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ACR9000 Motion Controller

Catalog 2007/US

Parker

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ACR9000 Motion Controller
Fast, Efficient, Connected



The ACR9000 is Parker's premier standalone motion controller, capable of controlling up to 8 axes of motion. Connectivity and communication features give the ACR9000 flexibility for use in a wide variety of machine architectures. The ACR9000 excels as a standalone machine and motion controller, interfacing with a PC or working alongside a PLC. A powerful DSP makes the ACR9000 an outstanding multi-tasking servo controller. The ACR9000 includes easy-to-use project-development tools that enable fast, efficient application creation and maintenance. The ACR9000 is the solution for standalone applications requiring industry-leading performance in an affordable and easy-to-use package.

ACR9000 Features

- Up to 8 axes of servo or stepper control
- Advanced Multi-tasking of up to 24 simultaneous programs
- Interpolation of 8 axes in any combination
- 10/100 Base-T Ethernet
- USB 2.0
- EtherNet/IP compatibility
- Absolute Encoder support via SSI
- ACR-View Software Development Kit
- 24 VDC optically isolated onboard inputs and outputs
- CANopen expansion I/O
- 120/240 VAC power input
- CE (EMC & LVD), UL, cUL approval

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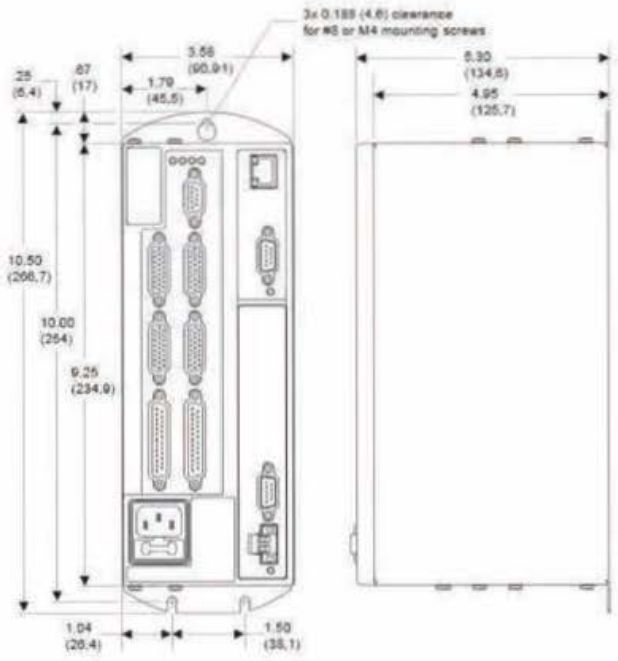
Specifications

Hardware	
Axes/controller	2, 4, 6 or 8 axes
Processor	32-bit floating-point DSP @ 150 MFLOPS / 75 MHz
Trajectory calculation	64-bit precision
User memory	1 MB Flash-based. Retains user programs and system configuration parameters
Firmware	Flash-based
Size	3.58" W x 10.5" H x 5.3" D (2-4 axes), 5.0" W x 10.5" H x 5.3" D (6-8 axes)
Operating system	Multi-tasking RTOS
Battery Backup	Non-volatile memory retains all system and user variables. (Optional)
Performance	
Multi-tasking	8 coordinated systems/16 text programs/8 ladder programs
Trajectory update	Every 100-500 µs
Servo update	25 µs /axis
Ladder Logic PLC	100-500 µs scan time
Interpolation	Linear, circular, sinusoidal, helical, elliptical, spline, 3D arcs
Servo loop	PID, velocity feedforward, acceleration feedforward, Notch and LoPass filtering
Position regulation	Hardware, < 1usec
Communications	
Serial Interface	1 serial port (RS232 and/or RS422)
Ethernet	10/100 Base-T
USB	2.0
CANopen	DS401 protocol for I/O devices. (Optional)
Command Signal	
Analog outputs	16-bit resolution DAC, up to 8 outputs
Stepper outputs	Up to 8 @ 2.5 MHz maximum
Inputs/Outputs	
Encoder input	Up to 10 at 20 MHz post-quadrature maximum Software configurable for Synchronous Serial Interface (SSI), quadrature, step and direction, CW/CCW modes
Onboard analog inputs	8 single-ended (4 differential) inputs @ 12-bit resolution (optional)
Digital Onboard I/O	20, 24 VDC optically isolated onboard inputs for 2 to 4 axes 40, 24 VDC optically isolated onboard inputs for 6 to 8 axes 4, 24 VDC optically isolated onboard outputs for 2 to 4 axes 8, 24 VDC optically isolated onboard outputs for 6 to 8 axes
Software provided	
Development Software	ACR-View Software Development Kit
Language Support	Libraries for C++, VB6, C#, VB.NET

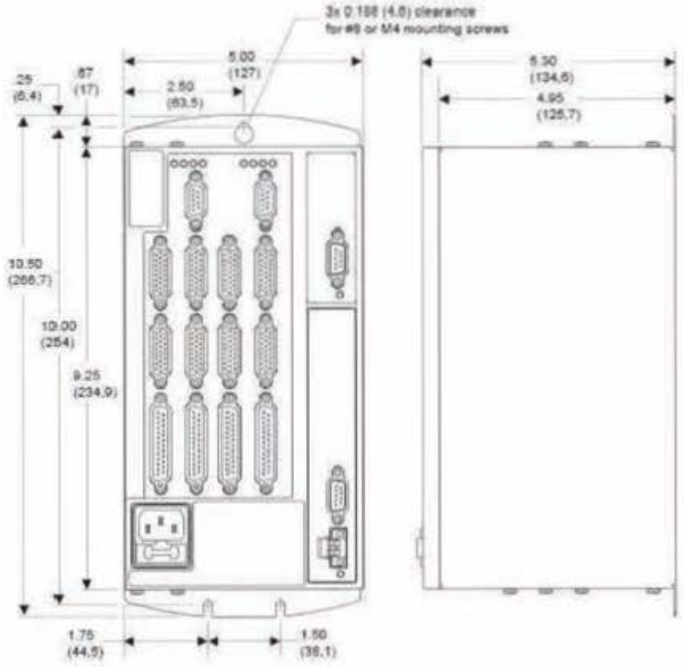
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Dimensional Drawings

2 to 4 Axes



6 to 8 Axes



ACR9000 Order Code

9000	P3	U4	M	0

P3 — Communications
P1 - Ethernet, USB and Serial
P3 - Add CANopen to P1 version

U4 — U2 – 2 Axes, 3 Encoder inputs
U4 – 4 Axes, 5 Encoder inputs
U6 – 6 Axes, 8 Encoder inputs
U8 – 8 Axes, 10 Encoder

M — M – Standard Flash memory
B– Add Battery Backed RAM

0 — 0– No Analog Inputs
1– Analog Inputs (8)

Example: ***9000P3U4M0***
4 axis controller with Ethernet, USB, CANopen and Standard Flash memory

All models include ACR-View Software Development Kit CD and a power cable for 120 VAC installations (Parker P/N: 44-000054-01).

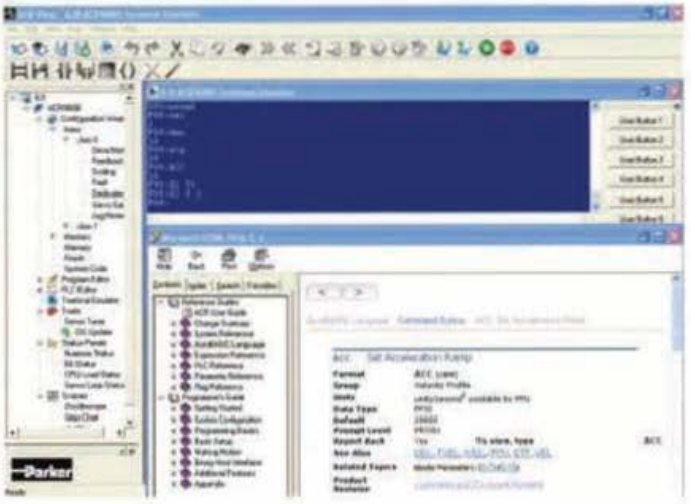
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ACR-View Software Development Kit

ACR-View is a powerful project-development suite that assists the user of the ACR family products in programming, debugging and commissioning their application. Many features are incorporated to assist both the novice and expert users in developing code. All the tools needed to build and maintain a motion project are included:

- Ethernet, USB, CANopen and serial connection support
- Project Configuration Wizard
- Servo tuning tools
- Built-in oscilloscope, strip chart and XY plot
- Structured text program editor
- Ladder logic program editor
- Real-time terminal interface
- Servo loop diagnostic tool
- Comprehensive status panels
- Integrated help files

Terminal, Help and Project Tree



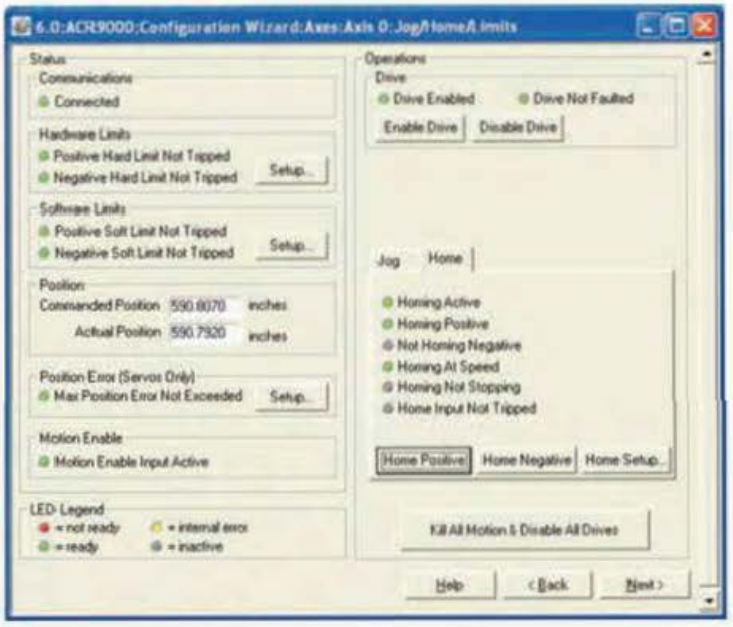
Configuration Wizard

Project set-up is streamlined through the use of the Configuration Wizard. The ACR9000 can be configured in a matter of minutes as the user is guided through a series of simple steps. ACR-View will set the necessary parameters to have the controller ready for motion and code development.



Commissioning

Within the Configuration Wizard is an easy-to-use commissioning tool. Quickly verify the key motion and hardware settings for each axis, such as direction, velocity and limit function. Users can then proceed to programming with confidence in the physical settings.



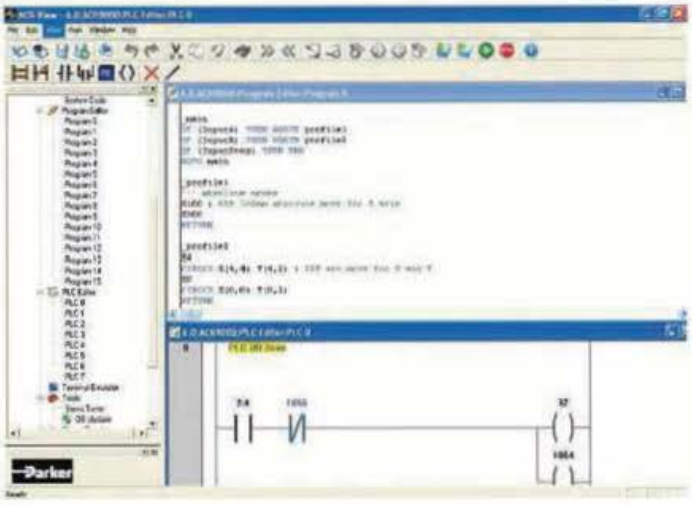
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ACR-View Software Development Kit

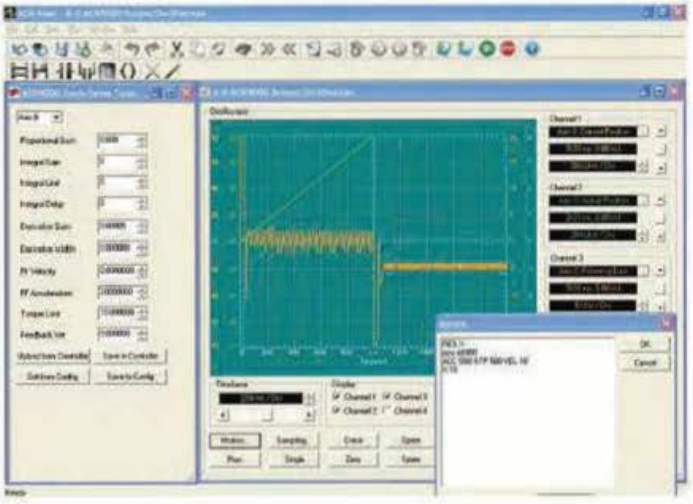
Editors

Program and ladder editor tools allow straightforward development of both motion and I/O application code. Color-coded syntax checker assist in programming. PLC programs can be written in either ladder or text.



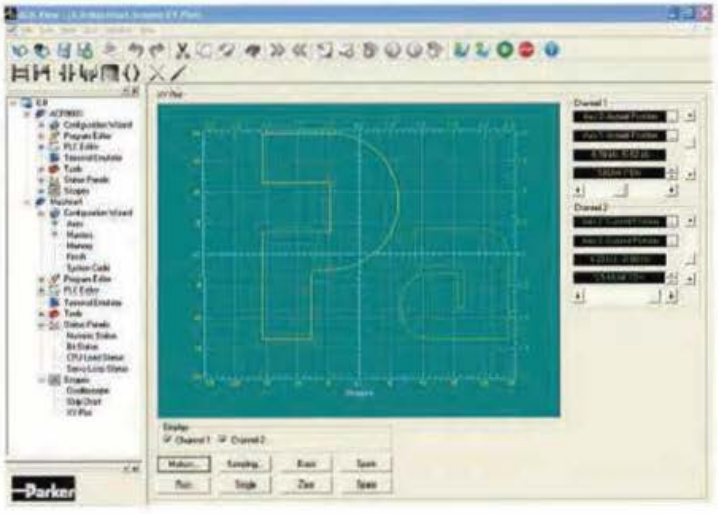
Tuning

Servo tuning can be optimized with ACR-View's powerful Oscilloscope feature. Up to four channels of data can be observed and stored. Tuning gains are updated immediately and move profiles can be tailored to best fit the application's needs.



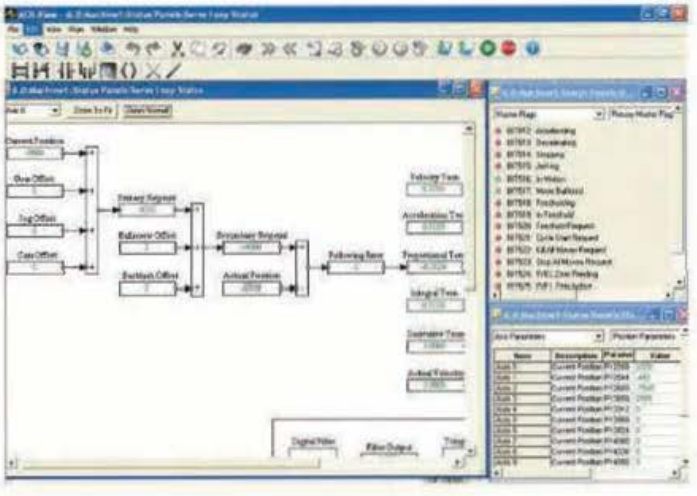
XY Plot

In addition to the Oscilloscope, ACR-View includes an XY Plot, which allows the user to display X vs Y positions for two pairs of axes at once. Easily visual a 2-D path, using any of the onboard position parameters.



Status Panels

View virtually any parameter or flag within the controller using the Bit and Numeric Status panels. The Servo Loop Status panel allows in-depth analysis of servo operation.



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ACR9000...Connect

EtherNet/IP™

The EtherNet/IP™ network is designed to use standard Ethernet and TCP/IP equipment for the industrial environment. The application layer protocol is an open standard—CIP™ (Control and Information Protocol). CIP is the same upper-layer protocol used by DeviceNet™ and ControlNet™ networks, allowing interoperability between various industrial devices.

EtherNet/IP Included

The ACR9000 can operate as a server/slave device within an EtherNet/IP network. This protocol is enabled in all ACR9000 controllers with Ethernet. No special order code or software is required. The EtherNet/IP protocol can run alongside standard TCP/IP, bringing together plant floor automation and office networks.

ACR9000 with Interact and InteractX™

Integrating the ACR9000 with Parker's CTC HMI is accomplished over Ethernet/IP.

- Drivers are available to enable communications to PA,EPX, PS, PX, HPC and HPX series
- Supports point-to-point or networked connections
- Parameters and BIT address referencing
- InteractX Windows HMI with unlimited tags
- Breakthrough graphic technology
- Panel tool library for easy screen development (no scripting)



Advanced Motion with PLC Automation

EtherNet/IP capability gives ACR9000 users a popular connectivity option to PLCs and other master devices supporting the protocol.

Applications can be developed in ACROBasic and reside in the 9000. The controller is added to the Ethernet/IP network as a slave I/O device, allowing the master PLC to interrogate or set any controller parameter, variable value or to initiate a motion sequence. The master has continuous access to ACR parameters and flags. Simply assign an IP address to the ACR without any additional set-up to integrate into the network.

When advanced motion is required in a machine utilizing PLCs, the ACR9000 is an easy-to-integrate alterative. Let the ACR9000 be the "motion module" in the PLC system to handle complex motion requirements such as linear and circular interpolation, contouring, camming and gearing.

Class 1 and Class 3 CIP Messages are Supported by the ACR9000

Class 1 (UDP) – I/O with Cyclic Updates
Implicit messaging is a "Class 1" connection type, providing point-to-point or multicast messaging over a UDP connection. Typical applications use implicit messaging for I/O data transfer. Data is sent cyclically based on a user-defined duration. In most PLCs, the ACR9000 will be seen as an Ethernet based I/O block.

Class 3 (TCP) CIP Messages (connected and unconnected)
Explicit messaging is a "Class 3" connection type, providing point-to-point, event-driven messaging over a TCP connection. The scanner/master PLC device reads and writes data to the slave. In a typical application, a function block in a ladder program would be used to send a message to the ACR to command or change motion.

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ACR9000...Solutions

Connectivity and communication features give the ACR9000 flexibility for use in a wide variety of machine architectures. The ACR9000 excels as a standalone machine and motion controller, interfacing with a PC or working alongside a PLC.

ACROBasic

The ACR series of controllers utilizes a dedicated high-level programming language called ACRO Basic. This easy-to use language supports a wide range of motion, I/O and communication functions. Several hundred intuitive pneumonic commands are incorporated into ACRO Basic for quick application development. The open nature of the ACR9000 appeals to advanced programmers as well. Virtually every possible motion parameter and flag can be readily accessed, allowing the user to tailor applications to the specific machine requirements.

Multi-Tasking

The ACR9000 controllers are true pre-emptive multi-taskers capable of performing multiple tasks simultaneously and toggling tasks based on the program conditions. The ACR multi-tasker can control up to 16 ACROBasic programs and 8 ladder logic PLC programs simultaneously. Due to the pre-emptive nature of the multi-tasking kernel, programs are only allocated processing time when running. Programs can be called on an as-needed basis.

Motion Features

The ACR9000 is loaded with powerful motion functionality, including:

- Segmented electronic CAM
- Electronic gearing with real-time phase advance
- Linear interpolation of up to 8 axes
- Programmable limit switch with multiple sources
- Advanced gantry control
- 3D arcs and tangent axis control
- Hardware & capture registers
- Time-based moves

Fast Ethernet & USB 2.0

With the P1 or P3 options, the ACR9000 is equipped with both 100baseT Ethernet and USB2.0. ACR9000 supports connection of up to four separate devices all over Ethernet or in combination with USB and RS232. Each ACR9000 has a programmable IP address so single or multiple controllers can be easily integrated in factory networks.

PC Centric Applications

In many machines, a host PC is responsible for management of the user interface, motion control, I/O, vision and other processes. For the OEM and end-users that require custom PC software, Parker supplies libraries for developing applications in C++, VB and .NET. The ComACRsrvr, a 32-bit OLE automation (COM) server, is included with the ACR-View Software Development Kit along with numerous sample applications. An extensive collection of functions is included to enable fast and stable communication, data sharing and motion.

With 100Mbs Ethernet, the ACR9000 becomes a viable alternative to controller cards installed in the PC. Installation, wiring and maintenance are greatly simplified and free the PC for other devices.

Machine Control

Onboard and expansion I/O and the multi-tasking programming environment make the ACR9000 a powerful choice for stand alone machine control. The ACR9000 PLC programs incorporate a set of ladder-logic commands that can be running alongside the motion programs for more flexible error handling and I/O monitoring. A full 200-line PLC program is scanned every 2ms and a total of 8 programs can be included in the scan cycle.

With the expansion I/O port, the ACR9000 becomes a CANopen master and is able to control devices that follow the DS401 protocol for I/O devices. The CANopen expansion I/O supports up to 4 nodes and over 1000 digital points.

Adding devices such as operator interfaces and vision can be accomplished over Ethernet

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ACR9000...Partners

Parker offers all the elements needed for a complete motion and control system. The ACR9000 is the brain of the typical Parker solution and offers unique benefits when combined with other Parker products.



Aries Servo Drives

The Aries family of servo drives is the perfect choice when a torque drive is needed. With its "plug in and spin" design, the Aries drives require no set-up. Simply attach a Parker smart encoder motor and the drive auto-configures.
Available in seven power levels, the Aries family gives users a robust and cost-effective digital servo product.

Features

- 120/240 VAC input
- CE (EMC & LVD), UL compliant
- 7 power levels, 1—16 amps RMS
- Torque, velocity or step/direction input
- Quadrature or SinCos encoders
- Linear and rotary motors supported

DriveTalkTM make Aries and ACR9000 a great match. Every axis on the ACR9000 includes a DriveTalk channel, which enables communication to Parker's Aries series servo drives. Configuration and diagnostics for the drive can be handled through the controller.

In addition to standard incremental encoder feedback, the ACR9000 and Aries support single and multi-turn absolute encoders. When absolute encoders are used, such as those offered with the MPP series of motors, the Aries drive utilizes SSI (Synchronous Serial Interface) to send position updates to the ACR9000, without the need for special hardware in the drive or controller. The ACR9000 can also receive SSI signals directly from the encoders.

PIO

The modular Parker I/O System (PIO) is a convenient and flexible product for connecting field devices to an ACR9000. The PIO communicates with the controller via CANopen. A wide variety of digital and analog modules are available.

Features

- Opto-Isolated
- Compact, DIN-rail mount
- Easy to install and expand
- Safe, reliable contacting
- Different voltages can be combined
- Error and status LEDs



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ACR9000...Partners

Rotary and Linear Motors

Parker offers a complete line of motor products meeting a broad range of application needs. Parker Trilogy's linear motors offer industry-leading solutions for both ironcore and ironless technologies. The wide range of rotary servo motors includes the high-torque MPP Series, the smooth/high-inertia SM Series and the cost-effective BE Series.





Daedal and Bayside Mechanics

Parker offers the widest range of precision mechanics in the industry. The 400XR series of modular linear positioners is available in an unrivaled array of sizes, features and options. Single- and multi-axis systems combine with the unique ACR9000 features for performance and value.

Gantry Control: LOCK feature of ACR offers outstanding control of linear motor gantry systems. A dedicated feedback loop monitors and corrects the position of the parallel axes to maintain precise alignment.



Ballscrew Compensation: Use the error map data provided with a precision grade XR table to improve accuracy with the powerful yet easy-to-use ACR compensation feature.

ACR Position maintenance for steppers Applications for steppers with encoders can benefit from this ACR feature. Position maintenance is invoked at the end of a move and will check the motor position for errors and correct if necessary







Stepper Drive and Motors

Parker's E series drives are low-cost, high-performance, high-reliability micro-stepping drives in a small package.

- E-AC: 120VAC, 3.5 amps
- E-DC: 24-48VDC, 4.8 amps
- Selectable resolution up to 50,800 steps/rev
- Auto standby reduces motor current (and heating) at rest
- Provides 0.02 Amps to 3.5 Amps

LV and HV Motors

- High performance
- Cost effective
- Optimized for both low-voltage and high-voltage applications
- Five frame sizes from 11 through 34

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ACR9000 Accessories

Part Number	Product Description
Drive Command Cables*	
71-021599-XX	ACR-to-Aries command cable (analog only)
71-021110-XX	ACR-to-ViX command cable
71-021108-XX	ACR-to-Compax3 command cable (analog only)
71-023715-XX	ACR-to-Dynaserv G3
71-021112-XX	ACR-to-Gemini command cable (analog only)
71-022316-XX	ACR-to-Gemini command cable (step & direction only)
71-021113-XX	ACR-to-stepper cable (25-pin stepper connector)
71-022344-XX	26-pin flying-lead cable
*-XX	Cables offered in 4' (-04) or -10' (-10) lengths, e.g., 71-021599-04
Expansion I/O Cable	
71-022338-02	2' Expansion I/O cable (9-pin D-sub to flying lead)
71-022338-04	4' Expansion I/O cable (9-pin D-sub to flying lead)
Communication Cable	
71-016939-10	10' RS-232 communication cable
Breakout Module	
VM25	25-pin screw terminal breakout board for onboard I/O connector and Limit/Home connector (1 required for each connector) DIN rail mount (2' cable included)
VM26	26-pin screw terminal breakout board for axes connectors, DIN-rail mount (2' cable included)
AC Power Adapter	
43-011905-01	240 VAC Power plug adapter
Power Supply	
PS-60W	24 VDC, 60 Watt power supply for I/O and enable
Parker I/O System (Expansion I/O)	
PIO-337	PIO Bus coupler, CANopen standard
PIO-347	PIO Bus coupler, CANopen economy
PIO-430	PIO 24 VDC digital input module, 8 channel
PIO-402	PIO 24 VDC digital input module, 4 channel
PIO-400	PIO 24 VDC digital input module, 2 channel
PIO-530	PIO 24 VDC digital output module, 8 channel, 0.5 Amp
PIO-504	PIO 24 VDC digital output module, 4 channel, 0.5 Amp
PIO-501	PIO 24 VDC digital output module, 2 channel, 0.5 Amp
PIO-468	PIO 0-10 VDC analog input module, 4 channel
PIO-480	PIO 0-20 mA analog input module, 2 channel, differential isolated
PIO-550	PIO 0-10 VDC analog output module, 2 channel
PIO-552	PIO 0-20 mA analog output module, 2 channel
PIO-600	PIO end module

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