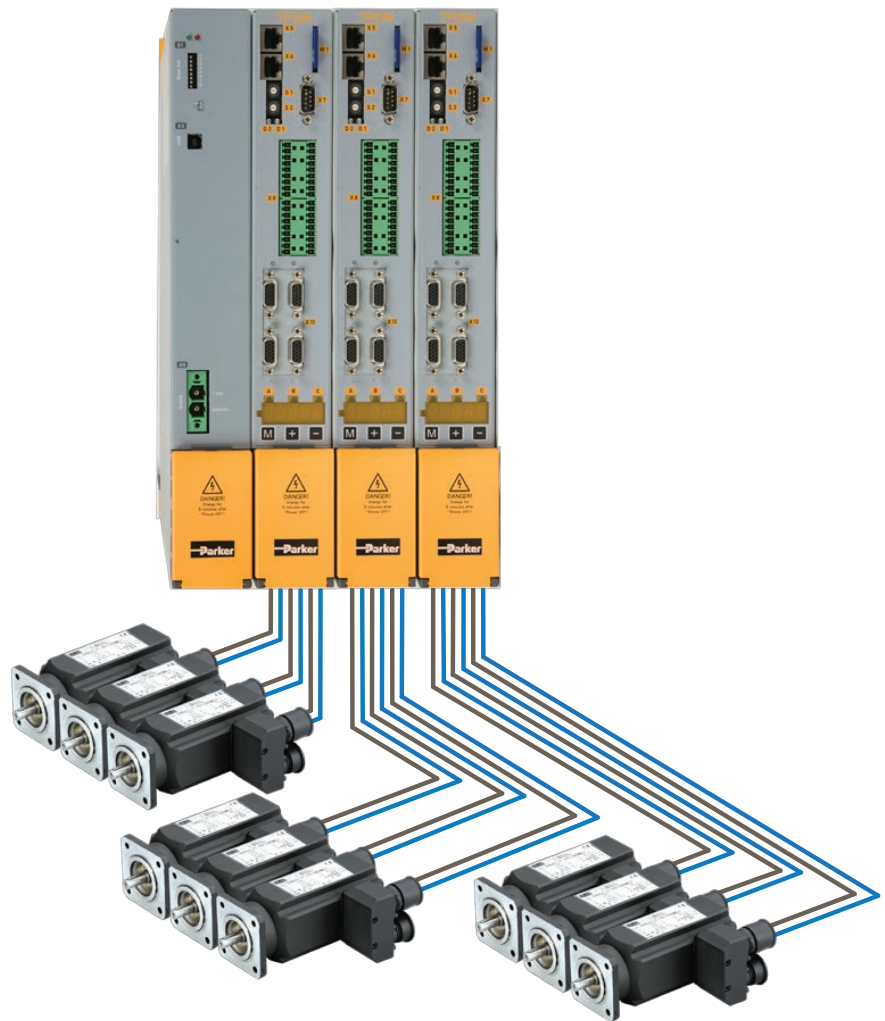
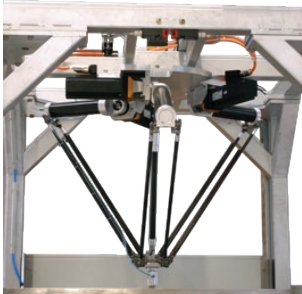




aerospace  
climate control  
**electromechanical**  
filtration  
fluid & gas handling  
hydraulics  
pneumatics  
process control  
sealing & shielding



## TPD-M

Triple Axis Servo Drive System



ENGINEERING YOUR SUCCESS.



**WARNING – USER RESPONSIBILITY**

**FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.**

- This document and other information from Parker-Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for further investigation by users having technical expertise.
- The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.
- To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications are suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

## Triple Axis Servo Drive - TPD-M

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# Parker Hannifin

## The global leader in motion and control technologies

### A world class player on a local stage

#### Global Product Design

Parker Hannifin has more than 40 years experience in the design and manufacturing of drives, controls, motors and mechanical products. With dedicated global product development teams, Parker draws on industry-leading technological leadership and experience from engineering teams in Europe, North America and Asia.

#### Local Application Expertise

Parker has local engineering resources committed to adapting and applying our current products and technologies to best fit our customers' needs.

#### Manufacturing to Meet Our Customers' Needs

Parker is committed to meeting the increasing service demands that our customers require to succeed in the global industrial market. Parker's manufacturing teams seek continuous improvement through the implementation of lean manufacturing methods throughout the process. We measure ourselves on meeting our customers' expectations of quality and delivery, not just our own. In order to meet these expectations, Parker operates and continues to invest in our manufacturing facilities in Europe, North America and Asia.

#### Electromechanical Worldwide Manufacturing Locations

##### Europe

Littlehampton, United Kingdom  
Dijon, France  
Offenburg, Germany  
Filderstadt, Germany  
Milan, Italy

##### Asia

Wuxi, China  
Jangan, Korea  
Chennai, India

##### North America

Rohnert Park, California  
Irwin, Pennsylvania  
Charlotte, North Carolina  
New Ulm, Minnesota



Offenburg, Germany

#### Local Manufacturing and Support in Europe

Parker provides sales assistance and local technical support through a network of dedicated sales teams and authorized technical distributors throughout Europe.

For contact information, please refer to the Sales Offices on the back cover of this document or visit [www.parker.com](http://www.parker.com)



Milan, Italy



Littlehampton, UK



Filderstadt, Germany



Dijon, France

# Triple Axis Servo Drive - TPD-M

## Overview

### Description

TPD-M is a multi axis system where each power module can supply up to three servo motors. The base configuration consists of a common DC bus supply (PSU) and multiples TPD-M modules, connected through DC bus bars.

The modules are available as one, two or three axis versions. This makes the system very flexible.

The TPD-M drive has been specifically designed for the Packaging OEM market but it can also be used in many other centralized automation structures which incorporate a large number of servo axes offering significant advantages.

TPD-M controls also induction motors with feedback or sensorless in V/f mode.

- Packaging machines
- Material forming machines
- Textile machines
- Paper and converting lines
- Plastics machines
- Machines tools

Motion control functionality is performed by means of EtherCAT Real Time CoE (CAN over Ethernet) communication, CAN / CANopen DS402 communication.

### Features

- The most compact multi-axis servo drive on the market
- Quick and simple wiring
- One, two or three axis versions combined in one housing
- Removable SD card
- Common DC bus connection for energy exchange between drives
- Feedback: Resolver, Hiperface and EnDat interface, Hall sensors, rotary and linear encoders
- New feedback: Hiperface DSL feedback ®  
Reduced cabling; only one cable connection between drive & motor
- Fieldbus: CANopen - standard, EtherCAT - option
- Serial link and CAN auto-address



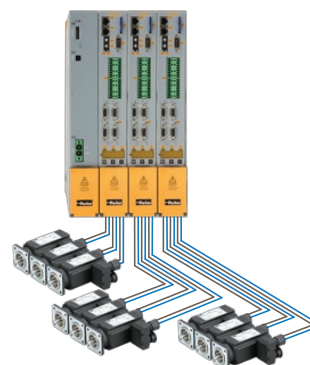
### Technical characteristics - Overview

TPD Axis	Continuous current [A <sub>rms</sub> ]	Peak current A (≤ 2 s)
3 axis	2 + 2 + 2	4 + 4 + 4
	8 + 5 + 5	16 + 10 + 10
2 axis	2 + 2	4 + 4
	5 + 5	10 + 10
	8 + 8	16 + 16
1 axis	15 + 5	30 + 10
1 axis	5/10/15/30	10/20/30/60

## TPD-M Overview

TPD-M has been developed for all applications where multiple drives are normally used and gives both OEMs and end users the opportunity to reduce build, configuration and operating costs, while boosting productivity and profitability.

Typical applications for TPD-M include packaging machines, material forming machines, textile, paper, converting and plastics machines, where large numbers of axes are required.



TPD-M system with Parker servo motors

### Features and Benefits

#### Control cabinet space, size and cost savings

The integration of three servo power stages in a single housing offers machine builders the opportunity of having more compact control cabinets. Each TPD-M module is only 50 mm width (100 mm in the single axis 30 A version).

#### Reduced system complexity

The complexity of the system is significantly reduced due to the following benefits:

- Fewer components (cables, connectors, filters and braking resistors)
- Fewer communication interconnections between devices
- Centralized filtration and braking resistance

#### Reduce setup and maintenance costs

Due to the modular nature of TPD-M, machine design is much more straight forward. Additional axes can be added easily, simply by reproducing schemes from other existing axes. Programming time is reduced as only one drive unit needs to be configured.

#### Efficient power control

TPD-M works on a common DC bus power supply that allows the system to absorb and re-supply much of the braking energy to other TPD-M units rather than dissipating it in the form of heat via external resistors. In some instances, resistors can be removed completely and in others smaller resistors are required.

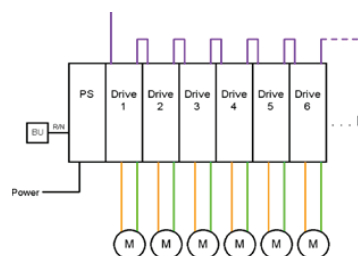
#### Standard Version

TPD-M servo drives is available as one, two or three axis versions. As standard TPD-M is supplied with:

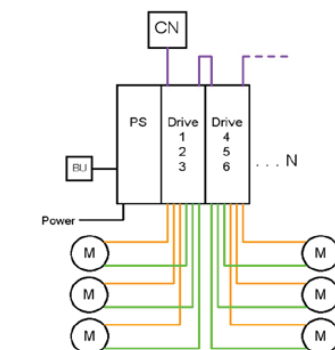
- CANopen
- STO functionality (certification expired)
- Digital and analog inputs/outputs
- Mechanical brake control



Traditional solution: one drive for each axis



Rack solution: one drive for each axes in a rack solution



TPD-M solution: one drive for three axis in a rack solution. Only one Power Supply

## TPD-M Overview

### Application

TPD-M servo drive is particularly suitable for all centralised automation systems, such as those found in many packaging machines, where large numbers of drives are often required.

- Packaging lines
- Material forming machines
- Textile machines
- Paper and converting lines
- Plastics machines
- Machine tools



### Functionality

Additional features of TPD-M include an USB interface for configuration and setup plus a standard SD card interface for storing system parameters.

TPD-M can be integrated into a larger hybrid motion solution (centralized and decentralized) using Parker Motornet DC system.



### Options

The capabilities of TPD-M can be further enhanced with numerous options which are available upon request, including:

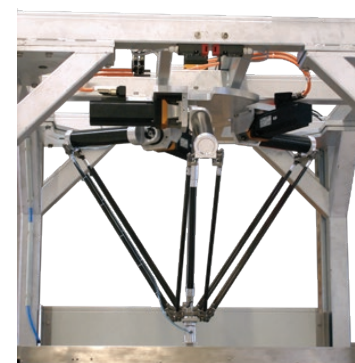
- EtherCAT communication
- Hiperface DSL® feedback
- Braking resistors
- Additional inputs/outputs



### Safety technology (certification expired)

TPD-M supports the "Safe Torque Off" (STO) safety function in the sense of the "Safe Stop", with protection against unexpected startup. Switching off the motor torque must be effected by the machine controller.

According to a risk analysis which must be carried out according to the machine standard 89/392/EWG or EN 292; EN ISO 13849-1 and EN 1050, the machine manufacturer must project the safety system for the entire machine including all integrated components. This does also include the electrical drives.



## Technical Characteristics

### Technical Data

Type	Unit	3 axis	
		2 + 2 + 2	8 + 5 + 5
Rated Output Current	[A <sub>rms</sub> ]	2 + 2 + 2	8 + 5 + 5
Peak Output Current (≤ 2 s)	[A]	4 + 4 + 4	16 + 10 + 10
Maximum Continuous Module Output Current	[A]	6	16 <sup>(1)</sup>
Maximum DC Voltage Supply		750 VDC	

<sup>(1)</sup> The max continuous module current is clamped to 16 A

Type	Unit	2 axis				1 axis			
		2 + 2	5 + 5	8 + 8	5 + 15	5	10	15	30
Rated Output Current	[A <sub>rms</sub> ]	2 + 2	5 + 5	8 + 8	5 + 15	5	10	15	30
Peak Output Current (≤ 2 s)	[A]	4 + 4	10 + 10	16 + 16	10 + 30	10	20	30	60
Maximum Continuous Module Output Current	[A]	4	10	16	30	5	10	15	30
Maximum DC Voltage Supply		750 VDC							

### PSUP - Power Supply Unit

#### Mains Supply

Power Supply Type	Unit	PSUP10			PSUP20			PSUP30 <sup>(2)</sup>		
Input Voltage		3*230 ... 480 VAC ±10 % 50...60 Hz (Rated voltage 3*400 VAC)								
Output Voltage		325...680 VDC ±10 %								
Supplied Voltage	[VAC]	230	400	480	230	400	480	230	400	480
Output Power	[kVA]	6	10	10	12	20	20	18	30	30
Peak Output Power (<5 s)	[kVA]	12	20	20	24	40	40	34	60	60

#### Control Supply

Rated Input Voltage		24 VDC ±10 %								
Maximum Ripple		1 V <sub>pkpk</sub>								
Supply Current	[A]	PSUP10D6: 0.2 A			PSUP20D6: 0.3 A			PSUP30D6: 0.3 A		

<sup>(2)</sup> Operation of the PSUP30 only with line choke.

### Environmental Characteristics

Type	TPD-M	PSUP
Operating Temperature	0...+40 °C	
Storage Temperature	-25 °C...+55 °C	
Shipping Temperature	-25 °C...+70 °C	
Product Enclosure Rating	IP20 (only in closed electrical cabinet) UL open type equipment	
Altitude	1000 m ASL. Derate output current by 1.5 % per 100 m to a maximum of 2000 m	
Operating Humidity	Class 3K3 - Maximum 85 % non-condensing	
Storage Humidity	Class 1K3 - Maximum 95 % non-condensing	
Shipping Humidity	Class 2K3 - Maximum 95 % at 40 °C	
Operating Vibration	IEC60068-2-6 10...57 Hz width 0.075 mm 57...150 Hz accel. 9.81 m/s <sup>2</sup>	

## TPD-M Features

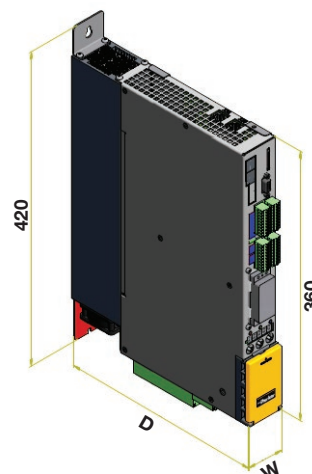
<b>Communication</b>	<ul style="list-style-type: none"> <li>• via USB port</li> </ul>
<b>Networks and Bus Systems</b>	<ul style="list-style-type: none"> <li>• CANopen, 20...1000kbit/s, SDO1, PDO1...PDO4</li> <li>• EtherCAT, 100Mbit/s, 1 ms cycle time</li> <li>• Via Gateway             <ul style="list-style-type: none"> <li>• Profibus</li> <li>• DeviceNet</li> </ul> </li> </ul>
<b>Inputs / Outputs</b>	<ul style="list-style-type: none"> <li>• 4 digital input,</li> <li>• 2 digital output,</li> <li>• 1 analog input</li> <li>• 1 analog output for each axes.</li> <li>• 1 incremental encoder input,</li> <li>• 1 incremental encoder output</li> <li>• Additional I/O             <ul style="list-style-type: none"> <li>• 3 analogue inputs 12bit,</li> <li>• 2 incremental encoder input,</li> <li>• 2 incremental encoder output</li> </ul> </li> <li>• Auxiliary Encoder</li> </ul>
<b>Supported Feedback</b>	<ul style="list-style-type: none"> <li>• Resolver,</li> <li>• SinCos,</li> <li>• SinCos + EnDat,</li> <li>• SinCos + Hiperface,</li> <li>• SinCos (1 per pole pitch),</li> <li>• Quadrature,</li> <li>• Quadrature + Hall,</li> <li>• SinCos + Hall,</li> <li>• Hiperface DSL®</li> </ul>
<b>Programming / Configuration</b>	<ul style="list-style-type: none"> <li>• PicoPLC</li> <li>• MotionWiz with Oscilloscope function, real time and debugging features</li> <li>• Removable SD card for             <ul style="list-style-type: none"> <li>• software upgrade,</li> <li>• parameters and</li> <li>• application memory</li> </ul> </li> </ul>
<b>Technology Functions</b>	<ul style="list-style-type: none"> <li>• Torque control</li> <li>• Speed control</li> <li>• Position control</li> <li>• Electronic gearbox</li> <li>• Camming</li> </ul>
<b>Safety Functions (certification expired)</b>	<ul style="list-style-type: none"> <li>• 1 Safety Torque Off circuit for 3 axis module</li> <li>• 2 independent Safety Torque Off circuit for 2 axis module</li> <li>• 1 Safety Torque Off circuit for 1 axis module</li> </ul>

### Standards & Conformance

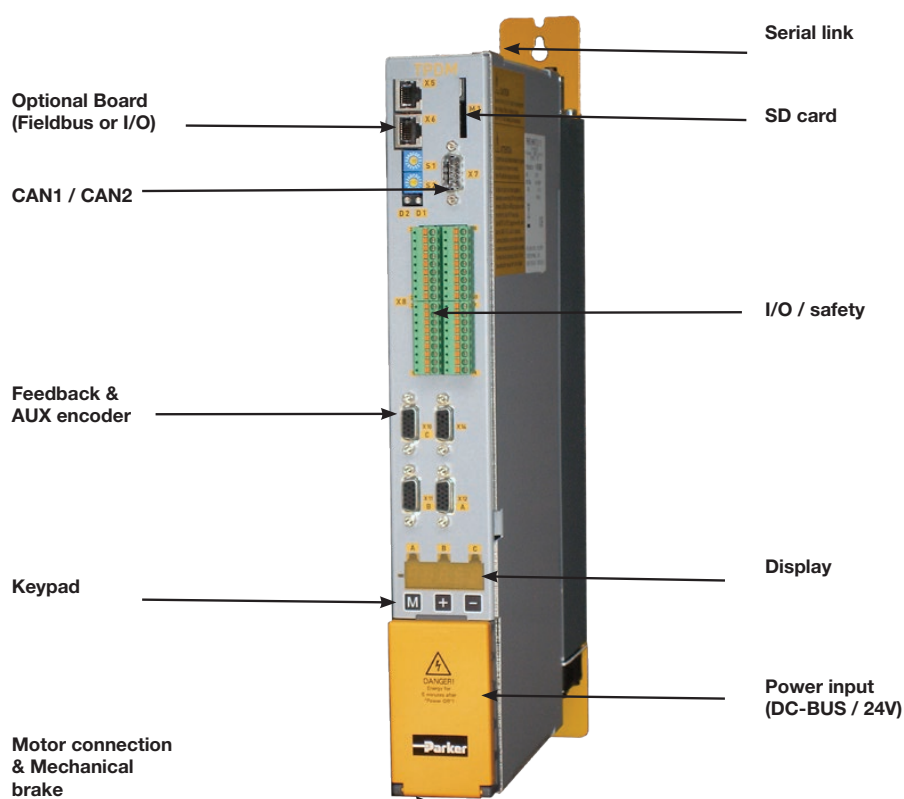
2006/95/EC	Low voltage directive
EN 60204-1	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
EN 61800-5-1	Adjustable speed electrical power drive systems - safety requirements, thermal and energy
UL508C	(USA) Power Conversion Equipment
2004/108/EC	EMC directive
EN 61800-3	Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test method

### Dimensions

Type	W [mm]	D [mm]	Weight [kg]
TPD-M 1/2/3 axes	50	270	4.3
TPD-M single axis 30 A	100	270	8.6
PSUP10	50	270	3.6
PSUP20 / PSUP30	100	270	5.4



### Connector Layout



## Accessories and Options

### Hiperface DSL® Feedback

#### Description

The Single Cable Servo Drive System from Parker is a combination of the low inertia servo motor SME and the triple axis servo drive TPD-M based on the Hiperface DSL® digital feedback technology. The encoder feedback communication is fully integrated into the motor power cable and thus no separate feedback cable between drive and motor is required.

The new feedback system is a purely digital encoder communication protocol with exceptional performance. The absolute position determination, a resolution of up to 20 bit per turn, as well as 4096 maximum rotations, is unique in it's class.

The System is completed by the multi-axis servo drive TPD-M which represents one of the most compact solutions on the market giving the possibility of controlling up to three single cable SME servo motors with one 50 mm drive module.

Therefore, the Single Cable Servo Drive System from Parker is a bespoke solution to provide machine builders with lower cabling and installation cost and the possibility to reduce control panel size and machine footprint.



TPD-M triple axis servo drive connected to SME motors via Hiperface DSL® interface: One cable per servo motor instead of two.

#### Feedback-Features

- One cable connection between drive and motor instead of two
- No need for separate feedback cable and connector
- Fully digital and interference-free communication
- Synchronous, bidirectional, multi-channel
- Easy setup and reduced wiring

#### Applications

- Packaging Machinery
- Material Handling
- Machine Tools
- Robotics
- Paper & Converting

## Configuration Software - MotionWiz

MotionWiz is free of charge downloadable configuration software that allows users to configure and optimise the TPD-M series with a few easy clicks of the mouse.

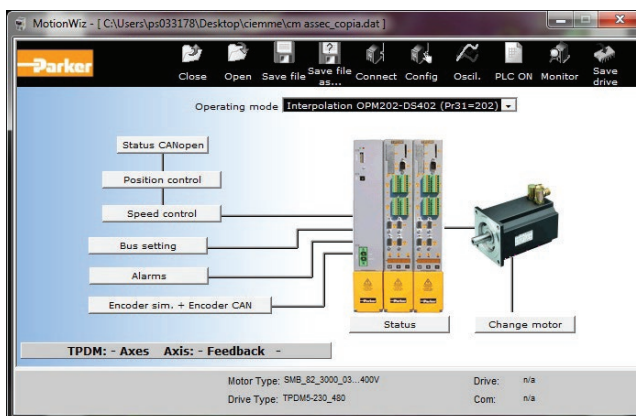
MotionWiz features an intuitive, easy and simple to use Windows® style environment to aid installation, optimisation and diagnostic use.

MotionWiz permits operation in both “on line” mode, directly in the controller, and in “offline” mode, remotely on the PC before downloading to the controller.

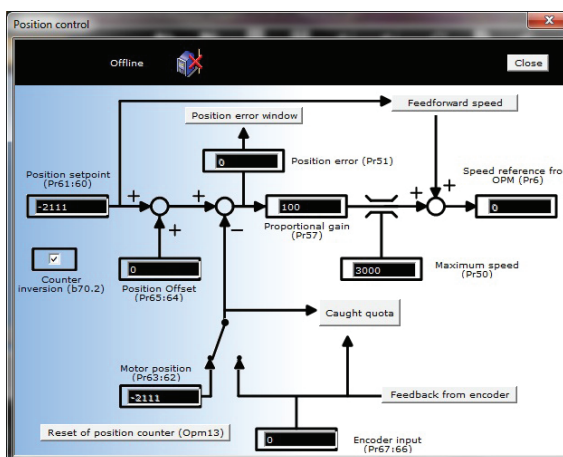
To simplify the configuration of systems with a large number of similar axes but with different motion profiles, MotionWiz allows users to copy the configuration from one application to another.

Inside the MotionWiz configurator is a database containing the technical characteristics of the full range of Parker motors and drives.

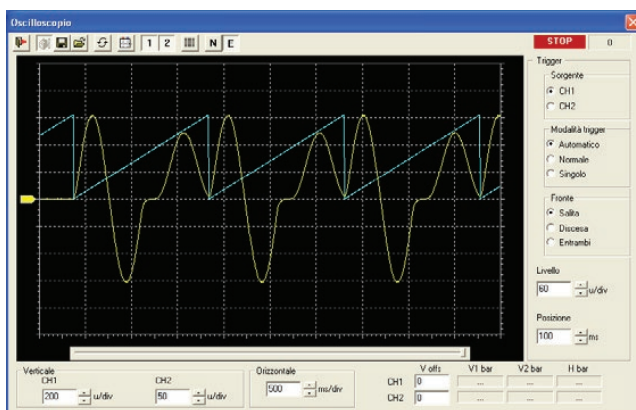
MotionWiz can be downloaded at [www.parker.com/eme/tpdm](http://www.parker.com/eme/tpdm)



MotionWiz: General settings



MotionWiz: Position control



MotionWiz Oscilloscope: Real speed & torque trends

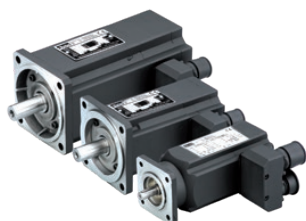
## Parker Solutions for Servomotors and Accessories

### NX: Brushless servo motors

The NX series brushless servo motors are characterized by a 10-pole innovative design for highest quality of motion, improved torque density and a compact and robust design. A large set of torque / speed characteristics, options and customization possibilities are available, making NX Series servomotors the ideal solution for most servosystems applications. The NX Series is available in sizes from 0,45 to 64 Nm.



### SMB/H-MB/H: Brushless servo motors



The MB/H and SMB/H Series of highly-dynamic brushless servo motors utilise "salient pole" technology to produce an extremely compact design. Motor dimensions are drastically reduced and significant gains in terms of torque and dynamic performance are achieved. The high quality Neodymium-Iron-Boron magnets and the encapsulation method used to fasten them to the shaft, allows the two Series' to achieve very high acceleration and withstand high overloads without risk of demagnetisation or detachment of the magnets. The MB/H and SMB/H Series is available in sizes from 0.2 to 285 Nm.

### Interact Xpress: HMI

Interact Xpress is Parker's HMI hardware and software solution, for the process's control in distributed applications where multiple HMIs are deployed on a single machine or across several remote stations. Interact Xpress software, features an advanced development environment for easy creation of rich graphics and multimedia applications. Interact Xpress allows you to run, view and edit on line - from any PC -applications in Internet Explorer™ browser. Available with 6, 8,10 and 15 inch, these units are specifically designed to optimize the performance, storage and connectivity features of the software.



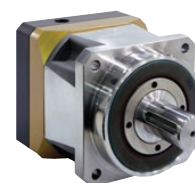
### PIO: I/O System



Parker's PIO modular bus terminal system offers a range of popular industrial fieldbus networks to interface to a wide variety of control signals from field-based devices. Connection to field level devices can be implemented quickly and reliably with PIO.

### PS/RS Series: Planetary Gearheads

Stealth advanced gearheads are available in either in-line or right-angled versions with 8 frame sizes and 12 gear ratios. With input speeds up to 6000 min<sup>-1</sup> and exceptionally quiet, strong and reliable operation, you can be confident that there is a Stealth advanced gearhead to fit any of your high performance servo application needs.



Triple Axis Servo Drive TPD-M  
Order Code

## Order Code

### TPD-M System

	1	2	3	4	5	6	7
Order example	TPD	M	02 02 02	D	L	E5	G

<b>1 Drive Family</b>	TPD	Triple Power Drive
<b>2 Axes</b>	M	Multi Axis
<b>3 Drive Size</b>	02 02 02	3 axis 2 A + 2 A + 2 A
	08 05 05	3 axis 8 A + 5 A + 5 A
	02 02	2 axis 2 A + 2 A
	05 05	2 axis 5 A + 5 A
	08 08	2 axis 8 A + 8 A
	15 05	2 axis 15 A + 5 A
	5	single axis 5 A
	10	single axis 10 A
	15	single axis 15 A
	30	single axis 30 A
<b>4 Fieldbus</b>	D	CANopen
<b>5 Feedback system</b>	Empty field	Resolver
	E	EnDat / Incremental / SinCos encoder
	H	Incremental encoder + Hall sensors
	L	DSL feedback
<b>6 Option board</b>	Empty field	No option
	E5	EtherCAT option board
	E7	Analogic expansion board
<b>7 Accessories</b>	G	Fixing shield

### Mains module: PSUP

	1	2	3	4	5
Order example	PSU	P	10	D6	USB M00

<b>1 Device family</b>	PSU	Power module
<b>2 Device typ</b>	P	Power module
<b>3 Nominal power; supply voltage</b>	10 D6	10 kW; 400 VAC (3-phase)
	20 D6	20 kW; 400 VAC (3-phase)
	30 D6	30 kW; 400 VAC (3-phase) <sup>1)</sup>
<b>4 Interface</b>	USB	USB connection
<b>5 Options</b>	M00	no additional supplement

<sup>1)</sup> Operation of the PSUP30 only with line choke.  
Required line choke for the PSUP30: 0.45 mH / 55 A

#### We offer the following line chokes:

LCG-0055-0.45 mH (WxDxH: 180 mmx140 mmx157 mm; 10 kg)  
LCG-0055-0.45 mH-UL (with UL certification)  
(WxDxH: 180 mmx170 mmx157 mm; 15 kg)

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### Capacitor module

	1	2
Order example	PSC	023 M00

<b>1 Accessories</b>	PSC	Capacitor module
<b>2 Type</b>	023 M00	23 µF no additional supplement
	047 M00	47 µF no additional supplement
	068 M00	68 µF no additional supplement

### Mains filter for PSUP

	1	2
Order example	NFI	03/01

<b>1 Accessories</b>	NFI	Mains filter
<b>2 Type</b>	03/01	for PSUP10 Reference axis combination 3 x 480 V 25 A 6 x 10 m motor cable length
	03/02	for PSUP10 Reference axis combination 3 x 480 V 25 A 6 x 50 m motor cable length
	03/03	for PSUP20, PSUP30 Reference axis combination 3 x 480 V 50 A 6 x 50 m motor cable length

### Braking resistors

	1	2
Order example	BRM	05/01

<b>1 Accessories</b>	BRM	Braking resistor
<b>2 Type</b>	13/01	30 Ω / 0.5 kW <sub>cont.</sub> for PSUP10D6, for PSUP20D6 (2x30Ω parallel)
	14/01	15 Ω / 0.5 kW <sub>cont.</sub> for PSUP10D6 (2 x 15 Ω in series) for PSUP20, PSUP30
	12/01	18 Ω / 4.5 kW <sub>cont.</sub> for PSUP30

### Motor output choke

For disturbance suppression when the motor connecting cables are long.

	1	2
Order example	MDR	01/04

<b>1 Accessories</b>	MDR	Motor output choke (for TPD-M >20 m motor cable)
<b>2 Type</b>	01/01	up to 16 A rated motor current
	01/02	up to 30 A rated motor current
	01/04	up to 6.3 A rated motor current

### Other Accessories

Order Code	Description
Motionwiz	Programming Software
Exp-Ground	Fixing shield assembly
USBTODRIVE	USB to RS232/422 converter with cable



# 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  
Oil & gas  
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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