



Stepper motor control IKS28-12 1.0



Picture 1 – IKS28-12

Name	Produkt Handbuch	Revision	05 / 15.12.2017
Nr.		Freigabe	AW
Legende		Seiten	1/10





1 IKS28-12-TMCL– Description and technical data

1.1 General information

	Notice
	The IKS28-12 is also available as a MocDrive MD28 mounted on several types of motors.

1.2 Overview

The stepper motor control IKS28-12 is designed as a motor mountable control with magnetic encoder option. It can be controlled by a host system via RS485 or act independently controlled by a script.

- Supply voltage 24V
- Motor current up to 1,4A RMS
- Communication by RS485
- In- and Outputs 24V compatible SPS
 - Endswitch left an right
 - 2x Input digital
 - 2x Outputs digital, Open Drain
 - Not all options ca be used at the same tiem
- IKS28 uses MocOS-CL as communication language, which is an extension of Trinamics TMCL™, it includes a emulation mode that shows up as a TCMC-1021 for compatibility with older applications

1.3 Technical data

Tab 1 Technical data

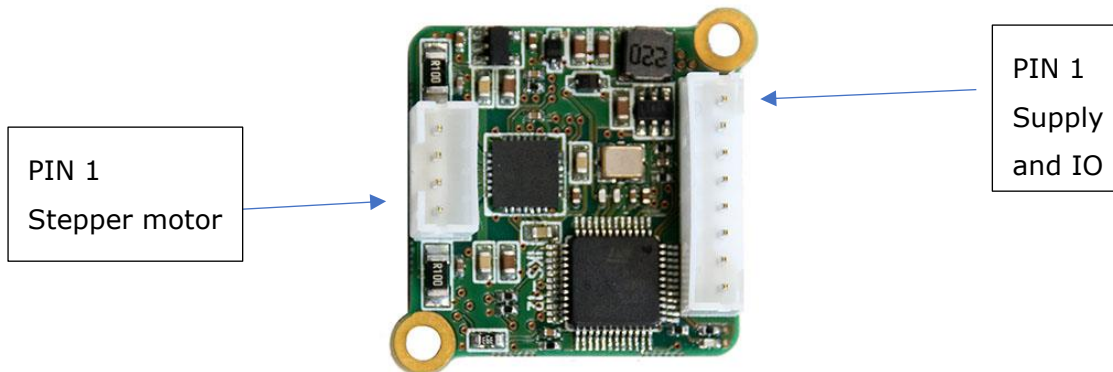
Symbol	parameter	Min	Typ	Max	Unit
U _{+24V}	Power supply for motor control	20	24	25,5	V
I _{Motor}	Motor current I _{RMS}			1,4	A
T _{Amb}	Ambient Temperature	10	20	40	°C

Name	Produktthandbuch	Revision	05 / 15.12.2017
Nr.		Freigabe	AW
Legende		Seiten	2/10





2 IKS28-12 – Connections



2.1 Stepper motor

Left connector

Tab 2 Connecting the stepper motor (X1)

	Pin	Marking	Description
	1	OA1	Stepper motor phase A 1
	2	OA2	Stepper motor phase A 2
	3	OB1	Stepper motor phase B 1
	4	OB2	Stepper motor phase A 2

Name	Produkt Handbuch	Revision	05 / 15.12.2017
Nr.		Freigabe	AW
Legende		Seiten	3/10





2.2 Inputs, outputs, supply and RS485

	Important!
	<p>In order to stabilize the operating voltage and to filter harmful voltage peaks on the supply voltage, it is urgently necessary to install an electrolytic capacitor of sufficient size (e.g. 1000µF/35V) in the supply line near the motor controller.</p> <p>Operating the controller on an unfiltered supply may result in firmware crashes or hardware corruption</p>

Right connector

Tab 3 Inputs, outputs, communication (X2)

	Pin	Marking	Description
	1	GND	Ground
	2	V+	Supply voltage 24V DC
	3	RS485+	RS485+ (RS485A). Please use termination at RS485 Bus
	4	RS485-	RS485- (RS485B)
	5	In0/RefSw L	Left limit switch or input 0
	6	In1/RefSw R	Right limit switch or input 1
	7	Out0/In2	Digital output 0 or input 2*
	8	Out1/In3	Digital output 1 or input 3*
			*Selectable by firmware

2.3 Status LED

Pulsating green -> normal mode

Blinking fast -> Bootloader mode

Name	Produkt Handbuch	Revision	05 / 15.12.2017
Nr.		Freigabe	AW
Legende		Seiten	4/10





3 Hints

3.1 TMCL-compatibility


The IKS28-12 motor control unit is TMCL-compatible. The control unit shows up itself as TMCM-1021.

- The microstep resolution is permanently set to 16 (axis parameter 140, value 4). For compatibility reasons, axis parameter 140 allows all values between 0 and 8.
- The encoder prescaler axis parameter 210 is preconfigured to the value 1600 for the microstep resolution of 16.
- From bootloader version 0.05, the function firmware is switched to immediately after the supply voltage is applied. The bootloader mode is accessed with a special command. This is sent by the MOC Flash Tool from version V.01.05.02 before the firmware is loaded. Note: the bootloader opens the serial interface with a baud rate of 9600.

3.2 Motor current

Values from 1 to 31 are allowed for the motor current.


Please use this parameter with caution to prevent the system from heating up to much and get damaged.



Warning

- The maximum motor current is allowed with ambient temperature up to 25 degrees. Ensure adequate ventilation !
- Using maximum motor current, the motor and the control heats up considerably, there is a risk or burns!

3.3 Mounting on motors



Warning

- During installation, make sure that the fastening screws do not touch any electrical parts of the circuit board. Use insulating washers if necessary.

Name	Produktthandbuch	Revision	05 / 15.12.2017
Nr.		Freigabe	AW
Legende		Seiten	5/10





4 Commands

4.1 Details

4.1.1 GIO (15) – Get Input Output

Tab 4 - GIO (15) - Get Input Output

Function	Type	Motor /Bank	Description
Read inputs digital	0: IN0 1: IN1 2: IN2 3: IN3 255: IN0-IN4 as pattern	0: Digital	Read the inputs, up to 24V, digital
Analog functions	0: IN3 9: CPU Temperature	1: Analog	Some analog functions Att.: <ul style="list-style-type: none"> Type 0: 0..4096, 0-6V. Type 9 in °C
State of the outputs	0: DOU0 1: DOU1	2: Digital	
			•

4.2 Global parameters



Attention

- The global parameters are written to the flash.
- Avoid writing the parameters regularly in the script in order to minimize flash wear.

4.2.1 Global parameters Bank 0

All parameters set and write to non-volatile memory. The parameter becomes active after a restart.

Tab 5 - Global Parameters Bank 0

No.	Parameter	Description	Allowed values	
65	RS485 Baud rate	Baudrate	0: 9600 (Default) 1: 14400 2: 19200 3: 28800 4: 38400 5: 57600 6: 76800 7: 115200 8: 230400	RWA
66	Serial address	Module (target) address for RS485.	0...255	RWA

Name	Produkt Handbuch	Revision	05 / 15.12.2017
Nr.		Freigabe	AW
Legende		Seiten	6/10





No.	Parameter	Description	Allowed values	
75	Telegramm pause time	<p>Telegram pause time</p> <p>In our system, you can specify a waiting time, the so-called telegram pause time. This time defines the pause between before the response telegram is sent. Please note that the timer of this system depends on the set baud rate and is therefore not constant.</p> <p>Behavior at different baud rates</p> <p>- Maximum baud rate (38400): At the highest baud rate of 38400, the specified telegram pause time corresponds almost exactly to the resulting waiting time.</p> <p>- Lower baud rates: If the baud rate is reduced, the actual waiting time is also reduced in proportion. This means that the actual telegram pause time can be shorter than the set time.</p> <p>Explanation</p> <p>This behavior is a consequence of the technical specifications of the timer, which adapts dynamically to the baud rate. It is not a malfunction, but a design-related characteristic of the system.</p> <p>Recommendation</p> <p>We recommend adjusting the telegram pause time according to the baud rate used in order to achieve the desired waiting time. For lower baud rates in particular, you should check the telegram pause time setting and adjust it if necessary to ensure that the communication requirements are met.</p>	0...255, Default 5 [ms]	RWA

Name	Produktthandbuch	Revision	05 / 15.12.2017
Nr.		Freigabe	AW
Legende		Seiten	7/10





5 Safety instructions and warnings

Mounting

The control unit is an incomplete machine in the sense of the Machinery Directive 2006/42/EC, which requires installation in a housing or control cabinet, preferably made of metal.

Environmental influences such as high temperatures, high humidity, condensation must be prevented. Dust, dirt, flammable atmospheres and aggressive gases must also be excluded. The place of installation should be a well ventilated place, not exposed to direct sunlight. Install the device on a non-flammable, vertical wall that does not transmit vibrations.

When mounting, be aware that the control unit generates heat. For this reason, mount the controller vertically and make sure that the installation location is well ventilated to ensure adequate heat convection.

EMC compliant installation

Installation instructions:

- Mounting the controller in a grounded metal enclosure.
- Ground the controller at the connections provided for this purpose.
- Shielded motor cable; shield coverage $\geq 85\%$; apply shield on both sides and over a large area
- Separate the control lines from the mains, power supply and motor lines; if unavoidable, make crossings of control and motor lines at right angles.
- The cable length between control and stepper motor should be less than 3m. Longer motor cables lead to worse EMC behavior.
- During installation, ensure that the RF impedance between the controller and ground is as small as possible.
- Ensure that the metallic connections are as large as possible.
- Conductor loops act like antennas. Especially if they are spatially extended.
- Avoid unnecessary conductor loops.
- Avoid parallel routing of "clean" and interfering cables.
- Lay the motor cable and all analog and digital control and regulation lines shielded.
- You should leave the effective shielding area of these cables as large as possible, i.e. do not place the shield further than absolutely necessary.
- The shield must be connected to ground on both sides over a large area; if necessary, note exceptions for control lines in branched systems.
- A large-surface contacting can be realized by metallic cable glands or metallic mounting clamps.
- Use only copper braided cable (CY) with a coverage of 85%.
- The shielding should not be interrupted over the entire cable length. If, for example, the use of chokes or clamps is required in the motor cable, the unshielded part should be kept as short as possible.
- Very often interference is coupled in via the installation cables. You can minimize this influence.
- Lay interfering cables separately - minimum distance 0.25m - from interference-sensitive cables. The parallel laying of cables over longer distances is particularly critical. If two cables cross each other, the interference is smallest if the crossing is at an angle of 90 degrees.

Risk assessment

Mocontronic motor controllers can potentially pose hazards due to electric shock, high temperatures and electromagnetic interference. When using electric motors, there are also possible mechanical hazards.

Due to the overall low amounts of energy absorbed at also low extra-low voltages, the risks are assessed as low, provided that the following protective measures are followed:

Name	Produktbandbuch	Revision	05 / 15.12.2017
Nr.		Freigabe	AW
Legende		Seiten	8/10





Protection against electric shock

All controllers are operated with extra-low voltage according to IEC 60449, therefore, according to DIN VDE0100-410, protection against accidental contact is only required from 60 volts DC, unless "normal, dry environment" is to be assumed. We recommend contact protection from 48 volts for operation in dry rooms.

All controllers are designed for installation in an earthed metal housing which ensures a protection class appropriate to the environment in accordance with DIN VDE 0470-1.

In case Mocontronic delivers unfinished machines which are operated on mains voltage, they are installed in an appropriate housing. To avoid protection against electric shock do not remove the cover of the housing. There is voltage inside the housing which can cause an electric shock. Have the device used only by qualified personnel. As a protective measure, a residual current circuit breaker (RCCB) must be used in the supply line. According to VDE 0100 410, a residual current circuit breaker with a cut-off current $\leq 30\text{mA}$ and a cut-off time $\leq 0.3\text{s}$ must be used. In addition, a miniature circuit breaker of 16A must be used. Failure to observe these instructions may result in death, serious physical injury or considerable damage to property. The power supplies used by Mocontronic and their mounting comply with SELV construction according to DIN EN / UL 90750-1. This ensures a safe separation of mains and secondary protective extra-low voltage.

Protection against extreme temperatures

Motor controllers generate waste heat due to their design, the safe dissipation of which must be checked after installation in the customer's system. The use of fans may be necessary.

In addition, provision must be made for suitable automatic shutdown of the supply voltage and/or limitation of the operating current so that no overheating of touchable parts can occur even in the event of a fault. This also applies to connected cables, whose appropriate conductor cross-sections must be taken into account. EN 60 204-1 and VDE 0298-4 must be observed.

Improper use, such as reversing the polarity of the supply voltage or overvoltage, may result in the formation of flames or even a fire. Injuries due to exploding components are also possible.

In case Mocontronic delivers unfinished machines which are operated at mains voltage, they are installed in an appropriate housing. For protection against fire and danger of burns, a current limiter and a thermal switch are provided. In addition, a residual current circuit breaker (RCCB $\leq 30\text{mA}$, $\leq 0.3\text{s}$) and circuit breakers of 16A must be used.

Protection against electromagnetic interference

If power supplies with a final interference filter are used, the control unit is installed in a grounded metal housing and shielded cables are used, the basic EMC requirements are usually met. However, since the EMC behavior depends to a large extent on the design and location of the overall machine, the customer must test in accordance with the relevant environmental standard EN 55011, the product standard EN 61800-3 and the "mains standard" EN 61000-3-12.

Protection against mechanical hazards after installation in the customer product:

Due to the installation of motor controls and motors, the following points of the Machinery Directive must be observed in particular:

- Annex 1, point 1.2.3. starting up
- Annex 1, point 1.2.4. stopping
- Annex 1, point 1.2.5. selection of control or operating modes
- Annex 1, point 1.3. protective measures against mechanical hazards
- Annex 1, point 1.5.5 Extreme temperatures
- Annex 1, point 1.5.6 Fire
- Annex 1, point 1.7.2 Warning of residual risks

We recommend that the safety distances according to EN ISO 13857 for moving parts be taken into account as early as possible in the design process. Furthermore, we point out that both stepper and BLDC motors have only a very low holding torque when de-energized. A mechanical brake is therefore required for safe stopping, especially for larger moving masses. The STO (safe torque off) safety function can only be achieved by switching off the supply.

For the individually required protection and safety measures, the standard EN ISO 12 100 "Safety of machinery" should be taken into account, for example.

Name	Produkt Handbuch	Revision	05 / 15.12.2017
Nr.		Freigabe	AW
Legende		Seiten	9/10





For electrical installation, EN 60204 (electrical equipment of machines), listed as a B standard in the Machinery Directive, should be observed, in particular the protective measures described there:

- Insulation of conductors
- Installation in housings
- Safety-conscious design of circuit diagrams
- Sensible arrangement of reclosing devices
- Overcurrent protection
- Protective grounding

Maintenance and inspection

In principle, no complex maintenance or inspection work is required on the motor control units. We recommend checking the following points at appropriate intervals:

Cleaning the motor control unit of impurities such as dust and dirt.

Checking the ventilation. Such as clear ventilation slots, functional fans, and clear air filters.

Checking cable connections for secure connection.

6 Revision Historie

6.1 Dokument Revision

Tabelle 6 - Dokument Revision

Version	Datum	Autor	Beschreibung
1.0	21.02.2022	AW	Erster Entwurf
1.01	16.02.2023	CR	Ergänzungen für Firmware Version 0.05
1.02	04.04.2023	CR	Tab 3, RS-485 korrigiert.
1.04	01.08.2024	CR	Beschreibung Globaler Parameter 75 hinzugefügt.
1.05	08.08.2024	AW	Anpassung allgemeine Version English version

6.2 Firmware Revision

Tabelle 7 - Firmware Revision

Version	Datum	Autor	Beschreibung
0.09.00	01.08.2024	CR	Globaler Parameter 75 hinzugefügt.

6.3 Hardwarerevision

Tabelle 8 - Hardware Revision

Version	Datum	Autor	Beschreibung
1.0	2022	NI	Erste Serienversion

Name	Produktthandbuch	Revision	05 / 15.12.2017
Nr.		Freigabe	AW
Legende		Seiten	10/10

