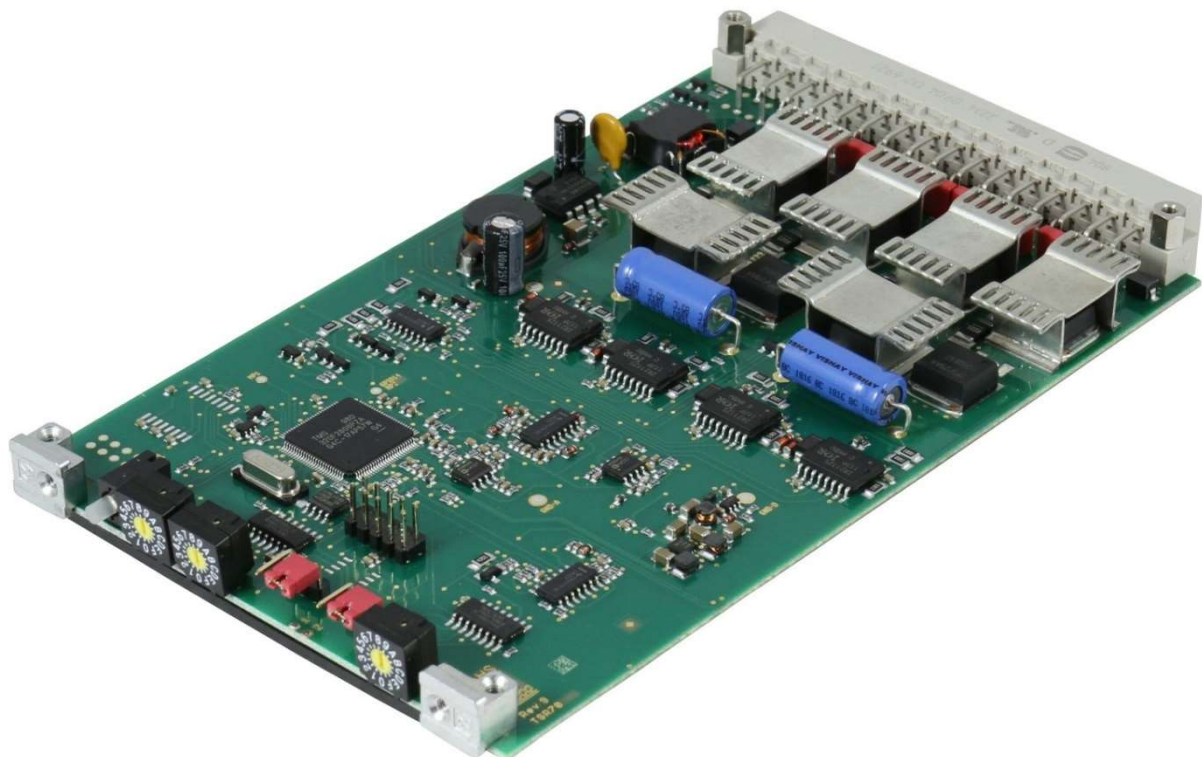


# Manual

## Step motor drives

### TSR70



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## 1 General

### 1.1 About this manual

These operating instructions contain information on the installation and use of the TSR70 step motor drive. They are intended for qualified personnel who have the following knowledge or training:

Transport: Knowledge of handling electrostatically sensitive components.

Installation: Electrical engineering training, knowledge of safety guidelines

Commissioning: Good knowledge of electrical engineering and drive technology

The national accident prevention regulations must be observed.

### 1.2 Characteristics and modes of operation

The TSR70 step motor drives is a compact microstepping power module for controlling 2-phase step motors.

Supply voltage : 24 ... 74 Volt DC

Motor current: 0,9 ... 6,3 A<sub>eff</sub> (in boost mode + 30 %)

The step motor drive TSR70 is controlled via clock and direction of rotation signals.

The unit parameters are set via two rotary switches and two jumpers on the front of the unit.





A two-colour LED indicates the status of the unit by its colours and flashing signals.

The TSR70 step motor drives are designed in Eurocard format as plug-in units with a VG strip (DIN 41612).

Heat is dissipated via the 6 heat sinks soldered to the circuit board.

### 1.3 Warning and note icons

The following warning and note icons are used in this manual:

Icon	Meaning
	Warning against a hazard which may cause heavy injury or death. Observe instructions to avoid hazards!
	Warning against a hazard which may cause slight injury. Observe instructions to avoid hazards!
	Note on a situation or unsafe procedure which may damage the product or objects nearby. Observe instructions on safe operation of the product!
	This is no warning icon against a dangerous or injurious situation. This icon indicates notes on use and other very useful information.

## 2 Safety

This chapter contains important information for the safe use of the TSR70 step motor drive.

As the machine manufacturer, you are responsible for the use of the TSR70 step motor drive in your machine. AHS Antriebstechnik GmbH is not liable for damage caused by improper use of the TSR70 step motor drive.

It is therefore essential that you follow the instructions in this manual in order to avoid personal injury or damage to property and to use the TSR70 step motor drive correctly and effectively.

### 2.1 Important safety notes

#### **⚠ WARNING**

High electric voltage may cause hazardous electric shock to people.

- Never use the step motor drive unless the case and all cable shields are grounded.
- Never use the step motor drive while the case is opened. Construction elements and wires in the device are live.
- Do not touch the connections of the supply voltage connector if power is on.
- Do not touch the connections of the motor connector if power is on. These contacts are live even if there is no motor connected.

#### **⚠ WARNING**

Unintentional movements of the driving mechanism may damage people or objects.

- Draw up a risk assessment for your machine and take appropriate measures to prevent unintentional movements from causing personal injury or damage to property.
- Always disconnect or switch off the supply voltage to safely switch off the drive. Switching off the step motor drive through the de-energise input is not a safe disconnection for emergency failure.

#### **⚠ CAUTION**

Connecting or separating live wires and connections may lead to arcing. This damages wires and contacts and may injure people.

- Connect or disconnect electric contacts only when the supply voltage is switched off.

#### **NOTICE**

The stepper motor control contains construction elements which are susceptible to electrical discharge and may be damaged by improper use.

- Observe ESD preventive measures according to DIN EN 61340-5.

## 2.2 Intended use

Use of the TSR70 step motor drives is only permitted in accordance with points (1) to (7) specified here.

- (1) The step motor drives of the TSR70 are intended for installation in electrical systems or machines and may only be put into operation as integrated components of systems or machines.
- (2) The step motor drives of the TSR70 may only be used in systems or machines that comply with the applicable national directives or standards.
- (3) The manufacturer of these systems or machines must prepare a risk assessment and take appropriate measures to ensure that unintentional movements of the drive do not result in injury to persons or damage to property.
- (4) To safely switch off the drive, the supply voltage of the step motor drive must always be interrupted or switched off.  
Switching off the step motor drive TSR70 through the De-energise input is not a safe disconnection for emergency failure.
- (5) The step motor drive of the TSR70 may only be used to drive suitable stepper motors. The output current of the step motor drive must not be set to more than the value of the rated motor current.
- (6) Only copper cables may be used for the electrical connections to the step motor drive of the TSR70. The conductor cross-sections result from the EN 60204 standard or Table 310-16 of the NEC (60°C or 75°C column for AWG cross-sections).
- (7)
- (8) Intended use also includes observing these operating instructions. In particular, the information on the supply voltage, ambient conditions and safe operation must be observed.

No other use of the stepper motor controls of the TSR70 is considered compliant with the requirements given in points (1) to (7).

AHS Antriebstechnik GmbH assumes no liability for damages which may result from use which is not compliant with the requirements.

## 2.3 Standards and directives

The TSR70 step motor drives are components intended for installation in machines or systems in the industrial sector.

The devices are compliant with EC Directive 2014/30/EU and meet the standard DIN EN 61800-3:2012-09(B1:2014-02) Variable speed electrical drives Part 3 EMC requirements including special test methods.

## 2.4 CE conformity

The step motor drive TSR70 is a component of a controllable drive which, when assembled with other components, results in functional machines or systems. The final supplier of the system or machine is responsible for compliance with the EMC directives and CE conformity.

The step motor drive TSR70 fulfils the applicable requirements for CE conformity only when installed.



### 3 Product identification

All versions of the TSR70 step motor drives are clearly identified by the type designation (order designation).

The type designation and other information can be found on the type plate of the unit.

#### 3.1 Type plate

The type plate is attached to the black cover that covers the underside of the circuit board. The type plate shown in the picture belongs to the TSR70-AA unit variant.



1	Type name (order name)
2	Serial number
3	Additional information on maximum output current, firmware version and operating voltage

#### 3.2 Scope of supply

The step motor drives of the TSR70 are delivered without accessories.

#### 3.3 Accessories

A front panel and a motherboard are available as accessories for the TSR70 step motor drive. Please contact your distributor for prices and delivery times.

## 4 Technical data

### 4.1 Electric data

<b>Supply voltage</b>	24 - 75 V <sub>DC</sub>
<b>Motor current</b> <b>Number of selectable values</b>	0,9 to 6,3 A <sub>rms</sub> + 30 % with boost 16
<b>Motor current @ ambient temperature</b>  <b>without heat sink</b>	3,2 A @ 25 °C 1,6 A @ 45 °C
<b>with heat sink</b>	6,3 A @ 25 °C 3,5 A @ 45 °C
<b>Permissible heat sink temperature</b>	Max. 70 °C (forced cooling may be necessary)
<b>Permissible ambient temperature</b> <b>Operation</b> <b>Storage</b>	0 °C to +50 °C -55 °C to +70 °C
<b>Humidity</b>	10-90 %, non-condensing
<b>Chopper frequency of power stage</b>	20 kHz
<b>Input signals</b>	Step Direction Disenergize Boost Reset Switching the step size
<b>Output signals</b>	Error Initial position
<b>Idle current reduction</b>	off (motor current always on 100%) active after 0,05 s, 0,1 s or 1,0 s at 20 %, 40 %, 50 %, 60 % or 80 %
<b>Max. input frequency</b>	500 kHz
<b>Adjustable step resolution</b>	200 to 25600
<b>Preset numbers of steps</b>	200, 400, 500, 800, 1000, 1600, 2000, 3200, 5000, 6400, 10000, 12800, 25000, 25600
<b>Operating lights</b>	Two-Colour-LED
<b>Fault protection</b>	Short circuit (phase to phase, phase to zero conductor) and over temperature

## 4.2 Mechanical data

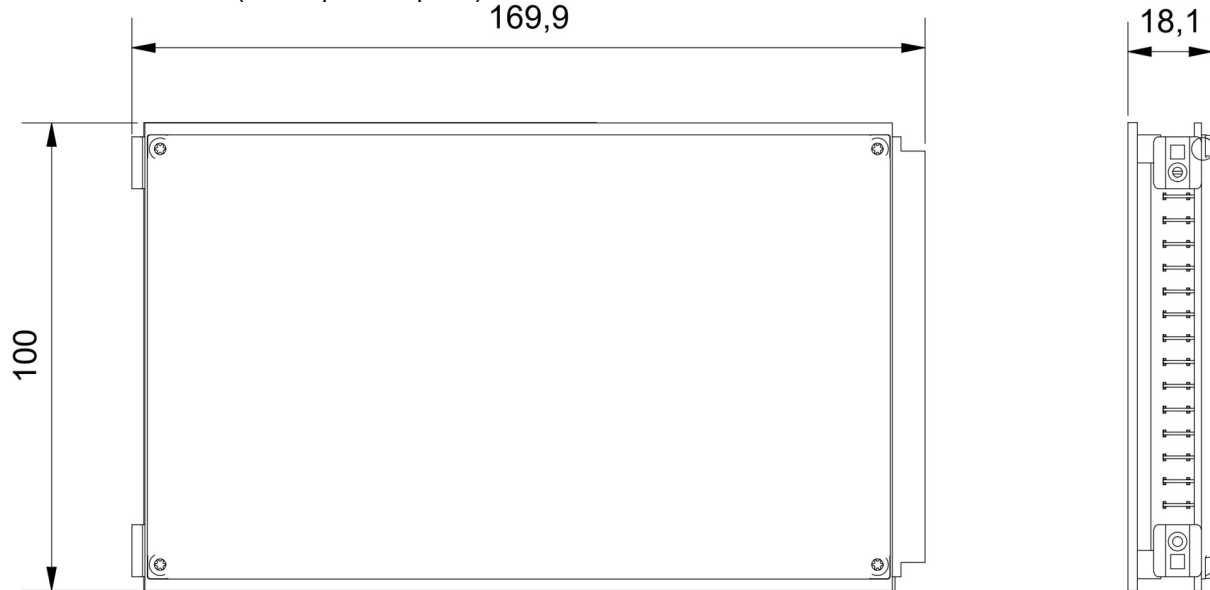
The step motor drive TSR70 consists of two or three parts, depending on the version. The printed circuit board, a lower black cover on which the type plate is attached and optionally an upper light-coloured cover. The covers are made of plastic.

The step motor drive unit does not have a closed housing.

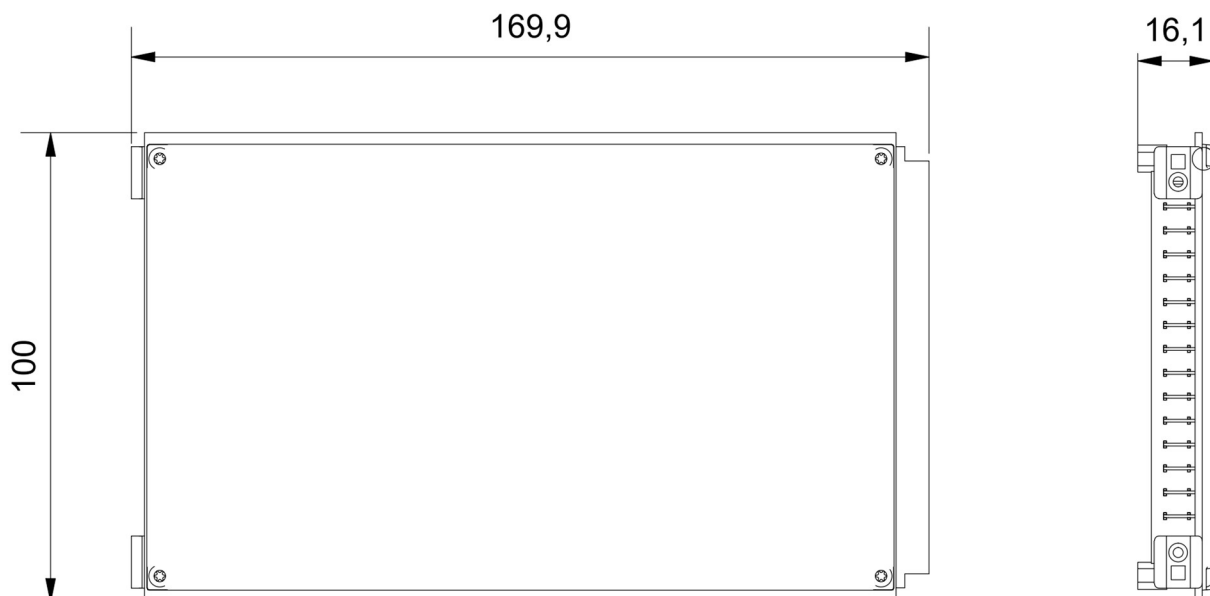
The weight of one unit is 185 g with the top cover and 153 g without the top cover.

The exact dimensions of the step motor drive TSR70 are given in the dimensional drawing.

Variant TSR70-AA (with top cover plate):



Variant TSR70-BA (without top cover plate):



all dimensions in mm

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## 5 Mechanical installation

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**NOTICE**

Strong magnetic fields can affect internal components of the TSR70. This can cause damage to the stepper motor controller or the connected motor..

- Mount devices that generate magnetic fields at a sufficient distance from the TSR70 and/or shield magnetic fields.
- 

### 5.1 Switchboard assembly

The step motor drive TSR70 is usually mounted as a plug-in unit in a subrack (e.g. 19 inch rack). The electrical connection is made completely via the 32-pole VG strip.

Observe the following requirements for assembly:

- Extreme shocks, vibrations or impacts must not affect the TSR70 step motor drive.
- The unit must be mounted in a vertical orientation. Cooling is impaired if the unit is mounted horizontally.
- A minimum clearance of 5 cm must be provided above and below the unit (in vertical alignment), and a minimum clearance of 5 cm must also be provided at the sides.
- The cooling/ventilation of the control cabinet must be carried out in such a way that the temperature of the heat sinks does not exceed 65 °C.
- The internal temperature of the control cabinet (ambient temperature for the TSR70) must not exceed 50 °C.

### 5.2 Cooling and permissible motor current

---

**NOTICE**

The step motor drive TSR70 switches off in case of overheating. This can possibly lead to damage in the machine.

- Observe the following instructions for cooling the step motor drive TSR70.
  - Design your machine in such a way that the automatic switch-off of the stepper motor control does not lead to damage.
- 

**INFO**

You should generally take the automatic switch-off of the step motor drive into account when designing your machine. For example, the switch-off also occurs when the motor current exceeds the permissible maximum value.

---

The heat loss generated in the step motor drive TSR70 is mainly dependent on the motor current and the set current reduction.

This means that the maximum permissible motor current depends on the cooling of the TSR70.

For better dissipation of the heat loss, the TSR70-AA unit variant has a cut-out above the heat sinks in the upper cover plate.

In the following, guide values are given as to how the maximum permissible motor current depends on the cooling. The specified motor currents are effective values.

Vertical mounting in the rack with prescribed minimum distances		
	Ambient temperature	Max. permissible motor current
Without forced ventilation	25 °C	3,2 A
	45 °C	1,6 A
With forced ventilation	25 °C	6,3 A
	45 °C	3,5 A

**INFO**

Check the heat sink temperature of the TSR70 by directly measuring it with a temperature sensor while the unit is running.

In addition, the unit temperature is recorded via a sensor installed on the circuit board. This measured value is used for the overtemperature shutdown.

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## 6 Electrical installation

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**▲ CAUTION**

Connecting or separating live wires and connections may lead to arcing. This damages wires and contacts and may injure people.

- Connect or disconnect electric contacts only when the supply voltage is switched off.
- 

**▲ CAUTION**

Improper installation of the stepper motor control may destroy the stepper motor control or connected devices, or people may be injured by electric shock.

- The step motor drive may be installed only by specialist staff trained in electrical engineering.
- 

The TSR70 step motor drive has the 32-pin VG connector as its only connection element. The following section describes the pin assignment and typical wiring.

The specified wire cross-sections, the design of the wiring, as well as the earthing and shielding measures correspond to the general state of the art and are sufficient for most applications.

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**INFO**

Special applications, operating conditions and system configurations or standards and regulations may require to connect the TSR70 in a manner not described in the following paragraphs. In particular standards and regulations will then override the information given here.

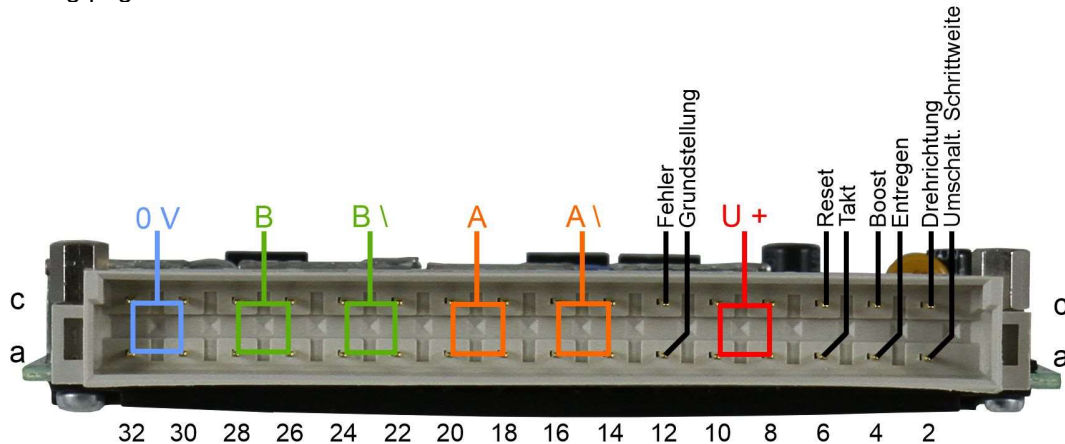
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## 6.1 Pin assignment

### INFO

The pin assignment of the VG-strip connector is compatible with the DSR92-70 step motor drive and other step motor drives.

The pin assignment of the TSR70 can be found in the following labelled illustration or in the tables on the following pages:



## 6.2 Signal inputs/outputs

Signal In-/Output		
TSR-Pin	Signal*	Note/Description
a2	E: Switching step size	Switch between decimal and binary step size
c2	E: Direction	Reversal of the direction of rotation of the motor shaft
a4	E: Disenergize	Motor is switched off
c4	E: Boost	Set motor current value is increased by 30%.
a6	E: Step	Step input for motor speed
c6	E: Reset	TSR70 restarts. Any error is deleted.
a12	A: Initial position	Initial position signal when 7.2° angle of rotation is reached in each case
c12	A: Error	Collective output for error messages

\* E = Input; A = Output

### NOTICE

The signal inputs of the TSR70 are designed for voltages of up to 30 V. Higher voltages can damage the step motor drive

### NOTICE

The signal outputs of the TSR70 are designed as open-collector outputs. If an output is active, the signal level is connected to ground with low impedance. The maximum current that may flow is 0.15 A at 40 V. Higher currents can damage the step motor drive.

To avoid electrical interference from the operation of the TSR70, you should always observe the following for the installation:

- Use a shielded and twisted cable for the signal connections.
- Ground the shields with shield clamps over a large area at both cable ends.

### 6.3 Supply voltage

Supply voltage		
TSR-Pin	Signal	Note/Description
8a, 8c, 10a, 10c	U +	Permissible voltage 24-75 VDC. Maximum current consumption 7 A. The connecting cables must be connected to all pins of the TSR70.
30a, 30c, 32a, 32c	0 Volt	

A power supply unit with a filtered output voltage is sufficient to supply power to the TSR70 step motor drive. An electronically regulated power supply unit is not required.

If full power is required from the TSR70, the power supply unit must be able to deliver a maximum current of approx. 7 A.

The TSR70 step motor drive does not continuously deliver the power to the motor, but works with switched power transistors. The motor current is controlled by pulse-width modulation of the switching signals, using the motor inductance as current storage.

This method of operation results in very good electrical efficiency, i.e. the step motor drive delivers most of the absorbed power to the motor and there is little power loss in the TSR70. However, the current consumption from the power supply unit is not continuous, but pulsed.

In order for the TSR70 to be able to absorb the current in pulse form from the charging capacitor of the power supply unit or from an external backup capacitor, the cable length between the charging or backup capacitor and the TSR70 must not be too long ( $\leq 1$  m).

Which capacity is recommended for which motor current and operating voltage is summarised in the following table:

Motor current in A	Capacity at 24 V <sub>DC</sub>	Capacity at 48 V <sub>DC</sub>	Capacity at 75 V <sub>DC</sub>
0,9	4.000 $\mu$ F	2.000 $\mu$ F	1.300 $\mu$ F
1,2	4.800 $\mu$ F	2.400 $\mu$ F	1.500 $\mu$ F
1,5	5.500 $\mu$ F	2.800 $\mu$ F	1.800 $\mu$ F
1,9	6.800 $\mu$ F	3.400 $\mu$ F	2.200 $\mu$ F
2,2	8.000 $\mu$ F	4.000 $\mu$ F	2.600 $\mu$ F
2,5	9.100 $\mu$ F	4.600 $\mu$ F	2.900 $\mu$ F
2,8	9.500 $\mu$ F	4.800 $\mu$ F	3.100 $\mu$ F
3,1	11.000 $\mu$ F	5.500 $\mu$ F	3.500 $\mu$ F
3,4	11.500 $\mu$ F	5.800 $\mu$ F	3.700 $\mu$ F
3,7	12.000 $\mu$ F	6.000 $\mu$ F	3.800 $\mu$ F



4,0	13.500 µF	6.800 µF	4.400 µF
4,3	15.000 µF	7.500 µF	4.800 µF
4,7	16.500 µF	8.300 µF	5.300 µF
5,0	18.000 µF	9.000 µF	5.800 µF
5,6	20.000 µF	10.000 µF	6.400 µF
6,3	22.000 µF	11.000 µF	7.000 µF

In addition, the following specifications must be observed when connecting the TSR70 to the supply voltage:

- Use cables with a cross-section of 1.5 mm<sup>2</sup> for this purpose.
- The U + and 0 V lines must be sheathed with a shielding braid.
- Earth the shielding over a large area with shield clamps.
- The cable between the charging capacitor of the power supply unit and the TSR70 must not be longer than 1 m. If the cable is longer, an external back-up capacitor must be installed.
- The cable between the support capacitor and the TSR70 must not be longer than 1 m.
- Use a 10 A fuse (not an automatic circuit breaker) with a carrier characteristic between the power supply unit and the support capacitor for line protection.

### NOTICE

If the maximum value of the supply voltage is exceeded, this will destroy the step motor drive.

Short-term exceeding of the maximum value (voltage peaks) can also destroy the step motor drive.

- Observe the specifications for the design of the supply voltage and take appropriate measures to prevent the maximum value of the supply voltage from being exceeded.

### INFO

Due to its mode of operation, the stepper motor control feeds energy from the motor back into the supply voltage when braking.

In applications with a large moment of inertia, this can lead to an increase in the supply voltage, which is greater the more the motor is braked and the longer this braking process lasts. In this case, the power supply unit must be able to absorb the regenerated energy without the output voltage rising too much. In the case of a simple, unregulated power supply unit, a circuit may have to be added to limit the rise in the supply voltage to a value below the maximum value.

## 6.4 Motor connection

Motor connection		
TSR-Pin	Signal	Note/Description
a14, c14, a16, c16	A\	Motor phase 1
a18, c18, a20, c20	A	
a22, c22, a24, c24	B\	Motor phase 2
a26, c26, a28, c28	B	

When connecting a 2-phase stepper motor to the TSR70 step motor drive, the following specifications must be observed:

- Use cables with a cross-section of 1.0 mm<sup>2</sup> to 1.5 mm<sup>2</sup>.
- The cables of one motor phase each must be designed as a twisted pair of wires.
- The motor cables must be sheathed with a shielding braid.
- Earth the shielding over a large area with shield clamps.
- For longer motor cables, it is advantageous if the two twisted pairs of cores are additionally shielded.
- For motor cable lengths over 20 m, please consult your distributor.

## 7 Parameter settings

To adapt to different stepper motors and applications, the following parameters can be set on the TSR70 step motor drive:

- Motor current
- Step resolution
- Current reduction at standstill (motor current and waiting time)
- Logic of the inputs
- Switching of the error output

The parameters are set using three rotary switches and two jumpers located on the front of the unit. The parameters must be set before the operating voltage is switched on. Changes to the parameters during operation can lead to unexpected behaviour of the unit.

The tables with the setting values can be found on the next pages.

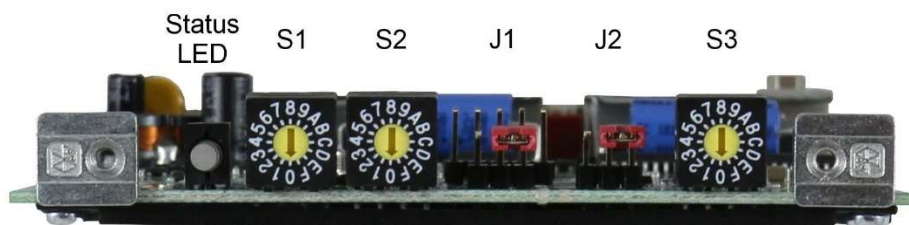


Figure: Rotary switch for setting the motor current and step resolution

The functions of the individual rotary switches and jumpers are shown in the following table:

Label	Function
<b>S1</b>	Motor current
<b>S2</b>	Standstill current
<b>J1</b>	Input logic: Plugged in on the left: Positive; Plugged in on the right: Negative
<b>J2</b>	Error output Plugged in on the left: normally open contact; Plugged in on the right: normally closed contact
<b>S3</b>	Step resolution

## 7.1 Motor current and current reduction at standstill

The motor current is set with rotary switch S1 and the current reduction at standstill with rotary switch S2 according to the following table:

Switch position	S1: Effective current in $A_{rms}$		S2: Standstill current and Waiting time in ms	
	TSR70-AA	DSR92-70		
0	0,9	0,3	20 %	50
1	1,2	0,6		100
2	1,5	0,9		1000
3	1,9	1,2	40 %	50
4	2,2	1,5		100
5	2,5	1,9		1000
6	2,8	2,2	50 %	50
7	3,1	2,5		100
8	3,4	2,8		1000
9	3,7	3,1	60 %	50
A	4,0	3,4		100
B	4,3	3,7		1000
C	4,7	4,0	80 %	50
D	5,0	4,3		100
E	5,6	4,7		1000
F	6,3	5,0	100 %	-

### NOTICE

If the rated nominal motor current is exceeded, this can lead to destruction of the motor due to demagnetisation or thermal overload.

- Set the output current of the TSR70 step motor drive to no more than the value of the rated motor current.

## 7.2 Step resolution

The step resolution is set with the rotary switch S3 according to the following table:

Switch position	Resolution decimal	Resolution binary
0	200	200
1	400	400
2	500	800
3	1000	1600
4	2000	3200
5	5000	6400
6	10000	12800
7	25000	25600

Switching the step size from decimal and binary is done via the signal input a2 (see chapter 6.2 Signal inputs/outputs).

From switch position 8, the values for the step resolution are repeated, but the standard direction of rotation is inverted.

## 8 Operating display: Status LED

The TSR70 step motor drive has a two-colour LED on the front panel to display information about the operating status.

These are to be interpreted as follows:

Status LED	Description
Green, flashing	after switching on the TSR70, the firmware version is displayed as a blink code. e.g. 1x flashing, pause, 2x flashing = version 1.2
Yellow, Short lighting duration, Repetition after 3 sec.	TSR70 switched on but not released
Green, permanently luminous	Motor current switched on, motor at standstill
Yellow, flashing	Motor current switched on, motor turns
Red, flashing	TSR70 switched off due to an error. The flashing code indicates the type of error: 2x flashing = overcurrent 3x flashing = earth fault 4x flashing = overtemperature

## 9 Operatin mode: clock and direction of rotation

In principle, you only need to connect two input signals to the TSR70:

- clock pulse
- direction of rotation signal

The motor current is switched on immediately after the step motor drive TSR70 is ready for operation, unless the **Disenergize** input is active.

The clock pulses and the direction of rotation signal are generated by an external clock generator. With each incoming clock pulse, the TSR70 rotates the motor one step further. The closer the clock pulses follow each other, the higher the speed of the motor. The direction of rotation of the motor is determined by the direction of rotation signal.

Each stepper motor control has a certain moment of inertia and therefore cannot follow the clock frequency at will. If higher speeds are desired, it is therefore necessary to adapt the change in clock frequency to the acceleration capacity of the drive. These acceleration and deceleration ramps must be generated by the external clock generator.

Predefined step numbers and motor currents are set via rotary switches on the unit.

## 10 Commissioning

When commissioning for the first time, if possible, uncouple the load from the motor so that it can rotate freely. Mount the motor so that it cannot come loose during jerky movements and cause damage.

Observe the following important safety instructions!

---

**⚠ WARNING**

Unintentional movements of the drive can cause injury to persons or damage to property.

- The step motor drive may only be commissioned by qualified personnel with knowledge of electrical engineering and drive technology.
- To safely switch off the drive, always interrupt the supply voltage or switch it off. Switching off the step motor drive by the de-energise input is not a safe disconnection for emergency failure.

---

**⚠ CAUTION**

Connecting live lines or disconnecting live connections can cause sparkovers.

This will damage cables and contacts and may cause injury to persons.

- Only make or loosen electrical connections when the supply voltage is switched off.

---

**NOTICE**

If the rated motor current is exceeded, this can lead to destruction of the motor due to demagnetisation or thermal overload.

- Set the output current of the TSR70 step motor drive to no more than the value of the rated motor current.
-



## 10.1 Commissioning with clock and direction signal

### Requirement

The machine or system is prepared for the installation of the TSR70 (**chapter 5 Mechanical installation**). The electrical wiring is prepared for the connection of the TSR70 (**chapter 6 Electrical installation**).

The supply voltage for the TSR70 is switched off.

Die Maschine oder Anlage ist für den Einbau der TSR70 vorbereitet (**Kapitel 5 Mechanische Installation**). Die elektrische Verkabelung ist für den Anschluss der TSR70 vorbereitet (**Kapitel 6 Elektrische Installation**).

Die Versorgungsspannung für die TSR70 ist ausgeschaltet.

### Procedure

1. Remove the unit from the transport packaging and check it for damage.  
Damaged units must not be put into operation! This applies in particular if the VG strip or the circuit board is damaged. There is a risk of permanent destruction of the unit or other connected units.
2. Install the unit in your system and check that it is correctly seated in the connector strip.
3. Set the desired step resolution and current reduction (**chapter 7.2 Step resolution/current reduction at standstill**).
4. Set the motor current (**chapter 7.1 Motor current**).  
When commissioning for the first time, you should first set a lower motor current than is intended for normal operation. This will reduce the risk of damage to your machine.
5. Switch on the supply voltage.
6. Observe the LED display of the TSR70.  
First, the version number of the device firmware is indicated by the LED flashing (**chapter 8 Operating displays**). Then the TSR70 switches on the motor current and is active. With small motors and low motor current, you can now check by hand whether the motor develops torque.
7. Provide clock pulses with low frequency and check if the motor turns.
8. Invert the **direction of rotation** signal and check whether the motor reverses its direction of rotation..
9. Switch off the supply voltage.
10. Reconnect the load to the engine.
11. Switch on the supply voltage again, the TSR70 is ready for use.

If errors occur during commissioning, follow the instructions in **chapter 11 Debugging**.

## 11 Debugging

The TSR70 step motor drive switches off for its own protection if an error condition is detected due to internal measured variables. The two-colour LED on the front of the unit indicates the error number by a flashing code (**chapter 8 Operating display**). The colour of the two-colour LED changes to red.

### 11.1 Shutdown in case of error, error list

The following table lists all error messages and gives hints for debugging.

Error		
No.	Notification	Description / measure for the removal
2	Overcurrent	<p>The TSR70 has switched off because the limit value for the output current has been reached.</p> <p>The cause may be a short circuit between two motor phases.</p> <p>Switch off the supply voltage. Check the motor cables (wires and shield) and the motor itself. Check whether the error also occurs when the motor is not connected.</p>
3	Earth fault	<p>The TSR70 has switched off because a fault current has flowed between one of the two motor phases and earth.</p> <p>Switch off the supply voltage. Check the motor cables (wires and shield) and the motor itself. Check whether the error also occurs when the motor is not connected.</p>
4	Overtemperature	<p>The TSR70 has switched off because the limit value for the unit temperature has been reached.</p> <p>The cause is insufficient cooling of the TSR70.</p> <p>Improve the cooling of the TSR70 (<b>chapter 5.2 Cooling and permissible motor current</b>).</p>

## 11.2 Faulty behaviour

If the TSR70 does not report an error, but the drive does not behave as expected, follow these instructions.

### The supply voltage is switched on, but the LED display remains dark.

The supply voltage for the TSR70 is too low or not present.

Check whether the lines for the supply voltage are connected correctly.  
Check whether the supply voltage complies with the specifications (*chapter 6.3 Supply voltage*).

### The LED display lights up briefly every 3 seconds. The motor has no torque.

The TSR70 is ready but in de-energised state.

Check that the disenergize signal is present and meets the input specifications.  
Check that the input polarity is set correctly.

### The LED display lights up green (or flashes yellow). The motor has no torque.

The TSR70 is enabled (and the drive signals are detected), but too little or no motor current is flowing.

Check the cables for the supply voltage and the motor.  
Check whether the rotary switch S1 is set to the correct position (*chapter 7.1 Motor current*).

### The LED display lights up green, the motor has holding torque but does not rotate.

The control signal for the clock is not recognised.

Check the line for the clock signal (*chapter 6.5 Signal inputs/outputs*).  
Make sure that the clock signal of your clock generator meets the specified electrical and timing requirements.

### The motor does not respond to the direction of rotation input.

The control signal for the direction of rotation is not recognised.

Check the line for the direction of rotation signal (*chapter 6.5 Signal inputs/outputs*).  
Make sure that the direction of rotation signal of your clock generator meets the specified electrical and timing requirements.

**The motor turns in the wrong direction.**

The direction of rotation of the motor is reversed by swapping the two connecting leads of a motor phase.

Switch off the supply voltage.

Swap the lead A with A\ or B with B\ on the motor cable.

If the leads of both motor phases are swapped, there will be no reversal of the direction of rotation.

Alternative method:

Invert the logic of the inputs by changing the jumper J1. However, this not only inverts the logic of the direction of rotation input, but the logic of all inputs!

**The motor does not reach the expected position.**

Check whether the step size set on the TSR70 corresponds to the step size to which your controller is parameterised.

Check whether the motor stops or loses steps because it is overloaded by too high acceleration or load torque. Take into account that the torque curve of a stepper motor depends on the supply voltage of the control and the wiring of an 8-wire motor (parallel or serial).

Check whether the motor is operating in the resonance range. The operating noises often give clues to this. Use a higher step resolution to avoid resonance problems at low speeds (below approx. 30 rpm).

If small step errors add up when moving back and forth, then check whether your controller maintains the required lead time at the direction of rotation signal before the first clock pulse of a new movement is output.

Check whether the signals at the clock and direction of rotation input are distorted by interference.

**INFO**

If you conclude that the TSR70 step motor drive is faulty, DO NOT simply replace it with another one and switch on again.

Instead, check the power supply layout and the wiring design of the supply voltage. Improper supply voltage is the most common reason for control defects.

## 12 Maintenance and cleaning

The TSR70 step motor drive is maintenance-free.

There are no elements inside the unit that require adjustment or maintenance.

Remove surface dust and dirt from the unit using clean, dry, low-pressure compressed air.

## 13 Repair and disposal

### 13.1 Dismantle

If you want to dismantle the step motor drive (repair, replacement, disposal), proceed as follows:

1. Switch off the supply voltage.
2. Wait until the supply voltage of the logic and the power unit has dropped below 24 V.
3. Wait until the housing temperature has dropped below 40 °C.
4. Remove all electrical connections on the unit.
5. Loosen the fastening screws and remove the step motor drive.

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**⚠ WARNING**

High electrical voltages can give people a dangerous electric shock.

- Measure the voltage at the supply voltage connection of the TSR70 and wait until the voltage has dropped below 24 V before touching the electrical connections of the step motor drive.

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**⚠ CAUTION**

During operation, the heat sink can reach temperatures above 60 °C.

- Measure the heat sink temperature and wait until the stepper motor controller has cooled down to below 40 °C before touching the unit.
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## 13.2 Repair

The step motor drive TSR70 may only be repaired by authorised workshops or by the manufacturer. Any other repair attempts will invalidate the warranty.

If you are a customer of a machine manufacturer in whose machine the step motor drive TSR70 is used, please contact the machine manufacturer first for repair.

If you have purchased the step motor drive TSR70 directly from a distributor, please contact this distributor. He will tell you the quickest way to repair and replace it.

## 13.3 Disposal

In accordance with the WEEE-2002/96/EG directives and similar, the manufacturer will take back old appliances and accessories for proper disposal. The transport costs are to be borne by the sender.

Send the devices to this address:

AHS Antriebstechnik GmbH  
Im Waldfrieden 1  
64319 Pfungstadt

## 14 Order code

TSR70-AA = Version with cover plate

TSR70-BA = Version without cover plate