Universal Motion Controller—The 6K

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

The 6K comes with Compumotor's latest software interface, Motion Planner™, to allow for seamless integration and quick setup of the 6K. Motion Planner™ utilizes programming wizards, which eliminate the need to learn a proprietry language and take the chore out of repetitive programming tasks, and a SmartEditor™ to virtually eliminate debug time. ServoTuner™, a graphical tuning tool, and PanelMaker™, a VB Script 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 steppers and servos from 1 to 8 axes.

With its Ethernet capability, the 6K offers a flexible communication scheme compatible with hundreds of Ethernet devices on the market. From HMIs and PLCs to industrial I/O and vision systems, the 6K can connect to them all. Ethernet is a vendor-neutral, industry-accepted communication protocol, and it is very inexpensive to implement. The addition of fieldbus options (6K Profibus-DP and 6K DeviceNet) offer connectivity to PLCs and PCs using industry-standard protocols and hardware.

Networking

Every 6K Controller has a programmable IP address so single or multiple 6Ks can be easily networked in an Ethernet LAN. Ethernet devices such as hubs or switches allow multiple controllers to be linked onto 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 allows the 6K to expand with your application.

The EVM32 expansion I/O module allows easy configuration of digital I/O, analog I/O, and relay points in addition to the already extensive amount of standard 6K I/O.

Programmability

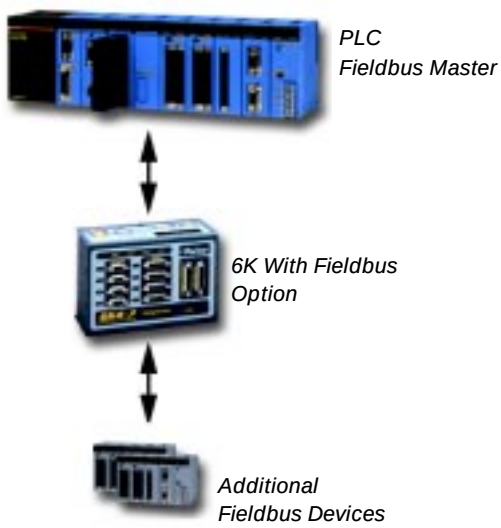
The 6K is built on the solid platform of Compumotor's 6000 Programming Language. With powerful features such as cam following, multitasking, PLC Scan Mode, PLS (Programmble Limit Switch) functionality, contouring, and teach mode, the 6K can handle the most demanding of applications. Yet program development time is greatly reduced with wizards, which uses a simple graphical environment to build the program structure, making the 6K easier then ever.

Discover How The 6K Motion Controller Can Solve Your Next Application. Call 1-800-358-9070 Today.

Fieldbus and the 6K

The 6K controller offers fieldbus options! For applications requiring a dedicated network to carry I/O and controller status information to and from PLCs or PCs, Compumotor has developed Profibus-DP and DeviceNet options for the 6K.

6K Fieldbus Specifications



- Profibus-DP or DeviceNet implementation
- Passive station (Slave device)
- Parity and cable disconnect error checking
- Cyclical Data Transfer
  - * Profibus-DP
    - Dual port transfer of first 16 binary variables
  - * DeviceNet
    - Dual port transfer of first 16 binary variables
- Network Addressing
  - * Profibus-DP
    - Manual addressing up to 127 nodes
  - * DeviceNet
    - Manual addressing up to 63 nodes

NOTE: Fieldbus options are not field installable. Call your local Automation Technology Center or Compumotor to order a fieldbus version of the 6K.

Expandable I/O

The ability to add digital and analog I/O to the 6K makes it a very flexible and attractive controller choice for both OEMs and end-users alike. You are free to choose exactly how much I/O your system requires. The expansion I/O of the 6K ensures that you pay only for the I/O that you need. Contrast this to other controller manufacturers that make you pay for a fixed amount of I/O regardless of whether you utliize all of it or not.

EVM32

The EVM32 is a compact and rugged DIN Rail-mountable module that houses up to 32 channels of I/O. Up to eight EVM32 modules may be used with each 6K. SIM (Single In-Line Module) cards are added to the EVM32 to expand the I/O.

SIM cards are available with:

- 8 analog inputs
  - 12-bit (+/- 10 V)
- 8 analog outputs
  - 10-bit (+/- 10 V)
- 8 digital inputs
  - 24 VDC, sourcing or sinking is jumper selectable
  - LEDs for visual reference
- 8 digital outputs
  - 24 VDC, sourcing or sinking, 300 mA current sink, short circuit protected
  - LEDs for visual reference
- 8 reed relay outputs
  - 10 Watt max power*
  - 0.5 A max current, 75 V max voltage*
  - 400 µs activation time typical
  - 100 µs release time typical

* **Note:** On the reed relay SIM, neither power, current nor voltage should ever exceed the maximum rated values listed. Exceeding the rated values will damage the reed relay SIM. Example: 10 Watts = 0.416 Amps @ 24 Volts.

Configuration

SIM cards may be added to the EVM32 to achieve a maximum of 256 bits (32 bits per EVM32 times eight EVM32 modules per 6K):

- 256 additional bits
  - 256 digital inputs
  - 256 digital outputs
  - 64 analog inputs (4 bits per input)
  - 64 analog outputs (4 bits per output)
  - 256 reed relay outputs

Note: The actual number of digital outputs is dependent on heat. Please consult the product documentation to determine duty cycle and load considerations.

Features

Motion

- 1-8 axes of stepper/servo control (any combination)
- Outputs standard +/- 10V or step & direction
- Servo update rates of 62.5 µs/axis

Interface Capability

- 10 Mbps twisted pair Ethernet
- Multiple protocols
- 1 RS232 port (3 wire) - 9600 or 19200 baud
- 1 RS232/485 port (2 or 4 wire) - 9600 or 19200 baud
- Profibus-DP option
- DeviceNet option
- Parker CTC Motion Panel™, PowerStation™ and other CTC touchpanels via Ethernet or RS232/485

Language and Software

- Wizards-based Motion Planner™ Software provided
- Compumotor 6000 programming language
- Multi-tasking (Up to 10 separate tasks)
- Position based following
- Contouring (2-axes circular, tangent & proportional third axis)
- Compiled moves
- PLC Scan Mode
- PLS (Programmable Limit Switch) capability
- Scaling
- Cam profiling
- Variables and high level math functions
- 300K non-volatile memory for program storage

Physical

- Standalone operation
- PC-based control via Ethernet
- Fieldbus via Profibus -DP or DeviceNet
- 24VDC user supplied
- DIN Rail mountable

Onboard I/O

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

Expansion I/O

- 12-24 VDC, 32 channel expansion modules
- Up to 256 digital I/O points
- Up to 64 analog I/O points
- All digital I/O is updated every 2ms
- Digital I/O have LEDs for visual reference
- Compatible with Ethernet I/O

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Ethernet

What is Ethernet?

Ethernet Today

Ethernet is a well-known and widely used communication protocol that has been in existence since the 1970s when it was developed by Xerox. Since that time it has expanded rapidly and today it is the most commonly used LAN in existence. We know Ethernet best for its everyday uses such as email, Internet and Intranet.

Availability of Ethernet

Ethernet is an open platform serial communication that is vendor neutral. It is governed by the IEEE 802.3 standard adopted in 1985. Due to the large market and availability, Ethernet component choices are numerous and inexpensive. Since Ethernet is a standard, connectivity between a wide range of Ethernet capable products is fast and easy.

Ethernet Mediums

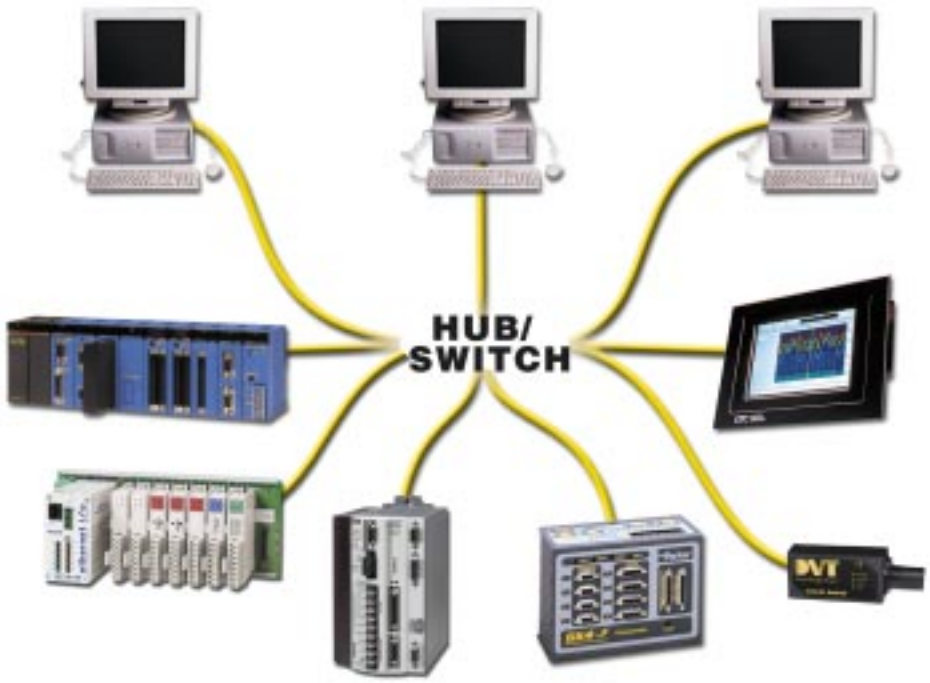
The medium over which Ethernet communication is transmitted is varied. The most common medium to date is 10Base-T. 10Base-T means a 10-Mbps (10 million bits per second) baseband signal carried over twisted pair cable. Most facilities using Ethernet are using 10Base-T as their medium. Other mediums used are 10Base5 and 10Base2, thick coaxial and thin coaxial cable respectively. 10Base-F is a fiber optic medium. 100 Base-T is becoming more common today. . . .

Communication Protocol

Ethernet is a standard of communication between hardware devices. Several protocols, or languages, are spoken over the Ethernet network and provide a common interface between devices. TCP/IP (Transfer Control Protocol/Internet Protocol) is by far the most prevalent protocol due to its common usage in office environments. Protocols such as Modbus/TCP and AB Ethernet have become more popular in industrial environments over Ethernet networks because they support industrial device communication better than typical PC protocols such as TCP/IP.

Summary

The availability of Ethernet, a wide range of Ethernet products, extremely fast communications, and proven communication protocols make Ethernet a perfect choice for networking and communication between industrial devices.



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Ethernet and Motion Control

Motion Control Via Ethernet

Ethernet was developed as a high-speed method of communication between two computers. When looking at a motion controller it is obvious that it is nothing more than a highly specialized computer; therefore, it makes sense to use Ethernet for high-speed communication between an industrial computer and a motion controller.

Ethernet Flexibility

On the market today are thousands of products with Ethernet communication capability. A motion controller using Ethernet can join these products on a LAN and share information with I/O modules, sensors, PLCs, HMIs and vision systems, to name a few. Additionally, Ethernet controllers allow connectivity to not just one PC but literally thousands and can have several host computers located throughout an entire factory.

Incorporating TCP/IP protocols in an Ethernet controller also allows for access to the Internet and other software and devices utilizing TCP/IP. Now you can sit at your desk and upload or download information to a motion controller on the factory floor. The factory floor might be in another building, another state or another country.

Ethernet Networking

With the popularity of Ethernet growing on the plant floor, the ability to network industrial devices over ethernet has become a viable alternative to traditional fieldbus. This type of communication is typically handled via a client/server relationship over the ethernet network.

The client is the device that opens a connection to a server and queries for information or commands some action. The client on an Ethernet network is synonymous with a “master” on a traditional fieldbus network. The server is the device that, once queried by a client, serves the information back to or carries out the actions commanded by the client and is synonymous with a “slave” on a traditional fieldbus network. As an example, in a system with a 6K and a PC running Motion Planner, the PC is the client and the 6K is the server. The following explains two ways to use networking capability of the 6K or Gem6K.

6K or Gem6K as a Client

You can connect the 6K via Ethernet to multiple devices, creating a client/server network. The 6K is the *client*, and has the ability to open or close a connection with another device (*server*) and request information from that device. The 6K supports up to 6 simultaneous server connections. Devices (servers) that may be connected to the 6K include:

- Allen Bradley SLC5-05 PLC, using AB Ethernet protocol
- OPTO22 SNAP I/O, using Modbus/TCP protocol
- DVT vision system cameras

Peer-to-Peer Network with other 6K or Gem6K units

The 6K may be connected to other 6K devices (6K Controllers or Gem6K drive/controllers) via Ethernet. This type of connection uses *UDP broadcasting* and is *not* a client/server relationship.

Data Chain is a peer-to-peer network created by Compumotor to share data between multiple 6K/Gem6K units. Up to eight units may broadcast on the Ethernet network simultaneously with an unlimited number of units subscribing to these broadcasts. Each broadcast unit may send up to eight 32-bit values. Each subscribing unit may receive all eight values from each broadcast unit, adding up to a possible 64 values in each subscribing units. The update rate in each unit is user definable for maximum system performance.

Determinism

Ethernet is a flexible alternative to traditional bus-based control. It also offers an attractive networking solution on a widely accepted platform. It is important however to understand how the 6K integrates on an open network. For applications requiring minimal data transfer such as periodic scanning of product status or program downloads, this can be accomplished on an open network. For highly data intensive applications such as continuously updating visual interfaces, Compumotor recommends a direct PC to 6K Ethernet connection via a crossover cable. For applications requiring intensive data transfer network access, isolate the 6K from the open network using an Ethernet switch.

Utilizing Ethernet as a motion control communication scheme makes sense from an economic, technological and adaptability standpoint. The sheer number of Ethernet compatible products and the low cost of obtaining Ethernet technology make it an attractive solution for many years to come.

The 6K Software

The Right Idea and the Right Tools

Motion Planner™

Motion Planner is a code development package like no other. Several features are incorporated to assist novice and expert users alike in developing code. Develop your code correctly the first time with powerful wizards and debugging tools. Tune servos quickly and easily with built in servo tuning software. Create visually appealing user interfaces with our PanelMaker Visual Basic scripting tool. Motion Planner is an essential part of any 6K project.

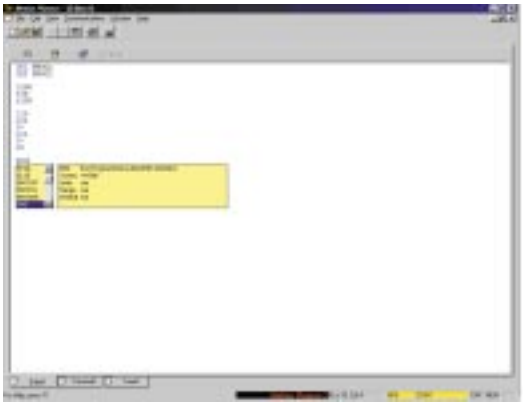
Wizards

Working with Compumotor's 6K multi-axis motion controllers just got even easier. Now the 6K's Motion Planner™ application software comes with wizards, eliminating any need to learn a proprietary language. Let our wizards do the programming for you!

- Develop your application code in one-third the time
- Multiple, modular wizards for set up, error handling, networking and all motion commands
- Generate error-free application code with full comments
- Eliminate the need to learn specific command syntax.

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 at our website: (www.compumotor.com).



SmartEditor™

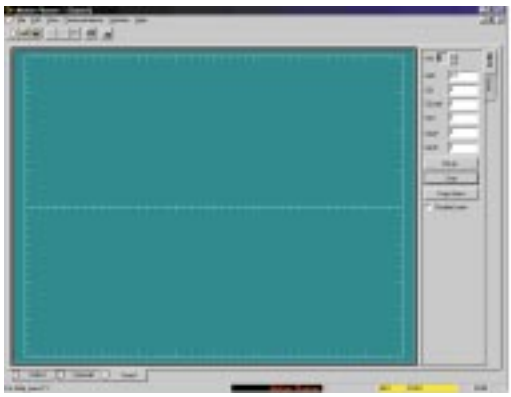
Creating code is one of the most time consuming aspects of system development. The software designers at Compumotor understand this, so Motion Planner's editor was designed with efficiency in mind. The SmartEditor™ incorporates these functions:

- Automatic syntax checking as you type
- Color coded syntax highlighting
- Ever present help screen to access command descriptions

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

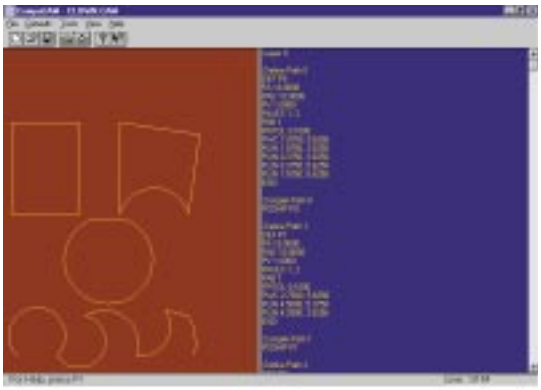
PanelMaker

You spend a lot of time developing your application potential. You need a way to relay that potential to users and operators. Motion Planner's PanelMaker features allows you to create informative and aesthetically pleasing interface screens without purchasing expensive software. PanelMaker utilizes powerful Microsoft® Visual Basic™ scripting to assist in panel creation. If you are already familiar with Visual Basic™ you will find the programming very similiar and if not, we have created several pre-defined interfaces for you in our interface gallery. An ActiveX control is also provided for fast checking of controller parameters.



ServoTuner™

To help you optimize your servo axes and speed you on your way towards creating motion, Motion Planner™ includes a servo tuning utility. 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 your application's full potential.



CompuCAM

Now you can convert your .DXF, HPGL or G-Code files directly into language that the 6K understands with CompuCAM. Built-in filters, available for this add-on utility to Motion Planner™, allow quick creation of complex contouring code. All scaling and tolerances are handled within CompuCAM, just set your default parameters, import your file to create the 6K code. It's that easy!

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