



# 6K Motion Controller

*Catalogue 1602.004.01  
April, 1999*



## The 6K - a product to redefine controller architecture

Parker's revolutionary 6K Controller is an embedded or stand-alone motion controller built into one convenient package. The 6K is a multi-axis controller capable of solving both basic and complex motion control applications including pick-and-place, packaging, following and cam profiling as well as many others. The 6K utilises Ethernet communications to allow high speed connections to many different products such as PLCs, MMIs, I/O modules and vision systems.

The 6K comes with Parker's latest software interface, Motion Planner™, to allow for seamless integration and rapid setup of the 6K. Motion Planner utilises programming wizards to simplify repetitive programming tasks and a SmartEditor to virtually eliminate debug time. ServoTuner, a graphical tuning tool, and PanelMaker, a Visual Basic operator interface, are also included with Motion Planner.

### Universal connectivity

The 6K is truly universal, providing industry standard +/-10V or step and direction output. It is capable of controlling any combination of stepper and servo drives from 1 to 8 axes.

With its Ethernet capability, the 6K offers a flexible communication scheme compatible with a wide range of Ethernet devices including MMIs, PLCs, industrial I/O and vision systems. Ethernet is a vendor-neutral communication protocol which is widely accepted throughout the industry and is inexpensive to implement.

### Networking

Every 6K Controller has a unique IP address, so single or multiple 6Ks can be easily networked within an Ethernet system. TCP/IP protocol ensures reliable transmission of data across the network. Ethernet devices such as hubs allow multiple controllers to be linked to a single LAN.

With the addition of more sophisticated equipment, complex factory networks incorporating motion control are possible, allowing easier troubleshooting and wider access to the controller.

### Flexibility and expandability

Expansion I/O and an optional synchronisation bus allow the 6K to expand with the application.

The EVM32 expansion I/O module allows straightforward addition of digital and analogue I/O points to supplement the extensive I/O incorporated into the 6K as standard. Where necessary, remote I/O points can be accommodated with up to 30 metres between expansion modules.

With the synchronisation bus option, the 6K can share information with an additional 4 controllers. This allows up to 40 axes to be synchronised using a high speed serial connection.



## Features of the 6K

### Motion

- 1-8 axes of stepper or servo control (any combination)
- Axis outputs standard +/-10V or step & direction
- Maximum servo update rate 62.5  $\mu$ s/axis

### Interface capability

- 10 Mbps twisted pair Ethernet (TCP/IP protocol)
- 1 RS232 port (3 wire) - 9600 or 19200 baud
- 1 RS232/485 port (2 or 4 wire) - 9600 or 19200 baud

### Onboard I/O

- 5-24 VDC
- Home, Positive and Negative Limits per axis
- 9 or 17 trigger inputs for high speed position capture
- 4 or 8 digital outputs
- Drive Fault, Shutdown and Enable functions per axis
- 12 MHz encoder input for each axis
- Auxiliary encoder input for following

### Expansion I/O

- 12-24V DC, 32 channel expansion modules
- Up to 8 modules may be serially linked to each 6K
- Up to 30m between I/O modules
- Up to 128 additional digital inputs & 128 digital outputs
- Up to 64 additional analogue inputs (12 bit resolution)
- All digital I/O is updated every 2ms

### Language and Software

- Improved Parker 6000 programming language
- Motion Planner Software provided (SmartEditor, Servo Tuner and Visual Basic PanelMaker)
- Multi-tasking, position-based following, contouring, compiled moves, scaling, PLC scan mode

### Physical

- Power input 24V DC (user-supplied)
- Dimensions - please see diagrams on page 9

## Powerful support software to speed application development

Motion Planner is the latest addition to the already extensive library of software products available from Parker, and is quite unlike any other code development package. Many innovative features are incorporated to assist both novice and expert users in developing code.

- Develop code correctly the first time with powerful debugging tools
- Create rigorous setup procedures effortlessly with wizards
- Tune servos quickly and easily with built-in servo tuning software
- Create visually appealing user interfaces with PanelMaker Visual Basic scripting tool

Motion Planner is an essential part of any 6K project.

### It's Ergonomic

We like to call Motion Planner an ergonomic software package because it is designed to save a substantial amount of mouse clicking and typing while you concentrate on system design. Motion Planner speeds program development by giving access to program wizards that provide an easy and intuitive way to create your code. System debugging is simplified through a highlighted syntax checker. As you type an unrecognised command, it is highlighted giving a visual clue to the error. No more searching through pages of code or waiting for program compilation to discover syntax errors.

### SmartEditor

Creating code is one of the most time consuming aspects of system development. The software designers at Parker understand this, so Motion Planner's editor was designed with efficiency in mind. The SmartEditor incorporates these functions:

- Automatic syntax checking as you type
- Object-oriented code insertion
- Setup wizards for routine tasks
- Permanent help screen to access command descriptions

Motion Planner's SmartEditor virtually eliminates syntax debugging and will help you generate efficient error-free code first time.

### ServoTuner

To help optimise servo axes and speed you on your way towards creating motion, Motion Planner includes a copy of ServoTuner. Using ServoTuner you can change all tuning gains and see the motor response on the graphical tuning interface. Motion Planner will seamlessly integrate your programming, setup and tuning so you spend more time developing the full potential of the application.



### PanelMaker

You spend a lot of time developing your application, and you need a way to relay its potential to users and operators. Motion Planner's PanelMaker feature allows you to create informative and aesthetically pleasing interface screens without purchasing expensive software. PanelMaker utilises powerful Microsoft Visual Basic scripting to assist in panel creation. If you are already familiar with Visual Basic you will find the programming very familiar; if not, we have made available a range of pre-defined interfaces in the interface gallery.

### ApplicationWizard

Just starting your application? New to 6000 Language? Don't know where to start first? ApplicationWizard is a feature of Motion Planner designed to assist you in beginning your code development. In many cases the most difficult part of writing software code is knowing where to start. ApplicationWizard presents a series of dialogue boxes which will prompt you for information about your application. When you are finished the result is a program template which you can fill in with additional programming wizard tools.

### It's Free

Motion Planner is shipped free with every 6K and together they present hardware and software designers with a faster and better motion control solution than ever before. We have spent time perfecting our software so you don't have to spend your time putting it to work. Motion Planner software is also available for free download on the Compumotor website ([www.compumotor.com](http://www.compumotor.com)).

## 6000 Language.... now more powerful than ever!

The 6000 Motion Control Language has been an integral part of Parker's control products for over 5 years. Users of 6000 products value the simple yet powerful nature of the 6000 Language and that is why the 6K continues to offer the same language. Several major new software features have been added to the 6K to make the 6000 Language even more powerful than before -

- Multi-tasking
- PLC Scan Mode
- Virtual Master
- Web Registration
- Repetitive Cycle

These features add to the already impressive list of 6000 language features including -

- Contouring
- Cam Profiling
- Teach Mode
- Data Arrays
- Position Following
- Registration

### Multi-tasking

The 6K offers pre-emptive multi-tasking which allows the user to run up to 10 tasks simultaneously from one controller. Separate logic and motion programs can now be created and executed at the same time allowing more flexible error handling and I/O monitoring than ever before.

### PLC Scan Mode

PLC Scan Mode allows you to mimic the functions of a PLC. A high speed compiled program is dedicated to scan every 2ms and handles only logic functions such as error bits, I/O bits, variables and timers.

### Following

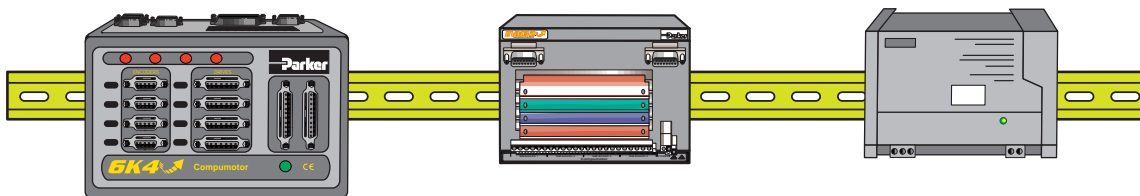
The 6K adds three new following features to its repertoire:

*Virtual Master* allows an internal count source to be followed to meet the needs of multi-axis electronic cams and sinusoidal move profile applications.

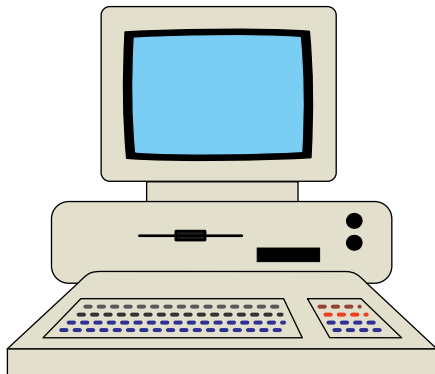
*Web Registration* allows web processing applications to be handled with ease, including dedicated registration handling subroutines.

*Following Repetitive Cycle* defines a motion profile synchronised to a repetitive external event such as high speed on-the-fly cutting.

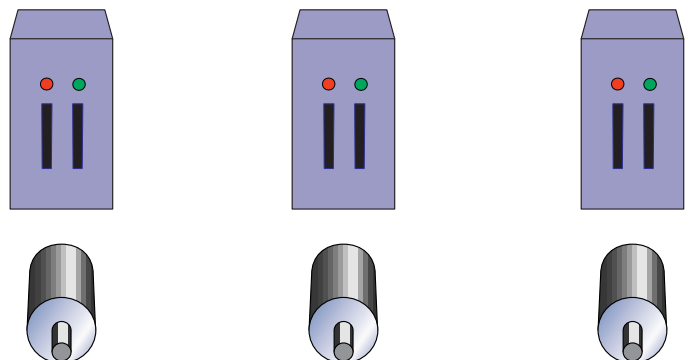
*controller, I/O and power supply are DIN Rail mountable*



*I/O expandable to 256 digital or 64 analogue points*



*Ethernet communication for all industrial busses and operator interfaces*





## The 6K Platform.... universal, flexible, expandable

The 6K hardware platform has been designed with one overriding consideration in mind - *connectivity*. This thought process has led to the design one of the most flexible and powerful controllers ever offered. Servo or stepper, embedded or stand-alone control, small or large amounts of I/O and expandable axes are all accommodated within the 6K platform. Some of the new features include:

### Ethernet connectivity

Embedded control is now a complex issue made even more complicated due to the number of bus architectures available. With the 6K's Ethernet capability, the type of bus architecture used is no longer a critical factor in choosing a controller. The 6K can interface with every popular bus structure on the market through readily available Ethernet cards. Ethernet also enables communication with PLCs, MMIs, I/O modules and vision systems.

### Compact design

The 6K was designed to occupy as little space as possible. This not only helps to reduce the total panel area required but also minimises the length of interconnections. Factors contributing to the compact design include the use of an external 24-volt power supply and the conversion to D-type signal connectors.

### Expandable I/O

Not every application requires large amounts of I/O. The 6K on-board I/O offers end-of-travel limits and home switch inputs for each axis, fast trigger inputs and digital outputs. If necessary, the EVM32 I/O expansion module may be used to extend the amount of I/O available. Up to eight EVM32 modules may be added, providing up to 128 additional digital inputs, 128 digital outputs and 64 analogue inputs. I/O scanning occurs every 2ms.

### Synchronisation bus

The 6K platform is capable of handling up to 8 axes from a single controller. If a situation arises where more than 8 axes must be synchronised, the 6K offers an optional synchronisation bus to connect up to 4 additional controllers or up to 32 additional axes. Information is passed via a serial bus which contains a synchronisation code to ensure that every controller receives the information at the correct time.

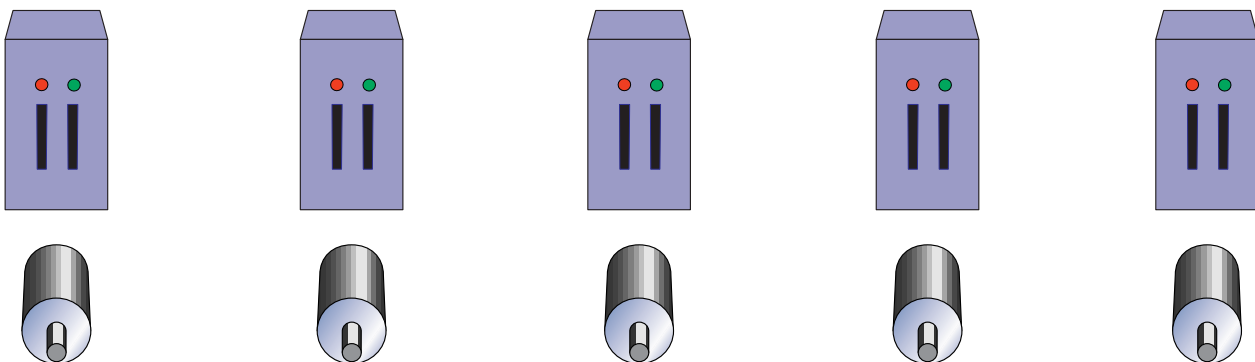
### Servo and step motor control

The 6K is designed to control industry-standard servo drives as well as step and direction drives. Axes may be configured via software in any combination.

### DIN rail mounting

All 6K controllers and accessories may be mounted on a standard 35 x 7.5mm DIN rail for simplified panel assembly and easy integration within industrial enclosures. Panel mounting is also available.

*up to 4 additional controllers (or 32 additional axes) via the synchronisation bus*



*up to 8 axes of direct servo or stepper motor control*

## Ethernet...what is it?

### Ethernet today

Ethernet is a well known and widely used communication system that has been in existence since the 1970's when it was developed by Xerox. Since that time it has expanded rapidly and today it is the most commonly used standard for Local Area Networks (LANs). We know Ethernet best for its everyday uses such as e-mail and the Internet.

### Availability of Ethernet

Ethernet is an open platform serial communication system which is vendor-neutral. It complies with the IEEE 802.3 standard adopted in 1985. Due to the large market and widespread availability, Ethernet components are both numerous and inexpensive. Since Ethernet complies with an agreed standard, connectivity between a wide range of Ethernet-compatible products is both simple and straightforward.

### Ethernet transmission

The medium over which Ethernet communication is transmitted varies. The most frequently-used system is 10Base-T; this indicates a baseband signal carried over twisted-pair cable at 10Mbps (10 million bits per second). Alternative media are known as 10Base5 and 10Base2, corresponding to thick and thin coaxial cable respectively. 10Base-F is a fibre-optic system used to ensure reliable communication in noisy environments. The next step in Ethernet technology is the 100Base-T Fast Ethernet - this is expected to become a standard over the next few years.

### Network access control

Ethernet uses a single communication link which interconnects all devices on the network. Some means of access control is therefore required to ensure that only one message is transmitted at a time. Ethernet uses CSMA/CD (Carrier-Sense Multiple-Access with Collision Detection).

Every station has equal access to the communication channel and no single station can lock out another station (Multiple-Access). An Ethernet station wanting to send a message first checks to make sure that the channel is not carrying a signal (Carrier-Sense). If more than one station detects that the channel is free and starts transmitting, a collision occurs. Each station then stops transmitting and makes a further attempt after a random time interval (Collision Detection). The chances of each station waiting for the same time before re-trying are extremely small, and most collisions are resolved within microseconds of detection.

### Communication protocol - TCP/IP

Ethernet is a standard for communication between hardware devices. TCP/IP (Transfer Control Protocol/Internet Protocol) is a standard used to communicate at software level. It is an open standard protocol making it easily accessible and available in a wide range of products.

### Embedded control via Ethernet

Ethernet was developed as a method of high-speed communication between computers. Since a motion controller is nothing more than a special-purpose computer, it is logical to use Ethernet for high speed communication between an industrial computer and a motion controller.

Embedded control is becoming increasingly popular, and a number of alternative bus architectures are used for this purpose. ISA, PCI, VME, CompactPCI, STD, PC/104 and PC Card are just a few of the options available. However, a unique motion control board is normally required to operate with each bus system.

Ethernet offers a clean solution to this problem. As a result of the open standard, low-cost Ethernet communication cards are available for every popular bus architecture. This means that a motion controller with Ethernet capability can be interfaced with all types of computer regardless of the internal bus architecture.

### Ethernet flexibility

Ethernet advantages don't stop at bus architecture flexibility. A wide variety of products are now available with Ethernet communication capability. A motion controller using Ethernet can join these products on a LAN and share information with units such as I/O modules, sensors, PLCs, operator interfaces and vision systems.

Incorporating TCP/IP protocol in an Ethernet controller also allows for access to the Internet and other devices based on TCP/IP. This means that an engineer sitting at a desk can upload or download information to and from a motion controller on the factory floor, in another building, at another location or even in another country.

### Integration into an open network

Ethernet is a flexible alternative to traditional bus-based control, offering an attractive networking solution on a widely accepted platform. However it is important to understand how to integrate the 6K successfully into an open network. Ethernet is a non-deterministic system and delays will occur due to collisions when the network is very busy. In applications requiring minimal data transfer such as periodic scanning of product status or program downloads, an open network can easily meet the requirements. For highly data intensive applications such as continuously updating a visual interface, a direct Ethernet connection between PC and 6K via a crossover cable is recommended. In applications requiring access to an intensive data transfer network, an Ethernet switch should be used to isolate the 6K from the open network.

Utilising Ethernet as a motion control communication scheme offers both economic and technological benefits. The large number of Ethernet and TCP/IP compatible products, their comparatively low cost and the planned upgrade to 100-Mbps Ethernet make it an attractive proposition for both current and future systems.

## Ordering codes

### Controller

#### 6Kn-NK

6K series controller

n = number of axes (2, 4, 6 or 8)

NK = no ship kit (omit to include ship kit)

#### Examples:

6K4-NK = 4-axis controller with no ship kit

6K8 = 8-axis controller with ship kit

### Ship Kit

#### 6K-Kit

6K Hardware Installation Guide

6K Programmer's Guide

6K Command Reference

Motion Planner CD-Rom

Panel Mounting Hardware

Crossover Ethernet cable for

direct PC to 6K communication only

### I/O Screw Terminal Breakout Board

#### VM25

25 pin-D to screw terminal breakout board  
& 600mm cable (for use with onboard I/O)

### I/O Expansion Module

#### EVM32-BASE\*

Expansion I/O module with 600mm cable

#### SIM8-IN

8 digital input SIM

#### SIM8-OUT-EVM32

8 digital output SIM, configurable  
as sink or source

#### SIM8-AN-IN

8 12-bit analogue input SIM

#### 71-016949-02

Expansion I/O cable (included with  
the EVM32 base module)

\*EVM32-BASE and SIM cards are sold separately

Up to four SIM cards fit in each EVM32 base module

### Cables

#### 71-016137-10

3m 6K to stepper drive  
(ZETA, OEM750, S drive)

#### 71-017003-10

3m 6K to servo drive (free end)

#### 71-016949-02

600mm I/O expansion cable

#### 71-016949-100

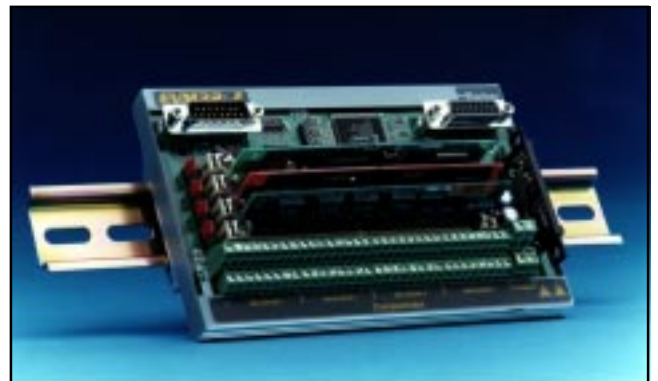
30m I/O expansion cable

#### 71-016939-02

600mm 6K to VM25 cable (included  
with the VM25 breakout board)



6K4 4-axis controller



EVM32 I/O expansion module

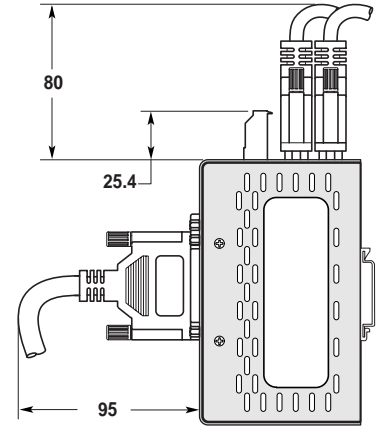
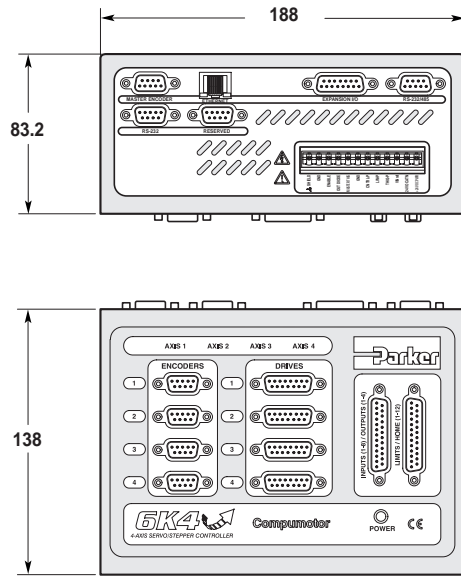


6K8 8-axis controller

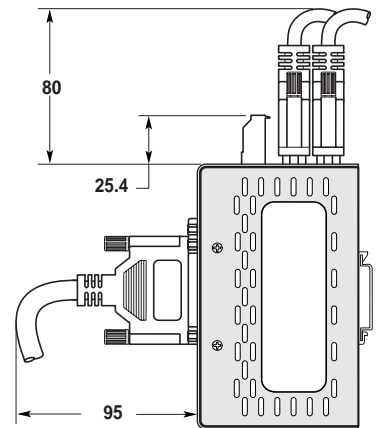
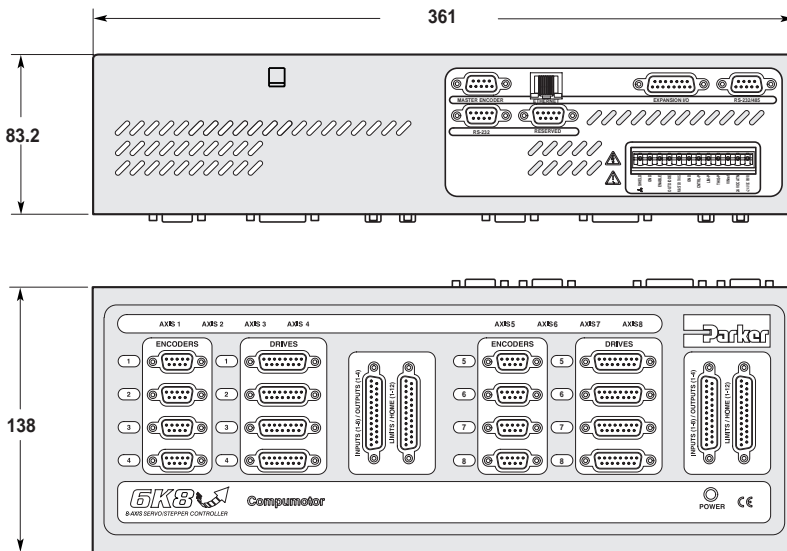
<b>Parameter</b>	<b>Value</b>
<b>Power Input</b>	24V DC at 2A, user-supplied Additional power may be required for I/O use See Installation Guide for further details
<b>Performance</b>	
Command output	+/-10V or Step & Direction, configurable per axis
Servo update rate	As fast as 62.5 $\mu$ s/axis
Stepping Accuracy	+/-0 steps from preset total
Position Range	+/-2,147,483,648 counts
Velocity Range	1 to 2,048,000 counts/sec (step/direction output) 1 to 12,000,000 counts/sec (+/-10V output)
<b>Inputs</b>	
Home & end-of-travel limits per axis	Factory default is 24 VDC source, jumper-selectable for sink 0-24 VDC range via $VIN_{ref}$ 1/3-1/3-1/3 voltage switching thresholds Configurable as general purpose I/O if not needed as limits
Onboard fast trigger inputs	9 on 6K2 & 6K4, 17 on 6K6 & 6K8 Factory default is 24 VDC source, jumper-selectable for sink 0-24 VDC range via $VIN_{ref}$ 1/3-1/3-1/3 voltage switching thresholds
Optional expansion	Up to 128 additional digital inputs (2 ms update rate) Up to 64 additional 12-bit analogue inputs (+/-10V DC) 12-24 VDC user supplied via EVM32 module 1/3-1/3-1/3 voltage switching thresholds on digital inputs Up to 30 metres between EVM32 modules
Encoder inputs	Accept two phase incremental encoders with differential (recommended) or single-ended outputs, 5V DC TTL-compatible levels, optically isolated Quadrature detection, max frequency = 12MHz post-quadrature
<b>Outputs</b>	
Onboard	4 on 6K2 & 6K4, 8 on 6K6 & 6K8 5-24V DC user supplied, 300 mA maximum sink current
Optional expansion	Up to 128 additional digital outputs 12-24V DC user supplied via EVM32 module 300 mA maximum sink current Up to 30 metres between modules
<b>Communications</b>	
Ethernet	10Base-T (10Mbps Twisted Pair) TCP/IP protocol
Serial	RS232, RS485 2-wire or 4-wire Up to 19200 baud, up to 99 units in daisy-chain or multi-drop
<b>Environmental</b>	
Operating Temperature	0° to 50°C
Storage Temperature	-30° to 85°C
Humidity	0% to 95% non-condensing



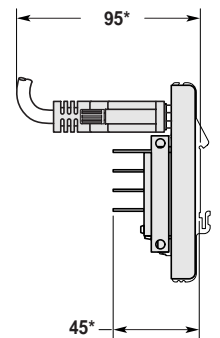
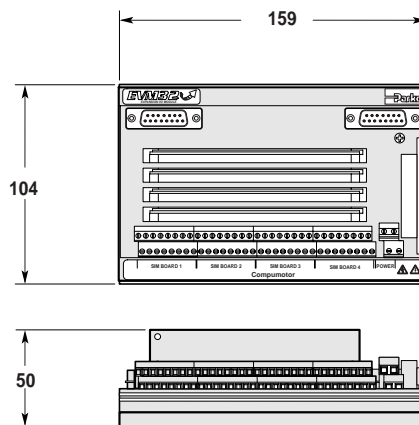
6K2 & 6K4



6K6 & 6K8



EVM32



\*DIMENSIONS ARE TO TOP SURFACE OF DIN RAIL

All dimensions in mm

## Front surface connectors

<b>Encoder</b> <i>9-pin D connector, female</i>		<b>Drive</b> <i>15-pin D connector, female</i>		<b>Limits/Home</b> <i>9-pin D connector, female</i>		<b>Triggers/Outputs</b> <i>25-pin D connector, female</i>	
<i>Pin</i>	<i>Signal</i>	<i>Pin</i>	<i>Signal</i>	<i>Pin</i>	<i>Signal</i>	<i>Pin</i>	<i>Signal</i>
1	+5VDC	1	Step+ (stepper)	1	Home 4	1	Output 4
2	A+	2	Direction+ (stepper)	3	-Limit 4	3	Output 3
3	A-	3	Command+ (servo)	5	+Limit 4	5	Output 2
4	B+	4	Stall (stepper)	7	Home 3	7	Output 1
5	B-	5	Drive Fault (both)	9	-Limit 3	9	Trigger 8
6	Z+	6	Command- (servo)	11	+Limit 3	11	Trigger 7
7	Z-	7	Shtdn (N0) (servo)	13	Home 2	13	Trigger 6
8	Single Ended	8	Shtdn (NC) (servo)	15	-Limit 2	15	Trigger5
9	ISO GND	9	Step- (stepper)	17	+Limit 2	17	Trigger 4
		10	Direction- (stepper)	19	Home 1	19	Trigger 3
		11	Shtdn+ (stepper)	21	-Limit 1	21	Trigger 2
		12	Shtdn- (stepper)	23	+Limit 1	23	Trigger 1
		13	ISO GND (both)	25	Reserved	25	Reserved
		14	Shtdn Common (servo)	Even	ISO GND	Even	ISO GND
		15	Analogue Ground (servo)				

## Top surface connectors

### **Power Input** *12-pin Screw Terminal*

<i>Pin</i>	<i>Signal</i>
1	SHIELD
2	ISO GND
3	ENABLE
4	OUT DIODE
5	MASTER TRIG
6	ISO GND
7	CNTRL-P
8	LIM-P
9	TRIG-P
10	VINref
11	24 VDC RTN
12	+ 24 VDC PWR

### **Master Encoder Input** *9-pin D connector, female*

<i>Pin</i>	<i>Signal</i>
1	+5VDC
2	A+
3	A-
4	B+
5	B-
6	Z+
7	Z-
8	ISO GND
9	ISO GND

### **I/O Expansion** *15-pin D connector, male*

Connection to the expansion I/O modules. I/O modules sold separately. Up to 128 digital inputs, 128 digital outputs and 64 analogue inputs may be added.

#### **Ethernet (RJ45 connector)**

10Base-T Ethernet connection with TCP/IP protocol

#### **RS-232/485 (9-pin D connector, male)**

Configurable for RS-232 or RS-485 at 9600 or 19200 baud

#### **RS-232 (9-pin D connector, male)**

RS-232 port at 9600 or 19200 baud



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## Parker Hannifin Corporation

### *About Parker Hannifin Corporation*

Parker Hannifin is a leading global motion-control company dedicated to delivering premier customer service. A Fortune 500 corporation listed on the New York Stock Exchange (PH), our components and systems comprise over 1,400 product lines that control motion in some 1,000 industrial and aerospace markets. Parker is the only manufacturer to offer its customers a choice of hydraulic, pneumatic, and electromechanical motion-control solutions. Our Company has the largest distribution network in its field, with over 7,500 distributors serving nearly 400,000 customers worldwide.

### *Parker's Charter*

To be a leading worldwide manufacturer of components and systems for the builders and users of durable goods. More specifically, we will design, market and manufacture products controlling motion, flow and pressure. We will achieve profitable growth through premier customer service.

### *Product Information*

European customers seeking product information, the location of a nearby distributor, or repair services will receive prompt attention by calling the Parker Product Information Centre at our toll-free number: 00800 27 27 5374 (AU, DE, FR, CH, UK), +44 1442 358429 from other countries. Customers in USA should contact 1-800-272-7537

**The Aerospace Group** is a leader in the development, design, manufacture and servicing of control systems and components for aerospace and related high-technology markets, while achieving growth through premier customer service.



**The Climate & Industrial Controls Group** designs, manufactures and markets system-control and fluid-handling components and systems to refrigeration, air-conditioning and industrial customers worldwide.



**The Fluid Connectors Group** designs, manufactures and markets rigid and flexible connectors, and associated products used in pneumatic and fluid systems.



**The Seal Group** designs, manufactures and distributes industrial and commercial sealing devices and related products by providing superior quality and total customer satisfaction.



**The Hydraulics Group** designs, produces and markets a full spectrum of hydraulic components and systems to builders and users of industrial and mobile machinery and equipment.



**The Filtration Group** designs, manufactures and markets quality filtration and clarification products, providing customers with the best value, quality, technical support, and global availability.



**The Automation Group** is a leading supplier of pneumatic and electromechanical components and systems to automation customers worldwide.



**The Instrumentation Group** is a global leader in the design, manufacture and distribution of high-quality critical flow components for worldwide process instrumentation, ultra-high-purity, medical and analytical applications.



## Engineering solutions in motion control...

The performance requirements of today's automation tasks demand reliable, cost-effective solutions and the reassurance of competent technical backup. A comprehensive product range supported by highly-trained, experienced application engineers forms the basis of Parker's motion control capability.

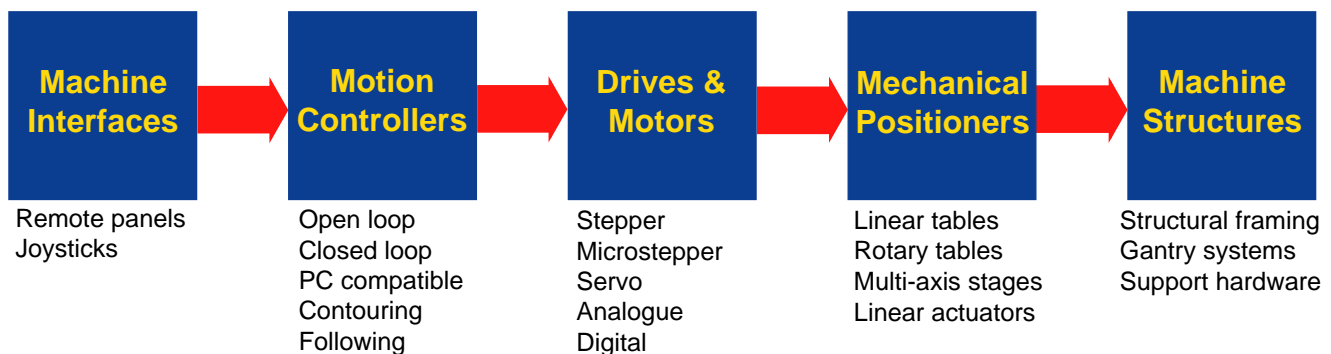
With the combined resources of world-class companies like Digiplan, Compumotor, Hauser and Daedal, Parker can offer a range of automation products which is second to none. High-performance stepper and servo systems combined with powerful, flexible controllers are complemented by a wide selection of mechanical positioning systems. This

equipment is supplied and supported through a worldwide network of Automation Technology Centres, each with factory-trained staff who specialise in the application of high-technology motion control systems.

Our aim is to give customers a competitive advantage by providing top-grade equipment and unrivalled technical support. Whether the application is in industrial automation, production machinery, instrumentation or research, you can be certain that your system will be precision-engineered and backed by the Parker guarantee of quality and reliability.



## Parker - we engineer solutions in motion control



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