

PowerFlex 700 Adjustable Frequency AC Drive



Product Overview

The PowerFlex 700 AC drive offers outstanding performance in an easy-to-use drive that you have come to expect from Rockwell Automation. This world-class performance comes in a small and competitively priced package. The PowerFlex 700 AC drive is designed to control three-phase induction motors in applications with requirements ranging from the simplest speed control to the most demanding torque control. The drive has volts per hertz, sensorless vector and vector control. Vector control includes Allen-Bradley's patented Force™ Technology which provides world class motor control.



Space Saving Hardware Features

- **Integral EMC Filtering** plus built-in DC bus choke common mode cores and common mode capacitors provides a compact, all-in-one package solution for meeting EMC requirements, including CE in Europe. Frames 0...6 only (Frames 7...10 meet CE when installed per recommendations).
- **Internal Communications** allow the user to integrate the drive into the manufacturing process. Status indicators for all internal communication options are visible on the cover for easy setup and monitoring of drive communications. Users can easily manage information from shop floor to top floor and seamlessly integrate their complete system as they control, configure and collect data.
- **Integral Dynamic Brake Transistor** delivers a cost effective means of switching regenerative energy without costly external chopper circuits. These internal transistors are available in power ratings from 0.5 to 200 Hp.
- **Internal Dynamic Brake Resistor** (up to 25 Hp) requires no extra panel space, and supplies a large amount of braking torque for short periods.

Easy to Use Human Interface Tools

The PowerFlex 7-Class AC drives provide common Human Interface tools that are familiar and easy to use. These include the LCD Human Interface modules and PC-based configuration tools.

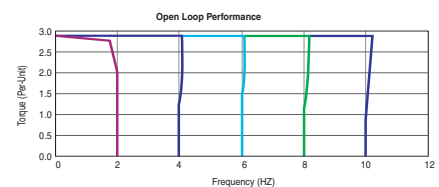
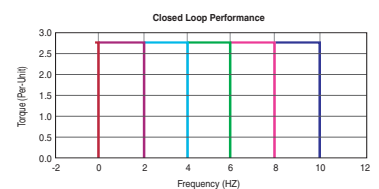
- LCD Human Interface modules provide:
 - Large and easy to read 7 line x 21 character backlit display
 - Variety of languages (English, French, German, Italian, Spanish, Portuguese, Dutch)
 - Alternate function keys for shortcuts to common tasks
 - “Calculator-like” number pad for fast and easy data entry (Full Numeric version only)
 - Control keys for local start, stop, speed, and direction
 - Remote versions for panel mount application

Outstanding Control and Performance

Multiple motor control algorithms allow performance matched to the application need:

- **Volts/Hertz** for simple Fan and Pump applications.
- **Sensorless Vector** for high torque production over a wide speed range.
- **Vector** for outstanding torque regulation and excellent low speed/zero speed performance (w/Vector Control cassette).

The PowerFlex 700 drive's Vector Control uses Allen-Bradley's patented Force™ Technology which provides excellent low-speed performance - whether it is operated with or without feedback. While this industry-leading control provides the highest level of drive performance, it is as easy to use as any general purpose drive available.



Drives Features

- Fast-acting **Current Limit** and **Bus Voltage Regulation** result in maximum accel/decel without tripping.
- **High speed analog inputs** improve drive response to torque or speed commands.
- **Programming flexibility** allows parameters to be linked within the drive.
- **Flying Start** delivers smooth and instantaneous connection into rotating loads, regardless of commanded direction, without the need for any speed feedback.
- **Integral Process PI Control** can eliminate the need for a separate process loop controller.
- **Inertia Ride-Through** offers tripless operation during a prolonged power outage by using the rotating energy stored in high inertia, low-friction loads.
- **Position Indexer/Speed Profiler** uses a 16 step indexer to provide point-to-point positioning or velocity profiling based on encoder counts, digital inputs, parameter levels or time.
- **TorqProve™** assures control of the load when transferring control between the drive and a mechanical brake.
- **Speed Regulation** - Open Loop or Closed Loop
 - **Slip Compensation** delivers a minimum 0.5% speed regulation without feedback hardware.
 - **Droop** allows drives to load share without fighting each other.
 - **Encoder Feedback** provides up to 0.001% speed regulation for the tightest application requirements.
- **Torque Regulation** - Open Loop or Closed Loop
 - **Open Loop** torque regulation provides $\pm 5\%$ regulation.
 - **Encoder Feedback** provides $\pm 2\%$ regulation and the ability to hold full load at zero speed.

Unsurpassed Capability in Network Communications

PowerFlex drives are fully compatible with the wide variety of Allen-Bradley DPI™ communication adapters, offering the following benefits:

BAcnet®	ControlNet™	DeviceNet™	EtherNet/IP™	LonWorks™	Modbus RTU	PROFIBUS™	Remote I/O ⁽¹⁾	RS485 DFI	USB	Description
	✓	✓	✓							(Unconnected Messaging) permits other network devices (e.g. PanelView™) to communicate directly to a drive without routing the communication through the network scanner.
✓	✓	✓	✓					✓	✓	Adapter Routing - Plug PC into one drive and talk to all other Allen-Bradley drives on same network, without being routed through network scanner.
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Access to 100% of all parameters over the network.
✓		✓	✓			✓				AutoBaud capability makes initial connections less problematic.
		✓								Change of State significantly reduces network traffic by configuring control messages to be sent only upon customer defined states. Very flexible configuration for each node (Example: "reference must change by more than 5%").
		✓	✓							Peer Control provides master-slave type control between drives, where one or more slave drives (consumers) can run based on the status of a master drive (producer), which can also significantly reduce network traffic.
		✓								ADR (Automatic Device Replacement) saves significant time and effort when replacing a drive, by allowing the scanner to be configured to automatically detect a new drive and download the required parameter settings.
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Flexible Fault Configuration - Adapters can be programmed to take fault based actions as ramp to stop, coast-to-stop and hold last state, as well as send user configurable logic control and speed reference values. In addition, different actions can be taken based on whether the network experienced a serious problem (broken cable etc.) versus network idle condition (PLC set to "Program").

(1) This item has Silver Series status. For information, refer to <http://www.ab.com/silver>.

Catalog Number Explanation

20B **D** **2P1** **A** **3** **A** **Y** **N** **A** **E** **C** **O** **NN** **AD**
a *b* *c1...c5* *d* *e* *f* *g* *h* *i* *j* *k* *l* *m* *n*

a

Drive	
Code	Type
20B	PowerFlex 700

b

Voltage Rating				
Code	Voltage	Ph.	Prechg.	Frames
B	240V AC	3	-	0...6
C	400V AC	3	-	0...10
D	480V AC	3	-	0...10
E	600V AC	3	-	0...6
F	690V AC	3	-	5...6
H	540V DC	-	N	5...6, 10
J	650V DC	-	N	5...6, 10
N	325V DC	-	Y	5...6
P	540V DC	-	Y	5...9
R	650V DC	-	Y	5...9
T	810V DC	-	Y	5...6
W	932V DC	-	Y	5...6

c1

ND Rating				
208/240V, 60 Hz Input				
Code	208V Amps	240V Amps	Hp	Frame
2P2	2.5	2.2	0.5	0
4P2	4.8	4.2	1.0	0
6P8	7.8	6.8	2.0	1
9P6	11	9.6	3.0	1
015	17.5	15.3	5.0	1
022	25.3	22	7.5	1
028	32.2	28	10	2
042	48.3	42	15	3
052	56	52	20	3
070	78.2	70	25	4
080	92	80	30	4
104	120	104	40	5
130	130	130	50	5
154	177	154	60	6
192	221	192	75	6
260	260	260	100	6

c2

ND Rating			
400V, 50 Hz Input			
Code	Amps	kW	Frame
1P3	1.3	0.37	0
2P1	2.1	0.75	0
3P5	3.5	1.5	0
5P0	5.0	2.2	0
8P7	8.7	4.0	0
011	11.5	5.5	0
015	15.4	7.5	1
022	22	11	1
030	30	15	2
037	37	18.5	2
043	43	22	3
056	56	30	3
072	72	37	3
085	85	45	4
105	105	55	5
125	125	55	5
140	140	75	5
170	170	90	6
205	205	110	6
260	260	132	6
292	292	160	7
325	325	180	7
365	365	200	8
415	415	240	8
481	481	280	8
535	535	300	8
600	600	350	8
730	730	400	9
875	875	500	10

c3

ND Rating			
480V, 60 Hz Input			
Code	Amps	Hp	Frame
1P1	1.1	0.5	0
2P1	2.1	1.0	0
3P4	3.4	2.0	0
5P0	5.0	3.0	0
8P0	8.0	5.0	0
011	11	7.5	0
014	14	10	1
022	22	15	1
027	27	20	2
034	34	25	2
040	40	30	3
052	52	40	3
065	65	50	3
077	77	60	4
096	96	75	5
125	125	100	5
156	156	125	6
180	180	150	6
248	248	200	6
292	292	250	7
325	325	250	7
365	365	300	8
415	415	350	8
481	481	400	8
535	535	450	8
600	600	500	8
730	730	600	9
875	875	700	10

c4

ND Rating			
600V, 60 Hz Input			
Code	Amps	Hp	Frame
1P7	1.7	1.0	0
2P7	2.7	2.0	0
3P9	3.9	3.0	0
6P1	6.1	5.0	0
9P0	9.0	7.5	0
011	11	10	1
017	17	15	1
022	22	20	2
027	27	25	2
032	32	30	3
041	41	40	3
052	52	50	3
062	62	60	4
077	77	75	5
099	99	100	5
125	125	125	6
144	144	150	6

20B **D** **2P1** **A** **3** **A** **Y** **N** **A** **E** **C** **0** **NN** **AD**
a *b* *c1...c5* *d* *e* *f* *g* *h* *i* *j* *k* *l* *m* *n*

c5

ND Rating			
690V, 50 Hz Input			
Code	Amps	KW	Frame
052	52	45	5
060	60	55	5
082	82	75	5
098	98	90	6
119	119	110	6
142	142	132	6

d

Enclosure	
Code	Enclosure
A	IP20, NEMA/UL Type 1
F ♣	Open/Flange Mount Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA Type 12
N ♣	Open/Flange Mount Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA 12
G ♣	Stand-Alone/Wall Mount IP54, NEMA/UL Type 12
U	Roll-In Front: IP00, NEMA/UL Type Open Back/Heatsink: IP54, NEMA 12 Frames 8 & 9 Only

♣ Only available for Frame 5 & Frame 6 drives, 400...690V.
 ♣ Only available for Frames 7...10.

e

HIM	
Code	Operator Interface
0	Blank Cover
3	LCD Display, Full Numeric Keypad
J ♣	Remote (Panel Mount), IP66, NEMA/UL Type 12 Full Numeric LCD HIM
K ♣	Remote (Panel Mount), IP66, NEMA/UL Type 12 Prog. Only LCD HIM

♣ Available with Frames 5...6 Stand-Alone IP54 drives (Enclosure Code "G").

f

Documentation	
Code	Type
A	Manual
N	No Manual
Q	No Shipping Package (Internal Use Only)

g

Brake	
Code	w/Brake IGBT ‡
Y	Yes
N	No

‡ Brake IGBT is standard on Frames 0-3, optional on Frames 4-6 and not available on Frames 7...10.

h

Internal Braking Resistor	
Code	w/Resistor
Y	Yes ★
N	No

★ Not available for Frame 3 drives or larger.

i

Emission		
Code	CE Filter §	CM Choke
A	Yes	Yes
B #	Yes	No
N	No	No

§ Note: 600V class drives below 77 Amps (Frames 0-4) are declared to meet the Low Voltage Directive. It is the responsibility of the user to determine compliance to the EMC directive. Frames 7...10, 400/480V AC drives (Voltage Rating codes "C" and "D") meet CE certification requirements when installed per recommendations.

Only available for 208...240V Frame 0-3 drives.

j

Comm Slot	
Code	Network Type
C	ControlNet (Coax)
D	DeviceNet
E	EtherNet/IP
N	None

k

Control & I/O		
Code	Control	I/O Volts
A	Standard ♣	24V DC/AC
B	Standard ♣	115V AC
C	Vector Δ	24V DC
D	Vector Δ	115V AC
N	Standard	None

Δ Vector Control Option utilizes DPI Only.

♣ Frame 0...6 drives only.

l

Feedback	
Code	Type
0	None
1	Encoder, 12V/5V

m

Future Use	
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n

Special Firmware (Frames 0...6 Only)	
Code	Type
AD ♣	60 Hz Maximum
AE ♣	Cascading Fan/Pump Control
AX ♣	82 Hz Maximum
BA ♣	Pump Off (for pump jack)

♣ Must be used with Vector Control option C or D (Position k). Positions m-n are only required when custom firmware is supplied.

Technical Specifications

Category	Specification							
Protection	Drive	200...208V	240V	380/400V	480V	600V Frames 0...4	600/690V Frames 5...6	
	AC Input Overvoltage Trip:	285V AC	285V AC	570V AC	570V AC	716V AC	818V AC	
	AC Input Undervoltage Trip:	120V AC	138V AC	233V AC	280V AC	345V AC	345V AC	
	Bus Overvoltage Trip:	405V DC	405V DC	810V DC	810V DC	1013V DC	1162V DC	
	Bus Undervoltage Shutoff/Fault:	153V DC	153V DC	305V DC	305V DC	381V DC	437V DC	
	Nominal Bus Voltage:	281V DC	324V DC	540V DC	648V DC	810V DC	932V DC	
	All Drives							
	Heat Sink Thermistor:	Monitored by microprocessor overtemp trip						
	Drive Overcurrent Trip	200% of rated current (typical)						
	Software Overcurrent Trip:	220...300% of rated current (dependent on drive rating)						
Hardware Overcurrent Trip:								
Line transients:	up to 6000 volts peak per IEEE C62.41-1991							
Control Logic Noise Immunity:	Showering arc transients up to 1500V peak							
Power Ride-Thru:	15 milliseconds at full load							
Logic Control Ride-Thru:	0.5 seconds minimum, 2 seconds typical							
Ground Fault Trip:	Phase-to-ground on drive output							
Short Circuit Trip:	Phase-to-phase on drive output							
Electrical	Voltage Tolerance:	See page 12 for full power and operating range						
	Input Frequency Tolerance:	47...63 Hz						
	Input Phases:	Three-phase input provides full rating for all drives. Single-phase operation possible on certain drives and provides 50% of rated current (see Installation Instructions for details). Frames 0...7: Drive can be supplied as 6 pulse or 18 pulse in an engineered package.						
	Displacement Power Factor:	0.98 across entire speed range						
	Efficiency:	97.5% at rated amps, nominal line volts						
	Maximum Short Circuit Rating:	200,000 Amps symmetrical						
	Actual Short Circuit Rating:	Determined by AIC rating of installed fuse/circuit breaker						
	Drive to Motor Power Ratio							
Minimum	Recommended not less than 1:2 ratio							
Maximum	Recommended not greater than 2:1 ratio							

Category	Specification	
Control	Method:	Sine coded PWM with programmable carrier frequency. Ratings apply to all drives (refer to the <i>Derating Guidelines</i> in the PowerFlex Reference Manual). The drive can be supplied as 6 pulse or 18 pulse in a configured package.
	Carrier Frequency:	2, 4, 8, and 10 kHz. Drive rating based on 4 kHz. See the Input Protection Device tables in the Installation Instructions for exceptions.
	Output Voltage Range:	0 to rated motor voltage
	Output Frequency Range:	Standard Control – 0 to 400 Hz., Vector Control – 0 to 420 Hz
	Frequency Accuracy Digital Input: Analog Input:	Within $\pm 0.01\%$ of set output frequency Within $\pm 0.4\%$ of maximum output frequency
	Frequency Control:	Speed Regulation - w/Slip Compensation (Volts per Hertz Mode) 0.5% of base speed across 40:1 speed range, 40:1 operating range 10 rad/sec bandwidth
		Speed Regulation - w/Slip Compensation (Sensorless Vector Mode) 0.5% of base speed across 80:1 speed range, 80:1 operating range 20 rad/sec bandwidth
		Speed Regulation - w/Feedback (Sensorless Vector Mode) 0.1% of base speed across 80:1 speed range, 80:1 operating range 20 rad/sec bandwidth
	Speed Control:	Speed Regulation - w/o Feedback (Vector Control Mode) 0.1% of base speed across 120:1 speed range, 120:1 operating range 50 rad/sec bandwidth
		Speed Regulation - w/Feedback (Vector Control Mode) 0.001% of base speed across 120:1 speed range, 1000:1 operating range, 250 rad/sec bandwidth
	Torque Regulation:	Torque Regulation - w/o Feedback $\pm 5\%$, 600 rad/sec bandwidth
		Torque Regulation - w/Feedback $\pm 2\%$, 2500 rad/sec bandwidth
	Selectable Motor Control:	Sensorless Vector with full tuning. Standard V/Hz with full custom capability. PF700 adds Vector Control.
	Stop Modes:	Multiple programmable stop modes including - Ramp, Coast, DC-Brake, Ramp-to-Hold and S-curve.
	Accel/Decel:	Two independently programmable accel and decel times. Each time may be programmed from 0...3600 seconds in 0.1 second increments.
	Intermittent Overload:	110% Overload capability for up to 1 minute, 150% Overload capability for up to 3 seconds.
Current Limit Capability:	Proactive Current Limit programmable from 20...160% of rated output current. Independently programmable proportional & integral gain.	
Motor Overload Protection Frames 0...6 Standard Control:	PowerFlex 700 drives with standard control, identified by an N, A, or B in position 15 of the catalog number, only provide Class 10 motor overload protection according to NEC article 430. They do not provide speed sensitive overload protection, thermal memory retention and motor over-temperature sensing according to NEC article 430.126 (A) (2). If such protection is needed in the end-use product, it must be provided by additional means.	
Frames 0...6 Vector Control:	PowerFlex 700 drives with vector control, identified by a C or D in position 15 of the catalog number, provide class 10 motor overload protection according to NEC article 430 and motor over-temperature protection according to NEC article 430.126 (A) (2). UL 508C File E59272.	
Frames 7...10 Vector Control:	Class 10 motor overload protection according to NEC article 430 and motor over-temperature protection according to NEC article 430.126 (A)(2). UL 508C File E59272.	

Category	Specification						
Control (continued)	Digital/Analog Input Latency	Signal		Motor Control	Latency		
					Min.	Max	Typical
		Digital Input	Start	FVC	8.4 ms	10.4 ms	8.4 ms
				SVC	9.2 ms	16.0 ms	9.2 ms
			Stop	FVC	10.0 ms	12.4 ms	10.4 ms
				SVC	10.0 ms	12.0 ms	10.4 ms
		Analog Input	Torque 4 kHz PWM	FVC	772 μ s	1.06 ms	840 μ s
			Torque 2 kHz PWM	FVC	1.008 ms	1.46 ms	1.256 ms
			Speed	FVC	4.6 ms	8.6 ms	4.8 ms
			Speed	SVC	4.8 ms	12.4 ms	6.4 ms
Encoder	Type:	Incremental, dual channel					
	Supply:	12V, 250 mA. 12V, 10 mA minimum inputs isolated with differential transmitter, 250 kHz maximum.					
	Quadrature:	90°, \pm 27 degrees at 25 degrees C.					
	Duty Cycle:	50%, +10%					
	Requirements:	Encoders must be line driver type, quadrature (dual channel) or pulse (single channel), 8...15V DC output (4...6V DC when jumpers are in 5V position), single-ended or differential and capable of supplying a minimum of 10 mA per channel. Maximum input frequency is 250 kHz. The Encoder Interface Board accepts 12V DC square-wave with a minimum high state voltage of 7.0V DC. With the jumpers in the 5V position, the encoder will accept a 5V DC square-wave with a minimum high state voltage of 3.0V DC. In either jumper position, the maximum low state voltage is 0.4V DC.					

Pollution Degree Ratings According to EN 61800-5-1

Pollution Degree	Description
1	No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.
2	Normally, only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation is to be expected, when the drive is out of operation.
3	Conductive pollution or dry non-conductive pollution occurs, which becomes conductive due to condensation, which is to be expected.
4	The pollution generates persistent conductivity caused, for example, by conductive dust, rain or snow.