Product Guide 2018
Embedded Modules

We transform
digital information
into **physical motion**

TRINAMIC
MOTION CONTROL

Decades of experience embodied in dependable building blocks.

Trinamic is the global leader in embedded motor and motion control. Our ICs and microsystems connect the digital and physical worlds. Our engineers are experts in solving real world problems, their decades of experience are embodied in each of our products. Trinamic is synonymous with precision, reliability and efficiency.

Amplify your product with Trinamic technologies

"Electric motors are such an essential part of everyday life that consumption of these devices has continued to rise in recent years. The growing expanse of the middle class, coupled with increases in household automation and the number of electric motor-driven products around the home, are major drivers of growth."

Bryan Turnbough, analyst with IHS.
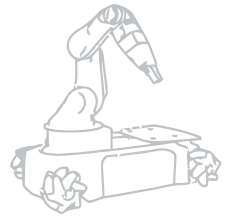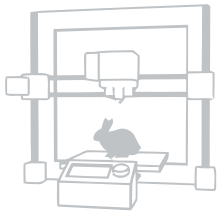
The trend towards automating all aspects of the human environment has resulted in an explosion in the deployment of controlled motion systems. Product developers must deal with increasingly complex systems and can no longer be experts in all aspects of the underlying technology. Trinamic addresses this issue through an API-based approach that reduces time to market, saves money and ultimately delivers better products with superior performance.

Trinamic is an established player with a range of products serving multiple markets. These include laboratory and factory automation, semiconductor manufacturing, textiles, robotics, ATMs and vending machines – wherever reliable positioning is required.

Our latest products set the performance standard for high-growth, emerging markets like 3D printing, medical pumps and liquid handling.

Why do the most forward-thinking companies on the planet repeatedly choose Trinamic?

Of course some choose us because of superior product features. However, the majority of our customers select us because our sole focus on motion control provides access to deep application knowledge and enables our customers to innovate faster in their specific areas.

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.

Integrated solution with motion controller and driver in a single device. It combines a flexible hardware ramp generator for automatic target positioning with the industries most advanced stepper motor driver.

cDriver™

High integration, high energy efficiency and a small form factor enable miniaturized and scalable systems for cost effective solutions. The complete solution reduces the learning curve to a minimum while giving best-in-class performance.

A sensorless load measurement for stepper motors. It gives cost effective realtime feedback on the load angle. It is the world's first sensorless load detection implemented in a standard stepper motor driver.

StallGuard™

StallGuard™ eliminates the need for reference or end switches. This reduces cost and complexity of applications, where a precise referencing is required. The high resolution feedback of StallGuard2™ allows for a continuous condition monitoring of the system.

CoolStep™ sensorless load-dependent current control using the StallGuard2™ load values. It always drives the motors at their optimum current and therefore enables to drive the motors in an energy-efficient way.

CoolStep™

Without the need for any sensors, coolStep™ eliminates the security current margin, boosts the motor, avoids stall and step loss to improve the reliability of the entire system.

StealthChop™ delivers exceptionally quiet stepper motor performance. Motors operating at low speed exhibit a phenomenon known as magnetostriction, which causes an audible high pitch noise.

StealthChop™

Based on the current feedback, the chip regulates the voltage modulation to minimize current fluctuation. StealthChop™ applications have achieved noise levels of 10dB and more below classical current control.

Using SpreadCycle™ the microstep current sinewave is always well formed with a smooth zero crossing. Drivers with SpreadCycle eliminate the spike in the current waveform caused by the motors back EMF.

SpreadCycle™

Stepper motors can be driven very fast without resonance effects. This reduces vibrations and improves the efficiency, as no energy is fed to the resonances.

The 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.

SixPoint™

SixPoint™ reduces the jerk at the end of standard acceleration ramp. For high-speed positioning as well as for handling jerk-sensitive goods or objects with extensive inertia, (S-Shaped) ramping profiles might be necessary.

The Trinamic Motion Control Language is a programming language dedicated to motion control. It uses simple commands for positioning and setting all relevant parameters of the motion controller accelerate application development.

TMCL™

Used as a protocol, it is very easy to control actuators with any programming language. It is supported by the TMCL-IDE – a PC based integrated development environment.

Digital technologies are making a dramatic impact on manufacturing. Technologies like 3D printing, CNC-milling and Laser Cutting become mature and accessible. Real-world products can now be manufactured directly from the design software.

Small Motors are ubiquitous!

Both rapid prototyping and digital manufacturing require precise and dependable motion control. With excessive experience in 3D printing and manufacturing Trinamic provides solutions for the manufacturing of the future.

Wherever reliable positioning is required, Trinamic's dependable hardware building blocks form the systems foundation.

What is your Application?

Trinamic's microsystems are suitable for all applications requiring controlled motion. Our products set the performance standard for applications like digital manufacturing, medical devices and laboratory automation.

Single Axis Stepper Self Sensing

PRODUCT	TMCM-1210	TMCM-1021	TMCM-1043	TMCM-1070	TMCM-1270	TMCM-1140	TMCM-1141
Number of axes	1	1	1	1	1	1	1
Motor type	Stepper	Stepper	Stepper	Stepper	Stepper	Stepper	Stepper
Phase current (RMS)	0.6A	0.7A/ 1.4A	1.1A	1.2A	1.2A	2A	1.1A/ 2.0A
Motor supply voltage	7V…30V	9V…28V	9V…28V	9V…26V	9V…26V	9V…28V	9V…28V
Max. microstep resolution	256	256	256	256	256	256	256
Interface: RS485	✓	✓	-	-	-	✓	✓
Interface: CAN	-	-	-	-	✓	✓	-
Interface: USB	-	-	-	-	-	✓	✓
Interface: S/D	-	(GP in)	✓	✓	-	✓	✓
MicroPlyer™ [µSteps]	16 to 256	-	16 to 256	any to 256	-	16 to 256	16 to 256
Bus protocol	TMCL	TMCL	(TMCL)**	(TMCL)**	TMCL / CANopen	TMCL / CANopen	TMCL
StallGuard2™	✓	✓	✓	-	✓	✓	✓
CoolStep™	✓	✓	✓	(✓)	✓	✓	✓
SpreadCycle™ chopper	✓	✓	✓	✓	✓	✓	✓
StealthChop™	✓	-	-	✓	✓	-	-
Encoder interface	-	-	-	-	-	✓	-
SensOstep encoder resolution	4096	1024	-	-	-	1024	-
Ramp generator	SixPoint™	trapezoidal	-	-	SixPoint™	trapezoidal	trapezoidal
Reference inputs	L/R*	HLR*	-	-	HLR*	HLR (PU)*	HLR (PU)*
General purpose IN (digital)	1x 5/24V	3x 5/24V	-	-	3x 5V TTL	3x 5/24V	3x 5/24V
General purpose IN (analog)	-	1x 0-6.6V, 12 bit	-	-	1x	1x 0-10V, 12 bit	1x 0-10V, 12 bit
General purpose OUT (digital)	-	2x OD, 100mA	2	-	-	1x 5V, 1x OD, 1A	2x OD, 100mA
Board dimensions	20 x 20mm²	28 x 28mm²	37 x 37mm²	42 x 42mm²	42 x 42mm²	37 x 37mm²	37 x 37mm²
Motor mountable	NEMA8	NEMA 11	NEMA 17	NEMA17	NEMA17	NEMA 17	NEMA 17
Product status	active	active	active	active	active	active	active

*PU = internal pull-up (programmable) | LR = STOP_L + STOP_R | HLR = HOME + STOP_L + STOP_R
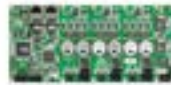
**parametrization only

Single Axis Stepper Self Sensing

TMCM-1160	TMCM-1161	TMCM-1180	TMCM-1181	TMCM-1110	PRODUCT
1	1	1	1		Number of axes
Stepper	Stepper	Stepper	Stepper	Stepper	Motor type
2.8A	2.8A	5.5A	6.4A	2.8A	Phase current (RMS)
9V...51V	10V...30V	18V...55V	11V...28V	10V...30V	Motor supply voltage
256	256	256	256	256	Max. microstep resolution
✓	✓	✓	✓	✓	Interface: RS485
✓	-	✓	-	-	Interface: CAN
✓	✓	✓	✓	✓	Interface: USB
✓	-	✓	(GP in)	✓	Interface: S/D
16 to 256	16 to 256	16 to 256	16 to 256	16 to 256	MicroPlyer™ [µSteps]
TMCL / CANopen	TMCL	TMCL / CANopen	TMCL	TMCL	Bus protocol
✓	✓	✓	✓	✓	StallGuard2™
✓	✓	✓	✓	✓	CoolStep™
✓	✓	✓	✓	✓	SpreadCycle™ chopper
-	-	-	-	-	StealthChop™
✓	-	✓	-	✓	Encoder interface
1024	1024	256	1024	-	SensOstep encoder resolution
trapezoidal	trapezoidal	trapezoidal	trapezoidal	trapezoidal	Ramp generator
HLR (PU)*	HLR (PU)*	HLR (PU)*	HLR (PU)*	3LR(PU)*	Reference inputs
3x 5/24V	3x 5/24V	3x 5/24V	-	3x 5V TTL	General purpose IN (digital)
2x 0-10V, 12 bit	1x 0-10V, 12 bit	2x 0-10V, 12 bit	2x 0-10V, 12bit	1x 0-10V, 12 bit	General purpose IN (analog)
2x OD, 1A	2x OD, 100mA	2x OD, 1A	2x OD, 100mA	2x OD, 100mA	General purpose OUT (digital)
60 x 60mm²	60 x 60mm²	86 x 86mm²	86 x 86mm²	55 x 85mm²	Board dimensions
NEMA 23/24	NEMA 23/24	NEMA 34	NEMA 34	-	Motor mountable
active	active	active	active	active	Product status

*PU = internal pull-up (programmable) | LR = STOP_L + STOP_R | HLR = HOME + STOP_L + STOP_R

Multi Axis Stepper Self Sensing

PRODUCT	TMCM-3110	TMCM-3212	TMCM-3213	TMCM-3214	TMCM-3215
Number of axes	3	3	3	3	3
Motor type	Stepper	Stepper	Stepper	Stepper	Stepper
Phase current (RMS)	2.8A	3A	3A	6.5A	6.5A
Motor supply voltage	9V...52V	12V...53V	12V...53V	18V...53V	18V...53V
Max. microstep resolution	256	256	256	256	256
Interface: RS485	✓	✓	-	✓	-
Interface: CAN	✓	✓	-	✓	-
Interface: USB	✓	✓	✓	✓	✓
Interface: EtherCAT	-	-	✓	-	✓
Interface: S/D	3x IN	-	-	-	-
MicroPlyer™ [µSteps]	16 to 256	16 to 256	16 to 256	16 to 256	16 to 256
Bus protocol	TMCL / CANopen	TMCL / CANopen	CoE	TMCL / CANopen	CoE
StallGuard2™	✓	✓	✓	✓	✓
CoolStep™	✓	✓	✓	✓	✓
SpreadCycle™	✓	✓	✓	✓	✓
StealthChop™	-	✓	✓	✓	✓
DcStep™	-	✓	✓	✓	✓
A/B/N encoder interface	3	3	3	3	3
Ramp generator	trapezoidal	SixPoint™	SixPoint™	SixPoint™	SixPoint™
Reference inputs	3LR (PU)*	3HLR (PU)*	3HLR (PU)*	3HLR (PU)*	3HLR (PU)*
General purpose IN (digital)	6x 5/24V	4x 5-24V (opt)	4x 5-24V (opt)	4x 5-24V (opt)	4x 5-24V (opt)
General purpose IN (analog)	2x 0-10V, 12 bit	4x 0-10V (opt)	4x 0-10V (opt)	4x 0-10V (opt)	4x 0-10V (opt)
General purpose OUT (digital)	6x OD,100mA + 2x OD,1A	4x OD,1A	4x OD,1A	4x OD,1A	4x OD,1A
Board dimensions	100 x 130mm²	215 x 100mm²	215 x 100mm²	215 x 100mm²	215 x 100mm²
Product status	active	active	active	active	active

*PU = internal pull-up (programmable) | LR = STOP_L + STOP_R | HLR = HOME + STOP_L + STOP_R

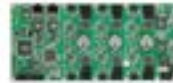# Multi Axis Stepper Self Sensing

TMCM-6110	TMCM-6210	TMCM-6211	TMCM-6212	TMCM-6213	PRODUCT
6	6	6	6	6	**Number of axes**
Stepper	Stepper	Stepper	Stepper	Stepper	**Motor type**
1.1A	0.7A	0.7A	1.1A	1.1A	**Phase current (RMS)**
9V...28V	10.5V...27V	10.5V...27V	11V...35V	11V...35V	**Motor supply voltage**
256	256	256	256	256	**Max. microstep resolution**
✓	✓	-	✓	-	**Interface: RS485**
✓	✓	-	✓	-	**Interface: CAN**
✓	✓	✓	✓	✓	**Interface: USB**
-	-	✓	-	✓	**Interface: EtherCAT**
-	-	-	-	-	**Interface: S/D**
16 to 256	16 to 256	16 to 256	16 to 256	16 to 256	**MicroPlyer™ [µSteps]**
TMCL	TMCL / CANopen	CoE	TMCL / CANopen	CoE	**Bus protocol**
✓	✓	✓	✓	✓	**StallGuard2™**
✓	✓	✓	✓	✓	**CoolStep™**
✓	✓	✓	✓	✓	**SpreadCycle™**
-	✓	✓	✓	✓	**StealthChop™**
-	✓	✓	✓	✓	**DcStep™**
-	6	6	6	6	**A/B/N encoder interface**
trapezoidal	SixPoint™	SixPoint™	SixPoint™	SixPoint™	**Ramp generator**
6LR (PU)*	6HLR (PU)*	6HLR (PU)*	6HLR (PU)*	6HLR (PU)*	**Reference inputs**
6x 5/24V	4x 5-24V (opt)	4x 5-24V (opt)	4x 5-24V (opt)	4x 5-24V (opt)	**General purpose IN (digital)**
2x 0-10V	4x 0-10V (opt)	4x 0-10V (opt)	4x 0-10V (opt)	4x 0-10V (opt)	**General purpose IN (analog)**
6x OD,100mA + 2x OD,1A	4x OD,1A	4x OD,1A	4x OD,1A	4x OD,1A	**General purpose OUT (digital)**
100 x 130mm²	215 x 100mm²	215 x 100mm²	215 x 100mm²	215 x 100mm²	**Board dimensions**
active	active	active	active	active	**Product status**

*PU = internal pull-up (programmable) | LR = STOP_L + STOP_R | HLR = HOME + STOP_L + STOP_R

Single Axis Stepper Servo

PRODUCT	TMCM-1310	TMCM-1311	TMCM-1111
Number of axes	1	1	1
Motor type	Stepper	Stepper	Stepper
Phase current (RMS)	3A	3A	1A, 2.8A
Motor supply voltage	9V...51V	9V...51V	10..30V
Max. microstep resolution	256	256	256
Interface: RS232	-	-	-
Interface: RS485	-	✓	✓
Interface: CAN	-	✓	(✓)
Interface: USB	✓	✓	✓
Interface: EtherCAT	✓	-	-
Bus protocol	CoE	TMCL / CANopen	TMCL
StallGuard2™	✓	✓	✓
CoolStep™	✓	✓	✓
SpreadCycle™	✓	✓	✓
StealthChop™	-	-	-
Field oriented control	✓	✓	-
Closed-loop position control	✓	✓	✓
Encoder interface	✓	✓	✓
Ramp generator	linear	linear	linear, S-Shaped
Reference inputs	LR*	LR*	HLR (PU)*
General purpose IN (digital)	6x 5-24V	6x 5-24V	3x 5V TTL
General purpose IN (analog)	2x 0-10V	2x 0-10V	1x 0-10V, 12 bit
General purpose OUT (digital)	6x OD, 100mA + 2x OD, 1A	6x OD, 100mA + 2x OD, 1A	2x OD, 100mA
Board dimensions	110 x 110mm²	110 x 110mm²	85 x 55mm²
Product status	active	active	active

*PU = internal pull-up (programmable) | LR = STOP_L + STOP_R | HLR = HOME + STOP_L + STOP_R

Multi Axis Stepper Servo

TMCM-3312	TMCM-3313	PRODUCT
3	3	**Number of axes**
Stepper	Stepper	**Motor type**
3A	3A	**Phase current (RMS)**
18V...53V	18V...53V	**Motor supply voltage**
256	256	**Max. microstep resolution**
-	-	**Interface: RS232**
✓	-	**Interface: RS485**
✓	-	**Interface: CAN**
✓	✓	**Interface: USB**
-	✓	**Interface: EtherCAT**
TMCL / CANopen	CoE	**Bus protocol**
✓	✓	**StallGuard2™**
✓	✓	**CoolStep™**
✓	✓	**SpreadCycle™**
✓	✓	**StealthChop™**
-	-	**Field oriented control**
✓	✓	**Closed-loop position control**
3	3	**Encoder interface**
SixPoint™ + S-Shaped	SixPoint™ + S-Shaped	**Ramp generator**
3HLR (PU)*	3HLR (PU)*	**Reference inputs**
4x 5-24V (opt)	4x 5-24V (opt)	**General purpose IN (digital)**
4x 0-10V (opt)	4x 0-10V (opt)	**General purpose IN (analog)**
4x OD,1A	4x OD,1A	**General purpose OUT (digital)**
215 x 100mm²	215 x 100mm²	**Board dimensions**
active	active	**Product status**

*PU = internal pull-up (programmable) | LR = STOP_L + STOP_R | HLR = HOME + STOP_L + STOP_R

Single Axis BLDC

PRODUCT	TMCM-1613	TMCM-1613-REC
Number of axes	1	1
Motor type	BLDC/PMSM	BLDC/PMSM
Motor supply voltage	7V..30V	-30V...30V**
Continuous output [W]	500W	500W
Rated phase current (RMS)	30A	30A
Interface: RS232	serial 2-wire interface	serial 2-wire interface
Interface: RS485	-	-
Interface: CAN	-	-
Interface: USB	-	-
Interface: S/D	-	-
Interface: EtherCAT	-	-
Bus protocol	TMCL	TMCL
Field oriented control	-	-
Current control	✓	✓
Velocity control	✓	✓
Position control	✓	✓
Reference inputs	HLR*	HLR*
General purpose IN (digital)	2x 24V	2x 24V
General purpose IN (analog)	0V...10V	0V...10V
General purpose OUT (digital)	1x OD	1x OD
Hall interface	✓	✓
Encoder interface	-	-
Ramp generator	trapezoidal	trapezoidal
Board dimensions	75 x 70mm²	75 x 70mm²
Product status	active	active

*PU = internal pull-up (programmable) | LR = STOP_L + STOP_R | HLR = HOME + STOP_L + STOP_R
**DC-Motor Replacement

Single Axis BLDC Servo

TMCM-1630-2C	TMCM-1633	TMCM-1640	PRODUCT
1	1	1	**Number of axes**
BLDC/PMSM	BLDC/PMSM	BLDC/PMSM	**Motor type**
12V...48V	12V...48V	15V...28.5V	**Motor supply voltage**
150W...300W	150W...300W	100W	**Continuous output**
10A	10A	5A	**Rated phase current (RMS)**
✓	✓	-	**Interface: RS232**
(option)**	-	✓	**Interface: RS485**
✓	✓	-	**Interface: CAN**
(option)**	-	✓	**Interface: USB**
-	-	-	**Interface: S/D**
-	-	-	**Interface: EtherCAT**
TMCL	CANopen	TMCL	**Bus protocol**
✓	✓	✓	**Field oriented control**
✓	✓	✓	**Current control**
✓	✓	✓	**Velocity control**
✓	✓	✓	**Position control**
HLR*	HLR*	HLR*	**Reference inputs**
2x 24V	2x 24V	2x 24V	**General purpose IN (digital)**
2x 10V	2x 10V	1x 10V	**General purpose IN (analog)**
3x OD	3x OD	1x OD	**General purpose OUT (digital)**
✓	✓	✓	**Hall interface**
✓	✓	✓	**Encoder interface**
trapezoidal	trapezoidal	trapezoidal	**Ramp generator**
50 x 92mm²	50 x 92mm²	42 x 42mm²	**Board dimensions**
active	active	active	**Product status**

*PU = internal pull-up (programmable) | LR = STOP_L + STOP_R | HLR = HOME + STOP_L + STOP_R

**TMCM-1630-4U

PANdrive™

PRODUCT	PD28-1021	PD42-1070	PD42-1270	PD42-1140	PD42-1141
Motor type	stepper	stepper	stepper	stepper	stepper
Motor flange size NEMA	28 x 28mm²	42 x 42mm²	42 x 42mm²	42 x 42mm²	42 x 42mm²
NEMA frame size	11	17	17	17	17
Motor supply voltage	9V...28V	9V...26V	6V...26V	9V...28V	9V...28V
Max. microstep resolution	51200	51200	51200	51200	51200
Motor resolution	1.8°	1.8°	1.8°	1.8°	1.8°
Interface: RS232	-	TTL-UART	-	-	-
Interface: RS485	✓	-	-	✓	✓
Interface: CAN	-	-	✓	✓	-
Interface: USB	-	-	-	✓	✓
Interface: EtherCAT	-	-	-	-	-
Interface: S/D	GP in	✓	-	-	✓
MicroPlyer™ [μSteps]	-	any to 256	-	16 to 256	16 to 256
Bus protocol	TMCL	TMCL	TMCL / CANopen	TMCL / CANopen	TMCL
StallGuard2™	✓	-	✓	✓	✓
CoolStep™	✓	-	✓	✓	✓
SpreadCycle™	✓	✓	✓	✓	✓
StealthChop™	-	✓	✓	-	-
Ramp generator	trapezoidal	-	SixPoint™	trapezoidal	trapezoidal
Reference inputs	HLR*	-	HLR*	HLR (PU)*	HLR (PU)*
Encoder interface	-	-	-	✓	-
SensOstep encoder resolution	1024	-	-	1024	-
General purpose IN (digital)	3x 5/24V	-	3x 5V TTL	3x 5/24V	3x 5/24V
General purpose IN (analog)	1x 0-6.6V, 12 bit		1x	1x 0-10V, 12 bit	1x 0-10V, 12 bit
General purpose OUT (digital)	2x OD, 100mA	-	-	1x 5V, 1x OD, 1A	2x OD, 100mA
PD...-1... torque [Nm]/[oz in]	0.06 / 8.5	0.22 / 31	0.22 / 31	0.22 / 31	0.27 / 38
PD...-2... torque [Nm]/[oz in]	-	0.36 / 50	0.36 / 50	0.36 / 50	0.35 / 50
PD...-3... torque [Nm]/[oz in]	0.12 / 17	0.44 / 62	0.44 / 62	0.44 / 62	0.49 / 69
PD...-4... torque [Nm]/[oz in]	-	-	-	0.7 / 99	-
Product status	active	active	active	active	active

*PU = internal pull-up (programmable) | LR = STOP_L + STOP_R | HLR = HOME + STOP_L + STOP_R

PANdrive™

PD57-1160	PD57-1161	PD60-1160	PD60-1161	PD86-1180	PRODUCT
stepper	stepper	stepper	stepper	stepper	**Motor type**
57 x 57mm²	57 x 57mm²	60 x 60mm²	60 x 60mm²	86 x 86mm²	**Motor flange size NEMA**
23	23	24	24	34	**NEMA frame size**
9V...51V	10V...30V	9V...51V	10V...30V	18V...55V	**Motor supply voltage**
51200	51200	51200	51200	51200	**Max. resolution [µStep/rev]**
1.8°	1.8°	1.8°	1.8°	1.8°	**Motor resolution**
-	✓	-	✓	✓	**Interface: RS232**
✓	✓	✓	✓	✓	**Interface: RS485**
✓	-	✓	-	✓	**Interface: CAN**
✓	✓	✓	✓	✓	**Interface: USB**
-	-	-	-	-	**Interface: EtherCAT**
✓	GP in	✓	GP in	✓	**Interface: S/D**
16 to 256	16 to 256	16 to 256	16 to 256	16 to 256	**MicroPlyer™ [µSteps]**
TMCL / CANopen	TMCL	TMCL / CANopen	TMCL	TMCL / CANopen	**Bus protocol**
✓	✓	✓	✓	✓	**StallGuard2™**
✓	✓	✓	✓	✓	**CoolStep™**
✓	✓	✓	✓	✓	**SpreadCycle™**
-	-	-	-	-	**StealthChop™**
trapezoidal	trapezoidal	trapezoidal	trapezoidal	trapezoidal	**Ramp generator**
HLR (PU)*	HLR (PU)*	HLR (PU)*	HLR (PU)*	HLR (PU)*	**Reference inputs**
✓	-	✓	-	✓	**Encoder interface**
1024	1024	1024	1024	256	**SensOstep encoder resolution**
3x 5/24V	3x 5/24V	3x 5/24V	3x 5/24V	3x 5/24V	**General purpose IN (digital)**
2x 0-10V, 12 bit	1x 0-10V, 12 bit	2x 0-10V, 12 bit	1x 0-10V, 12 bit	2x 0-10V	**General purpose IN (analog)**
2x OD, 1A	2x OD, 100mA	2x OD, 1A	2x OD, 100mA	2x OD, 1A	**General purpose OUT (digital)**
0.55 / 78	0.55 / 78	-	-	-	**PD...-1... torque [Nm]/[oz in]**
1.01 / 143	1.01 / 143	-	-	-	**PD...-2... torque [Nm]/[oz in]**
-	-	2.10 / 297	2.10 / 297	7.0 / 991	**PD...-3... torque [Nm]/[oz in]**
-	-	3.10 / 439	3.10 / 439	-	**PD...-4... torque [Nm]/[oz in]**
active	active	active	active	active	**Product status**

*PU = internal pull-up (programmable) | LR = STOP_L + STOP_R | HLR = HOME + STOP_L + STOP_R

High Resolution Encoders for Stepper Motors

PRODUCT	TMCS-20-4-8192-AT-01	TMCS-28-5-10000-AT-01	TMCS-28-6.35-10000-AT-01	TMCS-40-6.35-10000-AT-01
Housing diameter	20mm	28mm	28mm	40mm
For shaft diameter	4mm	5mm	6.35mm	6.35mm
Resolution [lines]	8.192	10.000	10.000	10.000
Resolution [increments]	32.192	40.000	40.000	40.000
Interface	ABN	ABN	ABN	ABN
Level	TTL	TTL	TTL	TTL
a/b/n incremental	✓	✓	✓	✓
Max. rpm	6000 rpm	6000 rpm	6000 rpm	7500 rpm
Max. frequency	1500 kHz	1500 kHz	1500 kHz	1500 kHz
Product status	active	active	active	active
Evaluation	TMCS-20-KIT	TMCS-28-KIT	TMCS-28-KIT	TMCS-40-KIT

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