Technical Manual

Stepper driver
SMCI47-S

Editorial/About this manual

Thank you for choosing a Nanotec stepper driver!

Target group

This technical manual is aimed at designers and developers who need to operate a Nanotec® stepper motor without much experience in stepper motor technology.

About this manual

This technical manual must be carefully read before installation and commissioning of the driver.

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

This manual has been written 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

Version/Change overview

Version	Date	Changes
1.0	2009-02-02	New issue C+P
2.0	2009-07-01	Revision C+P

Contents

1   Overview

Introduction

The stepper driver SMCI47-S is an extremely compact and cost-effective constant current power 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 integrated encoders or brakes.

The SMCI47-S

Variants

The SMCI47-S is available in the following variants:

- SMCI47-S-2: with RS485 interface
- SMCI47-S-3: with CanOpen interface

SMCI47-S functions

The stepper driver SMCI47-S contains the following functions:

- Microstep 1/1 – 1/64 Final output stage (0.014° step resolution)
- Closed-Loop current control (sinusoidal commutation via the encoder)
- Powerful DSP microprocessor for flexible I/O
- Rotation monitoring for optional encoder
- RS485-/CanOpen interface for parameterization and control (USB connection possible via converter cable ZK-RS485-USB)
- Network capability of up to 32 motors
- Easy programming with the Windows software NANOPRO

Operating modes

The following operating modes can be selected:

- Positioning
- Speed
- Flag positioning
- Clock direction
- Analogue or joystick operation (±10 V)
- Analogue positioning mode
- Torque mode

Function overview

The operating behaviour of the motor can be set and optimised according to individual requirements by setting the motor-related parameters such as phase current (selectable in 1% increments), step resolution (from 1.8° - 0.014°), as well as the adaptive microstep (automatic adaption of step width). Machine-related parameters can be set using the NANOPRO software and significantly reduce commissioning time:

- Distance in steps, degrees or mm
- Speed in Hertz, rpm or mm/s
- Feed constant in mm/revolution
- Gear reduction with reverse clearance

Three adjustable reference modes (external and internal) enable automatic machine settings, whereby external reference switches may be inapplicable if there is a shift < 360° possibly due to the index signal of the internal encoder.

Even if stepper motors do not lose steps during normal operation, the integrated speed control provides additional security in all operating modes, e.g. against motor stalling or other external sources of error. The monitoring function detects a stalled motor or step loss after half a step at the most (for 1.8° stepper motors).

Automatic error correction is possible after the drive profile is ended or during the drive.

Closed-Loop current control (sinusoidal commutation via the encoder)

In contrast to conventional stepper motor controls where only the motor is actuated or the position adjusted via the encoder, sinusoidal commutation controls the stator magnetic field as in a servomotor via the rotary encoder. 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 driver recognises 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 driver are much lower compared to normal controlled operation.

Activation via CanOpen

It is possible to include the stepper driver in a CanOpen environment with the SCM147-S-3. You will find all further information about this topic in CanOpen-HowTo under www.nanotec.com.

In addition, the control via CanOpen has another safety function: Even when the voltage supply of the SMCI is interrupted, the processor continues to be supplied with power via the communication line and the position data cannot be lost so that the machine does not need to be referenced after being switched on.

2 Connection and commissioning

2.1 Connection diagram

Introduction

In order to operate a stepper motor using the stepper driver SMCI47-S, you must carry out the wiring in accordance with the connection diagram below.

Inputs (Pin 1 to 6) on the connector X1 and the encoder input (connector X3) can be used optionally.
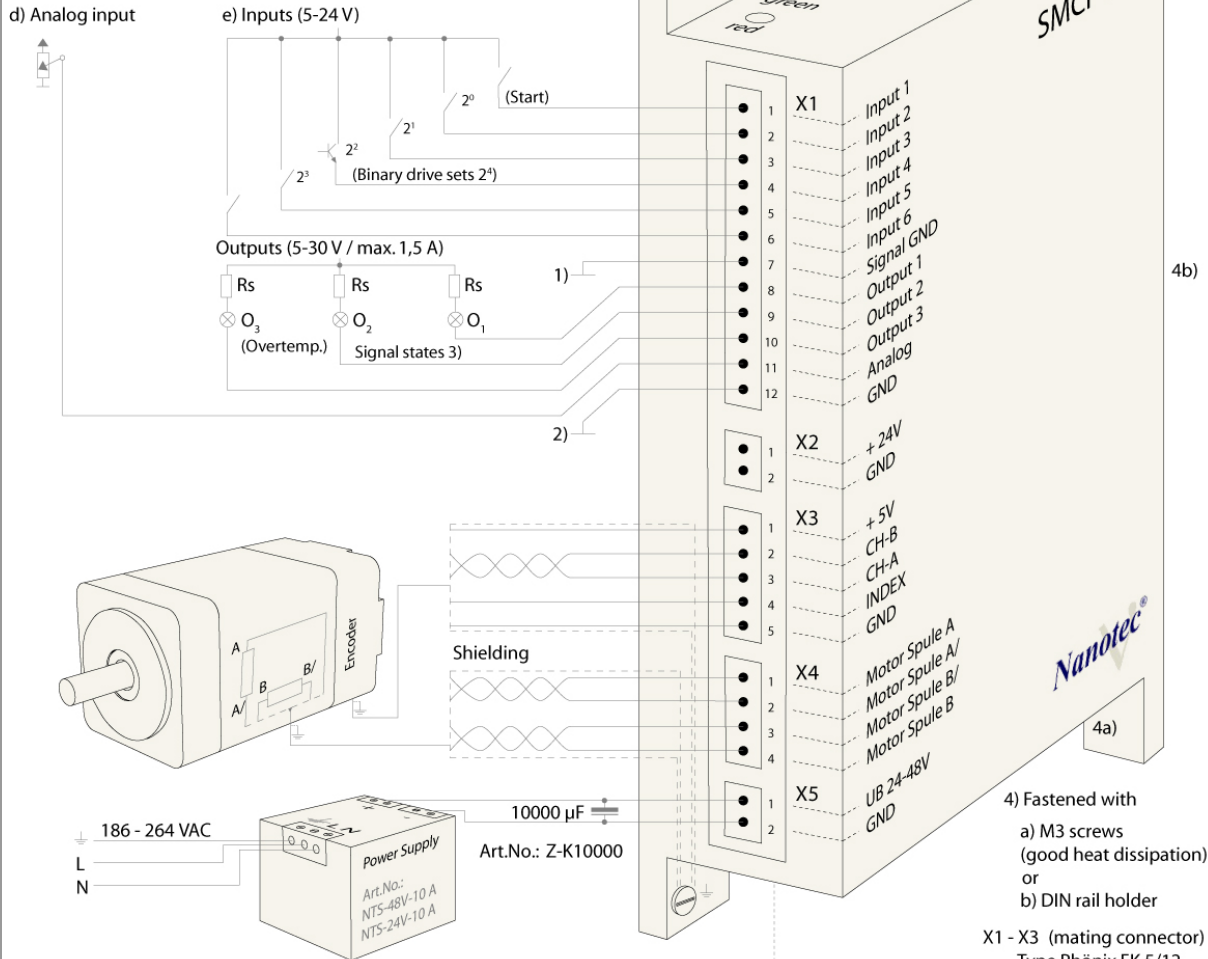
SMCI47-S connection diagram

Nanotec / Connection diagram / SMCI 47-S-2 (RS 485) / SMCI 47-S-3 (CanOpen)

Speed and positioning control (Closed Loop) via
a) PC - *for control and parameterization of c), d) and e)*
b) Industrial control system
c) SPS - *e.g. Logo or Easy*
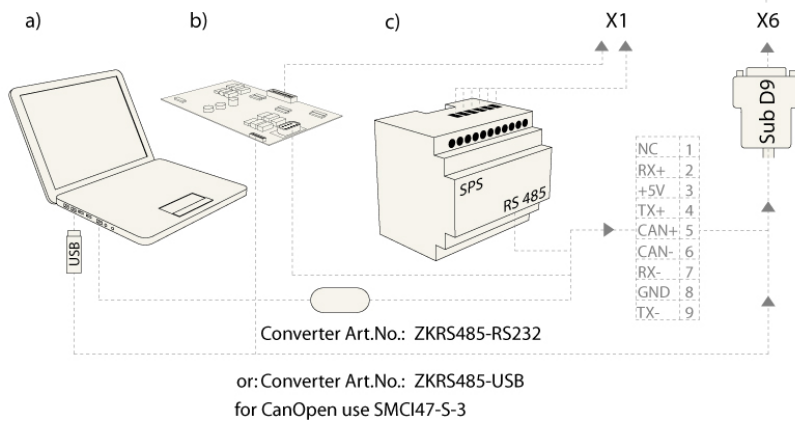d) Analog / Joystick
e) Stand alone - *via external switch*

X 1 - Inputs and outputs

d) Analog input   e) Inputs (5-24 V)

(Start)
2^0
2^1
2^2
2^3 (Binary drive sets 2^4)

Outputs (5-30 V / max. 1,5 A)

Rs   Rs   Rs
O_3 O_2 O_1
(Overtemp.)   Signal states 3)

1)
2)

X1
1 Input 1
2 Input 2
3 Input 3
4 Input 4
5 Input 5
6 Input 6
7 Signal GND
8 Output 1
9 Output 2
10 Output 3
11 Analog
12 GND

X2
1 + 24V
2 GND

X3
1 + 5V
2 CH-B
3 CH-A
4 INDEX
5 GND

Encoder
A B/
B A/

Shielding

X4
1 Motor Spule A
2 Motor Spule A/
3 Motor Spule B/
4 Motor Spule B

X5
1 UB 24-48V
2 GND

186 - 264 VAC
L
N

Power Supply
Art.No.:
NTS-48V-10 A
NTS-24V-10 A

10000 µF
Art.No.: Z-K10000

4a)

X6
Sub D9

SMCI 47-S

green
red

Nanotec

4b)

4a)

4) Fastened with
   a) M3 screws
      (good heat dissipation)
      or
   b) DIN rail holder

X1 - X3 (mating connector)
Type Phönix FK 5/12

X4 - X5 (mating connector)
Type Phönix FKC 2/4

a)   b)   c)   X1   X6

USB

SPS   RS 485

NC   1
RX+ 2
+5V 3
TX+ 4
CAN+ 5
CAN- 6
RX- 7
GND 8
TX- 9

Sub D9

Converter Art.No.: ZKRS485-RS232

or: Converter Art.No.: ZKRS485-USB
for CanOpen use SMCI47-S-3

3)

O_3	O_2	O_1	Signal states Output 1 and 2
	0	0	Rotary 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			Overtemperature

2.2   Commissioning

Provisions

The connection and commissioning of the SMCI47-S stepper driver are described below.
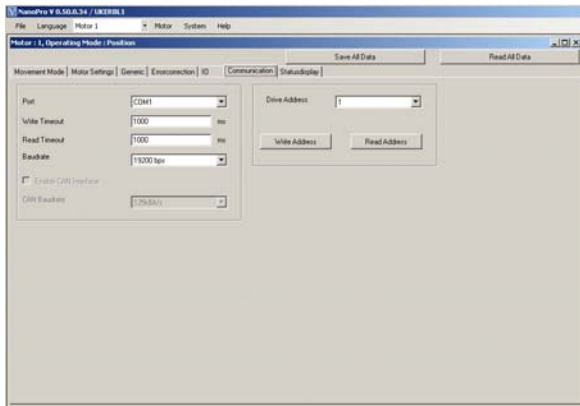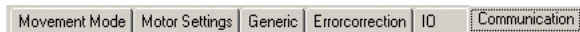
The main "First steps" are described here to work as fast as possible with the SMCI47-S if you want to work with the NANOPRO software from a PC. You will find more detailed information in the separate NANOPRO manual.
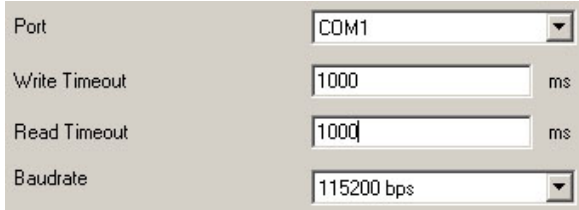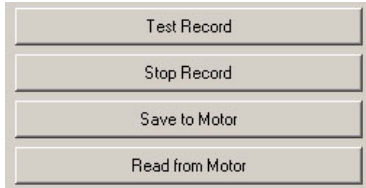
If you want to work at a later time with a PLC or your own program, you will find the necessary information in the separate "Command Reference".

Familiarise yourself with the SMCI47-S stepper driver and the corresponding driver software NANOPRO before you configure the driver for your application.

Procedure

Proceed as follows to commission the driver:

Step	Action	Note
1	Install the driver software NANOPRO on your PC. See the separate manual on NANOPRO as well.	Download from www.nanotec.com/downloads.
2	Connect the driver to the stepper motor according to the connection diagram.	Connection diagram, see Section 2.1. Detailled information on connections can be found in Chapter 3 „Connections and circuits".
3	Switch on the operating voltage (24 V DC ... 48 V DC).	The green LED lights up.
4	Connect the driver with your PC. Use one of the following converter cables for this purpose: • ZK-RS485-RS232 for connection to the serial interface • ZK-RS485-USB for connection to the USB interface	Order number: • ZK-RS485-RS232 • ZK-RS485-USB **Note:** Download the necessary driver from www.nanotec.com under the menu item Accessories/Converter
5	Start the NANOPRO software. 	The NANOPRO main menu appears.
6	Select the "Communication" tab. 	

| Step	Action	Note
7	In the field "Port", select the COM port to which the SMCI47-S is connected. Port COM1 Write Timeout 1000 ms Read Timeout 1000 ms Baudrate 115200 bps	The number of the COM port to which the driver is connected can be found in the device manager of your Windows' PC (System Supervision/ System/ Hardware).
8	Select the entry "115200 bps" in the selection field "Baudrate".	
9	Select the "Movement Mode" tab. Movement Mode | Motor Settings | Generic | Errorcorrection | IO | Communication	
10	Click on the button <Test Record> to carry out the pre-set travel profile. Test Record Stop Record Save to Motor Read from Motor	The connected motor operates with the pre-set travel profile (default travel profile after new installation).
11	You can now enter your required settings. For instance, you can enter a new travel profile.	See the separate manual on NANOPRO as well.

3 Connections and circuits

3.1 Inputs and outputs (I/O): Connector X1

Introduction

An overview of the assignments can be found in the connection diagram in Section 2.1. This section looks in detail at the assignment, functions and circuits of the connector X1.

The connectors and sockets used are from Phönix, Order number: FK-MC 2/4/5/12.

Connection diagram inputs and outputs (I/O) (X1)
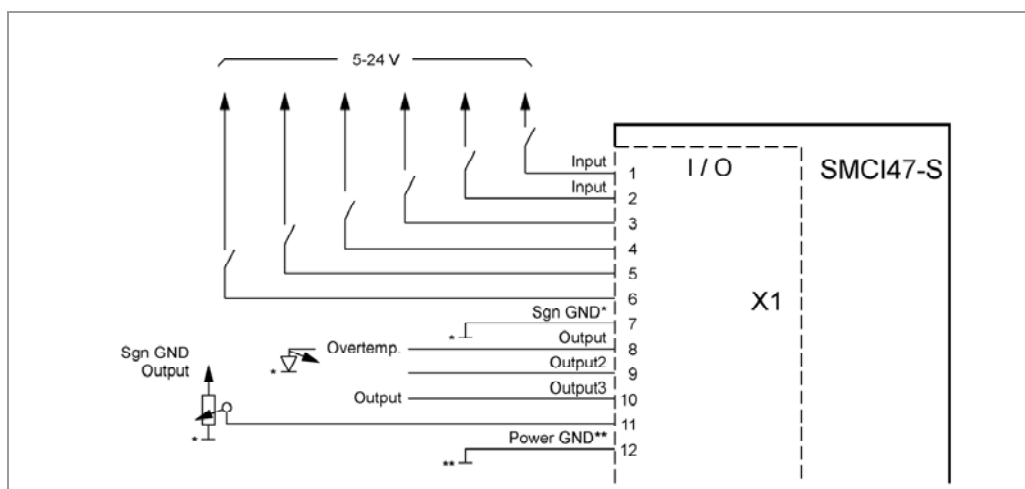
Pin assignment connector X1: Inputs and outputs (I/O)

Pin-No.	Name	Observations	Operating mode					
			Position	**Speed**	**Flag position**	**Clock direction**	**Analogue**	**Joystick**
1	Input1	5-24 V Optocoupler	Start Reset	Enable	Start	Enable	Enable	Enable
2	Input2	5-24 V Optocoupler	Travel profile	Speed	Travel profile	Manual mode	Speed	Speed
3	Input3	5-24 V Optocoupler	Travel profile	Speed	Travel profile	Manual mode	Speed	Speed
4	Input4	5-24 V Optocoupler	Travel profile	Speed	Travel profile	Ext. limit switch	Speed	Speed
5	Input5	5-24 V Optocoupler	Travel profile	Speed	Trigger	Direction	Speed	Speed
6	Input6	5-24 V Optocoupler	Ext. limit switch	Direction	Ext. limit switch	Clock	Direction	
7	Com	Signal GND						
8	Output1	Open-Collector						
9	Output2	Open-Collector						
10	Output3	Open-Collector						
11	Analogue In	–10 V ... +10 V					Analogue In	Analogue In
12	GND	Power & Analogue GND						

> **Note:**
> The Com and GND connections are not joined. Com provides the mass for the inputs
> and GND provides the mass for the outputs and the internal circuits.
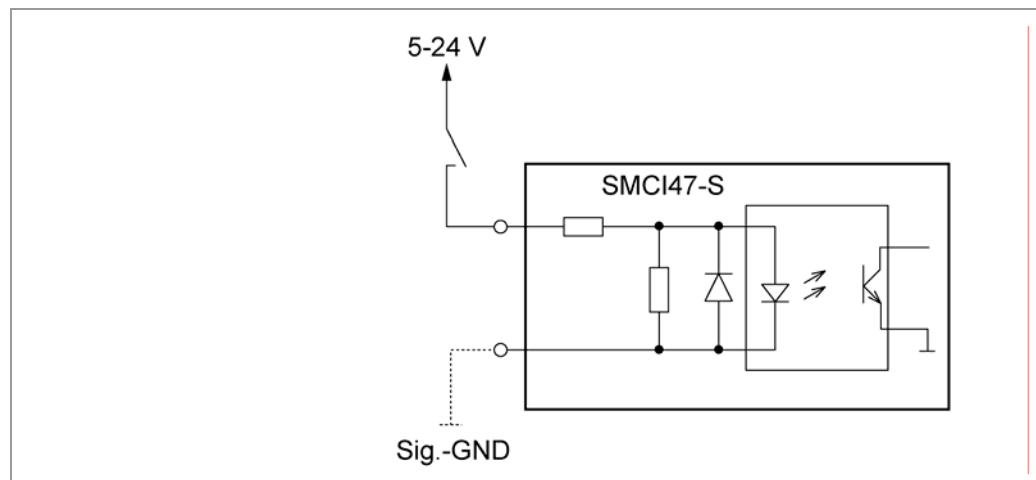
Input circuits

All inputs (apart from the "Analogue In" input) are electrically isolated by optocouplers
from the voltage supply of the SMCI47-S and designed for 5-24 V input signals at an
input current of 10 mA.

The digital inputs 1 to 6 can be configured with the aid of the software NANOPRO for
"active-high" or "active-low". In addition, these can be freely programmed there, e.g.
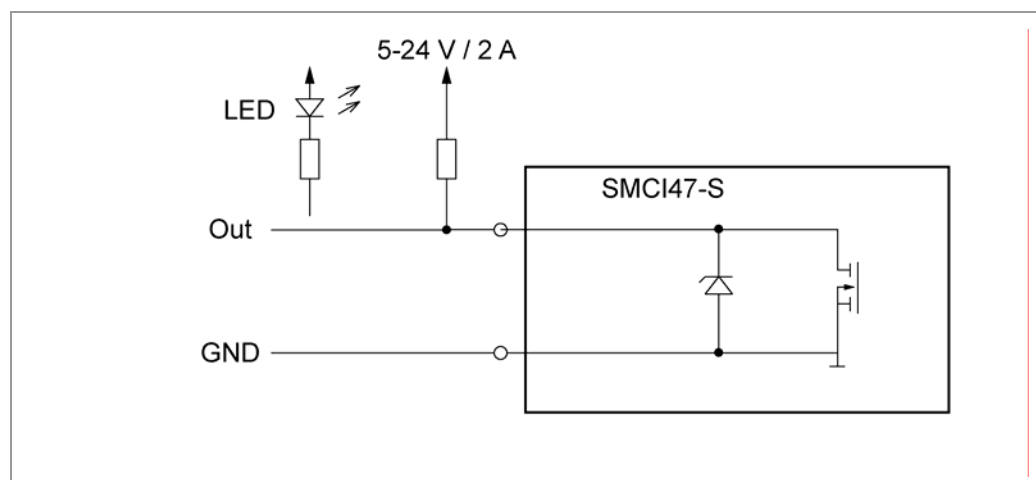as limit switch, enable, etc.

> **Note:**
> The voltage should drop below 2 V for safe switching off and be at least 4.5 V for safe
> switching on.

Output circuits

The outputs are MosFET outputs in an Open-Drain circuit (0 switching, max. 24 V /
2 A). An LED can be integrated to test the output. The LED lights up when the output
is active.

3.2 Brake connection: Connector X2

Function

The connector X2 is used to connect an external safety brake for the motor. This allows the holding torque and therefore the system stiffness to be increased further when necessary.

Parameters

The brake parameters can be configured in the "Motor Settings" tab, see the separate manual on NANOPRO as well.

Pin assignment connector X2

Pin-No.	Name	Observations
1	+24 V	
2	GND	

3.3   Encoder connection: Connector X3

Optional encoder

An optional encoder can be connected to the stepper driver.

By default, the closed-loop control for a three-channel encoder is set up with 500 pulses/revolution in an 1.8° stepping motor. With an 0.9° stepping 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 driver: 192, 200, 256, 400, 500, 512, 1000, 1024, 2000, 2048.

Recommended:
Where possible, use Nanotec encoders with the order number HEDS/HEDL-5540 Xxx.

If an encoder is **not** used, the mode "Disable" must be set in the tab "Errorcorrection" in the selection menu "Rotation Direction Mode". See the separate manual on NANOPRO as well.

Using encoders with line driver

As well as the encoder signal, the encoders of the HEDL series with line driver also output an inverted signal that contributes to better interference immunity and is especially recommended for long cable lengths.

SMCI drivers cannot currently evaluate this signal so only channels A, B and I have to be connected in order to monitor positioning. We recommend shielding and twisting the encoder line to minimise external interference influences on the encoder signal.

In the third quarter of 2009 Nanotec is bringing an adapter onto the market which can also evaluate the differential signal.

Encoder connection diagram (X3)
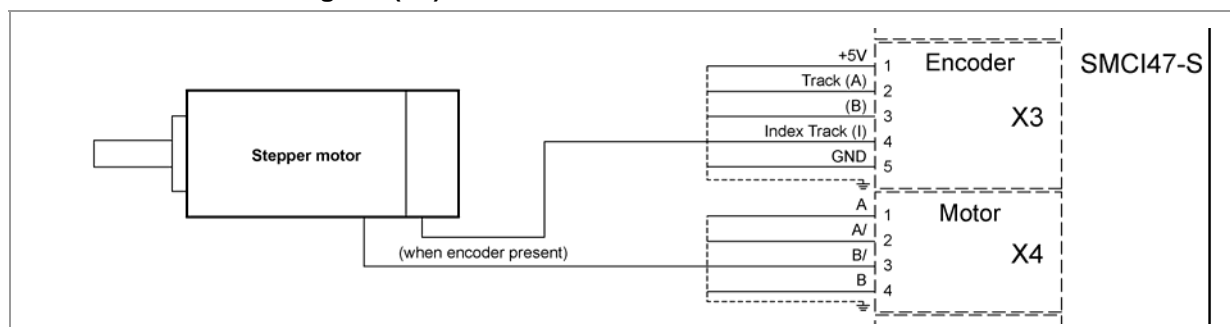
Note:
Complete connection diagram - see Section 2.1.

Pin assignment connector X3: Encoder

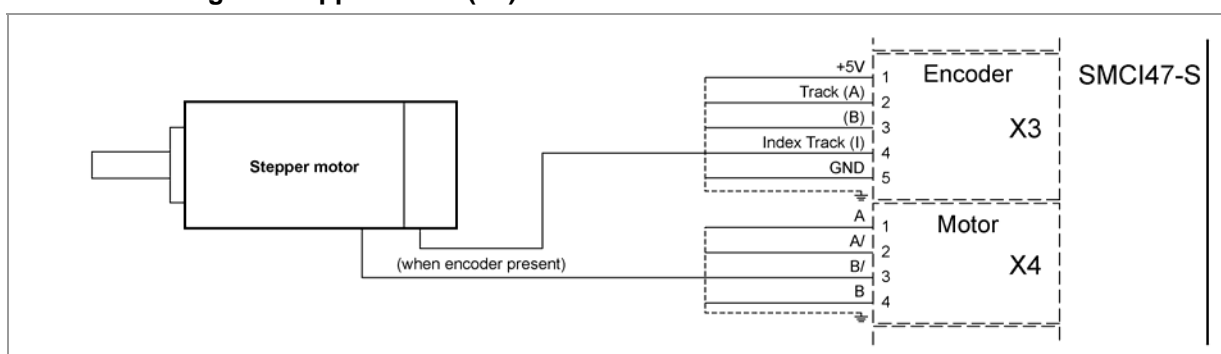| Pin-No.	Name	Observations
1	+5 V	
2	Track (A)	
3	Track (B)	
4	Index track (I)	
5	GND	

3.4 Stepper motor connection: Connector X4

General information

The motor is connected to the SMCI47-S 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! Never disconnect the link when operating voltage is applied! **Never** disconnect lines when live!

Connection diagram stepper motor (X4)

Note:
Complete connection diagram - see Section 2.1.

Pin assignment connector X4: Stepper motor

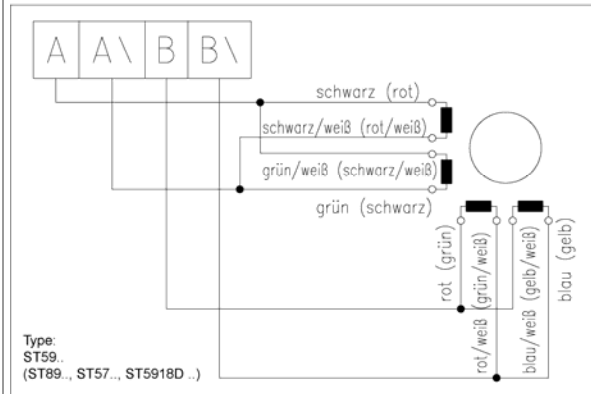| Pin-No.	Name	Observations
1	A	See also data sheet of connected stepper motor (colour code of 4 wires).
2	A/	
3	B/	
4	B	

If you are using a motor with 6 or 8 connections, you need to connect the windings.

The diagram on the next page shows four wiring plans for motors with 6 or 8 connections (page from the Nanotec product catalogue).

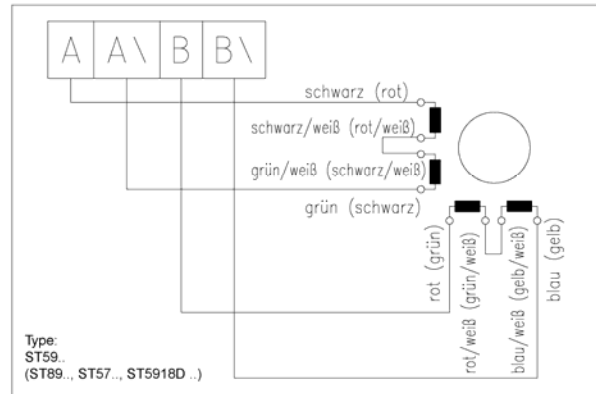Details can be found on the Nanotec website www.nanotec.com.

8 lead wire - parallel   for high frequency > 1 kHz

current per winding x 1,4   = current per Phase
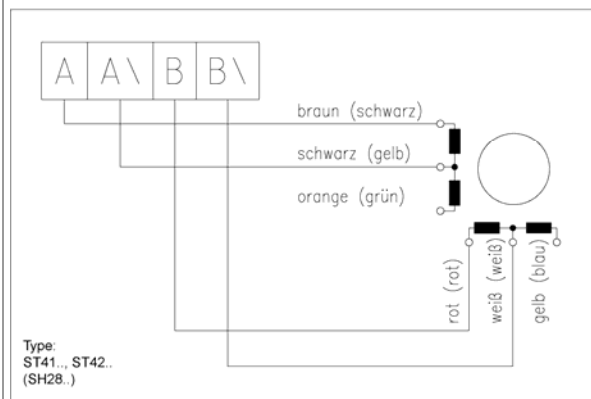example: current / winding 1A   = 1,4A / Phase

A   A\   B   B\

schwarz (rot)
schwarz/weiß (rot/weiß)
grün/weiß (schwarz/weiß)
grün (schwarz)

rot (grün)
rot/weiß (grün/weiß)
blau/weiß (gelb/weiß)
blau (gelb)

Type:
ST59..
(ST89.., ST57.., ST5918D ..)

8 lead wire - serial   for low frequency < 1 kHz

current per winding x 0,7   = current per Phase
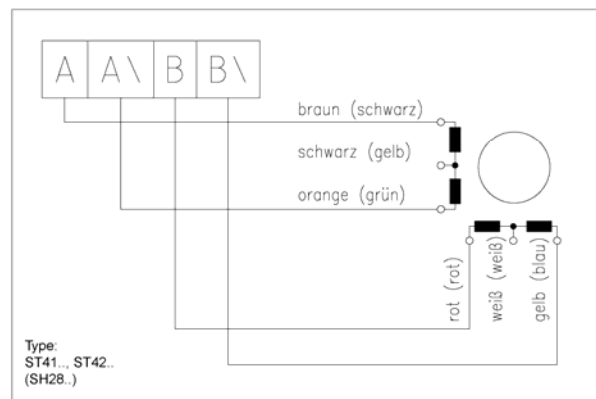example: current / winding 1A   = 0,7A / Phase

A   A\   B   B\

schwarz (rot)
schwarz/weiß (rot/weiß)
grün/weiß (schwarz/weiß)
grün (schwarz)

rot (grün)
rot/weiß (grün/weiß)
blau/weiß (gelb/weiß)
blau (gelb)

Type:
ST59..
(ST89.., ST57.., ST5918D ..)

6 lead wire

current per winding   = current per Phase
example: current / winding 1A   = 1A / Phase

A   A\   B   B\

braun (schwarz)
schwarz (gelb)
orange (grün)

rot (rot)
weiß (weiß)
gelb (blau)

Type:
ST41.., ST42..
(SH28..)

current per winding x 0,7   = current per Phase
example: current / winding 1A   = 0,7A / Phase

A   A\   B   B\

braun (schwarz)
schwarz (gelb)
orange (grün)

rot (rot)
weiß (weiß)
gelb (blau)

Type:
ST41.., ST42..
(SH28..)

4 lead wire

current per winding   = current per Phase
example: current / winding 1A   = 1A / Phase

A   A\   B   B\

braun (schwarz)
orange (grün)

rot (rot)
gelb (blau)

Type:
ST41.., ST42..
(SH20..)

current per winding   = current per Phase
example: current / winding 1A   = 1A / Phase

A   A\   B   B\

rot
weiß

gelb
grün

Type:
ST110..
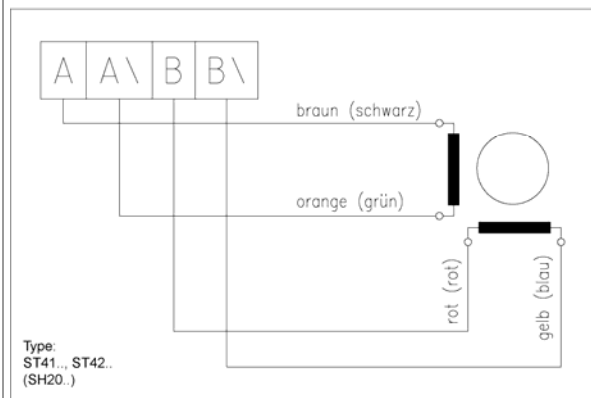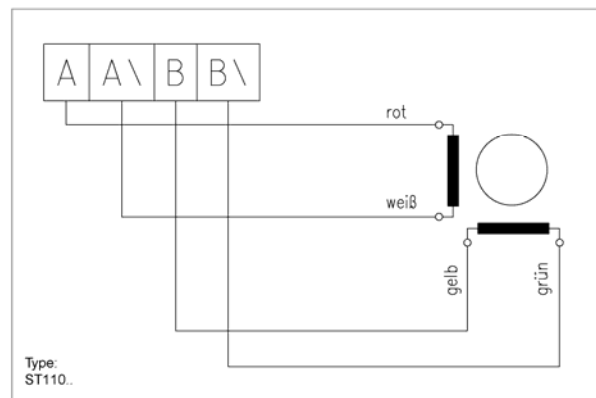
3.5 Voltage supply connection: Connector X5

Permissible operating voltage

The permissible operating voltage for the SMCI47-S stepper driver lies between +24 and +48 V DC; it must not exceed 50 V or fall below 21 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 condenser with minimum 4700 µF! Connect a condenser with 10000µF for motors with flange size 86x86 (series ST8918) or greater! An operating voltage > 50 V will destroy the output stage! Mixing up the connections can destroy the output stage! Never disconnect the link when operating voltage is applied! **Never** disconnect lines when live!

Connection diagram voltage supply (X5)
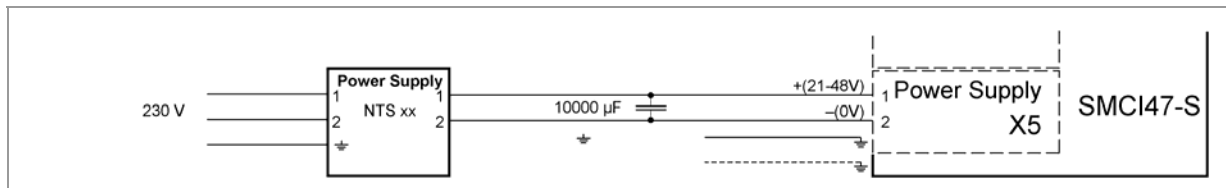
Note:
Complete connection diagram - see Section 2.1.

Voltage supply connections: Connector X5

Pin-No.	Name	Observations
1	Vcc	Switch on the operating voltage (+24 V DC ... +48 V DC)
2	GND	Earth (0 V)

Accessories for voltage supply

Appropriate power packs and charging condensers are available as accessories:

Name	Order number
Power pack	NTS-xxV-xA
Charging condenser	Z-K4700 or Z-K10000

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

3.6 RS485 network/CanOpen interface: Connector X6

SMCI47-S in a network

Up to 32 stepper drivers can be controlled in a network from a PC or PLC.

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

If you use the control with CanOpen you can use the additional safety function of the separate logic supply: Even when the voltage supply of the SMCI47-S is interrupted, the processor continues to be supplied with power via the communication line and the position data cannot be lost so that the machine does not need to be referenced after being switched on.

You will find all further information about communication with CanOpen in the corresponding instructions under www.nanotec.com

RS485/CanOpen interface (D-Sub socket connector): Connector X6

A 9 pin D-Sub socket connector is located on the top of the SMCI47-S (connector X6). The connector X6 can provide the optional connection to the RS485/CanOpen network
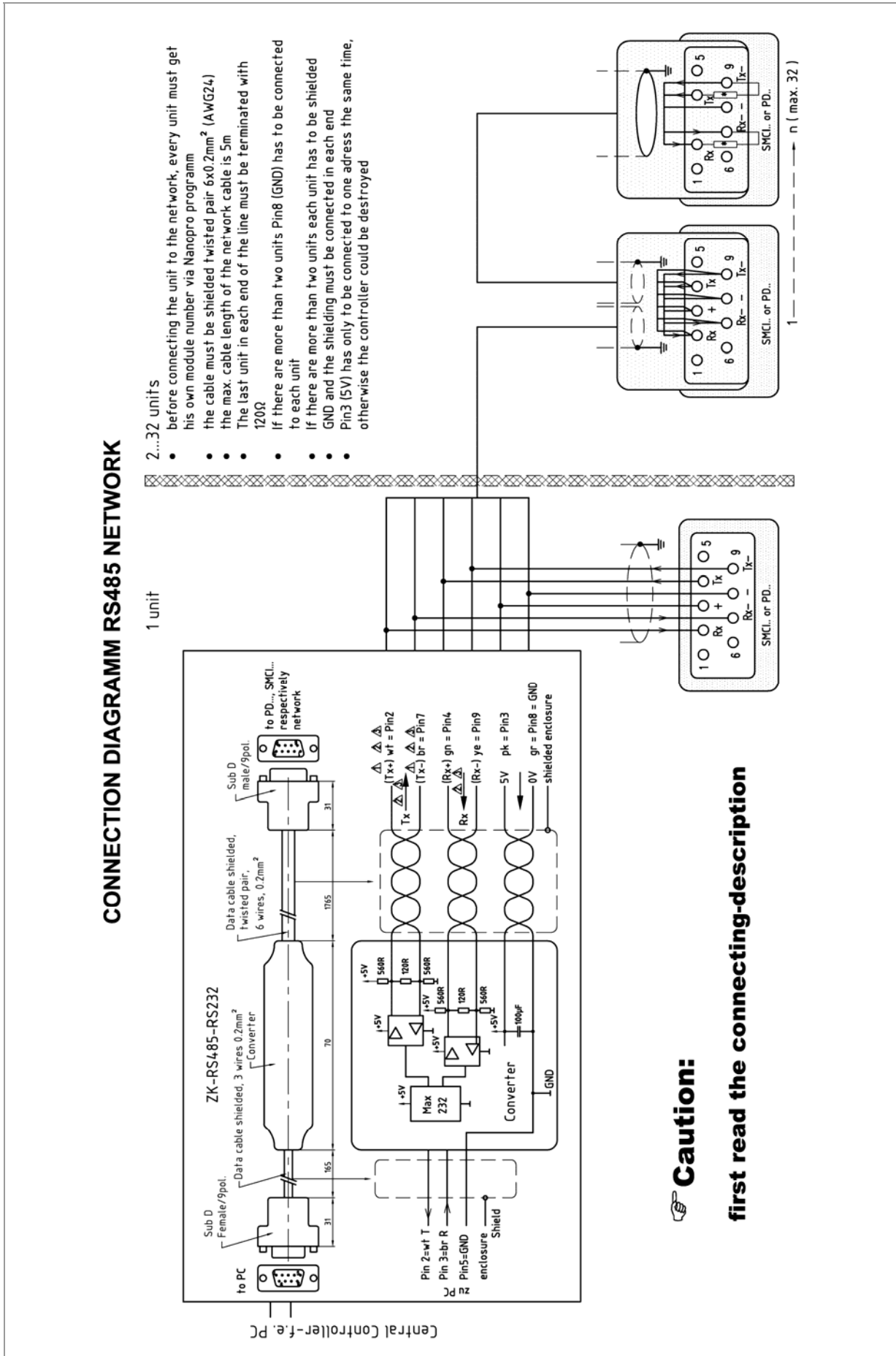
RS485/CanOpen socket connector
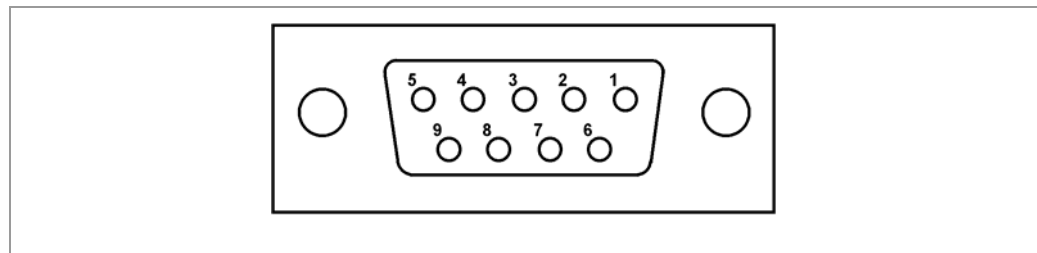
Connection requirements

- The RS485 4-wire bus is used as a pure Master-Slave application. All SMCI47-S are connected in parallel as Slaves to the bus.
- Up to 32 stations can be operated on the network.
- The length of the connection lines (stub lines) must be as short as possible and should not exceed 5 m.
- To avoid reflections during data transmissions, both ends of the bus line should be fitted with a 120 Ω termination resistor (typical value of the characteristic impedance of a 24 AWG twisted cable) (R1 to R4).
- To ensure a defined quiescent level, the resistances R5 to R8 must be connected permanently to the bus according to the above diagram.
- If a converter is connected between the Master and the network, only resistances R3 and R4 are necessary.
- Note the connection diagram. The output stages can be destroyed if this is not complied with.
- Use the recommended ZK-RS485-RS232 converter from Nanotec. Reliable operation cannot be guaranteed with other converters.

Circuit diagram RS485 network

CONNECTION DIAGRAMM RS485 NETWORK

2...32 units

- before connecting the unit to the network, every unit must get his own module number via Nanopro programm
- the cable must be shielded twisted pair 6x0.2mm² (AWG24)
- the max. cable length of the network cable is 5m
- The last unit in each end of the line must be terminated with 120Ω
- If there are more than two units Pin8 (GND) has to be connected to each unit
- If there are more than two units each unit has to be shielded GND and the shielding must be connected in each end
- Pin3 (5V) has only to be connected to one adress the same time, otherwise the controller could be destroyed

Caution:
first read the connecting-description

Pin assignment connector X6: RS485 interface

Pin-No.	Name	Observations
1	NC	not assigned
2	A	RS-485 Rx+
3	+5 V	Output +5 V
4	Y	RS-485 Tx+
5	NC	
6	NC	
7	B	RS-485 Rx–
8	GND	Output GND (0 V)
9	Z	RS-485 Tx–

Pin assignment connector X6: CanOpen interface

Pin-No.	Name	Observations
1	NC	
2	CAN–	CAN low
3	CAN Ground	Internally connected with pin 6
4	NC	
5	Shield	
6	CAN Ground	Internally connected with pin 3
7	CAN+	CAN high
8	NC	
9	Vcc	Supply up to 30 V. Used for safety feature.

Two-wire operation

To enable RS-485 two-wire transmission capability, all bus stations must have a direction control.

An intelligent converter, which automatically switches to transmission mode when a start bit is received at the RS-232 interface and returns to reception mode at the end of the stop bit, enables two-wire operation of the SMCI47-S. This solution requires no software support.

We can recommend the ICP-7520 converter, for example, that is available from Schuricht.

Talk to our Technical Hotline if you require support for this.

4 Operating modes

Introduction

The stepper driver can be operated in a total of eight 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 your stepper motor application and configure the driver according to your requirements. You will find more detailed information in the separate manual on NANOPRO.

Overview of operating modes and their areas of application

Operating mode	Application
Positioning mode	Use this mode when you wish to travel to a specific position.
	In the positioning mode, the motor travels according to a specified travel profile from a Position A to a Position B.
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; hen 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, e.g. for labelling: 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 travelled to apply the labels.
Clock direction mode	Use this mode, when you wish to operate the driver with a superordinate controller (e.b. CNC controller)
	In the clock direction mode, the SMCl47-S is operated via two inputs with a clock and a direction signal from a superordinate positioning control (indexer).
Analogue 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 stepper motor in simple applications:
	• Setting a specific speed e.b. via an external potentiometer,
	• Travelling synchronously with a superordinate controller with analogue 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, thus enabling servo behavior.

Operating mode	Application
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
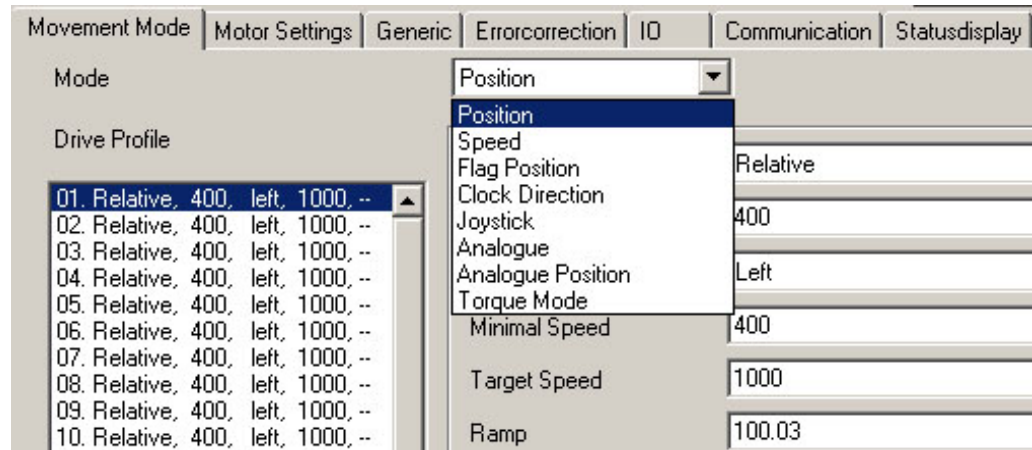
5 Reference runs and limit switch behaviour

5.1 Functional description

Function description "External reference run"

During an external reference run, the motor travels to a switch connected to the reference input.

> **Note:**
> The input varies according to the mode. See description of the input and output signals of the respective mode in the separate manual on NANOPRO.

After the start of the external reference run, the motor accelerates with the set ramp from the minimum to the maximum speed. When the reference switch is reached, movement is stopped for a break of 100 ms and then, according to the setting "Positioning behavior at the limit switch", travel is recommenced away from the switch at the minimum speed (start/stop speed).

The reference switch can be an opener or a closer. This must be set with the software during programming.

Function description "Internal reference run"

During the internal reference run, the motor travels to an internal reference point at the set minimum speed. This reference point is on the motor shaft and is therefore reached with each full motor revolution.

As with the external reference run, the behavior of the SMCI47-S recognizing the reference point in normal operation (positioning and flag positioning mode) can be defined.

5.2 Positioning behavior

Overview

The behavior of the SMCI47-S when recognizing the reference switch can be defined separately for normal operation (positioning and flag positioning mode) and for the reference run.

Settings of the limit switch behavior are made in the NANOPRO software. See the separate manual on NANOPRO as well.

There are four types of positioning behavior at the limit switch:

- "Free backwards" (reference run and normal operation)
- "Free forwards" (reference run and normal operation)
- "Stop" (only for normal operation)
- "Disable" (only for normal operation)

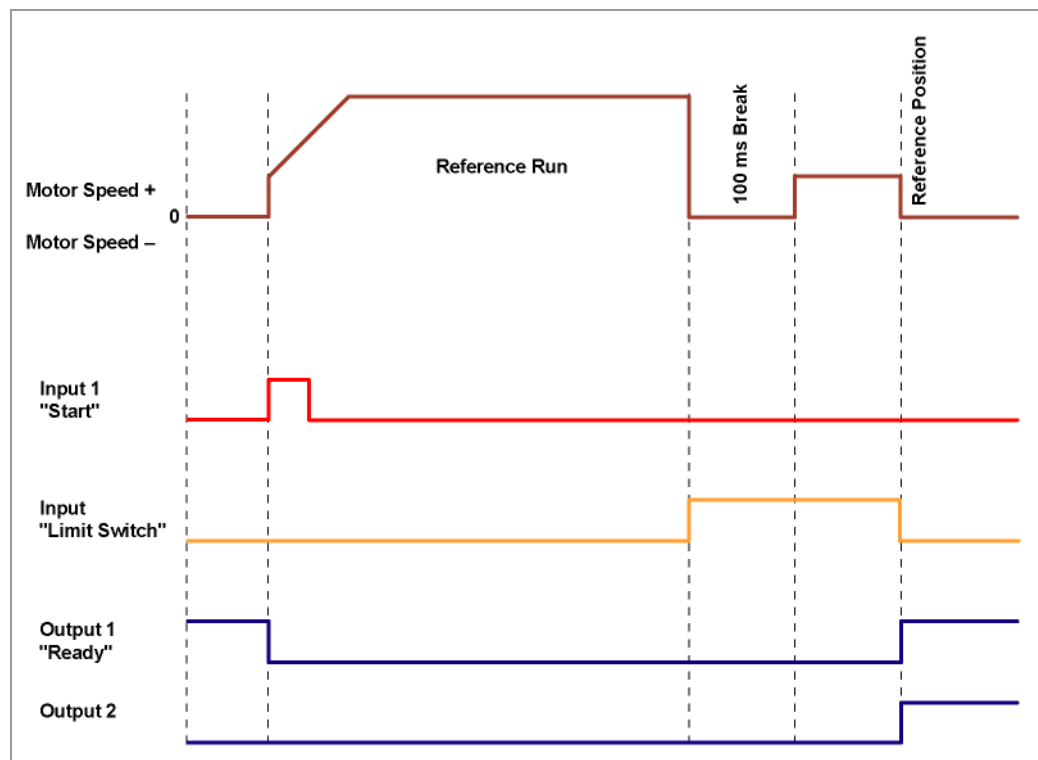These four types of positioning behavior are described below.

"Free backwards"

The motor changes direction on recognition of the limit switch and leaves the limit switch.
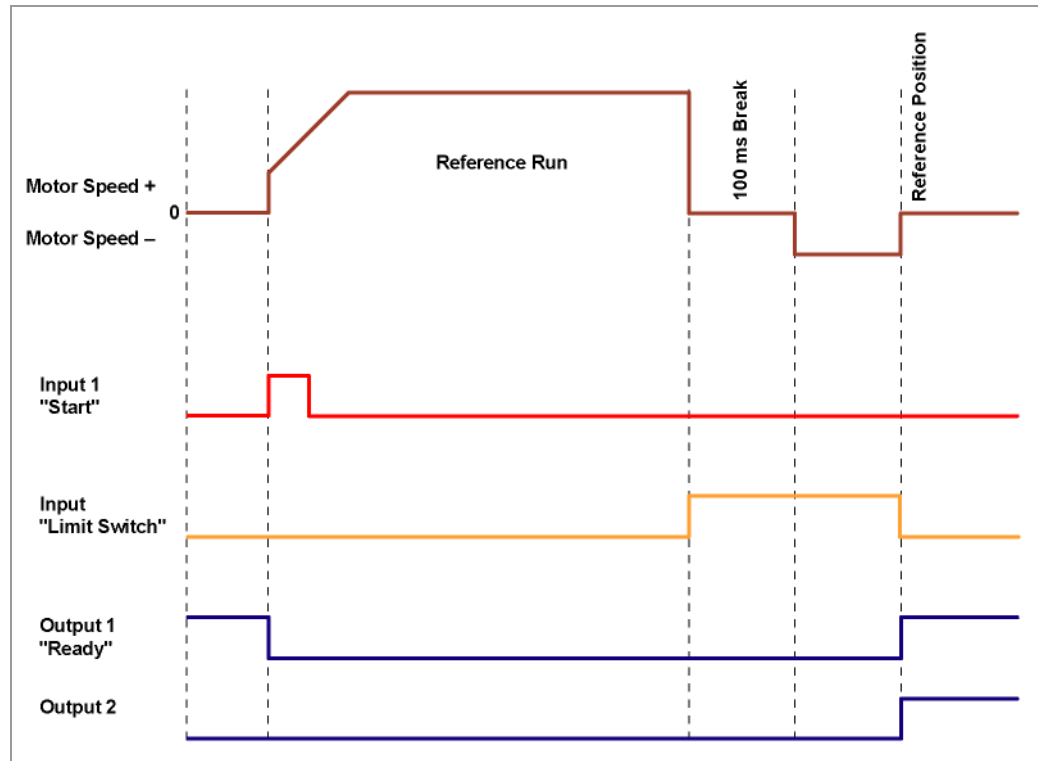
"Free forwards"

The motor continues in the same direction after recognising the limit switch and leaves the limit switch.

"Stop"

The motor stops immediately on recognition of the limit switch. A reference run must then be implemented as the motor may have lost steps (overflow).
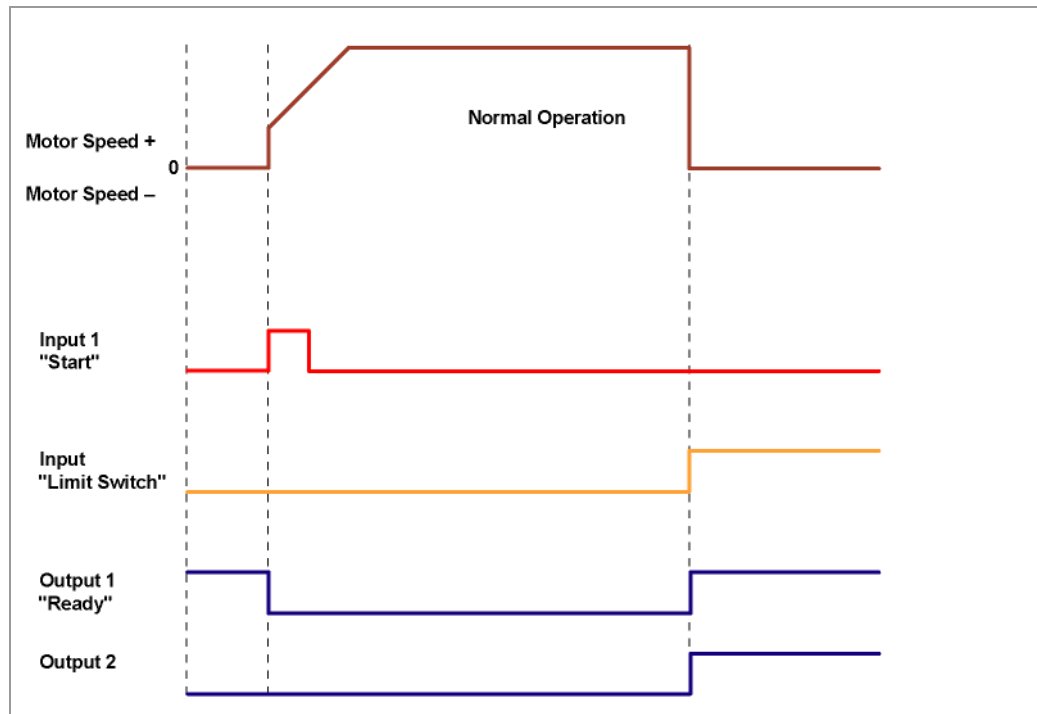
"Disable"

The limit switch has no function.

When a reference position is reached, outputs 1 and 2 are simultaneously switched on both in reference runs and in normal operation.

6 Troubleshooting

Troubleshooting procedure

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

⚠️	**Danger of electrical surges** An operating voltage > 50 V and incorrect connections can destroy the end stage. Never disconnect the link when operating voltage is applied! Never disconnect lines when live!

Possible error

Error	Possible cause	Rectification
Driver is not ready	Data transmission to SMCI47-S not possible (communication error): Incorrect COM port selected.	In the "Communication" tab, select the PC port to which you have connected the SMCI47-S (e.g."COM-1") The port used can be found in the device manager of your PC.
	Communication cable not connected or interrupted (incorrect RS232-RS485 converter used).	Function is not guaranteed with third-party 4-wire cables and 2-wire Nanotec converters do not function. Use the recommended RS232-RS485 converter from Nanotec: • Order number: ZK-RS485-RS232
	A non-existent motor number (module number) is set.	Set the correct module address. See the separate manual on NANOPRO as well.
	The power supply of the SMCI47-S is interrupted.	Check voltage supply, switch on if necessary.
	Another open program is blocking the COM port to which the SMCI47-S is connected.	Close down other programs on your PC.
	Inadmissible data was sent to the driver during the output of a travel profile.	Click on the <Yes> button to stop the travel profile. The SMCI47-S switches back to the "Ready" state. The data can then be resent to the driver.
Transmission error	Data transmission to the SMCI47-S is disturbed (sender or receiver are disturbed).	Check the possible causes for the transmission error and rectify the cause of the error.

Error	Possible cause	Rectification
Position error	A button was clicked while the driver was in error mode (position error or limit switch in normal operation).	Click the button <Yes> in the error message: the error is reset.
Red LED on the SMCI47-S lit up.	Overtemperature of power electronics > 75 °C	Switch off driver and allow to cool. The error is reset when the SMCI47-S is disconnected from the power supply unit.
	Undervoltage	Check voltage supply.

7   Technical data

Electrical connections

Operating voltage U_b	DC 24 V to 48V ±4%
Max. phase current	Adjustable up to max. 12 A/Phase Continuous current 7.5 A/Phase
Current drop	Adjustable 0 to 80% of phase current
Interfaces	SMCI47-S-2: RS-485 (4-wire) • 115200 Baud (adjustable) • 1 Startbit, 8 Databits, 1 Stopbit • No parity SMCI47-S-3: CAN bus (CanOpen) • Extended functionality • Brake output • Separate circuit for supply and processor • Closed-Loop capable

Driver parameters

|	
Step resolution	Full step Half step Quarter step Fifth step Eighth step Tenth step 16th step 32th step 64th step Adaptive microstep (1/128)
Step angle	1.8°
Operating modes	Position Speed Flag position Clock direction Analogue Joystick
Step frequency	0 to 50 kHz in clock direction mode 0 to 25 kHz in all other modes
Position monitoring	Automatic error correction up to 0.9°

Inputs and outputs

Inputs	6 optocouplers 5 – 24 V ±10% • Safe switch off: max. 2 V • Safe switch on: min. 4.5 V Signal delay time: • Inputs 1 to 5: 120 µs • Input 6: 10 µs
Outputs	3 MosFET outputs • Open-Drain (0 switching, max. 24V/2A) • Signal delay time: Output 1/2: ≈ 12 µs (at 10 kΩ-Pull-Up on 24 V) 1 brake output

Protective circuits

Overvoltage and undervoltage	Protective circuit for voltages > 50 V or < 21 V
Max. heat sink temperature	Approx. 67 °C External ventilation may be required in full step operation, depending on the switch-on duration, current drop set and external cooling area.
Max. ambient temperature	0 to 40 °C

SMCI47-S dimensions
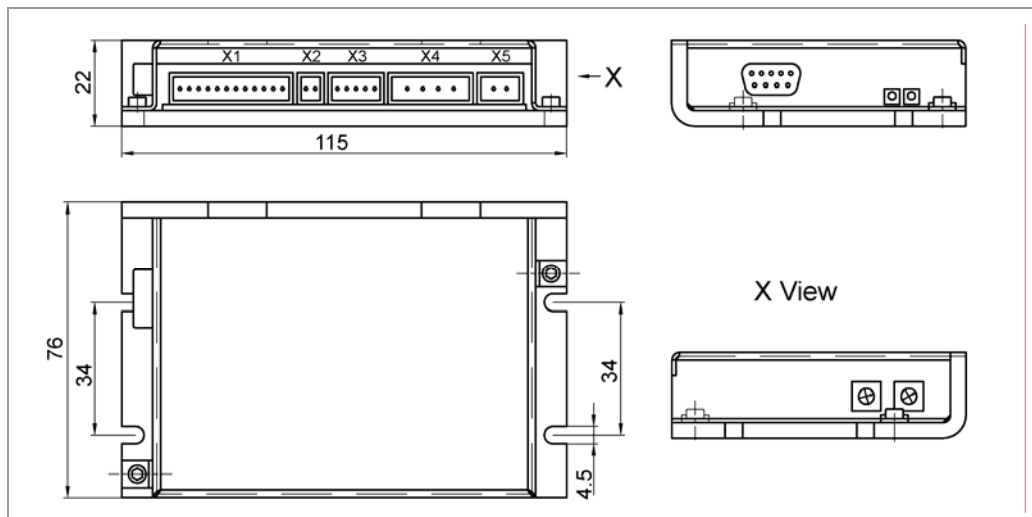
A complete set of datasheets is available for downloading at www.nanotec.com.

Connectors

The following connectors are available on the SMCI47-S:

- Connectors X1, X3:
  Phönix connector, Type MICRO COMBICON
- Connectors X4, X5:
  Phönix connector, Type COMBICON-HC
- Connector X6:
  Sub-D 9-pin (RS485 or CAN)

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