

ENG

PHASE



MOTION  
CONTROL



# TorqueWire servo systems

Cybernetics made simple



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Cybernetics made simple



The new TorqueWire series of integral servo systems sets a new style in complex automatic machinery architecture. TorqueWire motors are complete, self sufficient servo axis building blocks which allow the design, integration and operation of large multi axis systems with minimum hardware and surprising ease. The TorqueWire motor system consists of an advanced, high performance rare earth brushless servo motor, a DSP based, high voltage interpolating servo drive and a single or multi turn absolute encoder, all assembled in a very compact IP 67 protected frame.

The motor systems are controlled via a multi drop CanOpen field bus, linking together groups of motors on a single bus system. The motors are supplied from a common DC bus and braking energy from any drive is intrinsically recycled on any other axis on the network. The performance of TorqueWire originates in the advanced design of both motor and drives.

The motor parts take advantage of a novel, patent pending winding design, along with new magnetic materials and a special winding technique, all of which result in a servo motor with about 60% of the size of a conventional servo design. Such advantage is invested in both temperature rise derating and space for the drive, so that TorqueWire motors, including the drive, are smaller than comparable motors with similar rating. The built-in, DSP based drive is a step forward in power drive miniaturisation. According to the established Phase drive technology, neither electrolytic capacitors nor any components subject to ageing or temperature decay are used. All magnetics are planar, integrated in the drive PCB. The drive is an ultra compact, single board unit in high density SMD technology with no massive components and is vibration tested to 200 Hz, 5g. The drive is conformally coated and sealed; connection is via IP 67 industrial circular connectors.

Drive temperature, long considered the limiting factor in integral drives, is controlled with an accurate strategy; all components are rated for 120 °C operation, while the drive is temperature limited at 100 °C. The DSP senses motor temperature, power device temperature, and drive ambient temperature. All these data are available on the bus for application monitoring and optimization. Drive loss and EMI are minimized intrinsically by the drive location, with zero wiring stray capacitance and minimized winding capacitance.

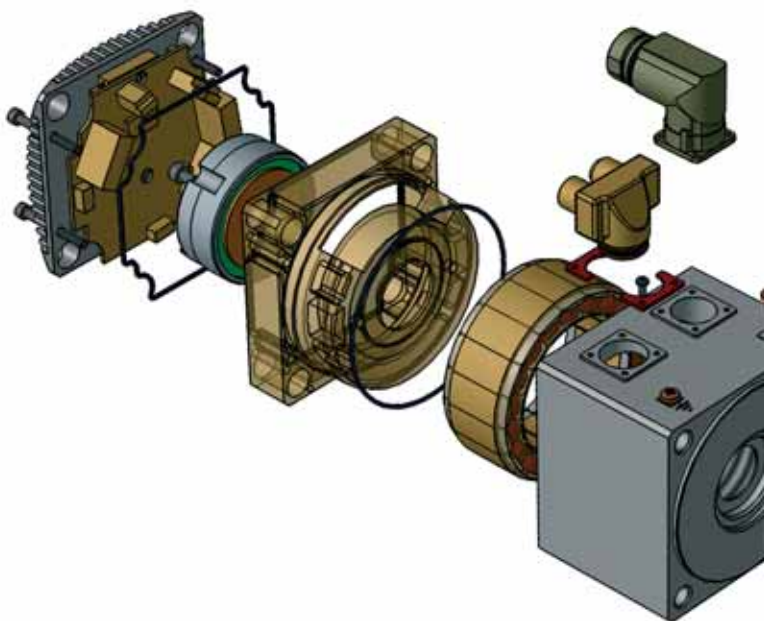
In general, all servo systems are intrinsically limited in performance by the S/N ratio of the encoder signal. In the TW motors,



# Tw Motors

*With Integrated Servodrive*

the interpolating drive is positioned in close proximity of the encoder, thus ensuring the best possible position signal quality and integrity; the servo performance is consequently optimal. The CanOpen protocol implementation of the TW series is in full compliance with the standards DS 301 and device profile drives DSP 402v2.0. TW drives are controlled in space, speed or torque. The servo loops are updated at 4 kHz frequency. In the interpolated mode, a position profile synchronized with




## TW Motors - Size 3, 75 mm square

- *High torque density, small size, low inertia, high voltage supply, high speed*
- *Torque continuous 3 Nm, peak 8 Nm*
- *Maximum power density 650 W in 2.8 kg including drive 5000 rpm operation*
- *Small diameter for limited pitch multi axis applications*
- *310 Vdc and 550 Vdc bus compatible*
- *Universal 14 mm shaft with half key*
- *Resolver, single turn and real multi turn absolute encoder without battery (17 bits/turn, 4096 turns, 1 arcmin accuracy)*
- *IP 68 protection*

### Applications:

- Workpiece setting for wood and metal forming
- Packaging, bottling, wrapping, especially on rotary machines (single wire commend for multi axis)
- Tool changers
- Laser plotter
- Pick and place robots
- Mould automation
- Assembly machines



other axes is followed with a maximum throughput of 500 samples/sec, corresponding to a maximum mechanical bandwidth of 250 Hz, far in excess of the best mechanical systems available, The TW interpolates points with a second order spline. A separate, programmable, hardwired I/O which overrides all software instructions is provided to cater for machine safety requirements.

The 2 wire, optically isolated digital interface, and the suppression of all other interfaces, grants reliability, fault tolerance and ease of installation, especially in multi axis systems. The motors can be programmed and monitored via the CAN Cockpit Windows interface (supplied with all TW motors). All TW motors embody a non volatile memory to store permanent data, settings and fault conditions irrespective of power supply availability.



## TW Motors - Size 5, 100 mm square

- *New technology ultra short motor for high torque density in a small axial size*
- *Torque continuous up to 4.5 Nm, peak 9 Nm*
- *3000 rpm operation*
- *Ideal for low speed and direct drive gearless application*
- *310 Vdc bus compatible*
- *Universal 19 mm shaft with half key*
- *Resolver, single turn and real multi turn absolute encoder without battery (17 bits/turn, 4096 turns, 1 arcmin accuracy)*
- *IP 68 protection*
- *Double insulation*
- *Integrated EMI filter class B*

### Applications:

- Packaging, bottling, wrapping, especially on rotary machines (single wire command for multi axis)
- Tool changers
- Interpolated axis control for machine tools: aluminium and PVC window frame cutting, model carving, tool grinders, multispindle lathe
- Laser plotter
- Pick and place robots



# TW 3 Motors

	Symbol	TW 302.50.4	Units
<b>REFERENCE DATA (WINDING INDEPENDENT)</b>			
Nominal torque, S1, 0 speed, suspended in free air 1)	Tnc	2,36	Nmrms
Nominal torque, S1, 0 speed, flange mount 2)	Tnw	2,50	Nmrms
Peak torque, S6 10% 1)	Tpk	6,00	Nmrms
Maximum structural speed	Pn	800	rad/sec
<b>PHYSICAL DATA (WINDING INDEPENDENT)</b>			
Rotor inertia	Jm	0,094	mkgm2
Acceleration at maximum torque	apk	67000	rad/s2
Mass	Msta	2,8	kg
Insulation		Class H-F	
Protection		IP 68	
<b>THERMAL DATA (WINDING INDEPENDENT)</b>			
Thermal time constant susp. in air 1)	Tc	400	sec
Thermal time constant, flanged 2)	Tw	145	sec
Loss at Tnc	L0c	62	W
Loss at Tnw	L0w	72	W
Treshold of built-in PTC	PTCt	110	°C
<b>ELECTRICAL DATA (WINDING DEPENDENT)</b>			
Nominal speed flanged 3)	wn	500	rad/sec
Nominal power, flanged, 3)	Pnw	0,60	kW
<b>BRAKE DATA (OPTIONAL)</b>			
Supply voltage (+/- 10%)	Un	24	V
Input power	P20	13	W
Stall braking torque	Tbk	7,00	Nm
Additional inertia	Jbk	0,041	mkgm2

- 1) Motor susp. in free air (worse case), horizontal position, ambient 40 °C, copper 130 °C, frame 105 °C  
 2) Flange mount on solid steel flange, flange temperature <=60 °C







# TW 5 Motors

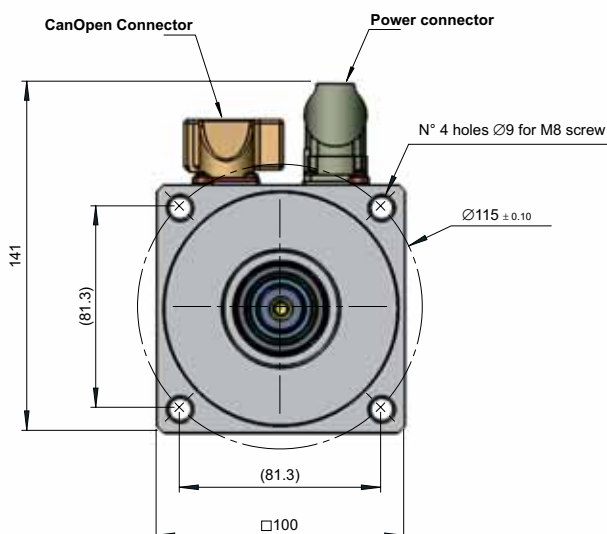
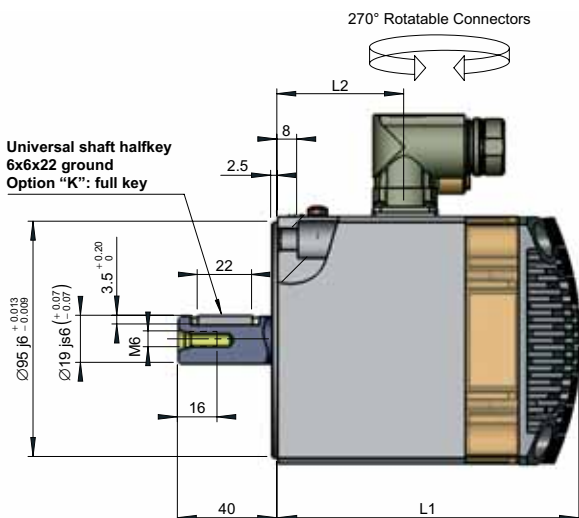
	Symbol	TW 503.30.2	TW 506.20.2	Units
<b>REFERENCE DATA (WINDING INDEPENDENT)</b>				
Nominal torque, S1, 0 speed, suspended in free air 1)	Tnc	2,51	4,5	Nmrms
Nominal torque, S1, 0 speed, flange mount 2)	Tnw	3,12	4,5	Nmrms
Peak torque, S6 10% 1)	Tpk	6,40	9,22	Nmrms
Maximum structural speed	Pn	600	600	rad/sec
<b>PHYSICAL DATA (WINDING INDEPENDENT)</b>				
Rotor inertia	Jm	0,27	0,46	mkgm <sup>2</sup>
Acceleration at maximum torque	apk	23704	20043	rad/s <sup>2</sup>
Mass	Msta	2,70	4,10	kg
Insulation		Class H-F	Class H-F	
Protection		IP 68	IP 68	
<b>THERMAL DATA (WINDING INDEPENDENT)</b>				
Thermal time constant susp. in air 1)	Tc	2189	2161	sec
Thermal time constant, flanged 2)	Tw	1247	930	sec
Loss at Tnc	L0c	41	72	W
Loss at Tnw	L0w	73	150	W
Treshold of built-in PTC	PTCt	110	110	°C
<b>ELECTRICAL DATA (WINDING DEPENDENT)</b>				
Nominal speed flanged	wn	250	170	rad/sec
Nominal power, flanged, 3)	Pnw	0,60	0,88	kW
<b>BRAKE DATA (OPTIONAL)</b>				
Supply voltage (+/- 10%)	Un	24	24	V
Input power	P20	13	13	W
Stall braking torque	Tbk	7,00	7,00	Nm
Additional inertia	Jbk	0,041	0,041	mkgm <sup>2</sup>

1) Motor susp. in free air (worst case), horizontal position, ambient 40 °C, copper 130 °C, frame 105 °C

2) Flange mount on solid steel flange, flange temperature ≤ 60 °C

3) Flange mount

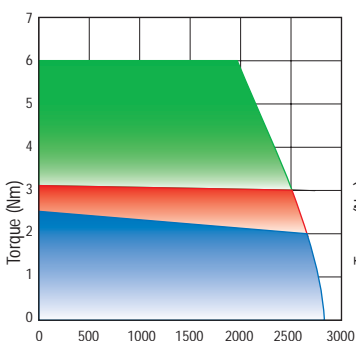




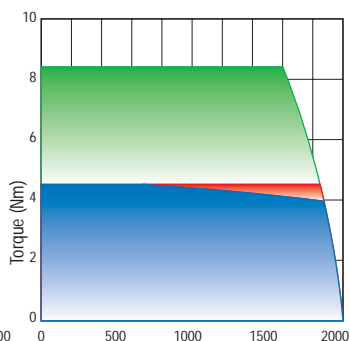
Motor length				
T	503.30.2	503.30.2B*	506.20.2	506.20.2B*
L1 (mm)	121	161	154.5	194.5
L2 (mm)	50		83	

\* Option "B": integrated brake

TW 503.30.2



TW 506.20.2



■ Torque cont. S1 (flanged\*)   ■ Torque cont. S1 (free air)   ■ Torque max S6-10% (flanged\*)

Curve di coppia (Nm) del motore in funzione della velocità (rpm), tensione Dc bus = 310 V

Motor curves (Nm) of motor versus speed (rpm)

\* Motore montato su flangia in acciaio con temperatura flangia  $\leq 60^\circ\text{C}$ ,  $T_{amb} = 40^\circ\text{C}$

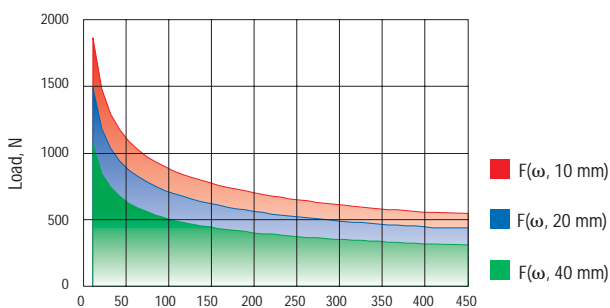
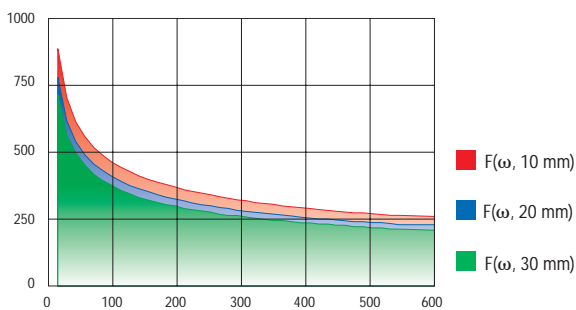
\* Flanged, temperature flange  $\leq 60^\circ\text{C}$ ,  $T_{amb} = 40^\circ\text{C}$



# TW Motors

## Permissible shaft loads

TW3 motors, which are long and thin, employ a classic dual bearing arrangement with axial preload for zero backlash, The bearings are heavy duty type, shielded and lubricated for life. The standard shaft lip seal is available from the motor front for easy replacement or suppression. The innovative design and ultra short geometry of TW5, instead, takes advantage of a single, double row angular contact bearing type 3204A Class C2, also life lubricated and maintenance free. All TW motors have a bearing system which is virtually backlash free, locked in the motor frame, and able to support radial, axial and momentum loads. The permissible radial loads vs. point of load application on the shaft are defined in the graphs below for a life expectancy of 30,000 h.



Axial loads should never exceed 30% of radial load. Avoid impacts on the shaft during assembly (hammering) as this would degenerate bearing life. A threaded axial hole is provided to fasten keyless locking assemblies (recommended). Flange concentricity and perpendicularity are in conformity to IEC 72, Grade R (Reduced tolerance).



## Tw Accessories

**TW-S Single phase power supply with precharge cycle and integral brake unit.**

*SMD Technology, Single phase supply operation, Single phase supply 220 +/- 20% Vac, Dynamic braking (external resistor required), Precharge capabilities, Integrated EMC filter, Nominal output voltage 310 Vdc, continuous output power up to 1kW, Nominal braking power up to 1kW, DIN rail mounted, Free air convection cooling.*

**TW-T Three phase, 400 Vac rated 1 kW power supply with precharge cycle and integral brake unit.**

*SMD technology, 3 phase supply operation, 3 phase supply 200-440 Vac, Dynamic braking (external resistor required). Precharge capability. Integrated EMC filter. Nominal output voltage,  $V_{in} \times 1.35$  volt, max 600 Vdc. Continuous output power 1 kW. Din rail mounted. Free air convection cooling.*

**CanPC interface board.**

*CanBus-PC-USB interface, Modbus-CanOpen protocol conversion, Programmable filters and monitoring of can lines, Transmission of can messages programmable, Can bus baud rate selectable from 50kbps up to 1Mbps.*

*In order to provide our Customers with a continuously improved product, all technical data, drawings and product informations contained hereof are subject to change. For up to date information, software and drawings please refer to our web site: [www.phase.eu](http://www.phase.eu)*

#### COME ARRIVARE A PHASE MOTION CONTROL:

In automobile: direzione Genova; A12 direzione Livorno; uscita Genova Est; seguire la mappa (5Km), salire le rampe interne e parcheggiare al 3° piano negli spazi designati.

In aereo: il taxi dall'aeroporto impiega circa 20 minuti.

In treno: scendere a Genova P. Brignole, il percorso taxi dura circa 10 minuti.

#### HOW TO REACH PHASE MOTION CONTROL:

By car: drive to Genoa, take A12 to Livorno, exit Genova Est, drive according to the road map (5Km from motorway exit), drive inside Phase Motion Control building, park on 3rd floor.

By air: taxi from airport takes approximately 20 minutes.

By train: use Genova Brignole station, taxi ride approximately 10 minutes.





## WORLD WIDE SUPPORT AND DISTRIBUTION NETWORK



Phase Motion Control S.r.l. ●●  
ITALY

Phase Automation ■  
FRANCE

Phase Motion Control Ningbo Ltd. ■●  
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● R&D, Company headquarters ● Manufacturing and support ■ Sales and technical support

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