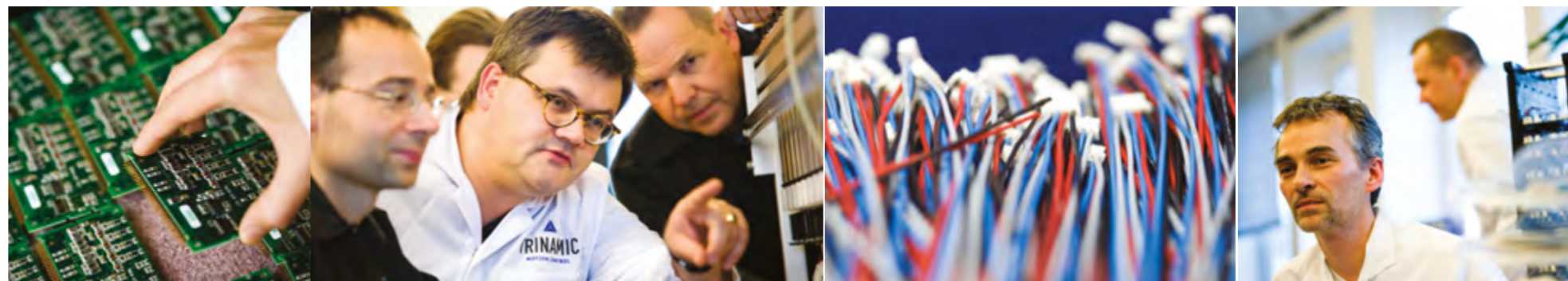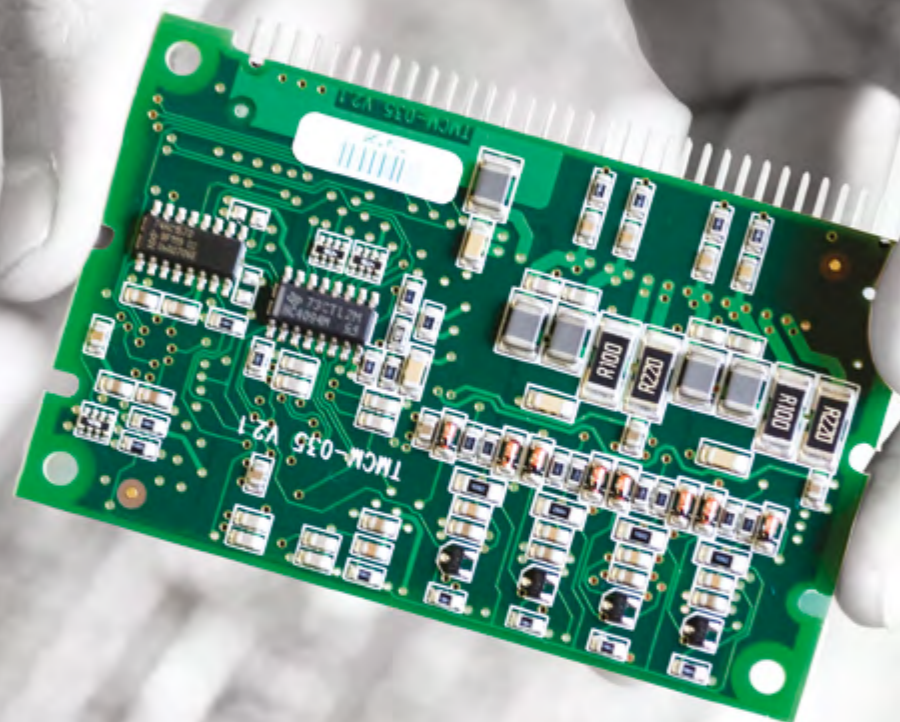# TRINAMIC
MOTION CONTROL

SMART SOLUTIONS
FOR MOTION CONTROL

PRODUCT GUIDE 2014

TRINAMIC – SMART SOLUTIONS FOR MOTION CONTROL

Based in Hamburg, Germany, TRINAMIC provides integrated Circuits and Modules for Motor and Motion Control to customers all over the world, most of them leaders in their Industry.

The use of small motors is increasing rapidly in many different types of products. In leading-edge industries such as biotechnology, lab automation, semiconductor handling equipment, CCTV and factory automation, TRINAMIC products control all kinds of embedded motion control systems.

TRINAMIC's application-driven approach and deep application understanding means that customers do not need in-depth knowledge of motors, nor of control circuitry. Consequently, the design phase is simplified, resulting in significant labor and cost savings in development as well as a reduction in the total cost of ownership.

TRINAMIC's Motion Control Language (TMCL) makes it easy to develop motion control applications and allows for shorter development cycles and a short time to market.

The patented stallGuard™ load detection enables precise and silent homing without any homing switches. Integrated diagnostic features can detect potential system faults to reduce downtime.

TRINAMIC cherishes the core values of German engineering and is committed to reliability, not only concerning the products, but also with regard to business ethics and processes.

TRINAMICs quality management system is certified according to ISO9001 and ISO13485 (medical).

Embedded in a network of strong strategic relationships with leading research institutions and industrial partners, TRINAMIC's research efforts are superior, geared entirely to the enhancement of product performance, to innovation and invention, at the same time increasing efficiency and reducing power consumption.

With a history going back more than 20 years and a traditional private ownership of the company shares, TRINAMIC is able to give a commitment to long term availability.

TRINAMIC customers benefit from the company's extensive knowledge of motor physics and its library of intellectual property (IP), built over years of application knowledge.

Product development at TRINAMIC focuses on meeting customer demands for miniaturization, efficiency, diagnostic support and protection, all of which ensure the reliability of the complete system.

TRINAMIC is committed to energy efficient solutions. With industry leading technologies such as the patented coolStep™, TRINAMIC products add energy-saving to the ease of use and precision of stepper Motors

Headquartered in Hamburg, Germany, TRINAMIC products are sold via a global distribution network. New offices in Singapore (since May 2012) and in North America reflect the long term commitment concerning these fast-growing markets.

TRINAMIC Motion Control made easy

TRINAMIC
MOTION CONTROL

TRINAMIC is a fabless semiconductor company and serves the market with self developed integrated circuits for the control of small electrical motors in a wide variety of applications. TRINAMIC's integrated circuits are manufactured to the highest standards in the world's most advanced manufacturing plants.

INNOVATION – MADE BY TRINAMIC

TRINAMIC is an innovative company with over 20 years of experiences in design and marketing of motion control chips, modules, and mechatronic drives.

Within its history, TRINAMIC engineers have been granted many patents including Dual Interface Control, and Automatic Mixed Decay. Our innovations address the needs of the OEM market and provide ideal solutions for our customers' applications.

This significantly reduces project time and cost as well as design risk.

An average of 6 months faster time to market compared to an in-house development can be achieved.

stallGuard™ TRINAMIC's patented sensorless stall detection **stallGuard™** enables customers to detect mechanical overload conditions and stall conditions without external sensors, by measuring the load at a predefined point where a step loss has not yet occurred. Thus, eliminates the need for reference or end switches. This reduces cost and complexity of applications, where a reference point is required. When compared to pure mechanical referencing, stress on the mechanic and noise is reduced.

stallGuard2™ Improved version of the successfull **stallGuard™** feature. **stallGuard2™** is the world's first sensorless high resolution load detection implemented in a standard stepper motor driver. This gives the user easy and cost effective real time feedback of his application. It enables to scan the motion system without additional sensors. This can help to find the right motor and mechanics during development phase or to detect abrasion or mechanical stiffnes.

coolStep™ Sensorless load dependent current control using the **stallGuard2™** feature. First time **coolStep™** enables to drive a stepper motor in a energy efficient way. Up to now stepper motors are driven with constant current. The new TMC260, TMC261 and TMC262 stepper motor driver series detects the actual load of the motor and adjusts the current accordingly. This eliminates the security current margin and allow also to boost the motor avoiding stall and step loss to improve the reliability of the entire system.

dcStep™ **dcStep™** closes the gap between fully featured closed Loop Stepper Motor Drives and cost efficient open Loop Systems. While most open loop Stepper Drives will loose steps in an overload situation, dcStep drives will reduce the speed in order to overcome the resistance. Thus the integrity of the position counter is always given. With **dcStep™** a stepper motor will act similar as a dc Motor with regards to energy efficiency. **dcStep™** allows for auto ramping and turning the motor as fast as possible in the actual load situation.

spreadCycle™ New patent pending constant Toff chopper scheme. Using the spreadCycle chopper the µStep current sine wave is always well formed with a smooth zero crossing. Due to this effect the stepper motor can be driven very fast without resonance effects. All the **coolStep™** drivers are using this new technology.

chopSync™ The patented **chopSync™** feature allows very high velocity operation of stepper motors using the standard TRINAMIC [stepper motor] drivers TMC236, TMC239, TMC246 and TMC249. This is achieved by reducing resonances occurring when operating the motor at velocities where the EMF voltage exceeds the level of the supply voltage. With **chopSync™**, motor velocities of several 1000 RPM can be reached.

TMCL™ **TMCL™** – the TRINAMIC Motion Control Language – is a programming language dedicated to motion control applications. The software includes commands for moving one or more motor axes at certain velocities or to certain positions and for setting all relevant parameters of the motion controller. It is possible to access additional general purpose digital and analog inputs and outputs. **TMCL™** is available on most TRINAMIC modules with integrated motion controller. Program development is supported by the **TMCL-IDE** – a **PC** based integrated development environment which is available free of charge.

Our engineering team and customer service offers:

▶ High-level specification, -jointly with customer

▶ Technical specification and system architecture

▶ ICs and PCB in-house design

▶ Software development

▶ Fast prototyping

▶ Testing and qualification

▶ Logistic warehouse

▶ After sales & technical support

▶ Online support forum: www.trinamic.com/ttdg

▶ RMA repair

LONG LIFE AVAILABILITY

TRINAMIC offers lifecycles of up to 10 years for almost all of our products, which reduces costs of re-designing, re-qualification and re-certifying for our customers. This does not only save valuable resources but reduces time-to-market.

QUALITY

Today TRINAMIC has strategic alliances with partners to ensure access to the latest technologies and processes. TRINAMIC's QMS is ISO 9001:2000 certified by Germanischer Lloyd and EN ISO 13485 certified for "Medical Components" by Medcert.

GL ISO 9001
GL Systems Certification

MED/CERT
EN ISO 13485

RESPONSIBILITY –
PROVIDED BY TRINAMIC

TRINAMIC GREEN

We refer to the Directive 2011/65/EU of the European Parliament and the Council on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment.

That means, all electrical and electronic equipment put on the market by TRINAMIC are compliant with the RoHS directive currently valid

TRINAMIC MEMBERSHIPS

TRINAMICs ambitions are to commence different innovation platforms, where various industries and leading suppliers join forces to support, promote and advance the technology.

TRINAMIC is member of the following organizations:

EtherCAT. The EtherCAT Technology Group is a global organization in which OEM, End Users and Technology Providers join in order to support and promote the technology development. EtherCAT sets new standards for real-time performance and topology flexibility, whilst meeting or undercutting field bus cost levels.

www.ethercat.org

INNOMAG INNOMAG is an innovate platform for Magnetic Microsystems that combines the interests and potentials of manufacturers, service providers and users in a network. The target is to develop applications of magnetic Microsystems and nanotechnologies in Germany.

www.innomag.org

CiA CiA is the international users' and manufacturers' group that develops and supports CANopen and other CAN-based higher-layer protocols. The nonprofit group was founded in 1992 to provide CAN-based technical, product and marketing information.

www.can-cia.de

FACTORY AUTOMATION

▶ Textile

▶ Semiconductor Handling

▶ Chip feeder

▶ Pick & place machines

▶ Valves

▶ Electronic Manufacturing

MEDICAL & LAB AUTOMATION

▶ Analyzers

▶ Cryostats

▶ Eye inspection

▶ Dental milling

▶ Peristaltic pumps

▶ Liquid handling robots

SECURITY

▶ CCTV cameras

▶ X-Ray scanner

▶ Radar detection

▶ Access control systems

ROBOTICS

▶ Educational Robots

▶ Autonomous systems

BANKING & VENDING

▶ ATM

▶ Vending machines

▶ Cash recycler

▶ Automated retail systems

OFFICE AUTOMATION

▶ POS printer

▶ Copy binder

▶ Copy machines

▶ Multi function printers

▶ Digital printing

▶ Paper handling

AEROSPACE & HOMELAND SECURITY

▶ Antenna positioning
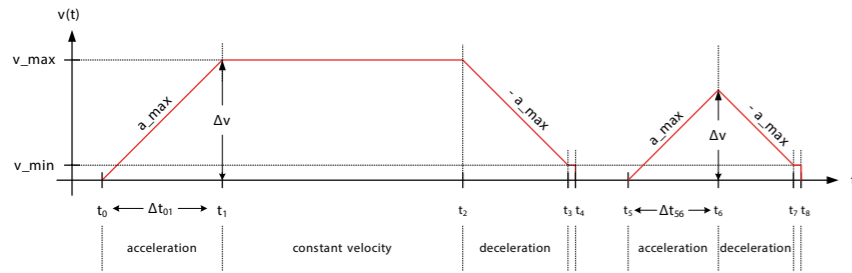
▶ Long range high precision camera

▶ Border control

OTHERS

▶ Stage lighting

▶ Art installations

WHAT IS YOUR APPLICATION?

KUKA

Acceleration and positioning matter. Full stop.

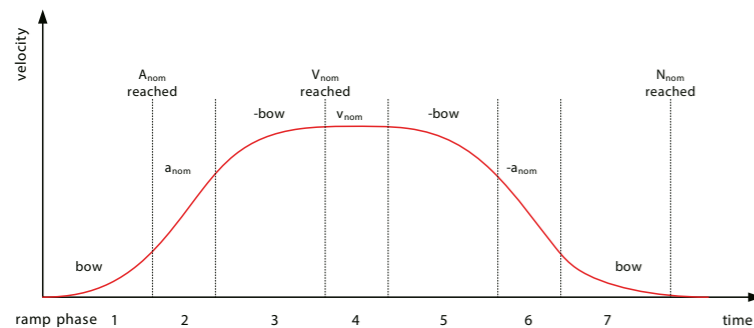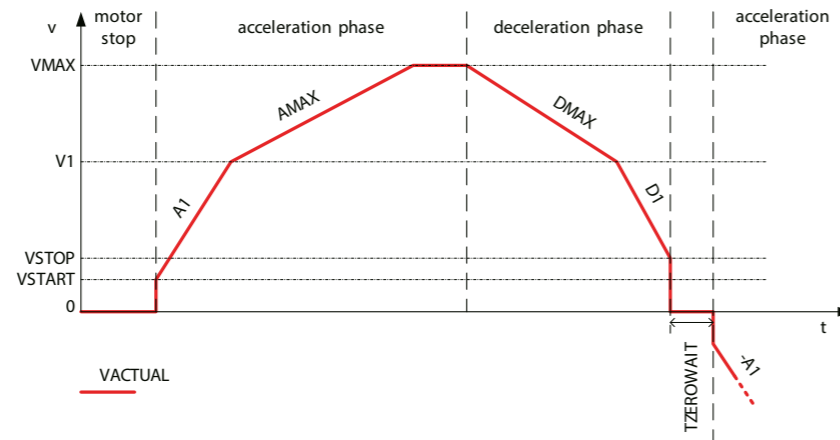# TMCM-131x closed loop stepper control

Driving a stepper motor at velocities higher than its physical start stop frequency requires a defined acceleration. For the great majority of positioning applications linear ramping profiles are sufficient.

TRINAMIC motion controllers with linear ramping allow for a fast and accurate positioning of one or several axes and offload the MCU from time-consuming real time tasks.

TMCM-131x family are fully closed loop Stepper control units for Stepper motors with EtherCAT® real time bus control or CAN and RS485 field bus interface or standalone operation. With incremental a/b/n or SSI absolute Encoders they form precise, rugged and efficient positioning systems.

To simplify the parameterization in addition to the field bus interfaces USB is available.

A graphical parameterization tool for quick and easy parameterization of all closed and open loop functions is available for download free of charge.

TMCM-131x family control each one bipolar stepper Motor with up to 3.0A RMS coil current and supply voltages up to +51V.

TRINAMICs advanced sixPoint™ ramping profile allows for faster positioning by adding a free configurable start stop frequency to a linear motion profile plus adding a reduced acceleration value at high velocity to reduce the jerk at the end of standard acceleration ramp.

With regards to faster positioning this profile can be even better than sinusoidal ramping.

PRODUCT	TMCM-1310	TMCM-1311
Number of axes	1	1
Max. phase current [A] (RMS)	3	3
Supply voltage DC [V]	9 - 51	9-51
Max. microstep resolution	256	256
Closed loop velocity mode	✓	✓
Closed loop torque mode	✓	✓
Closed loop position maintenance	✓	✓
TMCL controller	✓	✓
TMCL program memory [commands]	2048	2048
Acceleration ramps	linear	linear
RS-485	–	✓
CAN	–	✓
USB	✓	✓
EtherCAT™	✓	–
CANopen ready	–	✓
Encoder interface	ABN, SSI	ABN
Ref./End switch inputs	2x5-24V	2x5/-4V
GP inputs (digital / analog)	6x5-24V + 2x 0-10V	6x5-24V + 2x 0-10V
GP outputs (digital)	6x OD/100mA + 2xOD/1A	6x OD/100mA + 2xOD/1A
Size [mm]	110 x 110	110 x 110
Protection type	housing	housing

For high speed positioning as well as for handling of jerk sensitive goods or objects with extensive inertia sinusoidal (S-shaped) ramping profiles might be necessary.

TRINAMIC sinusoidal rampform motion controllers allow for an alteration of all motion parameters on the fly.

STEPPER MOTOR DRIVER + CONTROLLER WITH COOLSTEP™

coolStep™

PRODUCT	TMCM-1021	TMCM-1140	TMCM-1141	TMCM-1160	TMCM-1161
Number of axes	1	1	1	1	1
Max. phase current RMS [A]	0.7	2	1.1	2.8	2.8
Supply voltage typical DC [V]	24	24	24	48	24
Supply voltage range DC [V]	9 - 28	9 - 28	9 - 28	9 - 51	10 - 30
Max. microstep resolution	256	256	256	256	256
TMCL controller	✓	✓	✓	✓	✓
TMCL program memory [commands]	876	2048	2048	2048	2048
Motion Controller in hardware	-	✓	✓	✓	✓
Acceleration ramps	linear	linear	linear	linear	linear
Interface: RS-232	-	-	-	-	✓
Interface: RS-485	✓	✓	✓	✓	✓
Interface: CAN	-	✓	-	✓	-
Interface: USB	-	✓	✓	✓	✓
CANopen ready	-	✓	-	✓	-
S/D Driver interface	(GP IN)	-	opto isolated	opto isolated	(GP IN)
Encoder interface	-	(ABN)	-	ABN	-
sensOstep encoder resolution [ppr]	1024	1024	-	1024	1024
Ref./End switch inputs	(3x 24V)	(3x 24V)	(3x 24V)	2x (5/24V)	(3x 24V)
Shutdown input	-	-	-	✓	-
GP IN (digital)	(2x 5/24V)	(3x 5/24V)	(3x 5/24V)	(5x 5/24V)	(3x 5/24V)
GP OUT (digital)	-	1x 5V, 1x OD, 1A	(2x OD, 100mA	2x OD, 1A	2x OD, 100mA
GP IN/OUT	2x OD, 100mA	-	-	-	-
GP IN (analog)	1x 0-6.6V 12 bit	1x 0-10V 12 bit	1x 0-10V 12 bit	2x 0-10V 12 bit	1x 0-10V 12 bit
Board Size [mm]	28 x 28	37 x 37	37 x 37	60 x 60	60 x 60
Connector type	JST	JST	JST	JST	JST
Protection type	open frame	open frame	open frame	open frame	open frame
stallGuard2™	✓	✓	✓	✓	✓
coolStep™	✓	✓	✓	✓	✓
spreadCycle™ Chopper	✓	✓	✓	✓	✓
microPlyer™ [µSteps]	16 to 256	16 to 256	16 to 256	16 to 256	16 to 256
Motor mountable	NEMA 11	NEMA 17	NEMA 17	NEMA 23/24	NEMA 23/24
Related Cable Loom	TMCM-1021-CABLE	TMCM-1140-CABLE	TMCM-1141-CABLE	TMCM-1160-CABLE	TMCM-1161-CABLE

0 = optional function

STEPPER MOTOR DRIVER + CONTROLLER WITH COOLSTEP™

StepRocker
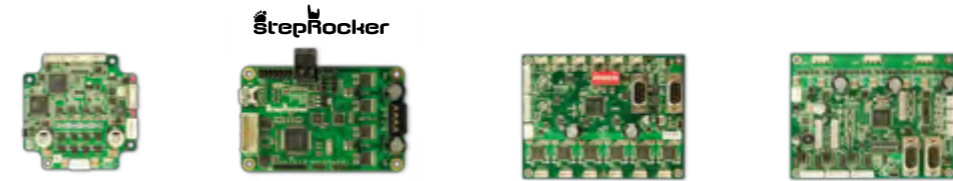
TMCM-1180	TMCM-1110	TMCM-6110	TMCM-3110	PRODUCT
1	1	6	3	Number of axes
5.5	1.0 / 2.8	1.1	2.8	Max. phase current RMS [A]
48	24	24	48	Supply voltage typical DC [V]
18 - 55	10 - 30	9 - 28	9 - 52	Supply voltage range DC [V]
256	256	256	256	Max. microstep resolution
✓	3-axis	6-axis	3-axis	TMCL controller
2048	2048	2048	2048	TMCL program memory [commands]
✓	✓	✓	✓	Motion Controller in hardware
linear	linear	linear	linear	Acceleration ramps
✓	-	-	-	Interface: RS-232
✓	✓	✓	✓	Interface: RS-485
✓	-	✓	✓	Interface: CAN
✓	✓	✓	✓	Interface: USB
✓	-	-	✓	CANopen ready
opto isolated	1x IN, 2x OUT TTL	-	3x IN	S/D Driver interface
ABN	(ABN TTL)	-	ABN	Encoder interface
256	-	-	-	sensOstep encoder resolution [ppr]
3x 24V	6x TTL	12x 5/24V	6x 5/24V	Ref./End switch inputs
✓	-	-	-	Shutdown input
(5x 5/24V)	(3x TTL)	6x 5/24V	6x 5/24V	GP IN (digital)
2x OD, 1A	2x OD, 100mA	6x OD, 100mA + 2x OD, 1A	6x OD, 100mA + 2x OD, 1A	GP OUT (digital)
-	6x TTL	-	-	GP IN/OUT
2x 0-10V 12 bit	1x 0-10V, 12 bit	2x 0-10V, 12 bit	2x 0-10V, 12 bit	GP IN (analog)
86 x 86	55 x 85	100 x 130	100 x 130	Board Size [mm]
JST	pluggable screw + header	JST, D-SUB,	JST, D-SUB,	Connector type
open frame	open frame	open frame	open frame	Protection type
✓	✓	✓	✓	stallGuard2™
✓	✓	✓	✓	coolStep™
✓	✓	✓	✓	spreadCycle™ Chopper
16 to 256	16 to 256	16 to 256	16 to 256	microPlyer™ [µSteps]
NEMA 34	-	-	-	Motor mountable
TMCM-1180-CABLE	-	TMCM-6110-CABLE	TMCM-3110-CABLE	Related Cable Loom

0 = optional function

STEPPER MOTOR CONTROLLER/DRIVER

PRODUCT	TMCM-102	TMCM-142	TMCM-342	TMCM-343	TMCM-351
Number of axes	1	1	3	3	3
Max. phase current [A] (RMS)	3.5	5.0	–	1.1	2.8
Supply voltage DC [V]	18 - 55	18 - 75	–	7 - 34	7 - 28.5
External logic voltage DC [V]	–	–	5	5	–
Max. microstep resolution	64	1024	–	64	64
TMCL controller	✓	✓	✓	✓	✓
TMCL program memory [commands]	2048	2048	2048	2048	2048
Acceleration ramps	linear	linear & S-shape	linear	linear	linear
Interface: RS-232	✓	✓	–	–	✓
Interface: RS-485	✓	✓	–	–	✓
Interface: UART (RS232/485)	–	–	✓	✓	–
Interface: IIC	–	–	–	–	–
Interface: CAN	✓	✓	✓	✓	✓
Interface: USB	✓	✓	–	–	✓
CANopen ready	–	✓	✓	✓	✓
Driver interface	–	–	S/D	–	–
Encoder interface	ABN	ABN	–	–	3x ABN
Ref./End switch inputs	1+2 (5V)	1+2 (5V)	3 x 2 (5V)	3 x 2 (5V)	3 x 2
Shutdown input	–	–	–	–	✓
GP inputs (digital / analog)	2 d+a (5V)	2 d+a (5V)	8 d+a (5V)	8 d+a (5V)	8d (24V) + 4a (3.3/10V)
GP outputs (digital)	3 (OC)	3 (OC)	8	8	8 (OC)
Size [mm]	76 x 70 x 33	76 x 70 x 33	50 x 80	50 x 80	100 x 160
Connector type	push/screw	push/screw	68 pin	68 pin	JST + screw
Protection type	open frame	open frame	open frame	open frame	open frame
stallGuard™	✓	–	–	✓	✓
chopSync™	–	–	–	–	–
Remarks	RS-422, IMS-commands	RS-422, IMS-commands			additional SPI interface

S/D = Step/Direction

BLDC MOTOR CONTROLLER/DRIVER

TMCM-1630-2C	TMCM-1630-4U	TMCM-1640	TMCM-1631	TMCM-1632	PRODUCT
1	1	1	1	1	Number of axes
10	10	5	5	5	Rated motor current [A]
12-48	12-48	12-28,5	12-48	12-28.5	Supply voltage [V]
✓	✓	✓	✓	✓	Block commutation with hall sensors
✓	✓	✓	✓	✓	Sine commutation with incremental encoders
✓	✓	✓	✓	✓	TMCL controller
2048	2048	2048	2048	2048	TMCL programm memory [commands]
–	–	–	✓	✓	Interface: UART (RS232/RS485)
✓	–	–	–	–	Interface: RS-232
–	✓	✓	–	–	Interface: RS-485
✓	–	–	–	–	Interface: CAN
–	✓	✓	--	–	Interface: USB
–	–	–	✓	✓	Interface: EtherCAT - E-Bus
–	✓	–	–	–	CANopen ready
ABN	ABN	ABN	ABN	ABN	Encoder interface
2 d (24V) + 2 a (10V)	2 d (24V) + 2 a (10V)	2 d (24V), 1 a (10V)	2 + 2 d (48V)	2 + 2 d (24V)	General purpose input (digital+analog)
3 (OD Vdd)	3 (OD Vdd)	2	2 (OD Vdd)	2 (OD Vdd)	General purpose output (digital)
✓	✓	✓	–	–	stand alone operation with analog input
50*92	50*92	42*42	42*64	42*72	Size [mm]
2*26pin	2*26pin	JST/Tyco	16+32pin	16+32pin	connector type
open frame	open frame	open frame	open frame	open frame	Protection type
BB-1630	BB-1630	–	on request	on request	Related baseboard
		motor mountable NEMA 17	on demand product	on demand product	Remarks

PANdrives™ WITH STEPPER MOTOR

PRODUCT	PD28-1021	PD42-1140	PD42-1141	PD57-1160
Motor flange size [mm]	28 * 28	42 * 42	42 * 42	57 * 57
Motor flange size NEMA	11	17	17	23
Supply voltage typical DC [V]	24	24	24	48
Supply voltage range DC [V]	9 - 28	9 - 28	9 - 28	9 - 51
Max. resolution [µStep/rev]	51200	51200	51200	51200
Fullstep Angle	1.8°	1.8 °	1.8°	1.8°
TMCL controller	✓	✓	✓	✓
TMCL program memory [commands]	876	2048	2048	2048
Motion Controller in hardware	-	✓	✓	✓
Acceleration ramps	linear	linear	linear	linear
Interface: RS-232	-	-	-	-
Interface: RS-485	✓	✓	✓	✓
Interface: CAN	-	✓	-	✓
Interface: USB	-	✓	✓	✓
CANopen ready	-	✓	-	✓
S/D Driver interface	(GP IN)	-	opto isolated	opto isolated
Encoder interface	-	(ABN)	-	ABN
sensOstep encoder resolution [ppr]	1024	1024	-	1024
Ref./End switch inputs	(3x 24V)	(3x 24V)	(3x 24V)	2x (5/24V)
Shutdown input	-	-	-	✓
GP IN (digital)	(2x 5/24V)	(3x 5/24V)	(3x 5/24V)	(5x 5/24V)
GP OUT (digital)	-	1x 5V, 1x OD, Vdd	(2x OD, Vdd)	(2x OD, 24V)
GP IN/OUT	(2x OD, Vdd)	-	-	-
GP IN (analog)	(1x 0-6.6V)	1x 0-10V	1x 0-10V	(2x 0-10V)
Connector type	JST	JST	JST	JST
Protection type	open frame	open frame	open frame	open frame
stallGuard2™	✓	✓	✓	✓
coolStep™	✓	✓	✓	✓
spreadCycle™ chopper	✓	✓	✓	✓
microPlyer™ [µSteps]	16 to 256	16 to 256	16 to 256	16 to 256
PD...-1... torque [Nm]/[oz in]	0.06 / 8.5	0.22 / 31	0.27 / 38	0.55 / 78
PD...-2... torque [Nm]/[oz in]	-	0.36 / 50	0.35 / 50	1.01 / 143
PD...-3... torque [Nm]/[oz in]	0.12 / 17	0.44 / 62	0.49 / 69	-
PD...-4... torque [Nm]/[oz in]	-	0.7 / 99	-	-
Related Cable Loom	PD-1021-CABLE	PD-1140-CABLE	PD-1141-CABLE	PD-1160-CABLE
coolStep™ Replacement for	PD-108-28	PD-140-42	PD-110-42 PD-013-42	PD-1060 PD-109-57

S/D = Step/Direction

PANdrives™ WITH STEPPER MOTOR

PD57-1161	PD60-1160	PD60-1161	PD146-60-SE	PD86-1180	PRODUCT
57 * 57	60 * 60	60 * 60	60 * 60	86 * 86	Motor flange size [mm]
23	24	24	24	34	Motor flange size NEMA
24	48	24	24	48	Supply voltage typical DC [V]
10 - 30	9 - 51	10 - 30	7 - 34	18 - 55	Supply voltage range DC [V]
51200	51200	51200	204800	51200	Max. resolution [µStep/rev]
1.8°	1.8°	1.8°	1.8°	1.8°	Fullstep Angle
✓	✓	✓	✓	✓	TMCL controller
2048	2048	2048	2048	2048	TMCL program memory [commands]
✓	✓	✓	✓	✓	Motion Controller in hardware
linear	linear	linear	linear & S-shape	linear	Acceleration ramps
✓	-	✓	✓	✓	Interface: RS-232
✓	✓	✓	✓	✓	Interface: RS-485
-	✓	-	✓	✓	Interface: CAN
✓	✓	✓	-	✓	Interface: USB
-	✓	-	✓	✓	CANopen ready
(GP IN)	opto isolated	(GP IN)	-	opto isolated	S/D Driver interface
-	ABN	-	ABN	ABN	Encoder interface
1024	1024	1024	4096	256	sensOstep encoder resolution [ppr]
(3X 24V)	2x (5/24V)	(3x 24V)	3X 24V	3x 24V	Ref./End switch inputs
✓	✓	✓	✓	✓	Shutdown input
(3X 5/24V)	(5x 5/24V)	(3x 5/24V)	2X 5/24V	(5x 5/24V)	GP IN (digital)
2X OD, VDD	(2x OD, 24V)	2x OD, Vdd	3X OD, 24V	(2x OC, 24V)	GP OUT (digital)
-	-	-	-	-	GP IN/OUT
1X 0-10V	(2x 0-10V)	1x 0-10V	(2X 0-10V)	(2x 0-10V)	GP IN (analog)
JST	JST	JST	D-SUB 9+15	JST	Connector type
open frame	open frame	open frame	IP10, PLASTIC	IP10, light cover	Protection type
✓	✓	✓	-	✓	stallGuard2™
✓	✓	✓	-	✓	coolStep™
✓	✓	✓	-	✓	spreadCycle™ chopper
16 to 256	16 to 256	16 to 256	-	16 to 256	microPlyer™ [µSteps]
0.55 / 78	-	-	1.10 / 156	-	PD...-1... torque [Nm]/[oz in]
1.01 / 143	-	-	1.65 / 234	-	PD...-2... torque [Nm]/[oz in]
-	2.10 / 297	2.10 / 297	2.10 / 297	7.0 / 991	PD...-3... torque [Nm]/[oz in]
-	3.10 / 439	3.10 / 439	3.10 / 439	-	PD...-4... torque [Nm]/[oz in]
PD-1161-CABLE	PD-1160-CABLE	PD-1161-CABLE	-	PD-1180-CABLE	Related Cable Loom
PD-113-60	PD-1060 PD-109-57	PD-113-60	-	-	coolStep™ Replacement for

S/D = Step/Direction

PIEZO MOTOR DRIVER

PRODUCT	TMCM-090
Number of axes	1
Supply voltage DC [V]	48
External logic voltage DC [V]	5
Max. microstep resolution	2048
Driver interface	S/D + SPI
size [mm]	50 x 80
Connector type	68 pin
Protection type	open frame
Remarks	for Piezo-LEGS motors

S/D = Step/Direction

TRINAMIC Motion Control GmbH & Co. KG
Waterloohain 5 · 22769 Hamburg · Germany

www.trinamic.com