



# AC20 Variable Speed Drive

IP20 Compact Drive for General Purpose Applications 1.5 – 180 kW



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# Variable Speed Drive - AC20 Series

## Overview

### Description

The AC20 Advanced Compact Drive is a highly featured yet economical solution to general purpose motor control applications. AC20 provides speed or torque control in the power range 1.5 kW to 180 kW. Its compact dimensions house many features normally only associated with system drives, including sensorless vector mode for control of Permanent Magnet (PMAC) and AC induction motors, encoder feedback and IO expansion option cards, Safe Torque Off and an onboard Ethernet port that supports major industrial Ethernet protocols. AC20 provides the perfect solution for OEM machine builders looking for a compact, cost-effective drive without compromising on performance.

### Features

#### Simplicity

AC20 is designed to reduce the time and effort required to select, install, set up and commission. Two variants of option card are available, and both are user installable/retrofitable. Minimal wiring requirements with two easily accessed terminal rails and removable power cable earthing brackets make AC20 fast and simple to install. All AC20 come with a high quantity of user configurable IO and a user disconnectable C3 EMC filter as standard. Programming and commissioning is made simple through its easy to use integrated keypad and the DSELite programming tool.

#### Reliability

Proven technology and manufacturing techniques ensure AC20 has been engineered and built to deliver consistently outstanding levels of performance day in, day out - ensuring maximum uptime and productivity. Thanks to its conformally coated PCBs, AC20 is built to withstand C3 environments.

#### Compatibility

AC20 has been designed with system compatibility in mind. The compact footprint allows installation into existing spaces, while the IO count has been chosen to allow maximum possible flexibility. The internal block diagram is fully featured to enable replacement of legacy Parker inverters, and the onboard Ethernet communications protocols aid integration into wider systems. Retrofittable, plug-in communications cards cover all popular protocols and are simple to configure.



### Technical Characteristics

<b>Power Supply</b>	220 ... 240 VAC ±10 % Single Phase 220 ... 240 VAC ±10 % Three Phase 380 ... 480 VAC ±10 % Three Phase
<b>Input Frequency</b>	50/60 Hz ±10 %
<b>Power Range</b>	1.5...180 kW Heavy Duty (HD)
<b>Overload</b>	150% for 60 sec.
<b>Output Frequency</b>	0.5 - 590 Hz
<b>Safe Torque Off (STO)</b>	SIL2, PLd
<b>Operating Temperature</b>	0...40 °C (derate possible up to 45°C)*
<b>Altitude</b>	0-1000m (derate 1% per 100m up to 2000m max.)

\* Without communications option fitted

**µSD Card Slot**

For application cloning and firmware updates in the field

**Built-in Display Keypad**

Operate the drive and see real time diagnostic feedback through the built-in 2-line alphanumeric display

**Standard Ethernet Port**

Modbus TCP/IP, ProfinetIO & Ethernet IP as standard. Access the drive webpage or program the drive through the popular and intuitive DSELite configuration tool



**User fittable Option Cards**

- Encoder Feedback card
  - GPIO card
- Both are compatible in each option slot & two identical cards can be fitted simultaneously

**Built-in RS232 Port**

Connect a remote 6901 keypad to the RJ11 port

**Safe Torque Off**

- Independently certified STO to SIL2, PLd as standard. Complies to:
- EN ISO13849-1:2015
  - EN 61800-5-2:2017
  - EN 61508

**Dedicated Motor Thermistor Input**

PTC Motor Thermistor feedback connection as standard

**Additional Communications Options**

- CANopen
- EtherCAT
- Ethernet IP
- Profibus DVP-1
- ProfiNet IO
- RS485 Modbus RTU slave

**Power Cable Shielding Bracket** (not shown)

Frames 2-5 fitted with a cable shielding and support bracket as standard

**User I/O**

Extensive analogue and digital I/O for application flexibility

**Standards & Compliance**

The product is certified to the latest international standards:

- Europe:
- Low Voltage Directive 2014/30/EU
  - Electro-Magnetic Compatibility Directive 2006/42/EC
  - EN61800-5-1:2007+A11;2021
  - EN61800-3:2018
  - IE 2 Compliant

North America & Canada:

- UL61800-5-1
- CSA22.2#274-17

## Applications

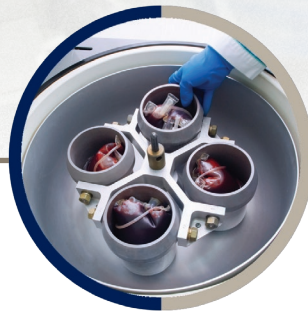
AC20 provides a no-fuss approach to general purpose industrial motor control applications across a wide range of industries, giving users the benefits of the inherent energy-saving properties of using a variable speed drive, as well as the improved reliability and extended service life benefits associated with smoother starting and stopping of regularly cycling loads.

### Typical applications for AC20 include...

- **Conveyor**
- **Centrifuge**
- **Fans**
- **Mixers**
- **Packaging Machines**
- **Textile Machines**
- **Strapping Machines**
- **Labelling Machines**
- **Industrial Washing Machines**
- **Machine Tool Spindles**
- **Roller Doors**



**Conveyors**



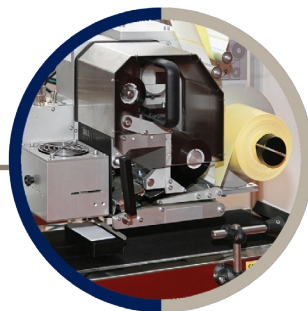
**Centrifuges**



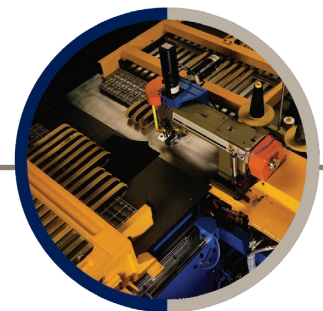
**Fans**



**Mixers**



**Packaging Machines**



**Textile Machines**

## Technical Characteristics

### Power Ratings

220-240 VAC, Single Phase Supply Voltage				
Order Code	Input Current [A]	Output Current [A]	HD Power Rating [kW]	Frame Size
20G-12-0070-BF	14	7	1.5	2
20G-12-0100-BF	20	10	2.2	

220-240 VAC, Three Phase Supply Voltage				
Order Code	Input Current [A]	Output Current [A]	HD Power Rating [kW]	Frame Size
20G-32-0070-BF	7.8	7	1.5	2
20G-32-0100-BF	11	10	2.2	
20G-32-0170-BF	18.5	17	4	3
20G-32-0210-BF	22	21	5.5	4
20G-32-0300-BF	31	30	7.5	5
20G-32-0400-BF	41	40	11	

380-480 VAC, Three Phase Supply Voltage				
Order Code	Input Current [A]	Output Current [A]	HD Power Rating [kW]	Frame Size
20G-42-0040-BF	5	4	1.5	2
20G-42-0065-BF	7.5	6.5	2.2	
20G-42-0090-BF	11	9	4	
20G-43-0120-BF	14	12	5.5	3
20G-43-0170-BF	18.5	17	7.5	
20G-44-0230-BF	24	23	11	4
20G-44-0320-BF	36.5	32	15	
20G-45-0380-BF	44	38	18.5	5
20G-45-0440-BF	51	44	22	
20G-45-0600-BF	70	60	30	
20G-46-0750-BF	80	75	37	6
20G-46-0900-BF	94	90	45	
20G-47-1100-BF	120	110	55	7
20G-47-1500-BF	160	150	75	
20G-48-1800-BF	190	180	90	8
20G-48-2200-BF	225	220	110	
20G-48-2650-BF	275	265	132	
20G-49-3200-BF	330	320	160	9
20G-410-3600-BF	370	360	180	10



## Electrical Characteristics

<b>Power Supply</b>	220 - 240 VAC ±10 % Single Phase 220 - 240 VAC ±10 % Three Phase 380 - 480 VAC ±10 % Three Phase
<b>Input Frequency</b>	50/60 Hz ±10 %
<b>Power Range</b>	1.5...180 kW Heavy Duty (HD)
<b>Overload</b>	150% for 60 sec.
<b>Output Frequency</b>	0.5...590 Hz
<b>Max. Switching Frequency</b>	10 kHz
<b>Control Modes</b>	Volts/Hertz, Sensorless Vector (SLV) or Closed-Loop Vector Mode (Induction only)
<b>Supported Motors</b>	Induction & PMAC

## Environmental Characteristics

<b>Temperature range</b>	0-40 °C (derate possible up to 45 °C)*
<b>Humidity</b>	Up to 90 % Relative Humidity, non-condensing
<b>Vibration</b>	< 0.5 g
<b>Altitude</b>	0-1000 m (derate 1% per 100m up to max. 2000m)
<b>Protection Degree</b>	IP20
<b>Pollution Degree</b>	Category 2
<b>Chemically Active Substances</b>	Compliance with EN60271-3-3: C3

\* De-rating only possible without communications option fitted

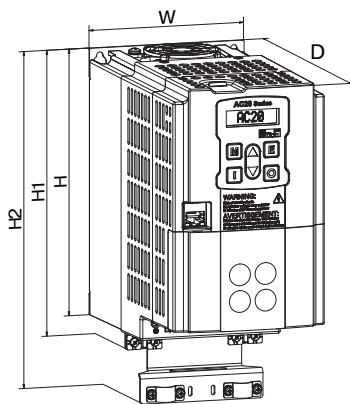
## Standards and Conformance

<b>Europe</b>	This product conforms with: - Low Voltage Directive 2014/30/EU - Electro-Magnetic Compatibility Directive 2006/42/EC - EN61800-5-1:2007+A11:2021 - EN61800-3:2018
<b>North America / Canada</b>	Complies with the requirements of: - UL61800-5-1 - CSA22.2#274-17 as an open-type drive
<b>STO</b>	Independently certified to: - EN ISO13849-1:2015 - EN 61800-5-2:2017 - EN 61508
<b>RoHS</b>	This product complies with the RoHS substance restrictions in accordance with EC Directive 2011/65/EU
<b>REACH</b>	This product complies with the REACH regulations EC1907/2006

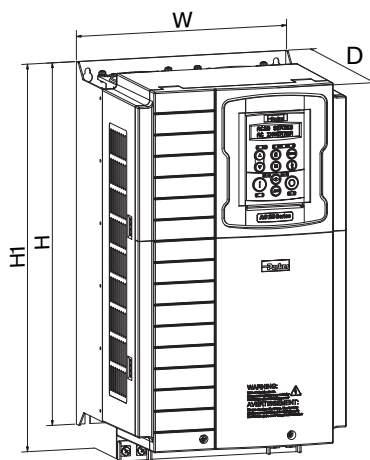
## Dimensions [mm]

Frame	Height (H)	Height (H1)	Height (H2)	Width (W)	Depth (D)	Weight [kg]
2	180	193	227,5	108.4	185	2
3	237,5	248	281,9	141.6	184	3.3
4	265	283	321,4	161	196	4.4
5	340	358	401,4	210	220.2	8
6	435	465	n/a	262	240.5	14
7	630	623,5	n/a	355	265	42
8	765	755	n/a	406	300	56.5
9	765	778	n/a	510	326	87
10	910	925	n/a	550	341.5	123

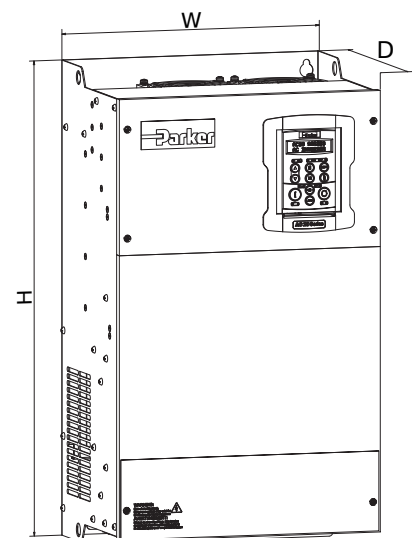
Frame 2-5



Frame 6



Frame 7-10



## Power Connections

### Frame 2-4

Terminal	Description
PE	Earth
L1 / L	Supply Input phase L1 / Live
L2 / N	Supply Input phase L2 / Neutral
L3	Supply Input phase L3
DC+	DC+ Dynamic Brake Resistor connection (+)
DBR	Dynamic Brake Resistor connection (-)
U	U Motor Output phase U
V	V Motor Output phase V
W	W Motor Output phase W

### Frame 5-6

Terminal	Description
PE	Earth
L1	Supply Input phase L1
L2	Supply Input phase L2
L3	Supply Input phase L3
DC+	DC+ Dynamic Brake Resistor connection (+)
DC-	DC-
DBR	Dynamic Brake Resistor connection (-)
U	U Motor Output phase U
V	V Motor Output phase V
W	W Motor Output phase W

### Frame 7-10

Terminal	Description
PE	Earth
DC+	DC+ Dynamic Brake Resistor connection (+)
DC-	DC-
DBR	Dynamic Brake Resistor connection (-)
L1	Supply Input phase L1
L2	Supply Input phase L2
L3	Supply Input phase L3
U	U Motor Output phase U
V	V Motor Output phase V
W	W Motor Output phase W



## Control Connections

Label	Description
RLY1A	RelayOutput 1 (Contact A)
RLY1B	RelayOutput 1 (Contact B)
RLY2A	RelayOutput 2 (Contact A)
RLY2B	RelayOutput 2 (Contact B)
TH1	Motor Thermistor Input
TH2	Motor Thermistor Input
AIN1	Analogue Input 1 ( $\pm 10V$ , 0-10V, 0-20mA, 4-20mA)
AIN2	Analogue Input 2 ( $\pm 10V$ , 0-10V, 0-20mA, 4-20mA)
AOUT1	Analogue Output 1 (0-10V, 0-20mA)
AOUT2	Analogue Output 2 (0-10V, 0-20mA)
AOUT3	Analogue Output 3 ( $\pm 10V$ , 0-10V)
0V	0V Reference for analogue & digital I/O
0V	0V Reference for analogue & digital I/O
24V	24V user supply
DIO1	Digital Input / Output 1 (24V configurable)
DIO2	Digital Input / Output 2 (24V configurable)
DIN3	Digital Input / Output 3 (24V configurable)
DIN4	Digital Input 4
DIN5	Digital Input 5
DIN6	Digital Input 6
DIN7	Digital Input 7
DIN8	Digital Input 8
DIN9	Digital Input 9*
DIN10	Digital Input 10*
STO1	STO input channel A
STO0V	STO 0V reference
STO2	STO input channel B

\* = Frames 6-10 only



## Software

### Parker Drive System Explorer (DSE Lite)

Parker drive configuration software Drive System Explorer (DSE) Lite is an easy to use drive configuration software package, designed to make programming your application as simple as possible without compromising on functionality.

DSE Lite is based around a straightforward block programming and an intuitive user interface which supports user-defined configurations and offers real-time monitoring and charting. DSE Lite allows the user to create, parameterize and configure user defined applications as well as parameterize and connect fixed Motor Control blocks with 70 user functions and up to 200 'links'

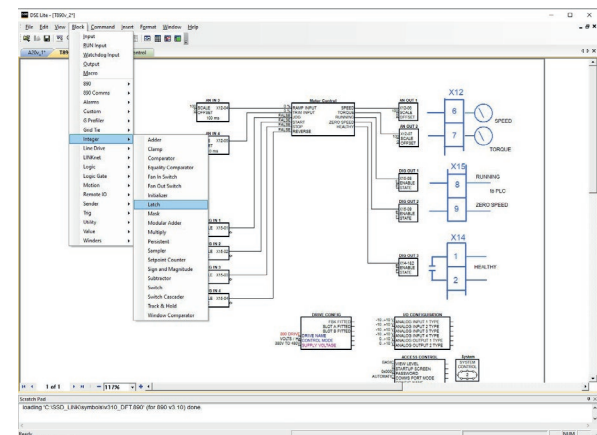
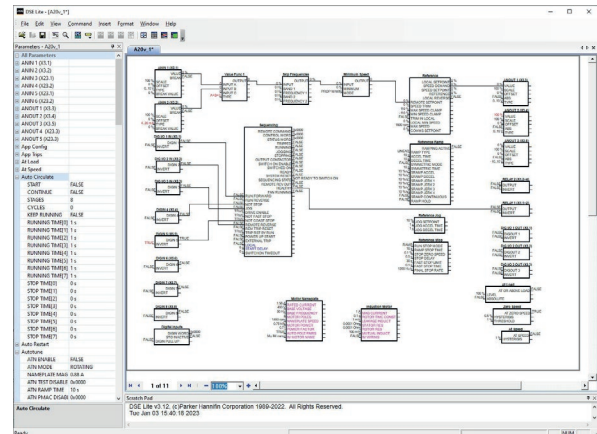
Thanks to the on-line help and pre-configured macro templates, users can achieve the optimum drive configuration without the need to navigate through complicated parameter menus.

DSE Lite for AC20 uses a standard Ethernet connection between PC and inverter, so no special lead is required.

Features new to the AC20 include:

- Ethernet connectivity
- Network scan feature
- Drive LED identification
- Firmware installs over Ethernet
- Ability to save a project to on-board Flash memory
- Compatibility with the AC30 Series PDD scope feature.
- Power 'on the bench' for programming

It is available free of charge to download from [www.parker.com](http://www.parker.com).



## Accessories and Options

### 6901 Remote Mounting Keypad

The popular 6901 remote mounting keypad can be mounted away from the drive, such as on the door of an electrical enclosure. This IP20 product allows users to configure, operate and monitor the drive without having to access the drive directly. The remote keypad provides an alternative to the drive mounted keypad, offering the same functionality, but can be connected to the drive via a 1.5 m cable plugged into a RJ11 port on the drive.



Order Code	Description
6901-00-G	6901 DisplayKeypad
6052-00-G	6901 remote mounting kit

### Option Slots

The AC20 features three option slots. All options are user installable and are ordered separately. Two option slots will accept either a speed feedback option or general-purpose IO expansion module, with a third option slot dedicated to communications option modules.



## General Purpose I/O (GPIO) Option Card

### Description:

The general purpose I/O (GPIO) option module offers users the opportunity to expand the drives standard I/O capability, allowing more complex motor control solutions to be implemented.

The option can be fitted in either slot 1 or 2, and two options can be fitted at the same time to maximize the IO compliment. For example, two fitted IO options will give an additional 4 analogue inputs



2004-IO-00	GPIO Option
<b>Analogue inputs</b>	2x Analogue inputs ( $\pm 10V$ , 0-10V)
<b>Analogue output</b>	1x Analogue outputs ( $\pm 10V$ , 0-10V)
<b>Digital I/O</b>	Digital Input/Output 1 (24V configurable)
<b>Reference voltages</b>	+/- 10V References

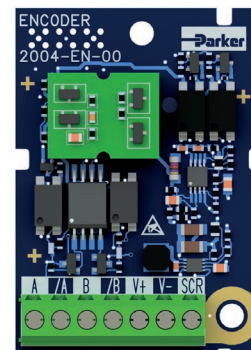
Terminal	Label		Description
	Slot 1	Slot 2	
<b>AI3</b>	AIN3	AIN5	Analogue input 3/5 ( $\pm 10V$ , 0-10V)
<b>AI4</b>	AIN4	AIN6	Analogue input 4/6 ( $\pm 10V$ , 0-10V)
<b>AO4</b>	AOUT4	AOUT5	Analogue output 4/5 ( $\pm 10V$ , 0-10V)
<b>DX11</b>	DIO11	DIO12	Digital I/O 11/12 (24V configurable)
<b>+10V</b>	+10V	+10V	+ 10V Reference voltage
<b>-10V</b>	-10V	-10V	- 10V Reference voltage
<b>0V</b>	0V	0V	0V Reference for analogue & digital I/O

## Encoder Feedback Card

### Description:

The HTTL pulse encoder feedback module allows an incremental encoder to be connected to the AC20, allowing users to take full advantage of closed-loop vector control.

The option can be fitted in either slot 1 or 2, and two identical options can be fitted at the same time, allowing for simple speed following applications.



2004-EN-00	Encoder Feedback Option
<b>Maximum input frequency</b>	250 kHz per channel
<b>Input format</b>	Quadrature
<b>Output supply voltage</b>	5V, 12V, 15V, 20V

Terminal	Label		Description
	Encoder 1	Encoder 2	
<b>A</b>	A	A	Channel A input
<b>/A</b>	/A	/A	Channel /A input
<b>B</b>	B	B	Channel B input
<b>/B</b>	/B	/B	Channel /B input
<b>V+</b>	V+	V+	Encoder supply +
<b>V-</b>	V-	V-	Encoder supply -
<b>SCR</b>	SCR	SCR	Cable screen

## Communication Option Cards

The AC20 takes advantage of commonly available third-party communication modules, allowing communication over a range of popular protocols. Also included in the supported range are Ethernet IP and ProfiNet modules, for when two ports are required. Adding an Ethernet based option card is possible in addition to the onboard Modbus TCP/IP, ProfiNet or Ethernet IP port.

<b>2003-CB-00</b>	<b>CANopen communication interface</b>
<b>Supported Protocols</b>	DS301 V4.02
<b>Communication Speed</b>	10 k, 20 k, 50 k, 125 k, 250 k, 500 k, 1 Mbits/s or automatically detected
<b>Max. number of devices</b>	127
<b>Supported Messages</b>	SDO, PDO, NMT, SYNC



<b>2003-EC-00</b>	<b>EtherCAT communication interface</b>
<b>Supported Protocols</b>	CANopen over EtherCAT (CoE) DS301 compliant
<b>Communication Speed</b>	100 Mbits/s
<b>Max. number of devices</b>	65534
<b>Supported Messages</b>	SDO, PDO, NMT, SYNC



<b>2003-IP-00</b>	<b>Ethernet IP communication interface</b>
<b>Supported Protocols</b>	Ethernet IP
<b>Communication Speed</b>	10/100 Mbits/s full/half duplex
<b>Max. number of devices</b>	Virtually unlimited
<b>Supported Messages</b>	Up to 256 bytes of consumed data and 256 bytes of produced data, CIP parameter object support, Explicit messaging



<b>2003-PB-00</b>	<b>PROFIBUS DP-V1 communication interface</b>
<b>Supported Protocols</b>	PROFIBUS-DP; Demand data and Data exchange
<b>Communication Speed</b>	Up to 12 Mbits/s; automatically detected
<b>Max. number of devices</b>	32 per segment, 126 total
<b>Supported Messages</b>	Up to 152 bytes cyclic I/O, 68 bytes class 1 and 2 acyclic data, 152 bytes configuration data. GSD file provided



<b>2003-RS-00</b>	<b>RS485 / Modbus RTU communication interface</b>
<b>Supported Protocols</b>	Modbus RTU
<b>Communication Speed</b>	1200 to 115 200 bits/s
<b>Max. number of devices</b>	247
<b>Supported Messages</b>	Up to 256 bytes of cyclic I/O data in each direction



<b>2003-PN-00</b>	<b>PROFINET I/O communication interface</b>
<b>Supported Protocols</b>	PROFINET I/O generic device
<b>Communication Speed</b>	10/100 Mbits/s full/half duplex
<b>Max. number of devices</b>	Up to 128 submodules in total
<b>Supported Messages</b>	Up to 256 bytes of cyclic I/O in data in each direction





## Braking Resistor

During deceleration, or with an over-hauling load, the motor acts as a generator. Energy flows back from the motor into the DC link capacitors within the drive, causing their voltage to rise. If this voltage exceeds a maximum value, the drive will trip to protect the capacitors and internal power devices. The amount of energy that can be absorbed by the capacitors can vary between different applications causing the drive to trip on overvolts. To increase the drive's dynamic braking capability, high power resistor(s), connected across the DC link, allow the dissipation of this excess energy for short term stoppage or braking.

### Brake resistor selection

Brake resistor assemblies must be rated to absorb both peak braking power during deceleration and the average power over the complete cycle.

$$\text{Peak braking power} = \frac{0.0055J \times (n_1^2 - n_2^2)}{t_b} \text{ (W)}$$

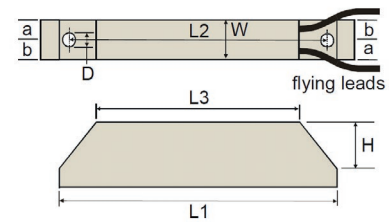
$$\text{Average braking power } P_{av} = \frac{P_{pk} \times t_b}{t_c}$$

J: total inertia [kgm<sup>2</sup>]  
n<sub>1</sub>: initial speed [min<sup>-1</sup>]  
n<sub>2</sub>: final speed [min<sup>-1</sup>]  
t<sub>b</sub>: braking time [s]  
t<sub>c</sub>: cycle time [s]



Model	Impedance [Ω]	Nom. Power [W]	Dimensions [mm]							
			L1	L2	L3	W	H	D	a	b
CZ467715	500	60	100	87	60	22	41	4.3	10	12
CZ467714	200	100	165	152	125	22	41	4.3	10	12
CZ389853	100	100	165	152	125	22	41	4.3	10	12
CZ467717	100	200	165	146	125	30	60	4.3	13	17
CZ463068	56	200	165	146	125	30	60	4.3	13	17
CZ388397	56	200	165	146	125	30	60	4.3	13	17
CZ388396	36	500	335	316	295	30	60	4.3	13	17
CZ467716	28 x 2	500	335	316	295	30	60	4.3	13	17

Overload 5 s : 500 %  
Overload 3 s : 833 %  
Overload 1 s : 2500 %



## EMC Filter

AC20 are supplied as standard with an EMC filter fitted that meets the requirements of a class C3 environment. For class C2 or C1 environments, an additional external filter may be required. An internal wire link may be easily removed to disconnect the Y capacitors for those installations where earth currents are undesirable.

## Order Code

### AC20

	1		2	3		4		5	6
Order example	<b>20G</b>	-	<b>1</b>	<b>2</b>	-	<b>0070</b>	-	<b>B</b>	<b>F</b>

<b>1</b>	<b>Device Family</b>
<b>20G</b>	AC20 Series, Advanced, General Purpose AC Drive
<b>2</b>	<b>Voltage</b>
<b>1</b>	230 V Single Phase
<b>3</b>	230 V Three Phase
<b>4</b>	400 V Three Phase
<b>3&amp;4</b>	<b>Frame Size &amp; Current Rating (Heavy Duty)</b>
	<b>230Vac, Single Phase Supply Voltage</b>
<b>2-0070</b>	Frame 2 - 7A (1.5 kW)
<b>2-0100</b>	Frame 2 - 10A (2.2 kW)
	<b>230Vac, Three Phase Supply Voltage</b>
<b>2-0070</b>	Frame 2 - 7A (1.5 kW)
<b>2-0100</b>	Frame 2 - 10A (2.2 kW)
<b>3-0170</b>	Frame 3 - 17A (4.0 kW)
<b>4-0210</b>	Frame 4 - 21A (5.5 kW)
<b>5-0300</b>	Frame 5 - 30A (7.5 kW)
<b>5-0400</b>	Frame 5 - 40A (11 kW)
	<b>400Vac, Three Phase Supply Voltage</b>
<b>2-0040</b>	Frame 2 - 4A (1.5 kW)
<b>2-0065</b>	Frame 2 - 6.5A (2.2 kW)
<b>2-0090</b>	Frame 2 - 9A (4.0 kW)
<b>3-0120</b>	Frame 3 - 12A (5.5 kW)
<b>3-0170</b>	Frame 3 - 17A (7.5 kW)
<b>4-0230</b>	Frame 4 - 23A (11 kW)
<b>4-0320</b>	Frame 4 - 32A (15 kW)
<b>5-0380</b>	Frame 5 - 38A (18.5 kW)
<b>5-0440</b>	Frame 5 - 44A (22 kW)
<b>5-0600</b>	Frame 5 - 60A (30 kW)
<b>6-0750</b>	Frame 6 - 75A (37 kW)
<b>6-0900</b>	Frame 6 - 90A (45 kW)
<b>7-1100</b>	Frame 7 - 110A (55 kW)
<b>7-1500</b>	Frame 7 - 150A (75 kW)
<b>8-1800</b>	Frame 8 - 180A (90 kW)
<b>8-2200</b>	Frame 8 - 220A (110 kW)
<b>8-2650</b>	Frame 8 - 265A (132 kW)
<b>9-3200</b>	Frame 9 - 320A (160 kW)
<b>10-3600</b>	Frame 10 - 360A (180 kW)
<b>6</b>	<b>Brake Switch</b>
<b>B</b>	Brake Switch Fitted
<b>7</b>	<b>EMC Filter</b>
<b>F</b>	Category C3 Filtered







# Parker's Motion & Control Technologies

At Parker, we're guided by a relentless drive to help our customers become more productive and achieve higher levels of profitability by engineering the best systems for their requirements. It means looking at customer applications from many angles to find new ways to create value. Whatever the motion and control technology need, Parker has the experience, breadth of product and global reach to consistently deliver. No company knows more about motion and control technology than Parker. For further info call 00800 27 27 5374



## Aerospace

### Key Markets

Aftermarket services  
Commercial transports  
Engines  
General & business aviation  
Helicopters  
Launch vehicles  
Military aircraft  
Missiles  
Power generation  
Regional transports  
Unmanned aerial vehicles

### Key Products

Control systems & actuation products  
Engine systems & components  
Fluid conveyance systems & components  
Fluid metering, delivery & atomization devices  
Fuel systems & components  
Fuel tank inerting systems  
Hydraulic systems & components  
Thermal management  
Wheels & brakes



## Climate Control

### Key Markets

Agriculture  
Air conditioning  
Construction Machinery  
Food & beverage  
Industrial machinery  
Life sciences  
Oil & gas  
Precision cooling  
Process  
Refrigeration  
Transportation

### Key Products

Accumulators  
Advanced actuators  
CO<sub>2</sub> controls  
Electronic controllers  
Filter driers  
Hand shut-off valves  
Heat exchangers  
Hose & fittings  
Pressure regulating valves  
Refrigerant distributors  
Safety relief valves  
Smart pumps  
Solenoid valves  
Thermostatic expansion valves



## Electromechanical

### Key Markets

Aerospace  
Factory automation  
Life science & medical  
Machine tools  
Packaging machinery  
Paper machinery  
Plastics machinery & converting  
Primary metals  
Semiconductor & electronics  
Textile  
Wire & cable

### Key Products

AC/DC drives & systems  
Electric actuators, gantry robots & slides  
Electrohydraulic actuation systems  
Electromechanical actuation systems  
Human machine interface  
Linear motors  
Stepper motors, servo motors, drives & controls  
Structural extrusions



## Filtration

### Key Markets

Aerospace  
Food & beverage  
Industrial plant & equipment  
Life sciences  
Marine  
Mobile equipment  
Oil & gas  
Power generation & renewable energy  
Process  
Transportation  
Water Purification

### Key Products

Analytical gas generators  
Compressed air filters & dryers  
Engine air, coolant, fuel & oil filtration systems  
Fluid condition monitoring systems  
Hydraulic & lubrication filters  
Hydrogen, nitrogen & zero air generators  
Instrumentation filters  
Membrane & fiber filters  
Microfiltration  
Sterile air filtration  
Water desalination & purification filters & systems



## Fluid & Gas Handling

### Key Markets

Aerial lift  
Agriculture  
Bulk chemical handling  
Construction machinery  
Food & beverage  
Fuel & gas delivery  
Industrial machinery  
Life sciences  
Marine  
Mining  
Mobile  
Oil & gas  
Renewable energy  
Transportation

### Key Products

Check valves  
Connectors for low pressure fluid conveyance  
Deep sea umbilicals  
Diagnostic equipment  
Hose couplings  
Industrial hose  
Mooring systems & power cables  
PTFE hose & tubing  
Quick couplings  
Rubber & thermoplastic hose  
Tube fittings & adapters  
Tubing & plastic fittings



## Hydraulics

### Key Markets

Aerial lift  
Agriculture  
Alternative energy  
Construction machinery  
Forestry  
Industrial machinery  
Machine tools  
Marine  
Material handling  
Mining  
Oil & gas  
Power generation  
Refuse vehicles  
Renewable energy  
Truck hydraulics  
Turf equipment

### Key Products

Accumulators  
Cartridge valves  
Electrohydraulic actuators  
Human machine interfaces  
Hybrid drives  
Hydraulic cylinders  
Hydraulic motors & pumps  
Hydraulic systems  
Hydraulic valves & controls  
Hydrostatic steering  
Integrated hydraulic circuits  
Power take-offs  
Power units  
Rotary actuators  
Sensors



## Pneumatics

### Key Markets

Aerospace  
Conveyor & material handling  
Factory automation  
Life science & medical  
Machine tools  
Packaging machinery  
Transportation & automotive

### Key Products

Air preparation  
Brass fittings & valves  
Manifolds  
Pneumatic accessories  
Pneumatic actuators & grippers  
Pneumatic valves & controls  
Quick disconnects  
Rotary actuators  
Rubber & thermoplastic hose & couplings  
Structural extrusions  
Thermoplastic tubing & fittings  
Vacuum generators, cups & sensors



## Process Control

### Key Markets

Alternative fuels  
Biopharmaceuticals  
Chemical & refining  
Food & beverage  
Marine & shipbuilding  
Medical & dental  
Microelectronics  
Nuclear Power  
Offshore oil exploration  
Oil & gas  
Pharmaceuticals  
Power generation  
Pulp & paper  
Steel  
Water/wastewater

### Key Products

Analytical Instruments  
Analytical sample conditioning products & systems  
Chemical injection fittings & valves  
Fluoropolymer chemical delivery fittings, valves & pumps  
High purity gas delivery fittings, valves, regulators & digital flow controllers  
Industrial mass flow meters/controllers  
Permanent no-weld tube fittings  
Precision industrial regulators & flow controllers  
Process control double block & bleeds  
Process control fittings, valves, regulators & manifold valves



## Sealing & Shielding

### Key Markets

Aerospace  
Chemical processing  
Consumer  
Fluid power  
General industrial  
Information technology  
Life sciences  
Microelectronics  
Military  
Oil & gas  
Power generation  
Renewable energy  
Telecommunications  
Transportation

### Key Products

Dynamic seals  
Elastomeric o-rings  
Electro-medical instrument design & assembly  
EMI shielding  
Extruded & precision-cut, fabricated elastomeric seals  
High temperature metal seals  
Homogeneous & inserted elastomeric shapes  
Medical device fabrication & assembly  
Metal & plastic retained composite seals  
Shielded optical windows  
Silicone tubing & extrusions  
Thermal management  
Vibration dampening

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