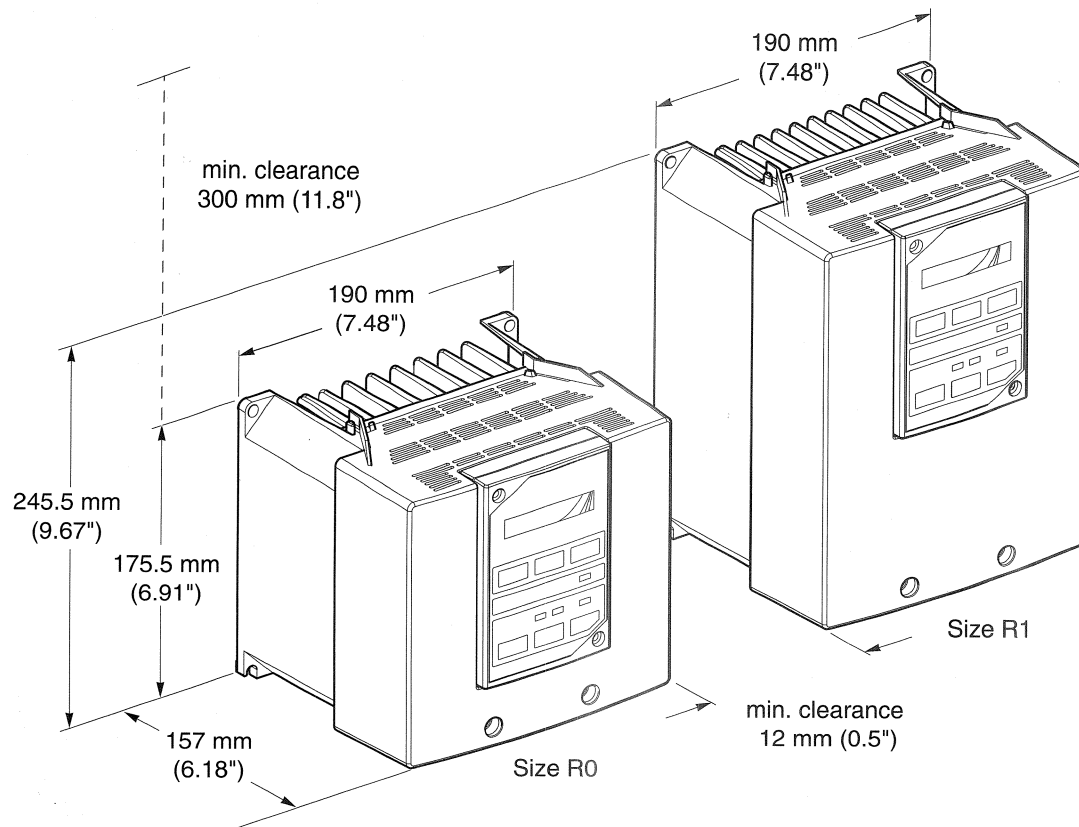
Code	Parameter	Range	Default	Description
101	OUTPUT f	Display only	–	Frequency to motor
102	REF FREQ/LOC FREQ	$f_{\text{MIN}} - f_{\text{MAX}}$	0 Hz	Frequency reference from remote or control panel
103	SPEED	Display only	–	Calculated motor speed
104	OUTPUT I	Display only	–	Motor current
105	COPY	Exit/Read/Write/ Set Factory Def.	Exit	Transfers all settings to and from panel
106	MIN FREQ	0.0 – 200/500 Hz	0.0 Hz	Reference input minimum frequency
107	MAX FREQ	0.0 – 200/500 Hz	50 Hz	Maximum output frequency
108	ACC 1	0.1 – 1800 s	3 s	Time for Ref Min f - Ref Max f acceleration ramp
109	DEC 1	0.1 – 1800 s	3 s	Time for Ref Max f - Ref Min f deceleration ramp
110	ACC 2	0.1 – 1800 s	3 s	Time for Ref Min f - Ref Max f acceleration ramp
111	DEC 2	0.1 – 1800 s	3 s	Time for Ref Max f - Ref Min f deceleration ramp
112	FAULT MEMORY	Display only	–	The last three fault indications
113	NOM RPM	0 – 19999	1500	Motor nameplate speed
114	NOM FREQ	50 – 400 Hz	50 Hz	Motor nameplate frequency
115	NOM VOLT	200 – 240V or 360 to 480 V	220 / 480	Motor nameplate voltage
116	COS PHI	0.40 – 0.99	0.75	Motor power factor
117	SUPPLY VOLTAGE	380 to 480 V	480	Supply voltage for 380-480 volt units.
118	LANGUAGE	GB,FIN,S,D,I,F, E,NL,DK, CO	English	Display language selection
119	TEMP MOD	Display Only		Calculated Motor Temperature
120	HOURS	Display Only		Operation Timer
1-2	Page 2 Press*	–	–	Press to change to page 2
201	OUTPUT V	Display only	–	Output voltage to motor
202	CON f1	0.0 – 200/500 Hz	5.0 Hz	Preset speed 1
203	CON f2	0.0 – 200/500 Hz	25.0 Hz	Preset speed 2
204	CON f3	0.0 – 200/500 Hz	50.0 Hz	Preset speed 3
205	I LIMIT	0.5 – 1.5 x I_N	1.5 x I_N	Output current limit
206	START	Acc Ramp/Flying/Auto Boost	Acc Ramp	Starting mode selection
207	STOP	Coasting/Dec Ramp/DC Brake/ Dec+Brake	Coasting	Stopping mode selection
208	RAMP	Linear/Fast S/Medium S/Slow S	Linear	Acceleration/deceleration ramp shape selection
209	REF OFFSET	0V0mA/2V4mA/Joystk/Custom	0V0mA	Analog input minimum and type selection
210	A. OUT	None/Out Freq/Ref Freq/Motor Curr	Out Freq	Analog output function selection
211	A. OUT OFFS	0mA/4mA	0mA	Analog output minimum
212	SWITCH f	1.0 – 16.0 kHz	8 kHz	Switching frequency
213	CRIT f1L	0.0 – 200/500 Hz	0.0 Hz	Critical frequency 1 start
214	CRIT f1H	0.0 – 200/500 Hz	0.0 Hz	Critical frequency 1 end
215	CRIT f2L	0.0 – 200/500 Hz	0.0 Hz	Critical frequency 2 start
216	CRIT f2H	0.0 – 200/500 Hz	0.0 Hz	Critical frequency 2 end
217	IR COMP	Off/0.1 – 60V	Off	Low speed torque boost value
218	DC-BRAKE t	0 – 250 s	3 s	Duration of DC injection braking
219	U/f RATIO	Linear/Squared/Optim	Linear	Voltage to frequency ratio
220	RESTART #	Off/1 – 10/Cont	Off	Number of start attempts after fault
221	TEMP LIM	Off/1 to 500 Hz.	Off	Motor thermal protection
222	MOTOR I	0.5 to 1.5 x I_N	I_N	I_{NMOT} for motor thermal protection
223	DIR	FWD/REV; FWD only	FWD/REV	Reverse lock-out
224	AI-FAULT	Enable/Disable	Enable	AI fault if AI<2 V/4 mA
225	P. LOCK	Open/Locked	Open	Parameter lock/Retrieval of default values
226	RELAY FUNC	1 - 11		Relay Function selection
227	F SUPERV	Hz		Relay Function output frequency limit
2-1	Page 1 Press*	–	–	Press to change to page 1

ORDERING INFORMATION

208 - 240 VAC Part Number	Rated Motor		Rated Output Current I _N /A	Short Term Overload Current I _{OVER} /A	Rated Input Current I ₁ /A		Recommended Input Fuses and Cables			Unit Weight kg (lbs)	Dimension Reference
	P _N /kW	P _N /hp			1 Φ	3 Φ	Fuse size/A		Input Cable/ mm ² (AWG)		
							1 Φ	3 Φ			
ACS 201-1P1-1-00P10	0.55	0.75	3.0	4.5	6.6	–	10	–	2×1.5+1.5 (12)	3.1 (6.8)	R0
ACS 201-1P6-1-00P10	0.75	1.0	4.3	6.5	8.9	–	15	–	2×1.5+1.5 (12)	3.1 (6.8)	
ACS 201-2P1-1-00P10	1.1	1.5	5.5	8.3	12.2	8.4	20	15	2×2.5+2.5 (10) 3×1.5+1.5 (12)	4.1 (9.0)	R1
ACS 201-2P7-1-00P10	1.5	2.0	7.1	10.7	15.7	9.8	20	15	2×2.5+2.5 (10) 3×1.5+1.5 (12)	4.1 (9.0)	
ACS 201-4P1-1-00P10	2.2	3.0	10.7	13.0	22.4	12.9	30	20	2×6.0+6.0 (8) 3×2.5+2.5 (10)	4.1 (9.0)	

380 - 480 VAC Part Number	Rated Motor		Rated Output Current I_N/A	Short Term Overload Current I_{OVER}/A	Rated Input Current I_1/A	Recommended Input Fuses and Cables		Unit Weight kg (lbs)	Dimension Reference
	P_N/kW	P_N/hp				Fuse size/A	Input Cable/ mm^2 (AWG)		
ACS 201-1P6-3-00P10	0.75	1.0	2.5	3.8	3.0	10	3×1.5+1.5 (12)	4.1 (9.0)	R1
ACS 201-2P1-3-00P10	1.1	1.5	3.2	4.8	3.9	10	3×1.5+1.5 (12)	4.1 (9.0)	
ACS 201-2P7-3-00P10	1.5	2.0	4.1	6.2	5.0	10	3×1.5+1.5 (12)	4.1 (9.0)	
ACS 201-4P1-3-00P10	2.2	3.0	6.2	9.3	7.5	15	3×2.5+2.5 (10)	4.1 (9.0)	
ACS 201-4P9-3-00P10	3	5.0	7.5	11.0	9.1	15	3×2.5+2.5 (10)	4.1 (9.0)	
ACS 201-6P6-3-00P10	4	7.5	10	15.0	12.1	20	3×4.0+4.0 (8)	4.1 (9.0)	

DIMENSIONS ACS 200



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