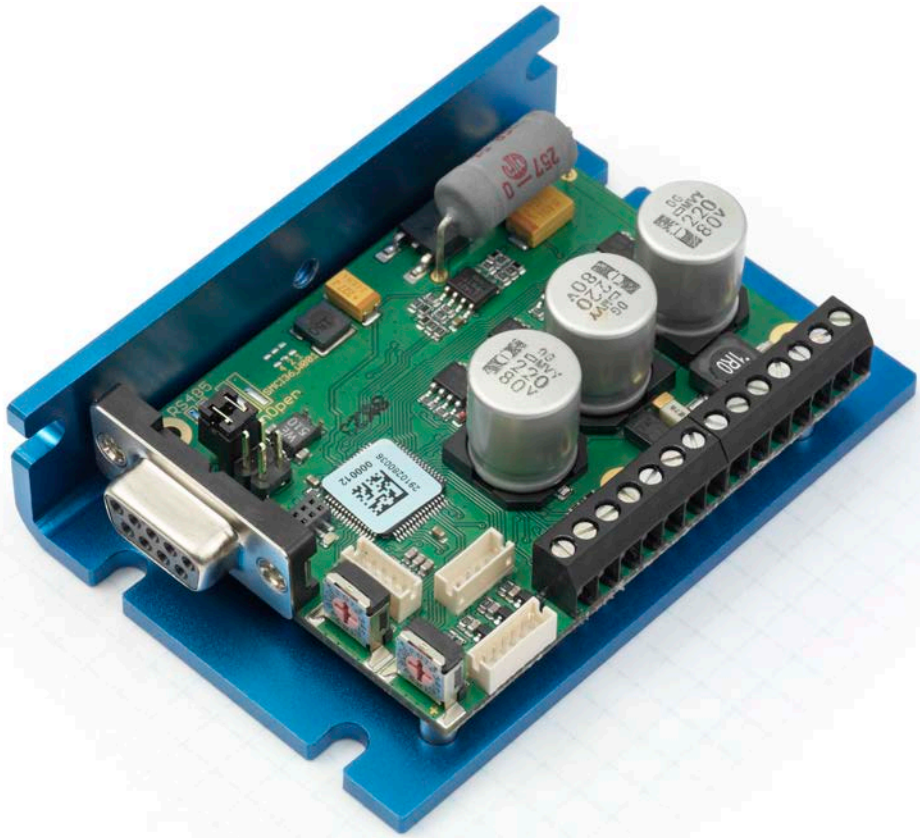
Technical Manual



Controller for stepper and BLDC motors
SMCI36

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Translation of original handbook

Version/Change overview

Version	Date	Changes
1.0	11.02.2011	New issue
1.1	03.11.2011	Revision
1.2	04.07.2012	Firmware update
1.3	25.06.2013	Revision

About this manual

Target group

This technical manual is intended for designers and developers who lack extensive experience with stepper motor technology but who need to commission a Nanotec® motor.

Important information

This technical manual must be carefully read before installing and commissioning the controller.

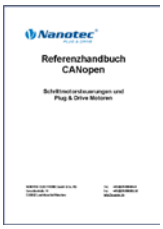
In the interests of its customers and to improve the function of this product, Nanotec® reserves the right to make technical alterations and further develop hardware and software without prior notice.

This manual was created with due care. It is exclusively intended as a technical description of the product and as commissioning instructions. The warranty is exclusively for repair or replacement of defective equipment, according to our general terms and conditions; liability for subsequent damage or errors is excluded. Applicable standards and regulations must be complied with during installation of the device.

For criticisms, proposals and suggestions for improvement, please contact the above address or send an email to: info@nanotec.com

Additional manuals

Please also note the following manuals from Nanotec:

NanoPro User Manual	Configuration of controllers with the NanoPro software	
NanoCAN User Manual	Configuration of the CAN communication for CANopen-capable controllers with the NanoCAN software	
Nanotec CANopen reference	Comprehensive documentation of the CANopen functions	
Programming manual	Controller programming • Command reference • NanoJ • COM interface	

The manuals are available for download at www.nanotec.com.

Contents

1 Overview

Introduction

Motor controller SMCI36 is an extremely compact and cost-effective constant current final output stage with integrated closed loop current control.

Due to the great capacity and functions available, it offers designers and developers a rapid and simple method of resolving numerous drive requirements with less programming effort.

It is used for controlling standard stepper motors (including with attached encoders) or motors with an integrated encoder. BLDC motors are also supported.

The SMCI36 is ideal for device installation due to its open, economical design. For machine integration, we recommend the closed controllers SMCI33 and SMCI47-S-2, which can also process 24 V signals and are built on the same software basis.

SMCI36 functions

The SMCI36 controller features the following functions:

- 12-72 V supply voltage, nominal current 6 A eff., max. phase current 9 A eff.
- Microstep -1/1 – 1/64 final output stage (step resolution of up to 0.014° in motors with a step angle of 0.9° in 1/64 step mode)
- Closed loop current control (sinusoidal commutation via the encoder)
- Sinus commutation for BLDC motors with hall sensors for better running smoothness and higher speed ranges
- RS485/CANopen port for parameterization and control
- Network capability with up to 254 motors (RS485) or 127 motors (CANopen)
- Microstep emulation in full step operation for smoother running
- Powerful DSP microprocessor for flexible I/O
- Sequence programs with NanoJ
- Easy configuration with the NanoPro or NanoCAN Windows software

Closed loop current control (sinusoidal commutation via the encoder):

In contrast to conventional controllers where only the motor is actuated or the position adjusted via the encoder, sinusoidal commutation controls the stator magnetic field via the rotary encoder as in a servomotor. The stepper motor acts in this operating mode as nothing more than a high pole servomotor, i.e. the classic stepper motor noises and resonances vanish. As the current is controlled, the motor can no longer lose any steps up to its maximum torque.

If the controller recognizes that the rotor is falling behind the stator field due to overload, adjustments are made with optimal field angle and increased current. In the opposite case, i.e. if the rotor is running forward due to the torque, the current is automatically reduced so that current consumption and heat development in the motor and controller are much lower compared to normal controlled operation.

dspDrive®

With dspDrive®, the motor current is controlled directly by a digital signal processor. Unlike conventional ICs, which resolve the winding current measurement and the target current value with only 6 or 8 bit, the new dspDrive® performs the entire control with a resolution of 12 bit. The parameters of the PI current controller can be adjusted to the motor and by the user as a function of the rpm.

This has the following application advantages:

- Very smooth, low-resonance operation with a sinusoidal current in the windings, even at low speeds.
- Very good step angle precision and synchronicity, even in open loop operation.
- BLDC motors can be controlled as well.

NanoJ

The integrated programming language NanoJ, based on the Java standard, means complete application programs can be realized on the drivers that can be executed independently without a higher-order controller.

The programs can be created, compiled directly and written to the controller with the free NanoJEasy editor.

More detailed information can be found in the separate programming manual.

Activation via CANopen

CANopen

It is possible to include the stepper motor controller in a CANopen environment with the SMCI36.

More detailed information on this can be found in the CANopen reference and in the NanoCAN user manual.

Presettings

When the SMCI36 is delivered, it is preconfigured to relative positioning mode.

The step mode can only be changed via software. It is preset to the half step setting. Due to microstep emulation, however, the stepper motor runs very smoothly and with excellent performance even in the half step.

Further settings

The operating behavior of the motor can be set and optimized according to individual requirements by setting the motor-related parameters. The parameters can be set using the NanoPro or NanoCAN software and significantly reduce commissioning time.

Converter cable ZK-RS485-USB or a suitable CAN adapter is needed for the PC connection.

More detailed information on this can be found in the separate NanoPro or NanoCAN user manual.

2 Connection and commissioning

2.1 Overview

Plug connections

The controller has the following connectors:

X1: Hall sensor

X2: Encoder

X3: Motor and power supply

X4 and X5: Inputs and outputs

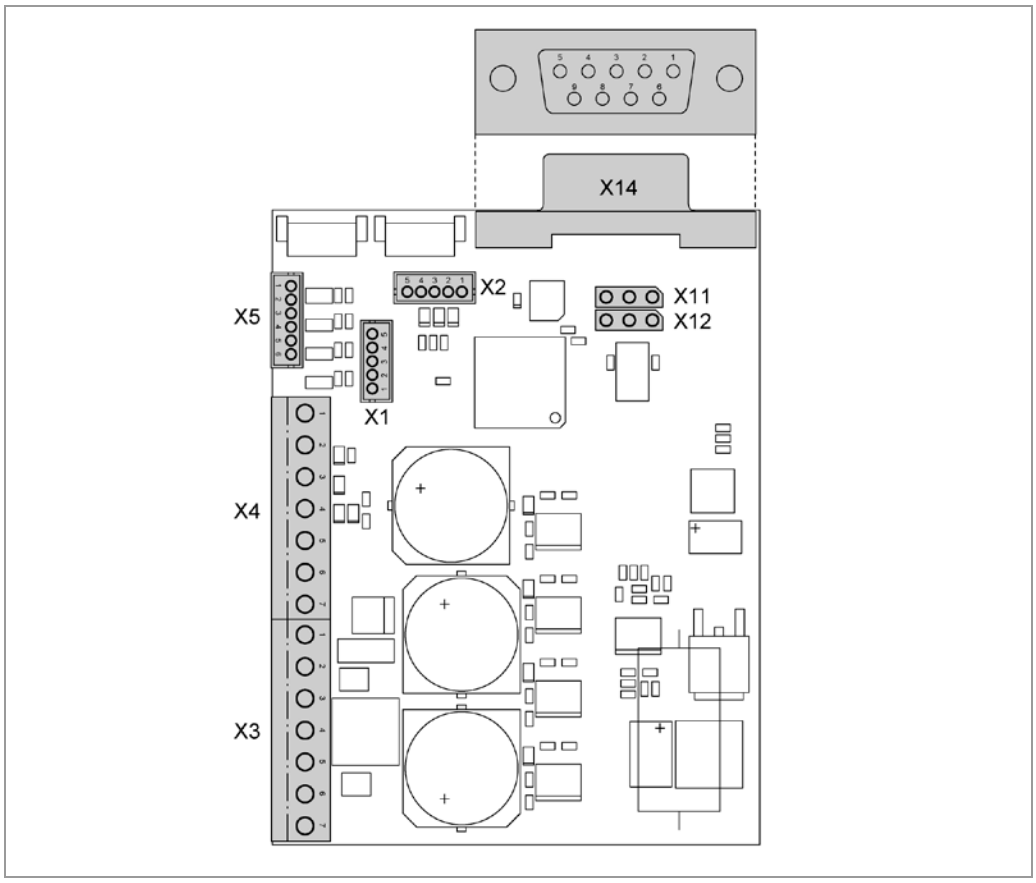
X14: Communication (RS485/CAN)

Jumper RS485/CAN

The controller has a jumper field (X11/X12) for selecting the communication port (RS485 or CAN).

Configuration

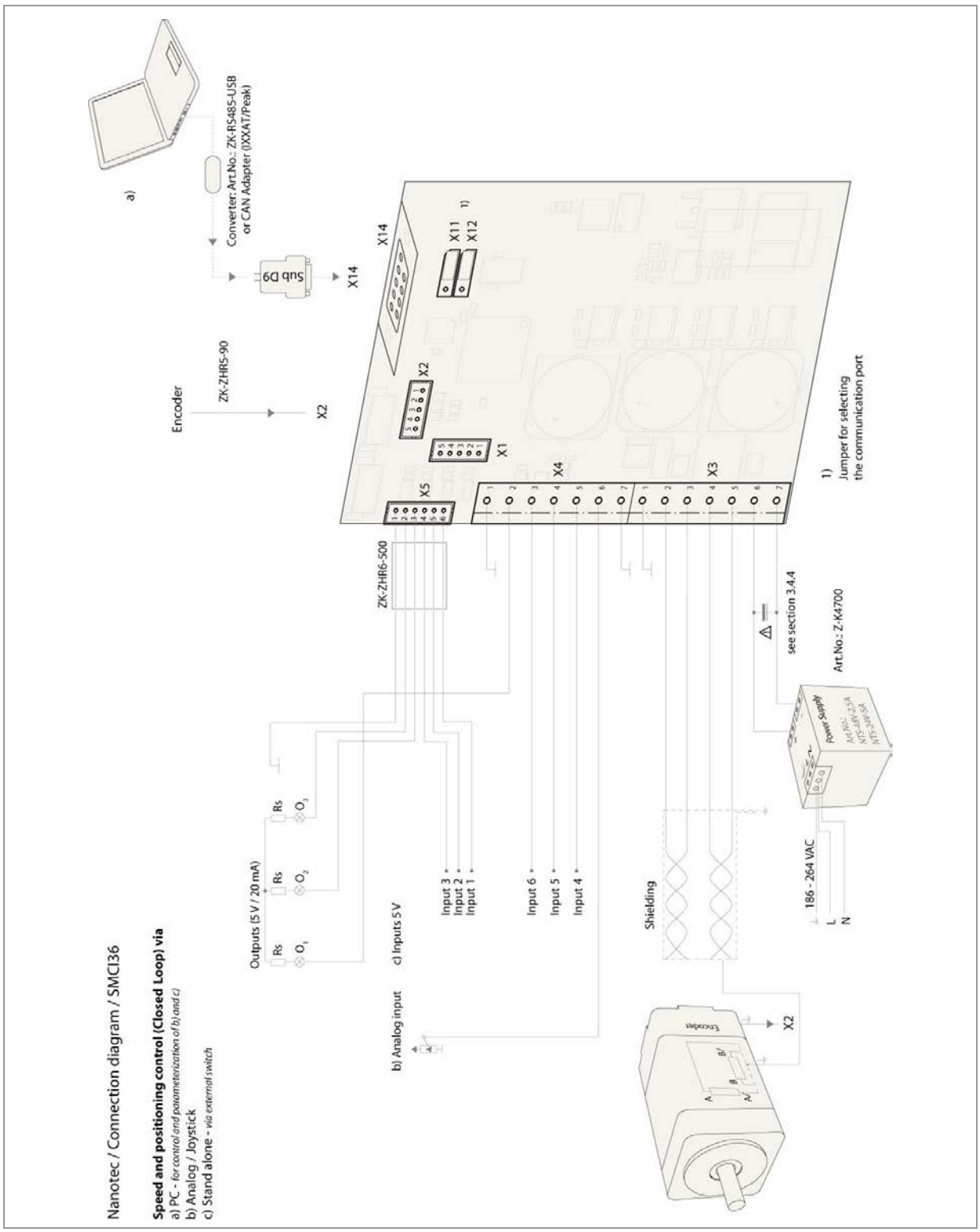
The following figure shows the arrangement of the connectors and the jumper on the printed circuit board.



2.2 Stepper motor

Connection diagram

To operate a stepper motor using the SMCI36, the wiring must be implemented according to the following connection diagram.

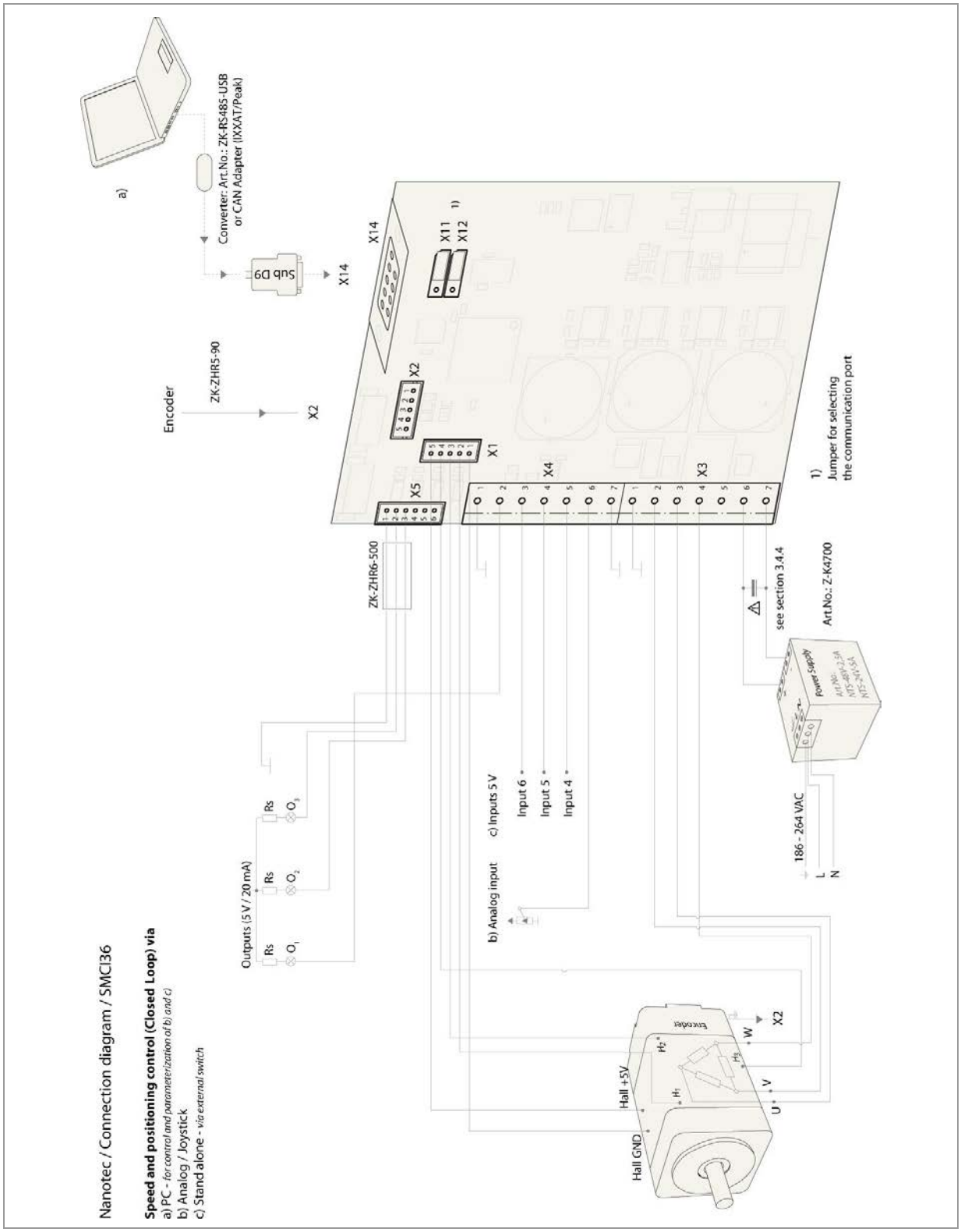


The pin configuration for the motor can be found on the motor data sheet, which can be downloaded from www.nanotec.com.

2.3 BLDC motor

Connection diagram

To operate a BLDC motor using the SMCI36, the wiring must be implemented according to the following connection diagram.



The pin configuration for the motor can be found on the motor data sheet, which can be downloaded from www.nanotec.com.

2.4 Commissioning

Introduction

Commissioning of the SMCI36 motor controller is described below.

If you want to work with a PLC or your own program later, you will find the necessary information in the separate "Programming Manual".

Familiarize yourself with the SMCI36 controller and the corresponding control software before you configure the controller for your application.

This section describes the main first steps you need to take to be able to begin working with the SMCI36 and the NanoPro software (RS485) or NanoCAN software (CANopen) from a PC. You will find more detailed information in the separate NanoPro and NanoCAN manuals.

Operation with presettings

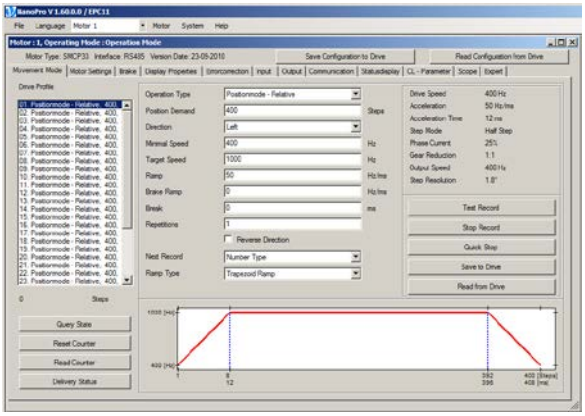
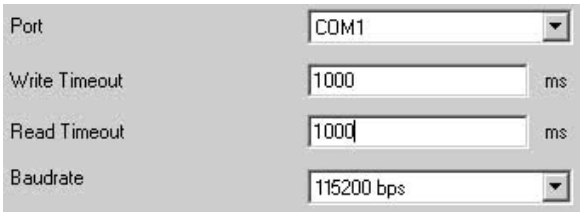
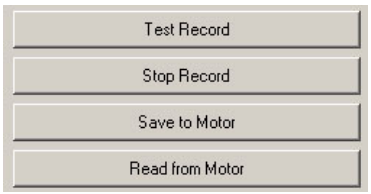
The SMCI36 is delivered with the following presettings:

- Operating mode: Positioning
- Step mode: Half step (with microstep emulation)
- Inputs on connectors X4/X5 (all 5 V):
  - Input 6 = external reference switch
  - Input 5 = record selection bit 3
  - Input 4 = record selection bit 2
  - Input 3 = record selection bit 1
  - Input 2 = record selection bit 0
  - Input 1 = start/reset
- Phase current: 50% (current level)
- Phase current during idle: 25% (idle current)

Commissioning with NanoPro

Proceed as follows when commissioning the controller with NanoPro:

Step	Action	Note
1	Install the NanoPro control software on your PC. See the NanoPro separate manual.	Download from www.nanotec.com
2	Connect the controller to the stepper motor according to the connection diagram.	Connection diagram, see Section 2. Detailed information on connections can be found in Section 3.
3	Switch on the operating voltage (12 V DC ... 72 V DC). **CAUTION!** An operating voltage > 75 V will destroy the output stage! • Follow the instructions in Section 3.4.4.	The red LED lights up briefly.
4	If necessary, install the driver for the converter cable ZK-RS485-USB.	Download from www.nanotec.com under the Accessories/Converter menu item

Step	Action	Note
5	Connect the controller to the USB port of your PC. Use the converter cable ZK-RS485-USB.	Order identifier: • ZK-RS485-USB
6	Start the NanoPro software. 	The NanoPro main menu opens.
7	Select the <Communication> tab. 	
8	In the "Port" field, select the COM port to which the SMCI36 is connected. 	The number of the COM port to which the controller is connected can be found in the device manager of your Windows PC (System Control/System/Hardware).
9	Select the "115200 bps" entry in the "Baudrate" selection field.	
10	Check the current setting using the motor data sheet. **Presettings:** • Phase current: 50% (current level) • Phase current during idle: 25% (idle current)	Under no circumstances may the current be set to a value higher than the rated current of the motor.
11	Select the "Movement Mode" tab. 	
12	Click on the <Test Record> button to carry out the pre-set travel profile. 	The connected motor operates with the pre-set travel profile (default travel profile after new installation).
13	You can now enter your required settings. For instance, you can enter a new travel profile.	See the NanoPro separate manual.

Commissioning with NanoCAN

Proceed as follows when commissioning the controller with NanoCAN:

Step	Action	Note
1	Install the NanoCAN control software on your PC.	Download from www.nanotec.com
2	Connect the controller to the stepper motor according to the connection diagram.	Connection diagram, see Section 2. Detailed information on connections can be found in Section 3.
3	Switch on the operating voltage (12 V DC ... 72 V DC). **CAUTION!** An operating voltage > 75 V will destroy the output stage! • Follow the information in Section 3.4.4.	
4	Install and configure your CANopen adapter from IXXAT or Peak.	Details can be obtained from the manufacturer of the CANopen adapter.
5	Start the NanoCAN software.	
6	Select the desired node ID, the baud rate and, if necessary, the CAN card in the <Configuration & NMT> tab.	
7	Check the current setting using the motor data sheet. **Presettings:** • Phase current: 50% (current level) • Phase current during idle: 25% (idle current)	Under no circumstances may the current be set to a value higher than the rated current of the motor!
8	Select the desired operating mode (e.g. PP mode) in the <Drive Modes> tab.	
9	Click on the <Power on> button.	
10	Enter the desired target position in the "target" field.	
11	Click on the <Start> button.	

3 Connections and circuits

3.1 Hall sensor: Connector X1

Pin assignment

Pin no.	Name	Observations
1	GND	
2	Hall 1	
3	Hall 2	
4	Hall 3	
5	+5 V	

3.2 Inputs and outputs: Connector X4 and X5

Introduction

An overview of the assignments can be found in the connection diagram in Section 2. This section looks in detail at the assignments, functions and circuits of connectors X4 and X5.

Pin assignment X4

Pin no.	Name	Observations
1	GND	
2	Output 1	Open collector output (max. 24 V, 0.5 A)
3	Input 6	Digital inputs (max. +5 V)
4	Input 5	
5	Input 4	
6	Analog In	Analog input (–10 V ... +10 V)
7	GND	

Pin assignment X5

The X5 connector is a JST-ZHR6 connector.
Matching connection cable: ZK-ZHR6-500 (length 500 mm, single-conductor).

Pin no.	Name	Observations
1	GND	
2	Output 3	Open collector outputs (max. 24 V, 0.5 A)
3	Output 2	
4	Input 3	Digital inputs (max. +5 V) In BLDC motors, inputs 1 to 3 cannot be used.
5	Input 2	
6	Input 1	

Function of the inputs

All digital inputs – with the exception of the "Clock" input in the clock directional mode – can be freely programmed using the NanoPro software (e.g. as a limit position switch, enable, etc.) and can be used for sequential control with NanoJ.

All inputs can be configured for “active-high" (PNP) or “active-low" (NPN) with NanoPro.

Signal states at the outputs

The following table shows the possible signal states at the outputs 1 to 3:

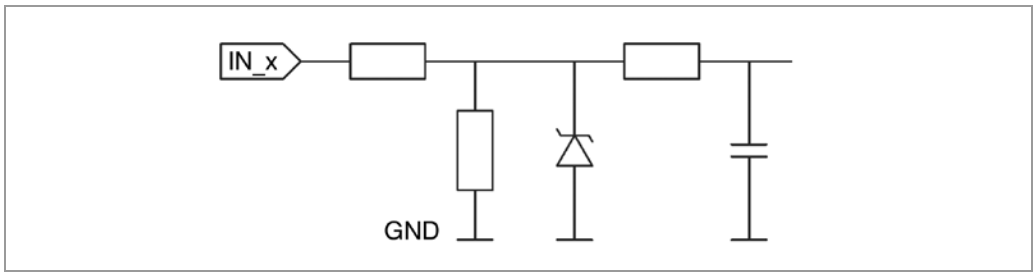
Signal states			**Meaning**
Output 3	Output 2	Output 1	
	0	0	Rotation monitoring (error) or limit switch
	0	1	Motor idle (waiting for new command)
	1	0	Busy (control processing last command)
	1	1	Reference point or zero point reached
1			Excess temperature or undervoltage

The outputs can be freely programmed using the NanoPro software.

Note:
Output 3 is also used to display errors and when switching on the controller.

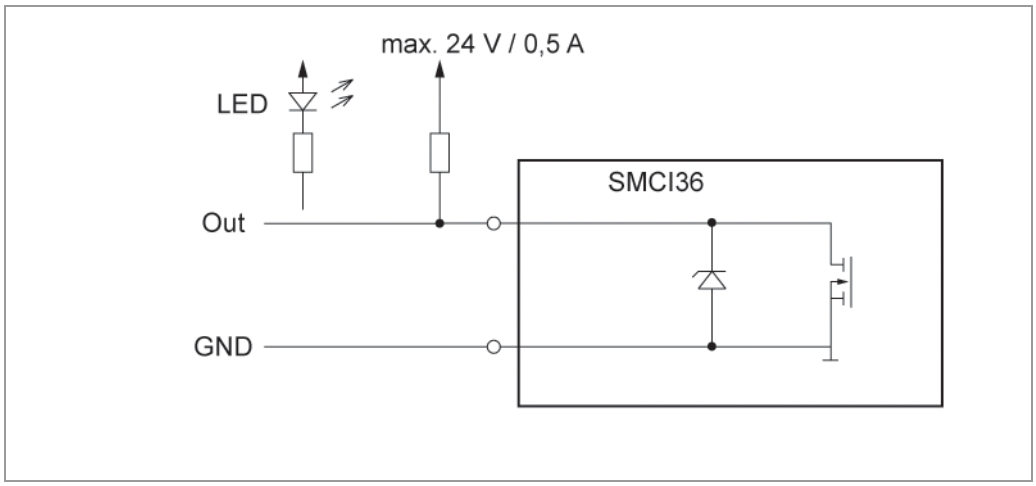
Input circuits

Note:
The voltage must not exceed 5 V. It should drop below 2 V for safe switching off and be at least 4.5 V for safe switching on.



Output wiring

The outputs are open collector outputs (0 switching; max. 24 V, 0.5 A). To be able to test the output, an LED with series resistance can be integrated. The LED lights up when the output is active.



3.3 Encoder connection: Connector X2

Pin assignment

The X2 connector is a JST-ZHR5 connector.
Matching connection cable: ZK-ZHR5-90 (length 90 mm, single-conductor).

Pin no.	Name	Observations
1	GND	
2	Track (B)	
3	Index track (I)	
4	Track (A)	
5	+5 V	

Optional encoder

An optional encoder can be connected to the controller.

By default, the controller is designed for a three-channel encoder with 500 pulses/revolution in a 1.8° stepper motor. With an 0.9° stepper motor, you should use an encoder with 1000 pulses/revolution to achieve the same control quality. Depending on the application, it may make sense to use higher encoder resolutions (up to max. 2000 pulses/revolution) to improve control quality or to use a lower resolution (min. 200 pulses/revolution) for low-cost applications or for step monitoring alone.

The following encoder resolutions can normally be processed by the controller: 192, 200, 256, 400, 500, 512, 1000, 1024, 2000, 2048, 4000, 4096.

Recommendation
If possible, use Nanotec encoders with the order identifier WEDS/WEDL-5541 Xxx.

If an encoder is **not** used, the "Disable" mode must be set in the <Errorcorrection> tab in the "Rotation Direction Mode" selection menu. See the NanoPro separate manual.

Using encoders with line drivers

The encoders of the WEDL series with a line driver output an inverted signal in addition to the encoder signal; this leads to better interference immunity and is especially recommended for long lines lengths (> 500 mm) and neighboring interference sources. The differential signal can be evaluated with a line driver/encoder adapter.

Since the SMCI36 is designed for device installation, the differential signals are not evaluated so that only channels A, B and I need to be connected to perform position monitoring. We recommend shielding and twisting the encoder line to minimize interference with the encoder signal from the outside.

If the line length in your application exceeds 500 mm, or if there is interference on the lines due to other sources, we recommend the use of controller SMCI33 or SMCI47-S, for which there is an adapter for encoders with a line driver.

3.4 Motor and voltage supply connection: Connector X3

3.4.1 Pin assignment

Pin no.	Name	Observations
1	GND	Earth (0 V)
2	A	See the data sheet of the connected stepper motor. For BLDC motors: • A = V • A/ = U • B = W • B/ = not connected
3	A/	
4	B	
5	B/	
6	Vcc	Operating voltage +12 V DC ... +72 V DC
7	GND	Earth (0 V)

3.4.2 Stepper motor connection

General information

The motor is connected to the SMCI36 with a 4-wire cable. Twisted wire pair cables with braided shields are recommended.

Danger of electrical surges

Mixing up the connections can destroy the output stage! See the data sheet of the connected stepper motor.

Never disconnect the motor when operating voltage is applied!

Never disconnect lines when live!

3.4.3 BLDC motor connection

See Section 2.3 "BLDC motor".

3.4.4 Power supply connection

Permissible operating voltage

The permissible operating voltage for the SMCI36 lies between +12 and +72 V DC; it must not exceed 75 V or fall below 10 V.

A charging condenser with minimum 4700 µF (10000 µF) must be provided for the operating voltage to prevent exceeding the permissible operating voltage (e.g. during braking).

Danger of electrical surges

Connect charging condensor with minimum 4700 µF!

Use charging capacitors Z-K4700 from Nanotec to a maximum operating voltage of 50 V only!

Connect a condenser with 10000 µF for motors with flange size 86x86 (series ST8918) or greater!

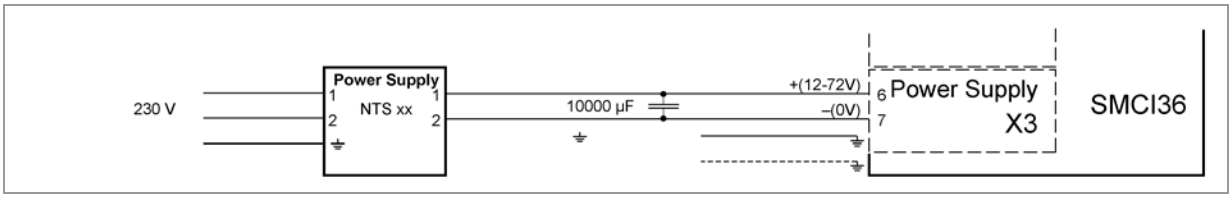
An operating voltage > 75 V will destroy the output stage!

Mixing up the connections can destroy the output stage! See the data sheet of the connected stepper motor.

Never disconnect the motor when operating voltage is applied!

Never disconnect lines when live!

Connection diagram



Note:
Complete connection diagram, see Section 2 "Connection and commissioning".

Accessories

Appropriate power packs and charging condensers are available as accessories:

Name	Order identifier
Power pack	NTS-xxV-yA (xx=voltage, y=current) Information on the selection of the required power supply unit can be found in our FAQ on www.nanotec.com.
Charging condenser	Z-K4700 (to max. 50 V) or Z-K10000

Note:
Further information about accessories can be found on the Nanotec website: www.nanotec.com.

3.5 RS485 network/CANopen: Connector X14

SMCI36 in a network

Up to 254 (RS485) or 127 (CANopen) stepper motor controllers can be controlled in a network from a PC or PLC.

These network connections are set up via the RS485/CANopen interface.

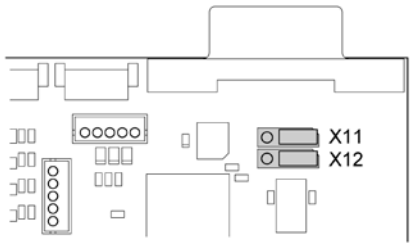
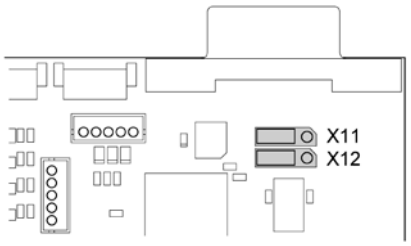
Pin assignment

Pin no.	Name	Observations
1	NC	Not assigned
2	Rx+ / CAN-	RS485 Rx+ / CAN low
3	CAN GND	Output GND (0 V)
4	Tx+	RS485 Tx+
5	NC	Not assigned
6	GND	Output GND (0 V)
7	Rx- / CAN+	RS485 Rx– / CAN high
8	GND	Output GND (0 V)
9	Tx–	RS485 Tx–

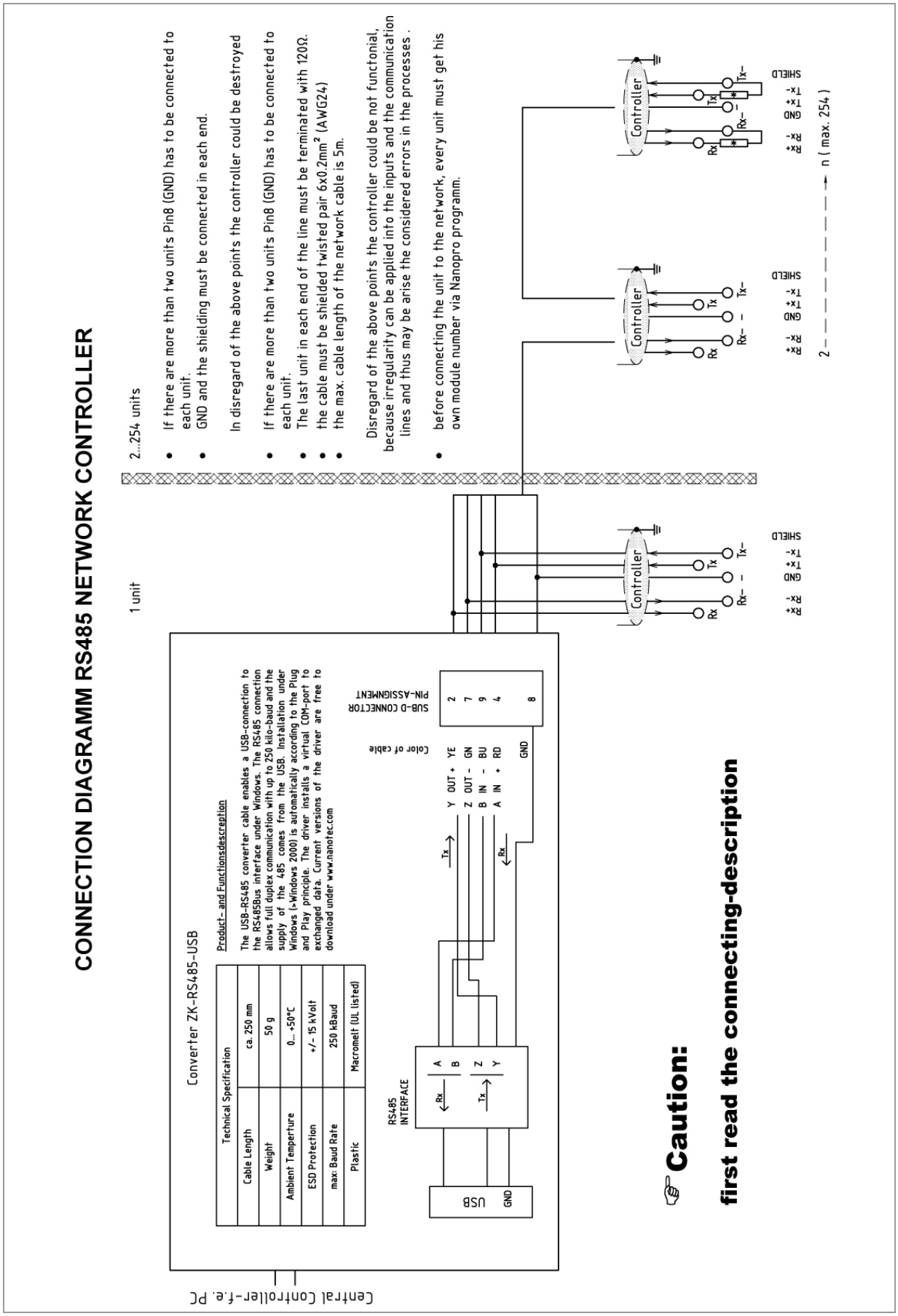
Jumper RS485/CAN

The controller has a jumper field (X11/X12) for selecting the communication port (RS485 or CAN).

When setting, note the copper label on the printed circuit board.

RS485	CAN
	

Circuit diagram RS485 network



CANopen connection

A suitable CAN interface adapter (e.g. USB adapter from IXXAT or PEAK) is required for connecting with a PC.

CANopen standard connector assignment (on the adapter)

Pin no.	Name
2	CAN low
3	CAN GND
7	CAN high

CANopen connection assignments on the controller

Circuits according to the CANopen standard connector assignment, see preceding table.

Notes on the baud rate

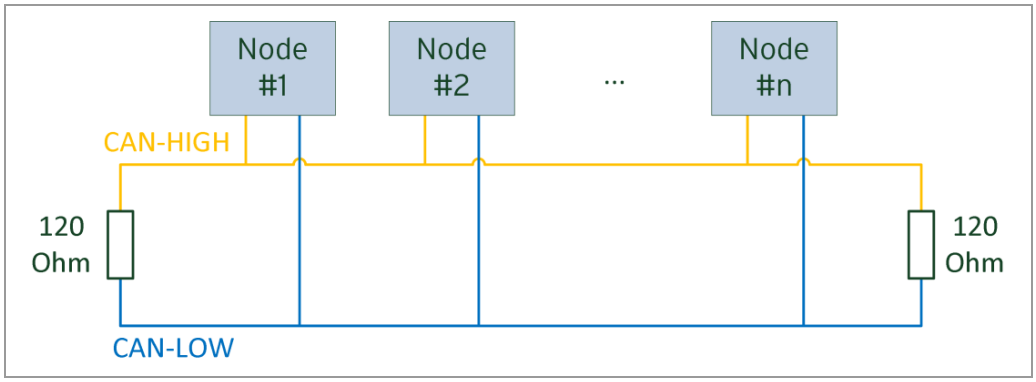
It is important to note that both the controller and the CAN master use the same baud rate. Only this way can communication be established.

The baud rate has a direct influence on the maximum possible bus length. The following setting shows the possible baud rates and the associated maximum permissible bus lengths.

Baudrate	Bus length
1 MBaud	40 m
500 kBaud	130 m
250 kBaud	270 m
125 kBaud	530 m
50 kBaud	1300 m
20 kBaud	3300 m

Notes on the bus termination

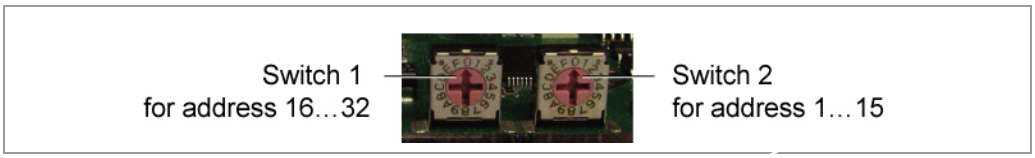
With CAN, the bus termination is handled by two 120 Ohm resistors on both ends of the bus.



Setting the RS485 module address

Hardware setting

The RS485 module address can be set by hardware via two HEX coded switches on the printed circuit board.



The 16's place is set with switch 1 (left) and the 1's place is set with switch 2 (right).

Addresses 0x00 and 0x80 signalize that the address can be set in the software.

For address settings via the HEX coded switches that are larger than 128, the value 128 must be subtracted from the set value.

Rotary switch value (decimal)	**0**	**1-127**	**128**	**129-255**
Rotary switch value (hex)	**0x00**	**0x01-0x7F**	**0x80**	**0x81-0xFF**
Node ID of rotary switch value		X		X-128
Node ID from EEPROM	X		X	

Example:

Module address	Switch 1 (left)	Switch 2 (right)
Software setting	0	0
1	1	0
2	2	0
...	...	...
15	F	0
16	0	1
17	1	1
...	...	...
32	0	2
...	...	...
64	0	3
...	...	...
80	0	5
...	...	...
96	0	6
...	...	...
112	0	7
...	...	...
127	F	7
Software setting	0	8
1 (129-128)	1	8
2 (130-128)	2	8
…	…	…
15 (143-128)	F	8
…	…	…
32 (160-128)	0	A
…	…	…
96 (224-128)	0	E
…	…	…
126 (254-128)	E	F
127 (255-128)	F	F

In case of the settings 0x00 and 0x80, between 1 and 255 can be set via the software addresses. Address values higher than 127 therefore can only be set via the software.

When the power supply is applied, the controller checks which address is set with the 2 hardware switches. This hardware address is then adopted. After the address is changed, the power supply must be briefly switched off and on again.

Software setting

Both switches are set to 0 at delivery. With this setting, the address can be changed in the software as of firmware status 04.12.2008 or later. See the NanoPro separate manual.

Setting the CANopen module address

There are two basic ways of setting the CANopen node ID and the baud rate:

- Hardware setting: via rotary switches on the controller
- Software setting: With NanoCAN, see separate manual for NanoCAN.

To be able to make a software setting with NanoCAN, a certain value must be set on the rotary switches of the controller; see the following table:

Rotary switch value dec (hex)	**Node ID**	**Baudrate**
0 (0x00)	from EEPROM	= 1 MBaud
1 - 127 (0x01 - 0x7F)	= rotary switch value	
128 (0x80)	from EEPROM	from EEPROM
129 - 255 (0x81 - 0xFF)	= rotary switch value minus 128	

Note:
The rotary switches must be set to the desired value before the controller is switched on since this value is only read in when the controller is restarted.

The rotary switches can be used to set a two-digit hexadecimal number (0x00 to 0xFF):

- Right rotary switch: 1's place (e.g. 0x0**F**)
- Left rotary switch: 16's place (e.g. 0x**F**0)

Example 1:

If the left rotary switch is set to 2 and the right rotary switch is set to 1 (0x**21**), this yields a decimal value of 33 (= 2*16 + 1*1).

In this case, the node ID is set to 33 on the hardware. The baud rate is set to 1 MBaud.

Example 2:

If the left rotary switch is set to 8 and the right rotary switch is set to 0 (0x**80**), this yields a decimal value of 128 (= 8*16 + 0*1).

In this case, the node ID and baud rate are read out of the EEPROM.

4 Operating modes

4.1 Serial operating modes

Introduction

Depending on the travel profile, the motor can be operated using different operating modes. Due to the great capacity and functions available, it offers designers and developers a rapid and simple method of resolving numerous drive requirements with less programming effort.

Select the required operating mode for each drive profile and configure the controller according to your requirements.

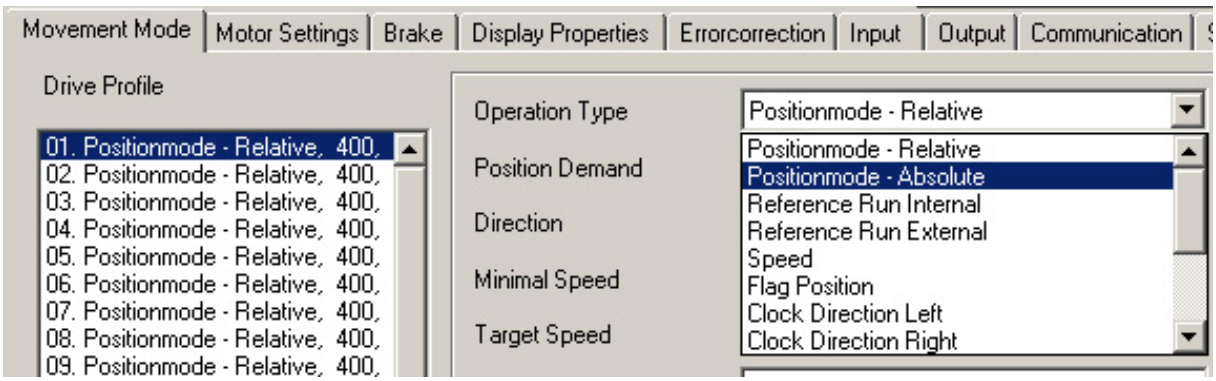
More detailed information can be found in the separate NanoPro manual.

Overview of operating modes and their areas of application

Operation mode	Application
Relative positioning	Use this mode when you wish to travel to a specific position. The motor travels according to a specified drive profile from a Position A to a Position B.
Absolute positioning	
Internal reference run	During the internal reference run, the motor travels to an internal reference point at the set minimum speed (index mark of encoder, only in combination with an encoder).
External reference run	During an external reference run, the motor travels to a switch connected to the reference input.
Speed mode	Use this mode when you wish to travel with a specific speed (e.g. a conveyor belt or pump speed). In the speed mode, the motor accelerates with a specified ramp from the starting speed (start frequency "V Start") to the specified maximum speed (maximum frequency "V Normal"). Several inputs enable the speed to be changed on-the-fly to different speeds.
Flag positioning mode	The flag positioning mode offers a combination of the speed and positioning modes. The motor is initially operated in speed mode; when a trigger point is reached, it changes to the positioning mode and the specified setpoint position (relative to the trigger position) is approached. This operating mode is used for labeling, for example: the motor first travels with the set ramp to the synchronous speed of the conveyed goods. When the labels are detected, the preset distance (position) is traveled to apply the labels.

Operation mode	Application
Clock direction mode, left	Use this mode when you wish to operate the motor with a superordinate controller (e.g. CNC controller). In the clock direction mode, the motor is operated via two inputs with a clock and a direction signal from a superordinate positioning control (indexer). Depending on the mode selected (Int. Ref./Ext. Ref.), the internal and external reference runs are supported.
Clock direction mode, right	
Clock direction mode Int. Ref.	
Clock direction mode Ext. Ref.	
Analog and joystick mode	The motor is controlled in this operating mode simply with a potentiometer or a joystick (–10 V to +10 V). Use this mode if you want to use the motor in a simple application: • Setting a specific speed, e.g. via an external potentiometer, • Traveling synchronously with a superordinate controller with analog output (–10 V to +10 V).
Analogue positioning mode	Use this mode when you wish to travel to a specific position. The voltage level on the analog input is proportional to the required position.
Torque mode	Use this mode when you require a specific output torque independent of the speed as is the case in typical winding and unwinding applications. The maximum torque is specified via the analog input.

Selecting the operating mode in NanoPro



4.2 CANopen operating modes

Introduction

The motor can be operated using a total of 5 different operating modes in CANopen mode.

More detailed information can be found in the separate NanoCAN manual.

Overview of operating modes and their areas of application

Operation mode	Application
Positioning Mode (PP Mode)	Use this mode if you want to use the motor for positioning. The motor moves from A to B with the set parameters (ramp, speed, etc.).
Speed Mode (Velocity Mode)	Use this mode when you wish to travel with a specific speed (e.g. a conveyor belt).
Reference run (Ref. Mode/Homing Mode)	Use this mode to reference the motor (internal/external/on block).
Interpolated Position Mode	Use this mode with a superordinate path control.
Torque Mode	Use this mode to specify a defined torque.

Selecting the operating mode in NanoCAN

In the <Drive Modes> tab the operating mode can be selected. When the tab is activated, the corresponding SDO is immediately written to the controller to activate the (possibly previously) selected operating mode.

5 Troubleshooting

Troubleshooting procedure

Proceed with care during troubleshooting and error rectification to avoid damaging the controller.

Danger of electrical surges

An operating voltage > 75 V and swapping of the connections can destroy the output stage.

Never disconnect the motor when operating voltage is applied!

Never disconnect lines when live!

Possible errors in serial mode

Error	Possible cause	Rectification
Controller is not ready	Data transmission to SMCI36 is not possible (communication error): Incorrect COM port selected.	In the <Communication> tab, select the PC port to which you connected the SMCI36 (e.g. "COM-1"). The port used can be found in the device manager of your PC.
	Wrong baud rate setting.	Select the baud rate 115200 bps in the <Communication> tab.
	The communication cable is not connected or is interrupted.	Only use the recommended ZK-RS485-USB converter from Nanotec.
	A non-existent motor number (module number) is set.	Set the correct module address. See the separate manual on NanoPro.
	The power supply of the SMCI36 is interrupted.	Check voltage supply, switch on if necessary.
	Another open program is blocking the COM port to which the SMCI36 is connected.	Close down other programs on your PC.
	Inadmissible data was sent to the controller during the output of a travel profile.	Click on the <Yes> button to stop the travel profile. The SMCI36 switches back to the "Ready" state. The data can then be resent to the controller.
Transmission error	Data transmission to the SMCI36 is disturbed (sender or receiver are disturbed).	Check that the motor connection is correctly wired. We recommend using Nanotec converter ZK-RS485-USB.
Position error	The motor cannot reach the position or the limit switch was overrun.	Click the <Yes> button in the error message; the error is reset.

Possible errors in CANopen mode

Error	Possible cause	Rectification
No communication with the controller	The wrong node ID has been set.	On the <Configuration & NMT> tab in NanoCAN, select the node ID that is set on the rotary switches of the controller.
	Wrong baud rate setting.	On the <Configuration & NMT> tab in NanoCAN, select the baud rate 1000 kbps.
	The communication cable is not connected or is interrupted.	Check all connections, especially the terminal resistances.
	CAN bus incorrectly terminated with 120 Ohm.	Ideally, terminate the bus on both ends with 120 Ohm.
Transmission error	Data transmission is disturbed (sporadically).	Switch the power supply off and on again.

6 Technical data

Electrical connections

Operating voltage V_b	DC 12 V to 72 V ±4%
Max. phase current	Adjustable up to max. 9 A/phase Continuous current 6 A/Phase
Current drop	Adjustable 0 to 150% of rated current
Interface	RS485 (4-wire) CAN bus (CANopen)

Controller parameters

Step resolution	Full Step Half Step Quarter Step Fifth Step Eighth Step 16th step 32nd Step 64th Step Feed rate Adaptive microstep (1/128)
Step frequency	16 kHz with a full step, corresponding multiples with a microstep (e.g. 1 MHz with 1/64) Max. input frequency, clock direction mode: 200 kHz
Position monitoring	depending on encoder resolution

Protective circuits

Overvoltage and undervoltage	Protective circuit for voltages > 75 V or < 10 V
Max. heat sink temperature	Approx. 75 °C
Max. ambient temperature	0 to 40 °C

Inputs and outputs

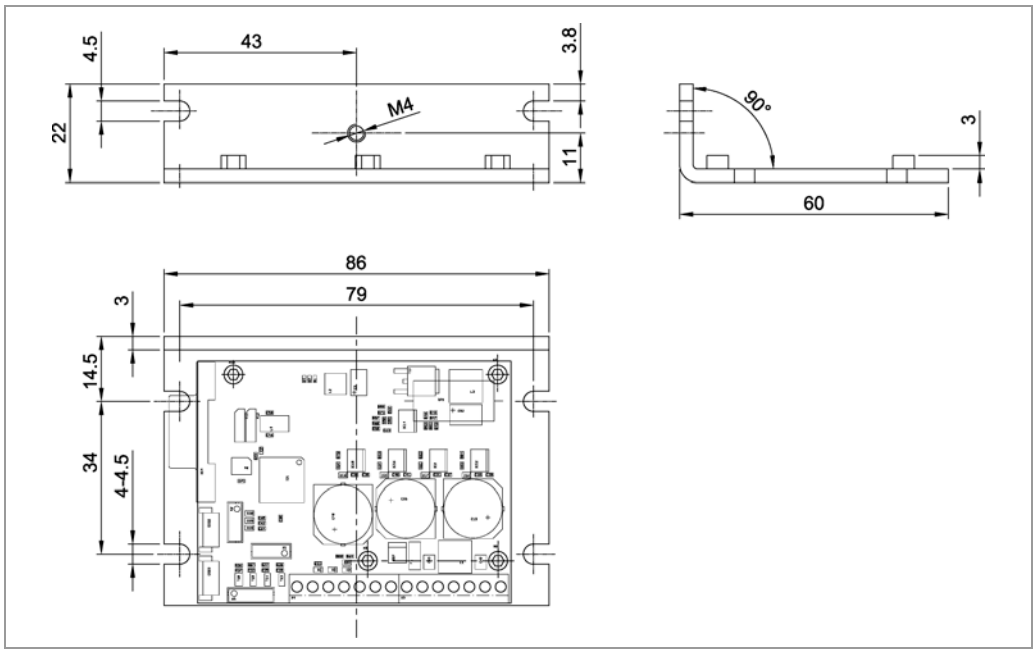
Inputs	• 6 digital inputs (TTL, max. 5 V) • 1 analog input (+10 V / • 10 V)
Outputs	• 3 open collector outputs (max. 24 V, 0.5 A)

Connectors

The following connectors are available on the SMCI36:

- Connectors X1, X2 and X5: JST-ZH
- Connectors X3 and X4: RIA type 059 screw terminal, 3.5 mm contact spacing
- Connector X14: D-sub 9-pin, socket (female)

Dimensions SMCI36



A complete set of datasheets is available for downloading at www.nanotec.com.

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