Product Information

Original Instructions

PowerFlex 4 Adjustable Frequency AC Drive

Catalog Number 22A

ATTENTION:
- **Before installing, configuring, operating, or maintaining this product, read this document and the documents that are listed in the Additional Resources section for installing, configuring, or operating equipment. Users should familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.**
- Installation, adjustments, putting into service, use, assembly, disassembly, and maintenance shall be carried out by suitably trained personnel in accordance with applicable code of practice.
- If this equipment is used in a manner that is not specified by the manufacturer, the protection that is provided by the equipment may be impaired.
- Solid-state equipment has operational characteristics that differ from those of electromechanical equipment. Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication SGI-1.1, available from your local Rockwell Automation sales office or online at rok.auto/literature describes some important differences between solid-state equipment and hard-wired electromechanical devices.

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Summary of Changes

This publication contains new or updated information. Changes throughout this revision are marked by change bars, as shown to the left of this paragraph.

Mounting Considerations

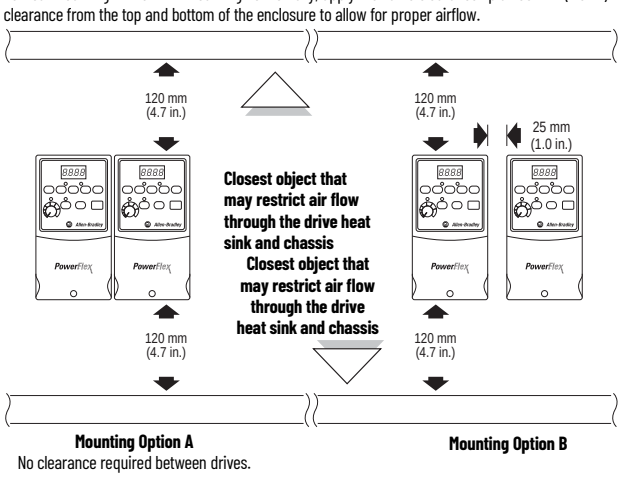
- Mount the drive upright on a flat, vertical, and level surface.

Min. Panel Thickness	Screw Size	Screw Torque	DIN Rail
1.9 mm (0.0747 in.)	M4 (#8…32)	1.56…1.96 N•m (14…17 lb•in)	35 mm

- Protect the cooling fan by avoiding dust or metallic particles.
- Do not expose to a corrosive atmosphere.
- Protect from moisture and direct sunlight.

Minimum Mounting Clearances

Vertical mounting is shown. If mounting horizontally, apply the same clearances plus 50 mm (2.0 in.) clearance from the top and bottom of the enclosure to allow for proper airflow.



Mounting Option A
No clearance required between drives.

Mounting Option B

Ambient Operating Temperatures

Ambient Temperature		Enclosure Rating	Minimum Mounting Clearances
Minimum	Maximum		
-10 °C (14 °F)	40 °C (104 °F)	IP20/Open Type	Use Mounting Option A
		IP30/NEMA 1/UL Type 1[1]	Use Mounting Option B
	50 °C (122 °F)	IP20/Open Type	

(1) Rating requires installation of the PowerFlex® 40P IP30/NEMA 1/UL Type 1 option kit.

Drive Dimensions

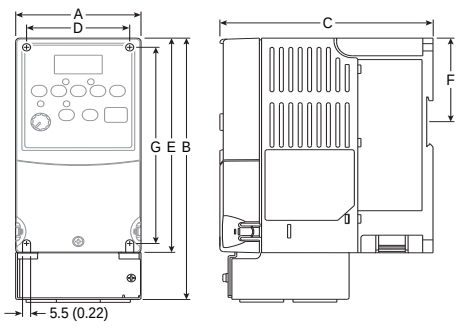
PowerFlex 4 Panel Mount Drives

Flange Mount drives are also available. See the PowerFlex 4 User Manual for more information. Ratings are in kW and (HP).

Frame	1-Phase 120V AC	1-Phase 240V AC No Brake	1-Phase 240V AC	3-Phase 240V AC	3-Phase 480V AC
A	0.2 (0.25) 0.37 (0.5)	0.2 (0.25) 0.37 (0.5) 0.75 (1.0)	0.2 (0.25) 0.37 (0.5) 0.75 (1.0)	0.2 (0.25) 0.37 (0.5) 0.75 (1.0) 1.5 (2.0)	0.37 (0.5) 0.75 (1.0) 1.5 (2.0)
B	0.75 (1.0) 1.1 (1.5)	1.5 (2.0) 2.2 (3.0)	1.5 (2.0)	2.2 (3.0) 3.7 (5.0)	2.2 (3.0) 3.7 (5.0)

PowerFlex 4 AC Drive

Dimensions are in mm and (in.). Weights are in kg and (lb).

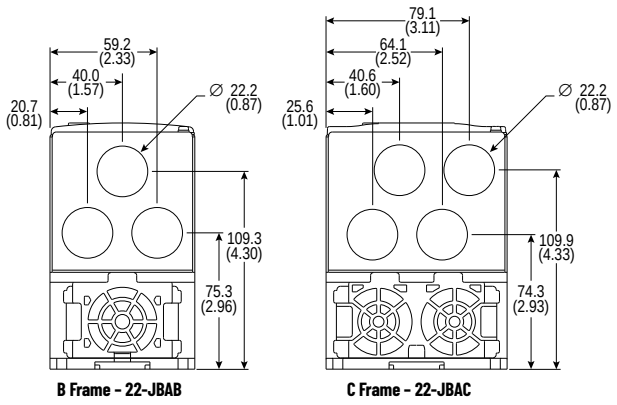


Frame	A	B[1]	C	D	E[2]	F	G	Ship Weight
A	80 (3.15)	185 (7.28)	136 (5.35)	67 (2.64)	152 (5.98)	59.3 (2.33)	140 (5.51)	1.4 (3.1)
B	100 (3.94)	213 (8.39)	136 (5.35)	87 (3.43)	180 (7.09)	87.4 (3.44)	168 (6.61)	2.2 (4.9)

(1) Overall height of drive with IP30/NEMA 1/UL Type 1 option kit installed.

(2) Overall height of standard IP20/Open Type drive.

IP30/NEMA 1/UL Type 1 Option Kit



B Frame - 22-JBAB **C Frame - 22-JBAC**

Fuses and Circuit Breakers

See the PowerFlex 4 Adjustable Frequency AC Drive User Manual for fuses and circuit breakers for non-UL applications.

Fuses and Circuit Breakers - UL 61800-5-1 Applications

Catalog No.	Output Ratings			Input Ratings			Branch Circuit Protection			Power Dissipation
	kW	HP	Amps	Voltage Range	kVA	Amps	Fuses	140M/MT Motor Protectors (2) (3) (4)	Min. Enclosure Volume[5] (in.^{3})	IP20 Open Watts
100…120V AC (±10%) — 1-Phase Input, 0…230V 3-Phase Output										
22A-V1P5N104	0.2	0.25	1.5	90…126	0.75	6.0	10	140M-C2E-C10 140MT-C3E-C10	1655	32
22A-V2P3N104	0.4	0.5	2.3	90…126	1.15	9.0	15	140M-C2E-C16 140MT-C3E-C16	1655	40
22A-V4P5N104	0.75	1.0	4.5	90…126	2.25	18.0	30	140M-D8E-C20 140MT-D9E-C20	1655	55
22A-V6P0N104	1.1	1.5	6.0	90…126	3.0	24.0	40	140M-F8E-C32	1655	80
200…240V AC (±10%) — 1-Phase Input[1], 0…230V 3-Phase Output, NO BRAKE										
22A-A1P4N103	0.2	0.25	1.4	180…265	0.7	3.2	6	140M-C2E-B40 140MT-C3E-B40	1655	32
22A-A2P1N103	0.4	0.5	2.1	180…265	1.05	5.3	10	140M-C2E-B63 140MT-C3E-B63	1655	40
22A-A3P6N103	0.75	1.0	3.6	180…265	1.8	9.2	15	140M-C2E-C16 140MT-C3E-C16	1655	55
22A-A6P8N103	1.5	2.0	6.8	180…265	3.4	14.2	25	140M-C2E-C16 140MT-C3E-C16	1655	85
22A-A6P8N103	2.2	3.0	9.6	180…265	4.8	19.6	30	140M-D8E-C25 140MT-D9E-C25	1655	125
200…240V AC (±10%) — 1-Phase Input, 0…230V 3-Phase Output										
22A-A1P5N104	0.2	0.25	1.5	180…265	0.75	5.0	10	140M-C2E-B63 140MT-C3E-B63	1655	32
22A-A2P3N104	0.4	0.5	2.3	180…265	1.15	6.0	10	140M-C2E-B63 140MT-C3E-B63	1655	40
22A-A2P3N104	0.75	1.0'	4.5	180…265	2.25	10.0	15	140M-C2E-C16 140MT-C3E-C16	1655	55
22A-A8P0N104	1.5	2.0	8.0	180…265	4.0	18.0	30	140M-D8E-C20 140MT-D9E-C20	1655	85
200…240V AC (±10%) — 3-Phase Input, 0…230V 3-Phase Output										
22A-B1P5N104	0.2	0.25	1.5	180…265	0.75	1.8	3	140M-C2E-B25 140MT-C3E-B25	1655	32
22A-B2P3N104	0.4	0.5	2.3	180…265	1.15	2.5	6	140M-C2E-B40 140MT-C3E-B40	1655	40
22A-B4P5N104	0.75	1.0	4.5	180…265	2.25	5.2	10	140M-C2E-C10 140MT-C3E-C10	1655	55
22A-B8P0N104	1.5	2.0	8.0	180…265	4.0	9.5	15	140M-C2E-C16 140MT-C3E-C16	1655	85
22A-B012N104	2.2	3.0	12.0	180…265	5.5	15.5	25	140M-C2E-C16 40MT-C3E-C16	1655	125
22A-B017N104	3.7	5.0	17.5	180…265	8.6	21.0	30	140M-F8E-C25	1655	180
380…480V AC (±10%) — 3-Phase Input, 0…460V 3-Phase Output										
22A-D1P4N104	0.4	0.5	1.4	340…528	1.4	1.8	3	140M-C2E-B25 140MT-C3E-B25	1655	32
22A-D2P3N104	0.75	1.0	2.3	340…528	2.3	3.2	6	140M-C2E-B40 140MT-C3E-B40	1655	50
22A-D4P0N104	1.5	2.0	4.0	340…528	4.0	5.7	10	140M-C2E-B63 140MT-C3E-B63	1655	70
22A-D6P0N104	2.2	3.0	6.0	340…528	5.9	7.5	15	140M-C2E-C10 140MT-C3E-C10	1655	100
22A-D8P7N104	4.0	5.0	8.7	340…528	8.6	9.0	15	140M-C2E-C16 140MT-C3E-C16	1655	150

(1) 200…240V AC - 1-Phase drives are also available with an integral EMC filter. Catalog suffix changes from N103 to N113 and N104 to N114.

(2) The AIC ratings of the Bulletin 140M/MT devices can vary. See publication 140-TD005 or 140M-TD002.

(3) Bulletin 140M/MT devices with adjustable current range must have the current trip set to the minimum range that the device does not trip.

(4) Manual Self-Protected (Type E) Combination Motor Controller, UL Listed for 208V Wye or Delta, 240V Wye or Delta, 480V Y/277 or 600V Y/347. Not UL Listed for use on 480V or 600V Delta/Delta, corner ground, or high-resistance ground systems.

(5) When using a Manual Self-Protected (Type E) Combination Motor Controller, the drive must be installed in a ventilated or non-ventilated enclosure with the minimum volume specified in this column. Application specific thermal considerations may require a larger enclosure.

Wiring

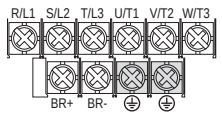
See the PowerFlex 4 Adjustable Frequency AC Drive User Manual for instructions on how to wire the power terminals and control terminals.

Power Wiring

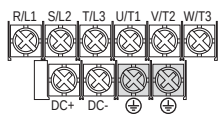
Power Wire Rating	Recommended Copper Wire
Unshielded 600V 75 °C (167 °F) THHN/THWN	15 Mils insulated, dry location
Shielded 600V 75 °C or 90 °C (167 °F or 194 °F) RHH/RHW-2	Belden 29501-29507 or equivalent
Shielded Tray rated 600V 75 °C or 90 °C (167 °F or 194 °F) RHH/RHW-2	Shawflex 2ACD/3ACD or equivalent

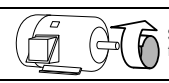
Power Terminal Block

Frame A



Frame A — No Brake IGBT



Terminal	Description	
R/L1, S/L2	1-Phase Input	
R/L1, S/L2, T/L3	3-Phase Input	
U/T1	To Motor U/T1	=  Switch any two motor leads to change forward direction.
V/T2	To Motor V/T2	
W/T3	To Motor W/T3	
BR+, BR-	Dynamic Brake Resistor Connection [0.75 kW (1 HP) ratings and higher]	
DC+, DC-	DC Bus Connection	
⏚	Safety Ground - PE	

IMPORTANT Terminal screws may become loose during shipment. Verify that all terminal screws are tightened to the recommended torque before you apply power to the drive.

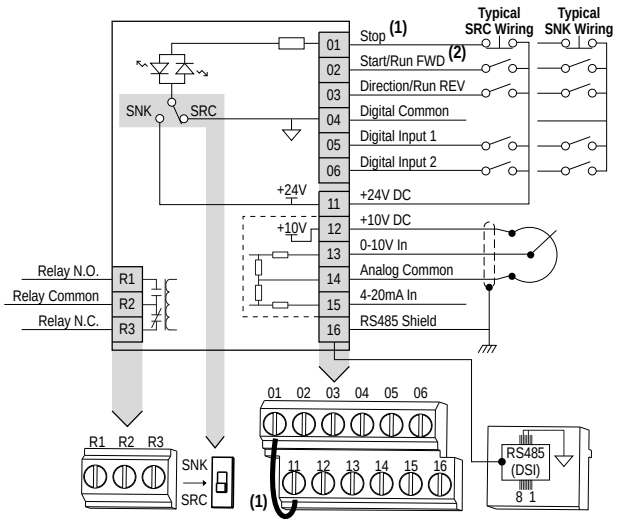
Power Terminal Block Specifications

Frame	Maximum Wire Size[1]	Minimum Wire Size[1]	Torque
A	3.3 mm^2 (12 AWG)	0.8 mm^2 (18 AWG)	1.7…2.2 N•m (16…19 lb•in)
B	5.3 mm^2 (10 AWG)	1.3 mm^2 (16 AWG)	

(1) Maximum/minimum sizes that the terminal block accepts. These are not recommendations.

Control Terminal Block

Control I/O Wiring Block Diagram



	30V DC	125V AC	240V AC
Resistive	3.0 A	3.0 A	3.0 A
Inductive	0.5 A	0.5 A	0.5 A

P036 [Start Source]	Stop	I/O Terminal 01 Stop
Keypad	Per P037	Coast
3-wire	Per P037	Per P037
2-wire	Per P037	Coast
RS485 Port	Per P037	Coast

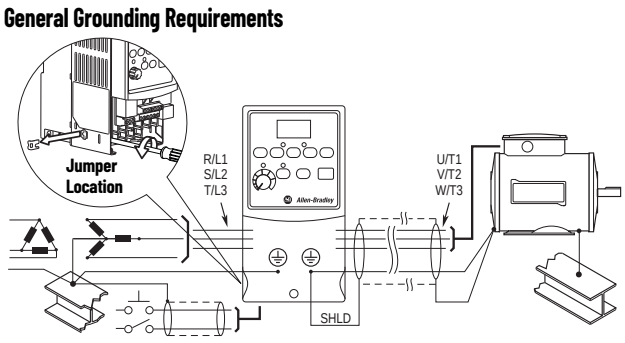
(1)

IMPORTANT
- I/O Terminal 01 is always a coast to stop input except when P036 [Start Source] is set to "3-Wire", "2-W Lvl Sens" or "Momt FWD/REV" control. In three wire control, I/O Terminal 01 is controlled by P037 [Stop Mode]. All other stop sources are controlled by P037 [Stop Mode].
- The drive is shipped with a jumper installed between I/O Terminals 01 and 11. Remove this jumper when using I/O Terminal 01 as a stop or enable input.

(2) Two wire control shown. For three wire control, use a momentary input on I/O Terminal 02 to command a start. Use a maintained input for I/O Terminal 03 to change direction.

(3) Only one analog frequency source may be connected at a time. If more than one reference is connected at the same time, an undetermined frequency reference will result.

General Grounding Requirements

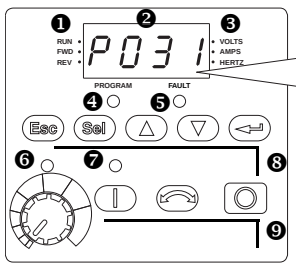


IMPORTANT The MOV to ground jumper must be removed if the drive is installed on an ungrounded (IT mains) or resistive grounded distribution system. Tighten screw after jumper removal.

Prepare For Drive Startup

ATTENTION: Power must be applied to the drive to perform the following startup procedures. Some of the voltages present are at incoming line potential. To avoid electric shock hazard or damage to equipment, only qualified service personnel should perform the following procedure. Thoroughly read and understand the procedure before beginning. If an event does not occur while performing this procedure, **Do Not Proceed. Remove All Power** including user supplied control voltages. User supplied voltages may exist even when main AC power is not applied to the drive. Correct the malfunction before continuing.

Integral Keypad



Menu	Parameter Group and Description
d	**Display Group (View Only)** Consists of commonly viewed drive operating conditions.
P	**Basic Display 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 (Color)	No.	LED (Color)
❶	Run/Direction Status (Red) **Note:** A flashing LED indicates that the drive has been commanded to change direction. Indicates actual motor direction while decelerating to zero.	❹	Program Status (Red)
		❺	Fault Status (Red)
❷	Alphanumeric Display (Red)	❻	Pot Status (Green)
❸	Displayed Units (Red)	❼	Start Key Status (Green)

No.	Key	Name	No.	Key	Name
❽	Esc	Escape	❾		Potentiometer
	Sel	Select			Start
	▲ ▼	Up Arrow/ Down Arrow			Reverse
	↵	Enter			Stop

Smart Start-Up with Program Group Parameters

The PowerFlex 40P is designed so that start up is simple and efficient. The Program Group contains the most commonly used parameters.

◎ = Stop drive before changing this parameter.

No.	Parameter	Min/Max	Display/Options	Default
P031 ◎	[Motor NP Volts] Set to the motor nameplate rated volts.	20/Drive Rated Volts	1V AC	Based on Drive Rating
P032 ◎	[Motor NP Hertz] Set to the motor nameplate rated frequency.	15/500 Hz	1 Hz	60 Hz
P033	[Motor OL Current] Set to the maximum allowable motor current.	0.0/(Drive Rated Amps× 2)	0.1 A	Based on Drive Rating
P034	[Minimum Freq] Sets the lowest frequency the drive will output continuously.	0.00/500.0 Hz	0.1 Hz	0.0 Hz
P035 ◎	[Maximum Freq] Sets the highest frequency the drive will output.	0.00/500.0 Hz	0.1 Hz	60.0 Hz
P036 ◎	[Start Source] Sets the control scheme used to start the drive.	0/5	0 = "Keypad"[1] 1 = "3-Wire" 2 = "2-Wire" 3 = "2-W Lvl Sens" 4 = "2-W Hi Speed" 5 = "Comm Port" [1] When active, the Reverse key is also active unless disabled by A095 [Reverse Disable].	5
P037	[Stop Mode] Active stop mode for all stop sources [e.g. keypad, run forward (I/O Terminal 02), run reverse (I/O Terminal 03), RS485 port] except as noted below. **Important:** I/O Terminal 01 is always a coast to stop input except when P036 [Start Source] is set for "3-Wire" control. When in three wire control, I/O Terminal 01 is controlled by P037 [Stop Mode].	0/7	0 = "Ramp, CF"[1] 1 = "Coast, CF"[1] 2 = "DC Brake, CF"[1] 3 = "DCBrkAuto,CF"[1] 4 = "Ramp" 5 = "Coast" 6 = "DC Brake" 7 = "DC BrakeAuto" [1] Stop input also clears active fault.	0
P038	[Speed Reference] Sets the source of the speed reference to the drive. **Important:** When A051 or A052 [Digital Inx Sel] is set to option 2, 4, 5, 6, 13 or 14 and the digital input is active, A051, A052, A053 or A054 will override the speed reference commanded by this parameter. Refer to Chapter 1 of the PowerFlex 40P User Manual for details.	0/5	0 = "Drive Pot" 1 = "InternalFreq" 2 = "0-10V Input" 3 = "4-20mA Input" 4 = "Preset Freq" 5 = "Comm Port"	0 1 (IP66, Type 4X)
P039	[Accel Time 1] Sets the rate of accel for all speed increases.	0.0/600.0 s	0.1 s	10.0 s
P040	[Decel Time 1] Sets the rate of decel for all speed decreases.	0.1/600.0 s	0.1 s	10.0 s
P041 ◎	[Reset To Defalts] Resets all parameter values to factory defaults.	0/1	0 = "Ready/Idle" 1 = "Factory Rset"	0
P043	[Motor OL Ret] Enables/disables the Motor Overload Retention function.	0/1	0 = "Disabled" 1 = "Enabled"	0

Fault Codes

To clear a fault, press the Stop key, cycle power or set A100 [Fault Clear] to 1 or 2.

Fault Code Descriptions

No.	Fault	Description
F2	Auxiliary Input[1]	Check remote wiring.
F3	Power Loss	Monitor the incoming AC line for low voltage or line power interruption.
F4	UnderVoltage[1]	Monitor the incoming AC line for low voltage or line power interruption.
F5	OverVoltage[1]	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install dynamic brake option.
F6	Motor Stalled[1]	Increase [Accel Time x] or reduce load so drive output current does not exceed the current set by parameter A089 [Current Limit].
F7	Motor Overload[1]	An excessive motor load exists. Reduce load so drive output current does not exceed the current set by parameter P033 [Motor OL Current]. Verify A084 [Boost Select] setting.
F8	Heatsink OvrTmp[1]	Check for blocked or dirty heat sink fins. Verify that ambient temperature has not exceeded 40 °C (104 °F) for IP 30/NEMA 1/UL Type 1 installations or 50 °C (122 ° F) for Open type installations. Check fan.
F12	HW OverCurrent	Check programming. Check for excess load, improper DC boost setting, DC brake volts set too high or other causes of excess current.
F13	Ground Fault	Check the motor and external wiring to the drive output terminals for a grounded condition.
F33	Auto Rstrt Tries	Correct the cause of the fault and manually clear.
F38	Phase U to Gnd	Check the wiring between the drive and motor. Check motor for grounded phase. Replace drive if fault cannot be cleared.
F39	Phase V to Gnd	
F40	Phase W to Gnd	
F41	Phase UV Short	Check the motor and drive output terminal wiring for a shorted condition. Replace drive if fault cannot be cleared.
F42	Phase UW Short	
F43	Phase VW Short	
F48	Params Defaulted	The drive was commanded to write default values to EEPROM. Clear the fault or cycle power to the drive. Program the drive parameters as needed.
F63	SW OverCurrent[1]	Check load requirements and A098 [SW Current Trip] setting.
F64	Drive Overload	Reduce load or extend Accel Time.
F70	Power Unit	Cycle power. Replace drive if fault cannot be cleared.
F71	Net Loss	The communication network has faulted. Cycle power. Check communications cabling. Check network adapter setting. Check external network status.
F81	Comm Loss	If adapter was not intentionally disconnected, check wiring to the port. Replace wiring, port expander, adapters or complete drive as required. Check connection. An adapter was intentionally disconnected. Turn off using A105 [Comm Loss Action]. Connecting I/O Terminal 04 to ground may improve noise immunity.
F100	Parameter Checksum	Restore factory defaults.
F122	I/O Board Fail	Cycle power. Replace drive if fault cannot be cleared.

[1] Auto-Reset/Run type fault. Configure with parameters A092 and A093.

Specifications

Agency Certifications

c UL us	Listed to UL508C and CSA C22.2 No. 14		Australian Radiocommunications Act, compliant with: EN 61800-3
CE	Marked for all applicable European Directives EMC Directive: 2014/30/EU: EN 61800-3 LV Directive: 2014/35/EU: EN 61800-5-1		
KC	KCC-REM-RAA-22A		
UK CA	EMC Regulations: 2016 No. 1091: EN 61800-3 LV Regulations: 2016 No. 1101: EN 61800-5-1		

Input/Output Ratings

Output frequency: 0…240 Hz (Programmable)

Efficiency: 97.5% (Typical)

Control Inputs

Digital control inputs		Analog control inputs
Input current: 6 mA		4…20 mA Analog: 250 Ω input impedance 0…10V DC Analog: 100 kΩ input impedance External Pot: 1…10 kΩ, 2 W min
SRC (Source) mode: 18…24V = ON 0…6V = OFF	SNK (Sink) mode: 0…6V = ON 18…24V = OFF	

Control Output (Programmable Output, form C relay)

Resistive rating: 3.0 A @ 30V DC, 125V AC and 240V AC
Inductive rating: 0.5 A @ 30V DC, 125V AC and 240V AC

Fuses and Circuit Breakers

Recommended Fuse Type: UL Class J, T, or Type BS88; 600V (550V) or equivalent
Recommended Circuit Breakers: HMCP or Bulletin 140U or equivalent.

Protective Features

Motor Protection:
I^2t overload protection – 150% for 60 s, 200% for 3 s (Provides Class 10 protection)

Overcurrent: 200% hardware limit, 300% instantaneous fault

Over Voltage:
100…120V AC Input – Trip occurs @ 405V DC bus voltage (equivalent to 150V AC incoming line)
200…240V AC Input – Trip occurs @ 405V DC bus voltage (equivalent to 290V AC incoming line)
380…460V AC Input – Trip occurs @ 810V DC bus voltage (equivalent to 575V AC incoming line)

Under Voltage:
100…120V AC Input – Trip occurs @ 210V DC bus voltage (equivalent to 75V AC incoming line)
200…240V AC Input – Trip occurs @ 210V DC bus voltage (equivalent to 150V AC incoming line)
380…480V AC Input – Trip occurs @ 390V DC bus voltage (equivalent to 275V AC incoming line)

Control Ride-through: Minimum ride-through is 0.5 s – typical value 2 s

Faultless Power Ride-through: 100 ms

Dynamic Braking

Internal brake IGBT included with all ratings except No Brake versions. See Appendix B of the PowerFlex 4 User Manual for DB resistor ordering information.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation. You can view or download publications at rok.auto/literature.

Resource	Description
PowerFlex 4 User Manual, FRN, publication 22A-UM001	Provides detailed information on the parameters and specifications of the PowerFlex 4 drives.
AC Drive Installation Considerations, publication DRIVES-IN003	Provides additional information that is needed to install PowerFlex AC drives properly.
Wiring and Grounding for Pulse Width Modulated (PWM) AC Drives, publication DRIVES-IN001	Provides basic information that is needed to wire and ground PWM AC drives properly.
Industrial Automation Wiring and Grounding, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
PowerFlex AC Drive Performance Specifications per Ecodesign Regulation (EU) 2019/1781, publication PFLEX-TD003	Provides specifications per Ecodesign Regulation (EU) 2019/1781 and UK SI 2021 No. 745, including efficiency class.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

Documentation Feedback

Your comments help us serve your documentation needs better. If you have any suggestions on how to improve our content, complete the form at rok.auto/docfeedback.

Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.

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