

Thank you for purchasing this Robo Cylinder Controller. Not only is it impossible to operate all the functions correctly without proper knowledge of the controller, but the controlled actuator may also be unintentionally damaged or its service life shortened. Therefore, in order to become familiar with the correct handling and operation of the controller, carefully read the instruction manual as well as any other documents relevant to the product. Keep this manual handy so that you can refer to the appropriate sections as the need arises.

All possible measures have been taken to ensure that the information contained in this manual is accurate. However, if you become aware of any inaccuracies or discrepancies, please contact your IAI sales representative or technical service department.

## **Warranty period and scope**

The RC Controller undergoes stringent testing before it is shipped from our factory. IAI provides the following warranty:

### **1. Warranty Period**

The warranty period is 12 months from the date the unit is shipped to the customer.

### **2. Scope of Warranty**

If within the period specified above, a breakdown occurs while operating the controller under normal conditions and this breakdown clearly is the responsibility of the manufacturer, IAI will repair the unit at no cost. However, the following items are not covered by this warranty:

- paling of lacquer coating or other natural alterations resulting from aging,
- consumable components that wear out with use (battery, etc.),
- unit seems to be noisy or similar impressions that do not affect machine performance,
- damage resulting from improper handling or use,
- damage resulting from user error or failure to perform proper maintenance,
- any alterations not authorised by IAI or its representatives, including parameters,
- damage caused by fire and other natural disasters or accidents.

The warranty pertains to the purchased product itself and does not cover any loss that might arise from a breakdown of the product. Any repairs will be carried out at our factory.

### **3. Service**

The purchase price of the product does not include programming or expenses for sending technicians to the customer's site. Even if the product is still under the warranty period, separate charges will be billed for the following services:

- assistance with unit installation or trial operation,
  - inspection and maintenance,
  - technical training concerning controller operation, wiring or programming,
  - any other services or work for which IAI normally bills separate charges.
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## 1 Safety

The RC Robo Cylinder Controller is a component of the RC positioning system. The RC positioning system is conceived and constructed in conformity with the basic safety requirements of the EU Machinery Directive.



**WARNING**

**Residual risk!**

**Severe injury as well as system damage or damage to the environment may result from misuse or incorrect operation.**

**Observe the warning and safety instruction signs!**

**Only sufficiently qualified personnel may operate the RC positioning system!**

**Every operator must have read and comprehended the operating manual!**

### 1.1 Warning Levels

Warnings and notes in this operating manual are marked by a symbol with a key word in the margin. The warnings and notes are printed in bold characters and highlighted by a margin line.

The warning signs are assigned different levels of importance:



**WARNING**

The key word **WARNING** is used to warn of a potentially threatening danger. Possible consequences could be death or most severe injuries (injury to persons).



**CAUTION**

The key word **CAUTION** is used to warn of a potentially dangerous situation. Possible consequences could be death, severe or light injuries (injury to persons), system damage or damage to the environment.



**NOTE**

The key word **NOTE** is used to recommend measures in connection with the application.

Possible consequences of non-observance of such notes could be damage to the system or a production standstill.

## 1.2 Intended Use

The RC Robo Cylinder Controller has been designed for installation in an RC positioning system and has been **exclusively** designed and constructed to control

- IAI servo drives (RC drives),
- an RC drive either
  - as slide version or
  - as push-rod version.



### CAUTION

#### Danger due to misuse of the RC positioning system

The consequences resulting from incorrect operation could be personal damage to the user or a third person, as well as damage to the system or the environment.

**Use the RC positioning system only in accordance with the regulations!  
Use only the specified cabling to connect the drive and controller!  
Observe the ambient conditions and measures for electromagnetic compatibility (EMC)!**

#### Unintended use:

- The RC positioning system is not designed or constructed for application in an environment containing dust, oil-mist or cutting oil.
- The RC positioning system may not be operated in areas with explosion hazard.

#### Limit values:

- Humidity: max. 95 % relative humidity  
Harmful effects resulting from occasional condensation must be avoided by correctly designing the equipment.
- Storage and transport temperature:
  - Range from  $-25\text{ °C}$  to  $+55\text{ °C}$ ,
  - temporarily, no longer than 24 hours, to max.  $+70\text{ °C}$ .
- Ambient air temperature:
  - Range from  $+5\text{ °C}$  to  $+40\text{ °C}$
  - Special measures must be taken for operation in very hot and cold environments.
- Altitude of operating site: max. 1000 m above sea level.
- Enclosure type: IP 20 (according to standard EN 60529).  
A suitable enclosure type, i. e. IP 54 must be assured by the ambience/installation.
- Contamination level 2 (according to standard EN 50178).

The RC positioning system has been safely designed and constructed by us.



**CAUTION**

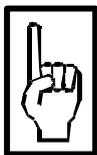
**Danger as a result of modifications and retrofitting**

**Possible consequences can be severe or light injuries (injury to persons), damage to the system or the environment.**

**Do not perform any unauthorised conversions!**

**Do not perform any retrofitting with accessories or equipment from other manufacturers, unless you have consulted with the IAI Industrieroboter GmbH, especially regarding the suitability of such components!**

The RC positioning system requires low maintenance, but is not maintenance-free.



**NOTE**

**Irregular maintenance**

**The consequences of irregular maintenance can be damage to the RC positioning system and production stillstand.**

**Observe the maintenance instructions!**

## 1.3 Danger Area

The RC positioning system should be protected by guards, if people could otherwise enter the area of machine movement during operation.



**WARNING**

**Moving axes**

**Moving axes can kill or severely injure a person.**

**Secure the movement area of the axes with a separating guard!**

**Prior to starting the axes, ensure that there are no persons or items in the working area of the robot!**

## 1.4 Electrical Connection

Connect the RC positioning system to the electrical power supply. Ensure there is a supply of 24 V direct current (range +20.4 to +28.8 V DC, protective low voltage PELV). If the primary voltage fluctuates substantially, provide a voltage stabiliser.



**WARNING**

### Electrical voltage

Electric shock could cause death or severe injury.

The 24 V DC power supply unit for generation of the protective low voltage (PELV) must be carried out by a qualified electrician to ensure that proper attention is paid to the supply voltage and the maximum current consumption!  
The line supply and the direct current circuit must be equipped with suitable fusing!

Rated voltage	Protection by low voltage with safe separation (PELV) 24 V DC
Rated current	max. 2.5 A

Table 1-1 Connected loads

## 1.5 Operator

The RC positioning system may be operated only by authorised persons.  
The operating manual must be made available to the operator.



**CAUTION**

### Observance of safety instruction

Incorrect operation can result in severe or light injury, damage to the system or the environment.

If more than one person is working on the system, agree on a common sign prior to commencing work in order to avoid causing danger to each other!  
Never operate the RC positioning system before having read and understood the operating manual and particularly the chapter entitled "Safety instructions"!



**WARNING**

### Maintenance work

Maintenance personnel can be severely injured when working on RC positioning systems which are not safely shut down.

Shut off the power supply to the RC positioning system!  
Safeguard it against restart!  
If cables need to be extended, check the wiring carefully to ensure it is connected correctly, prior to switching on the power supply. Incorrect wiring can lead to malfunctioning!  
Maintenance work should be carried out only by qualified personnel!

## 1.6 Workplaces

The RC positioning system has two workplaces:

Operation of the controller with

- the teaching pendant on site or
- at a programming workstation with the PC programming system.

## 1.7 Equipment for Personal Protection

Depending on the positioning task, the workpieces to be moved or processed or the tools used, it may be necessary to wear protective clothing.

## 1.8 Continuous Sound Pressure Level

The A-rated equivalent continuous sound pressure level of the RC positioning system is below 70 dB(A).

## 1.9 Disposal



**CAUTION**

**De-commissioning**

**Electronic waste can damage the environment.**

**Dispose of the RC positioning system according to regulations!**

## 1.10 Safety Devices

The RC positioning system is equipped with

- an EMERGENCY STOP button,
- guards and
- warning signs.

The controller is not equipped with a power switch.

### 1.10.1 EMERGENCY STOP Button

An EMERGENCY STOP button must be installed near the controller.

### 1.10.2 Guard Covers

Guard covers

- prevent contact with voltage conducting parts,
- prevent foreign particles from entering and
- serve as an electromagnetic shield.

The guard covers may only be removed temporarily by authorised personnel to perform maintenance work.

### **1.11 Emergency, Fire Extinguishing Materials**

In case of emergency, switch off the power supply to the RC positioning system.

If the RC positioning system catches fire, you can extinguish it using an **ABC powder** or **carbon dioxide** extinguisher.

In case you are using **water** to extinguish fire, observe the specified minimum distance! The minimum distance depends on the diameter of the jet, spray jet or full jet and other considerations. When using a C-type fire extinguishing tube with nozzle (12 mm) and a spray jet, the minimum distance must be one metre.

## 2 Assembly, Installation



### Assembly, installation

Incorrect assembly or installation can cause death, severe or light injuries as well as damage to the machine, product or the environment.

Assembly and installation of the RC positioning system may only be carried out by trained specialists!

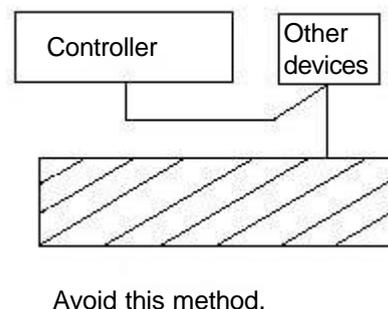
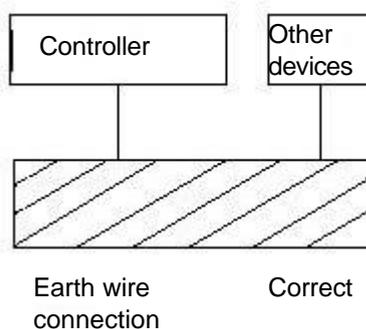
Observe the ambient conditions and EMC measures!

### 2.1 Ambient Conditions

- Do not block the vent openings of the controller when installing the IAI system.
- Your controller is NOT dust, water, or oil proof. Take steps to prevent foreign matter from getting into the controller air vents. Do not use the IAI system in an environment containing dust, oil-mist or cutting oil.
- Do not place the RC positioning system in direct sunlight and do not install the system close to any heat sources.
- Do not subject the RC positioning system to extreme temperatures exceeding +40 °C or below +5 °C (41 °F). The humidity should not exceed 50% at 40 °C at the site of operation. Do not expose the unit to corrosive or flammable gases.
- Avoid external vibration, unnecessary impact, or excessive shock to your IA system.

### 2.2 Reduction of Electromagnetic Interference

1. Cables:  
Shield all cables from radiated electromagnetic interference.
2. Wiring and power supply  
The unit must be earthed with a separate earth wire. The earth wire must be 2.5 mm<sup>2</sup> or more in size. Colour: yellow-green.



3. Interference source and noise suppression  
When using electrical components that cause electromagnetic interferences, i. e. electromagnets, solenoid valves or relays, an interference reduction component must be used.



## Wiring between overvoltage discharge and noise source

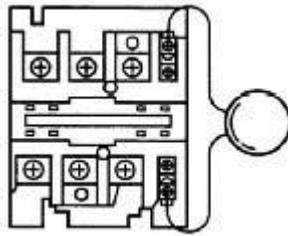
Connecting wires which are longer than required reduce the effect of the overvoltage discharge.

**Keep the wiring as short as possible!**

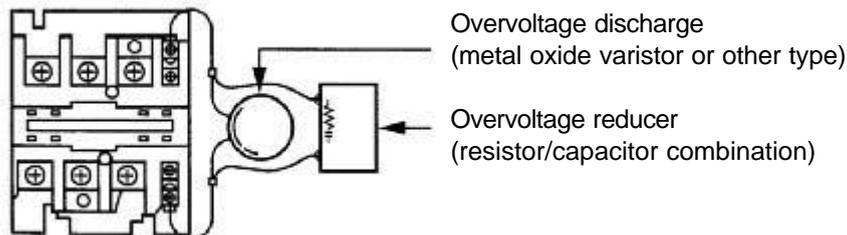
### NOTE

– AC solenoid valves – solenoid switch – relay:

- ◇ Connect an overvoltage discharge parallel to the reactive impedance (solenoid valve and relay coils):



- ◇ The most effective method is to switch an interference suppressing combination parallel to the reactive impedance (solenoid valve and relay coil). This reduces the transmission of interference within a wide frequency range:



– DC solenoid valve – solenoid switch – relay:



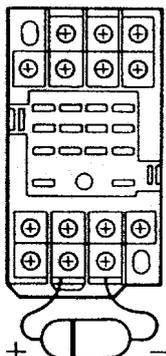
## Diode polarity

**Incorrect polarity can lead to malfunction of the diode, the controller or the direct current supply.**

**Observe the correct diode polarity for the direct current supply!**

### NOTE

Connect diode with correct rated voltage (dependent on the rated load of the system) parallel to reactive load or inductive load:



## 2.3 Electrical Connection

The RC positioning system must be connected to the electrical line supply. Ensure there is a power supply of 24 V direct current (range +20.4 to +28.8 V DC, protective low voltage PELV). If the primary voltage fluctuates substantially, provide a voltage stabiliser.



**WARNING**

### Electrical voltage

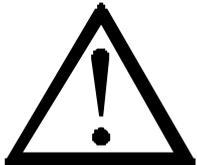
**Electric shock can cause death or severe injury.**

**The 24 V DC power supply unit for generation of the protective low voltage (PELV) must be carried out by a qualified electrician to ensure that proper attention is paid to the supply voltage and the maximum current consumption! The line supply and the direct current circuit must be equipped with suitable fusing!**

Rated voltage	Protection by low voltage with safe separation (PELV) 24 V DC
Rated current	max. 2.5 A

Table 2-1 Connected loads

## 2.4 Assembly



**CAUTION**

**Absence of air circulation, insufficient free space for assembly, disassembly and cable ways**

**The consequences can be death, severe or light injuries (injury to persons), damage to the system or the environment.**

**During assembly of individual or several controllers, always ensure the installation space enables simple assembly and disassembly! Circulation of the surrounding air must be assured!**

### Assembly manual:

1. Match the size of the mounting plate, the positioning of the controller and the measures for cooling to ensure that the limit temperature of the controller remains below 40 °C.
2. Mount the controller vertically (wall mounting): see following illustration. As the controller is cooled by normal convection, it must always be installed vertically.
3. Allow more than 50 mm free space above and below the controller, to maintain correct convection cooling.
4. Where several controllers are positioned next to each other:  
Fit a fan above the controller to maintain a constant ambient temperature.
5. Allow a distance greater than 95 mm between the front side of the controller and the wall (guard cover).

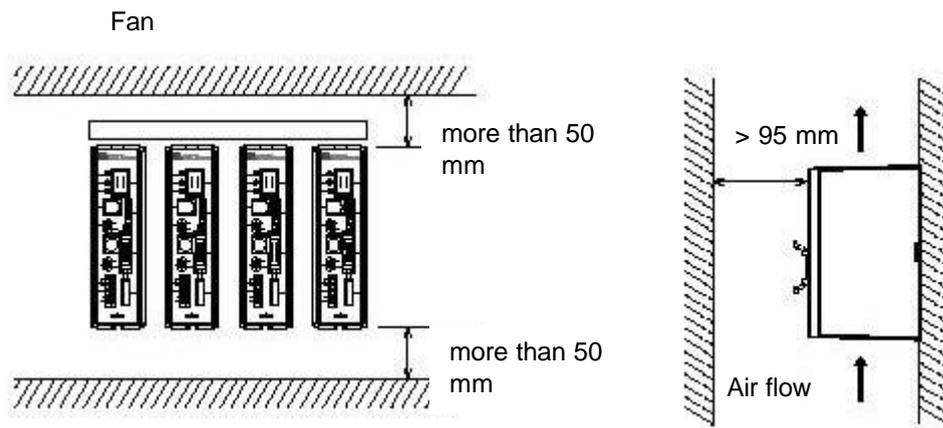


Fig. 2-1 Heat dissipation and assembly

## 2.5 Dimensions

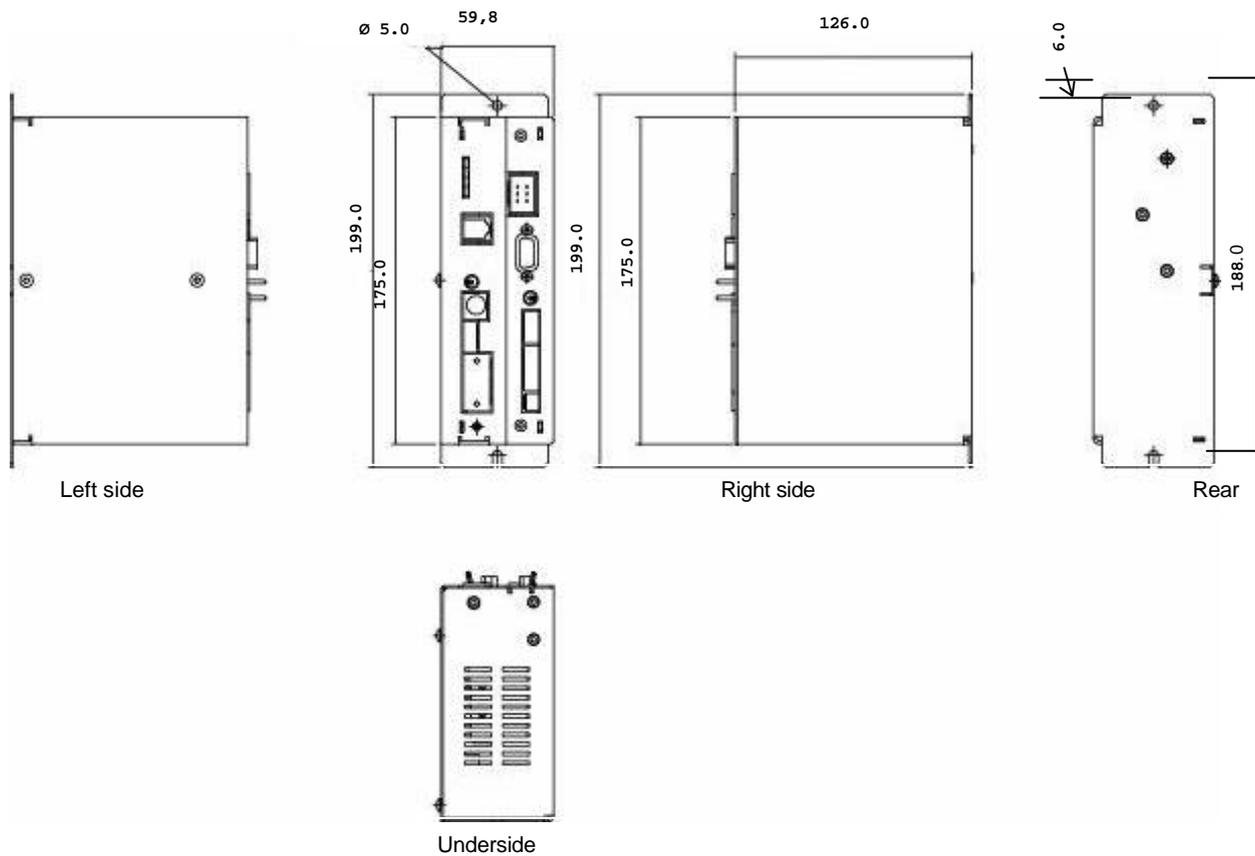


Fig. 2-2 Dimensions (mm)

## 2.6 Connections



**NOTE**

### Connection

Incorrect connection can cause damage to the system.

Do not disconnect or connect plugs (motor cable, measuring system cable, PORT IN, etc.) , while the power supply is switched on! Only connect the plug connector PORT IN when the switch SERIAL PORT is switched off!

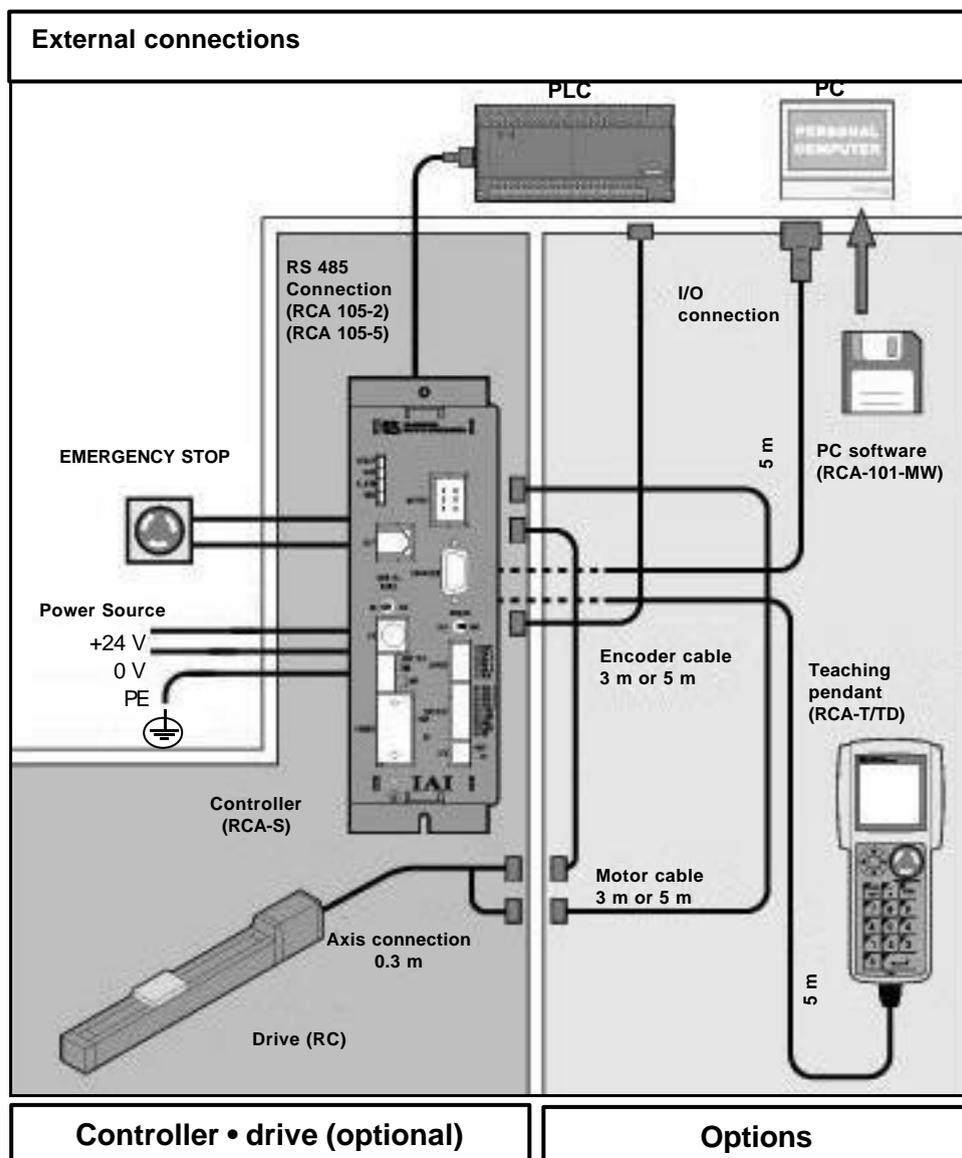


Fig. 2-3 Connections

## 3 Parts Names and Functions

### 3.1 Parts Names

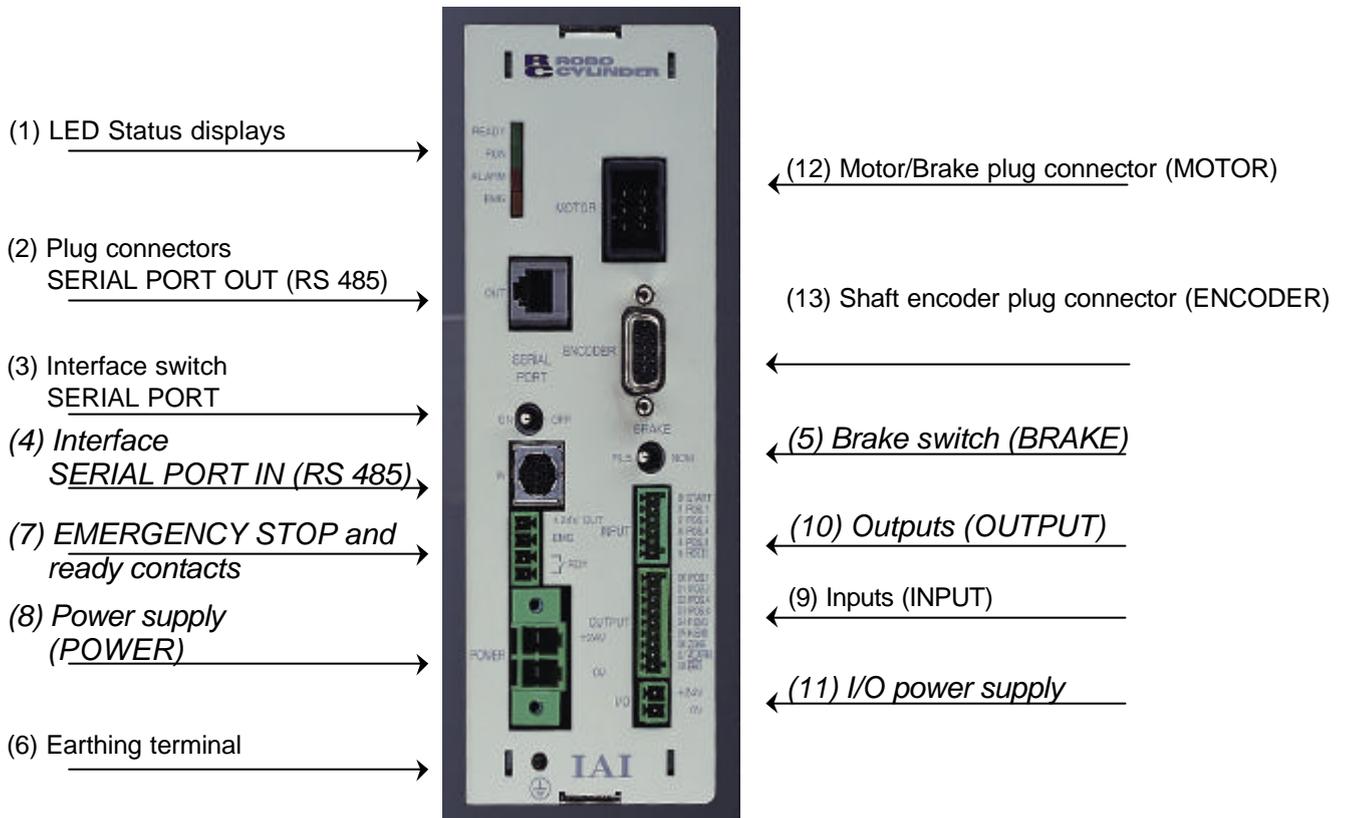


Fig. 3-1 Parts names

## 3.2 Functions

POS.-NO.	NAME	FUNCTION		
1	Status LED:	<ul style="list-style-type: none"> <li>• READY: Indicates that the CPU is running in normal operation.</li> <li>• RUN: Normal operation.</li> <li>• ALARM: Indicates that the alarm or EMERGENCY STOP mode is active.</li> <li>• EMG: Indicates an EMERGENCY STOP.</li> </ul>		
2	Connector SERIAL PORT OUT	Connector for more than two controllers connected serially.		
3	Interface switch SERIAL PORT	<ul style="list-style-type: none"> <li>• ON: PORT IN connection (teaching pendant • PC software) is activated. If the teaching pendant or the data transfer cable are not connected, the controller stops.</li> <li>• OFF: PORT IN connection (teaching pendant • PC software) deactivated. (Since the RS485 line is active, controllers can communicate with each other.)</li> </ul>		
4	Interface connector SERIAL PORT IN	Connector for teaching pendant or a data transfer cable from an external unit or a master RC controller.		
5	Brake switch BRAKE	Open brake switch; this is active only if a brake has been installed. <ul style="list-style-type: none"> <li>• RLS: Switches off the brake, off in servo mode.</li> <li>• NOM: Normal position, activates the brake, off in servo mode.</li> </ul>		
6	Earthing terminal 	<ul style="list-style-type: none"> <li>•  : earthing terminal.</li> </ul>		
7	EMERGENCY STOP and ready contacts	<ul style="list-style-type: none"> <li>• +24 V Out: Output of 24 V for EMERGENCY STOP circuit.</li> <li>• EMG: EMERGENCY STOP input.</li> <li>• RDY: Relay contact for ready to operate.</li> </ul>		
8	Power supply (POWER)	Connection of the 24 V supply (DC) approx. 2.5 A.		
9	Inputs (INPUT)	<ul style="list-style-type: none"> <li>• START: Starts movement, from pos. 1 to pos. 8.</li> <li> <table border="0"> <tr> <td> <ul style="list-style-type: none"> <li>POS1</li> <li>POS2</li> <li>POS4</li> <li>POS8</li> </ul> </td> <td>} Selection of desired position (hexadecimal).</td> </tr> </table> </li> <li>• HOLD : Temporary axis stop upon OFF (LOW).</li> </ul>	<ul style="list-style-type: none"> <li>POS1</li> <li>POS2</li> <li>POS4</li> <li>POS8</li> </ul>	} Selection of desired position (hexadecimal).
<ul style="list-style-type: none"> <li>POS1</li> <li>POS2</li> <li>POS4</li> <li>POS8</li> </ul>	} Selection of desired position (hexadecimal).			
10	Ports...(OUTPUT)	<ul style="list-style-type: none"> <li> <table border="0"> <tr> <td> <ul style="list-style-type: none"> <li>IPOS1</li> <li>IPOS2</li> <li>IPOS4</li> <li>IPOS8</li> </ul> </td> <td>} Output of position moved to (hexadecimal).</td> </tr> </table> </li> </ul>	<ul style="list-style-type: none"> <li>IPOS1</li> <li>IPOS2</li> <li>IPOS4</li> <li>IPOS8</li> </ul>	} Output of position moved to (hexadecimal).
<ul style="list-style-type: none"> <li>IPOS1</li> <li>IPOS2</li> <li>IPOS4</li> <li>IPOS8</li> </ul>	} Output of position moved to (hexadecimal).			

POS.-NO.	NAME	FUNCTION
		<ul style="list-style-type: none"> <li>• PEND: Position reached, signal HIGH, when axis is in position.</li> <li>• HEND: Moved to home, signal HIGH.</li> <li>• ZONE: Programmable "zone signal" during movement (standard LOW).</li> <li>• <math>\overline{\text{ALARM}}</math> : Alarm output of controller, alarm when signal LOW.</li> <li>• <math>\overline{\text{EMG}}</math> : EMERGENCY STOP output of controller, EMERGENCY STOP when signal LOW.</li> </ul>
11	I/O Power supply (I/O)	<ul style="list-style-type: none"> <li>• +24 : +24 V supply (DC)</li> <li>• 0V : 0 V supply (DC)</li> </ul>
12	Motor/Brake connector (MOTOR)	Connector for the supply lines of the drive motor and possibly the brake.
13	Shaft encoder connector (ENCODER)	Connector for shaft encoder cable.

Table 3-1 Parts names and functions

## Addressing of controller for serial coupling

AXIS NO.	ADRS (SW3)
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

Table 3-2 Address switch

The rotary switch for addressing is found on the amplifier board.

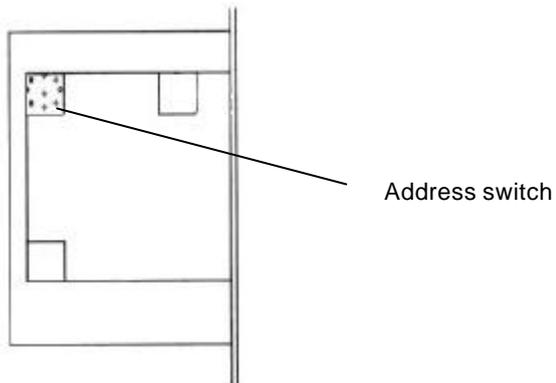
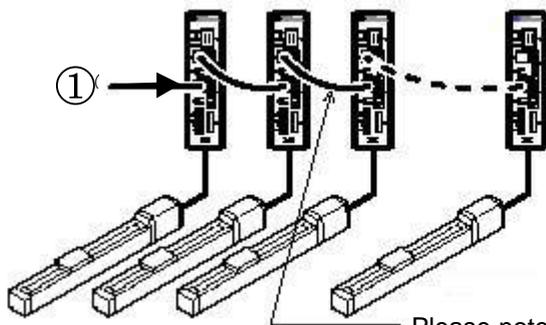


Fig. 3-2 Side view of amplifier board



Please note:  
The cable length for connecting the controllers to each other is 200 mm.  
To ① up to 16 units can be connected, i. e. PC for programming, teaching pendant, PC for operation.

Fig. 3-3 Serial controller coupling

## 4 Technical Data

### 4.1 Technical Data of Controller



**NOTE**

**Supply voltage**

If the voltage applied to an I/O connection exceeds the rated value, the connection is destroyed.

**Observe the specified rated value!**

ITEM		SPECIFICATIONS	
Supply voltage		Protection by low voltage with safe separation (PELV) 24 VDC -15 % / +20 % (max. 2.5 A)	
Ambient Temperature - Humidity		5 - 40 °C, relative humidity below 95 %	
Ambient conditions		no corrosive gases, especially no explosive gases, enclosure type IP20	
Weight		1.260 g	
Protection		EEPROM checksum, bank data error, shaft encoder stop detection error, shaft encoder counter compensation error, READY (ready to operate) RUN ALARM	
LED display		READY (ready to operate) RUN ALARM EMG	
Inputs	Inputs	Start Target position number (4 bit binary) HOLD	6 Ports
Outputs	Outputs	Position number reached (4 bit binary) Positioning complete Homing complete Zone ALARM EMG	9 Ports
Number of Positions		16	
Data Input Procedure		Teaching pendant or RS485 data transfer (PC software)	
Memory Device		E <sup>2</sup> PROM	

Table 4-1 Technical data of controller

## 4.2 List of Interfaces

### 4.2.1 Pin Assignment of OUT Connector

PIN NO.	SIGNAL NAME	FUNCTIONS
1	+5 V	DC 5 V voltage output
2	SGA	RS-485 Line transceiver
3	GND	Ground for RS-485 communication
4	SGB	RS-485 Line transceiver
5	GND	Ground for RS-485 communication
6	+5 V	DC 5 V voltage output

Table 4-2 Pin assignment of OUT connector

### 4.2.2 Pin Assignment of Interface Connector

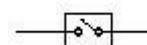
PIN NO.	SIGNAL NAME	FUNCTIONS
1	SGA	Serial data transfer
2	SGB	Serial data transfer
3	5 V	5 V voltage output
4	EMGS	EMERGENCY STOP status
5	EMGA	*Note 1
6	24 V	24 V voltage output
7	GND	Ground
8	EMGB	*Note 1

Table 4-3 Pin assignment of interface connector

\*Note 1: Is used as EMERGENCY STOP (normally closed contact).

Short these connections, if no EMERGENCY STOP switch is connected.

Interface switch  
(PORT SW)



### 4.3 Assignment of Connector Pins and Terminal Rail

#### 4.3.1 Motor/Brake Connector (178303-5: AMP)

PIN No.	Signal Name
1	B
2	⊕
3	A
4	BK -
5	BK +
6	B

Table 4-4 Pin assignment motor/brake plug connector

#### 4.3.2 Shaft Encoder Connector (15 pin. D-Sub)

PIN No.	Signal name
1	NC = not used
2	GND
3	ENC
4	ENB
5	ENA
6	NC
7	+5 V
8	%.∩
9	%.B
10	%.⊕
11	FG
12	NC
13	NC
14	NC
15	NC

Table 4-5 Pin assignment shaft encoder connector

### 4.3.3 Terminal Rail for Power Supply

Terminal no.	Signal	Function
1	+24 V	
2	0 V	
3		Earthing screw

Table 4-6 Terminal assignment for power supply

Terminal assignment for EMERGENCY STOP and ready see page 3-2.

## 4.4 Wiring



**NOTE**

### Wiring

Failure to use the tools or materials here specified can lead to system damage. Incorrect wiring can lead to malfunction.

Observe the specifications outlined!

Inspect the wiring carefully for correct connection prior to turning on the power supply!

### 4.4.1 Power Supply and EMERGENCY STOP

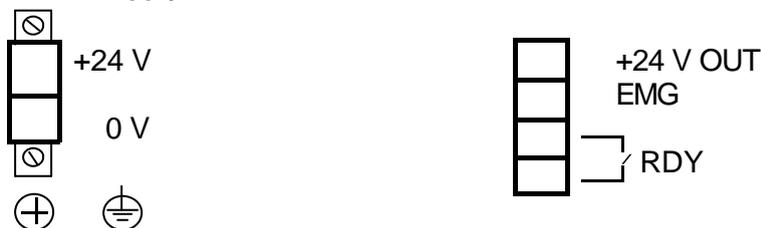


Fig. 4-1 Terminal rails for power supply and EMERGENCY STOP

The terminals "+24 V OUT" and "EMG" serve to connect an EMERGENCY STOP switch; this is no-load current circuit (normally closed contact). At the time of shipment, the terminals are shorted.

## Specifications

Required conductor cross-section	Wire	Ø 1.2 mm (AWG16) 1.25 mm <sup>2</sup> (AWG16)
Admissible conductor cross-sections	Wire Stranded wire	Ø 0.4 mm (AWG26) to Ø 1.2 mm (AWG16) 0.3 mm <sup>2</sup> (AWG22) – 1.25 mm <sup>2</sup> (AWG16)
Standard line length	Strand cross-section	Ø > 0.18 mm

Table 4-7 Wiring specifications

## 4.4.2 Several EMERGENCY STOP Switches and Controllers

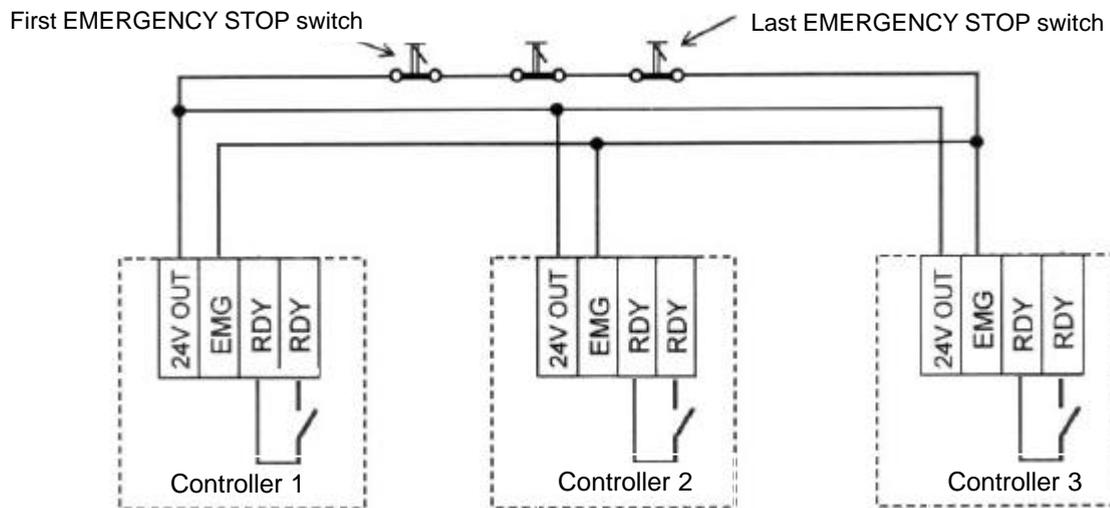


Fig. 4-2 Wiring example for several EMERGENCY STOP switches and controllers

- Always connect the last EMERGENCY STOP switch input to terminal no. 2 on each of the controllers.
- Connect the 24 V line of each controller to the first EMERGENCY STOP switch.

4.4.3 Connection Diagram for Peripherals

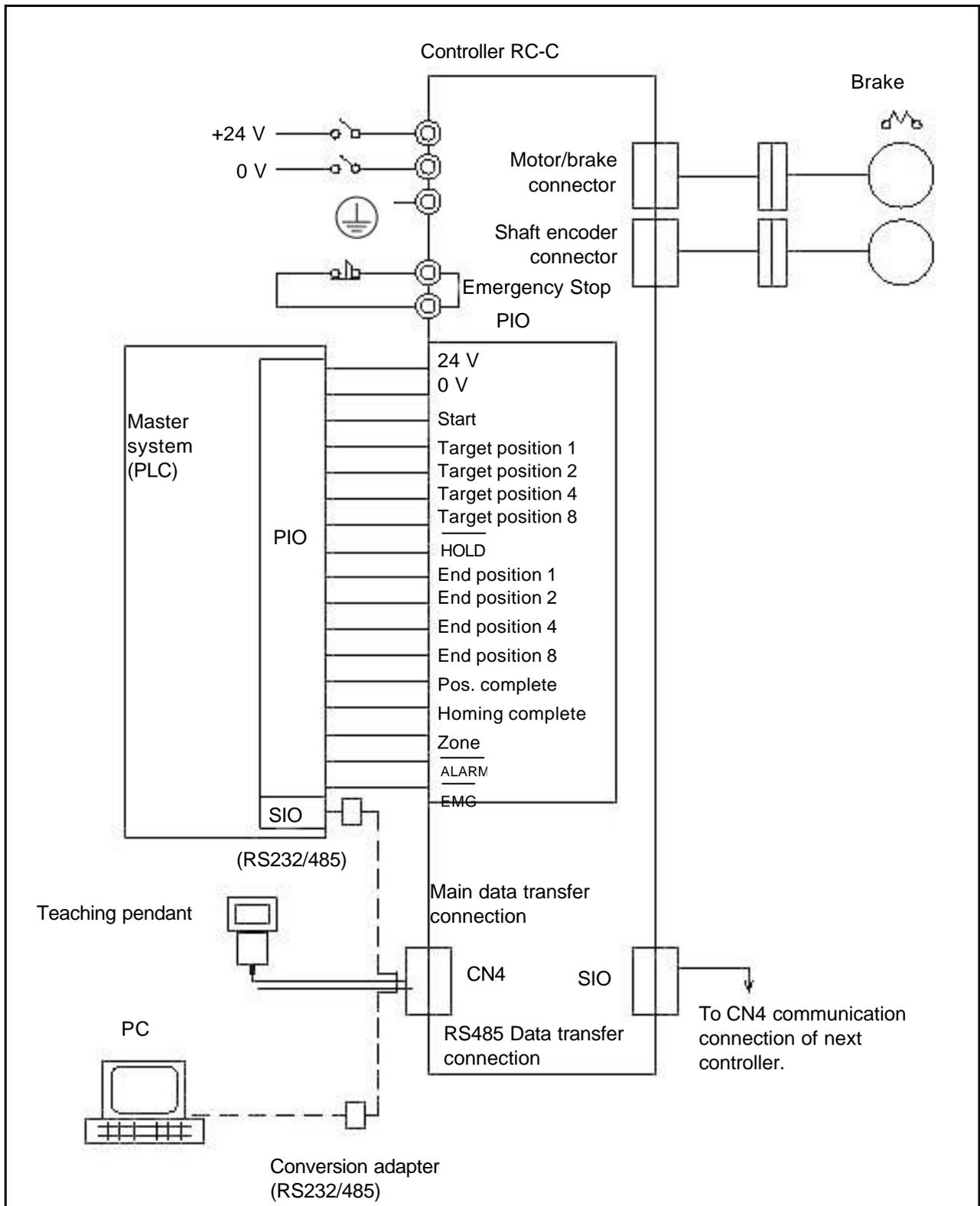


Fig. 4-3 Connection diagram for peripherals

## 4.4.4 I/O Interfaces

The following is a list of the I/O interfaces for the controller:  
The connections are made with single strands.



**NOTE**

**Outputs with \* sign**

**Outputs with \* sign operate with inverted logic.**

**Do not connect these to a vacant terminal, do not load any output with more than 20 mA!**

**Connect 24 V lines with special care!**

SIGNAL GROUP	SIGNAL DESIGNATION	FUNCTION	TERMINAL DESIGNATION
	+24 V	24 V supply	+24 V
	0 V	0 V of supply	0V
	Start	Input start movement	START
	Position 1		POS1
	Position 2		POS2
	Position 4		POS4
	Position 8		POS8
	(2) * HOLD	Stops the moving axis abruptly. Normally closed contact. 24 V must be applied for operation.	$\overline{\text{HOLD}}$
	End position 1		IPOS1
	End position 2		IPOS2
	End position 4		IPOS4
	End position 8		IPOS8
	(3) Positioning complete	Is switched on upon successful movement.	PEND
	(4) Homing complete	Is switched on upon successful homing.	HEND
	Zone	Is switched on while axis passes the path adjusted with the zone parameters.	ZONE
	(5) *Alarm	Is switched off when controller errors occur.	$\overline{\text{ALARM}}$
	(6) *EMERGENCY STOP	Is switched off upon EMERGENCY STOP.	$\overline{\text{EMG}}$

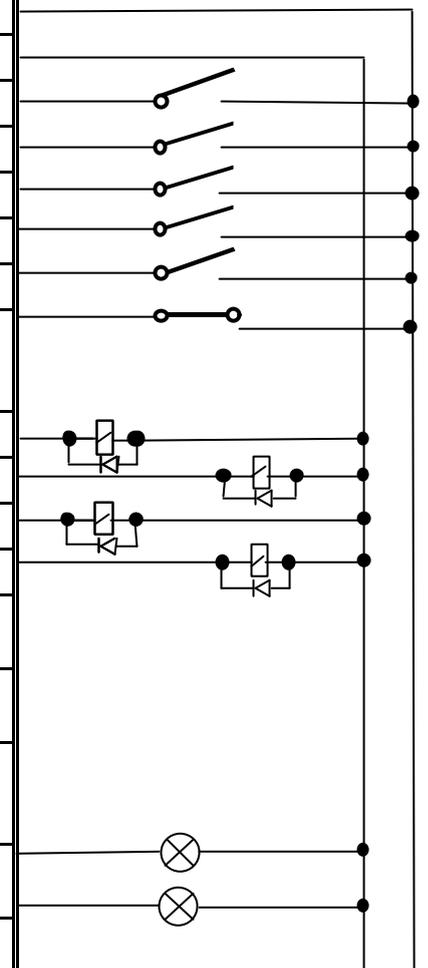


Table 4-8 Connection diagram for I/O interfaces

24 V DC,  
External power supply

$\overline{0\text{ V}}$   
 $\overline{+24\text{ V}}$

## 4.4.5 Selecting the Position Numbers



### NOTE

**Selection of undefined position numbers:**

**When the start input is switched on, undefined position numbers can lead to malfunction.**

**Do not select undefined position numbers!**

POSITION NUMBER		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
POS1	Target position 1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
POS2	Target position 2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
POS4	Target position 4	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
POS8	Target position 8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Selected position number		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Table 4-9 Selecting position numbers

1.  $\overline{\text{HOLD}}$  :  
⇒ This is a normally closed contact input. During movements it will be ON and will shut OFF for sudden stop.
2. Positioning complete:  
⇒ Is switched on when the desired movement has been completed.
3. Homing complete:  
Is switched on when homing has been completed. After that the input will remain ON until an alarm occurs or supply power is shut off.
4.  $\overline{\text{ALARM}}$  :  
⇒ This input is switched off if an alarm occurs; **it is switched on during normal operation.**
5.  $\overline{\text{EMG}}$  :  
⇒ This input is switched off if an EMERGENCY STOP occurs; **during normal operation it is switched on.**

## 4.4.6 External I/O

Designation	DATA
Input voltage	24 V DC -15% / +20%
Input current	max. 2 mA / 1 terminal
Leakage current	< 0.1 mA (caution)
Galvanic separation	Opto coupler

Table 4-10 External inputs

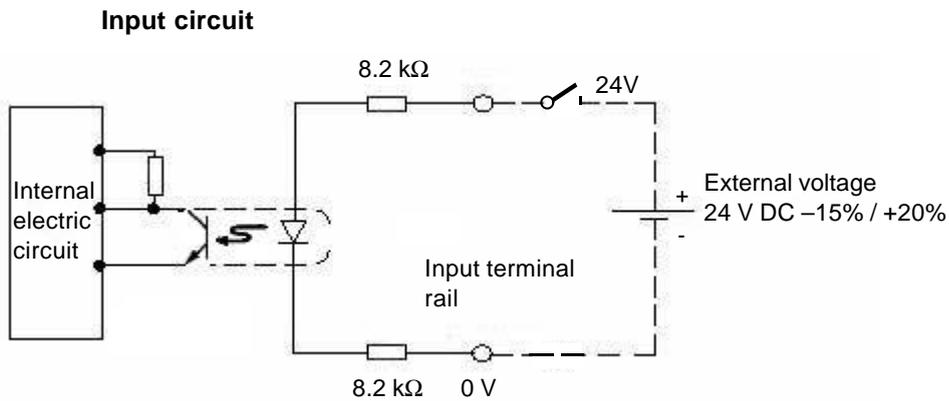


Fig. 4-4 External inputs

Designation	DATA
Load voltage	DC 24 V -15% / +20%
Max. load current	20 mA / 1 port
Leakage current	Max 0.1 mA / 1 point
Galvanic separation	Opto coupler

Table 4-11 External outputs

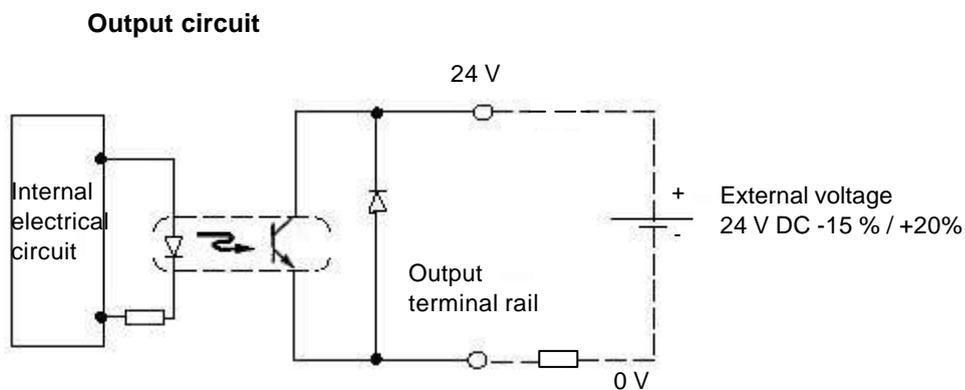


Fig. 4-5 External outputs

## 5 Data Input, Basics

The RC controller does not function on a command basis. Therefore it is not necessary to write any programmes. In order to enable movement of the axis to the selected positions, you only need to enter positioning data in a positioning table.

### 5.1 Positioning Table

The positioning table contains six columns: position, speed, acceleration/deceleration, thrust force, positioning width and acceleration with maximum value.

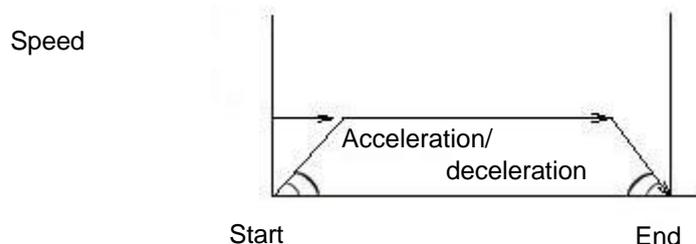
No.	POSITION in mm	SPEED in mm/s	ACC./DEC. in G	FORCE in %	POSITIONING WIDTH in mm	ACC. WITH MAXIMUM VALUE 0 or 1
0		100	0.3	0	0.1	0
1		100	0.3	0	0.1	0
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
15		100	0.3	0	0.1	0

Table 5-1 Positioning data

Make necessary changes:

Modify the default value by overwriting. The default value depends on the axis type.

1. Position:  
⇒ Distance from home (in mm).
2. Speed:  
⇒ Speed at which the axis moves (in mm/s). The maximum value depends on the axis type.
3. Acceleration/deceleration:  
⇒ Controls the acceleration/deceleration of the axis (G) movement. The specified value depends on the axis type.



Acceleration/deceleration speed G:

min. 0.01 G minimum acceleration/deceleration. / max. 1.00 G maximum acceleration/deceleration.



## NOTE

**Too low adjustment of thrust force.**

**Friction can cause malfunction.**

**Observe the maximum value specified for the current limit value in table 5-2!**

### 4. Thrust force:

⇒ The value entered selects either the positioning mode or the thrust mode.

The default value is: =0: positioning mode (= normal operation), > 0: thrust mode (%)

⇒ In the thrust mode, the input value indicates the percentage ratio of the maximum **motor current**. When it is reached the controller switches on the position complete output but maintains its thrust force.

#### NOTE:

The ratio between the motor current (%) and the thrust force (N) during movement is listed for the various types of actuators in the diagrams on pages 5-4 and 5-5. Refer to the relevant sections there.

### 5. Positioning width:

⇒ Depending on the entry in the fourth column of the positioning table, the positioning width is either 0 or > 0. The function depends on the entry in column 4.

(A) Thrust force = 0 (positioning mode)

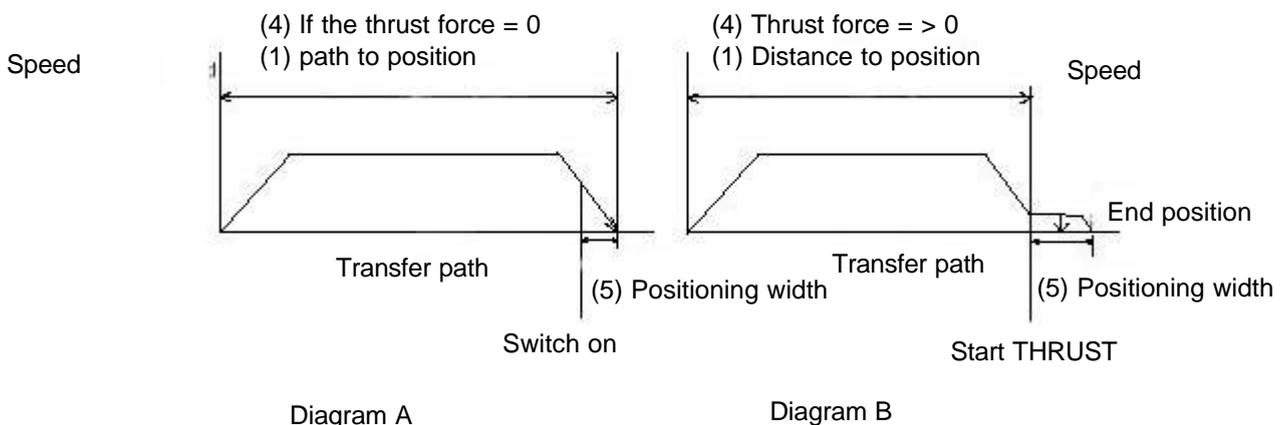
⇒ In the positioning mode, the positioning width is used, in order to switch on the output positioning complete directly prior to reaching the actual target position.

⇒ The default value is 0.1 mm (see diagram A).

(B) thrust force = > 0 (thrust mode)

⇒ Determines the maximum thrust path (distance from target point) in thrust mode (mm) (see diagram B).

⇒ If the thrust direction is a negative value as seen from the displayed coordinate, a negative sign should be placed before the positioning width value.



6. Acceleration at maximum value:  
⇒ Selects either the acceleration value entered or the maximum acceleration value. Input values are 1 or 0. The default value is 0.

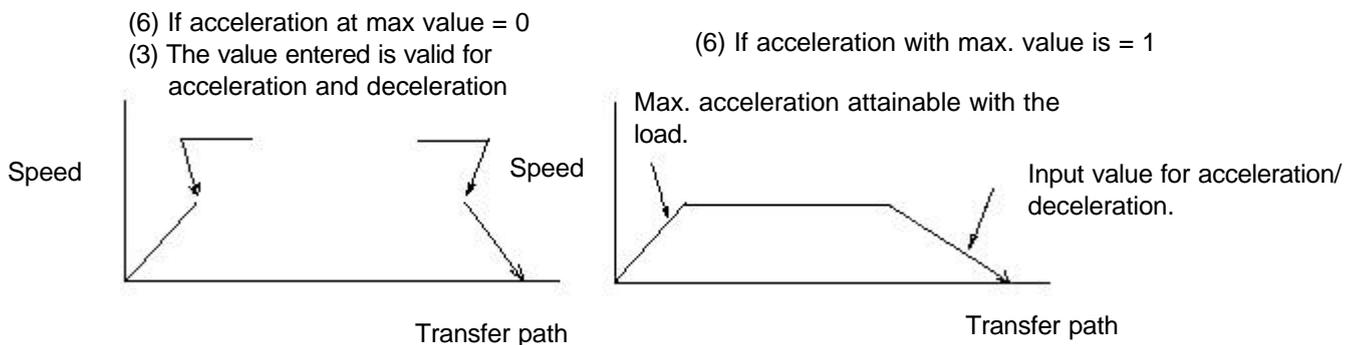
0 = acceleration value entered:

⇒ The value entered in column 3 is used for acceleration and deceleration.

1 = acceleration with maximum value:

⇒ When this value is entered, the maximum acceleration value is automatically used.

Deceleration still is governed by the value entered in column 3.



## Ratio of thrust force and current limit value

When the actuator is to operate in the thrust mode, enter the current limit value in "% of maximum" in the column "thrust force" of the positioning table. Determine the current limit value (in %) on the basis of the required thrust force, according to the table below.

The diagrams display the ratio of current limit value and thrust force for the various actuator types.

Please remember that the thrust force is an approximate value and cannot be guaranteed.



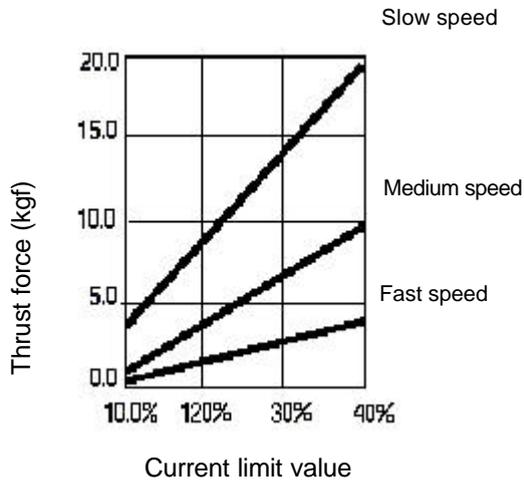
### NOTE

**Too low adjustment of thrust force.**

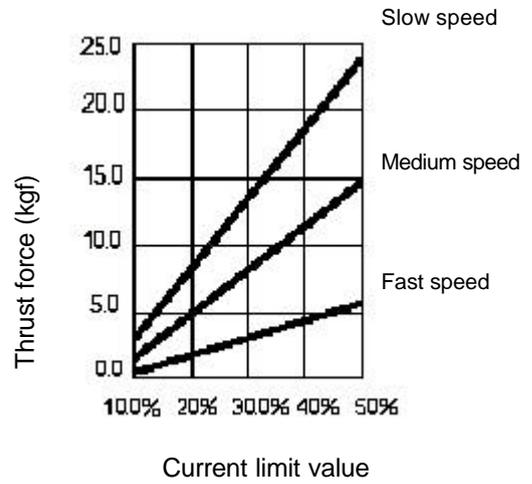
**Friction can lead to malfunctions.**

**Observe the maximum current limit value in the diagrams on pages 5-4 and 5-5 as well as table 5-2!**

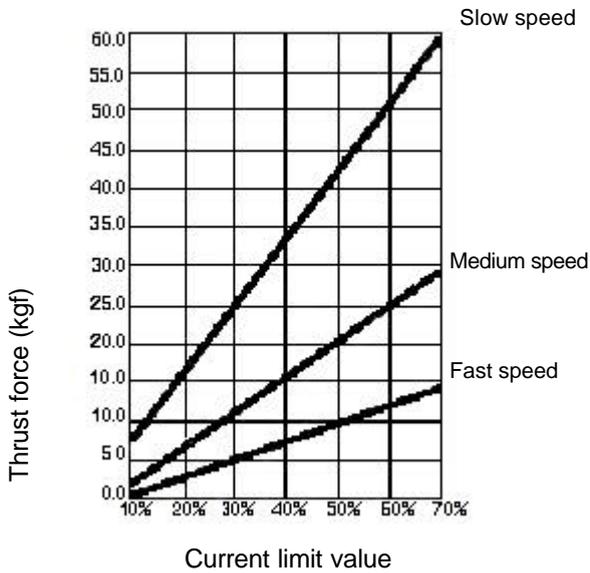
**S5 type**



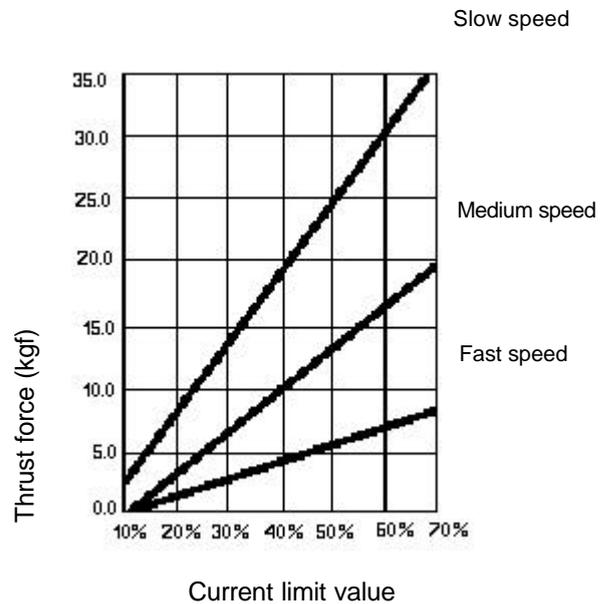
**S6 type**



**SM & SMR types**



**SS & SSR types**



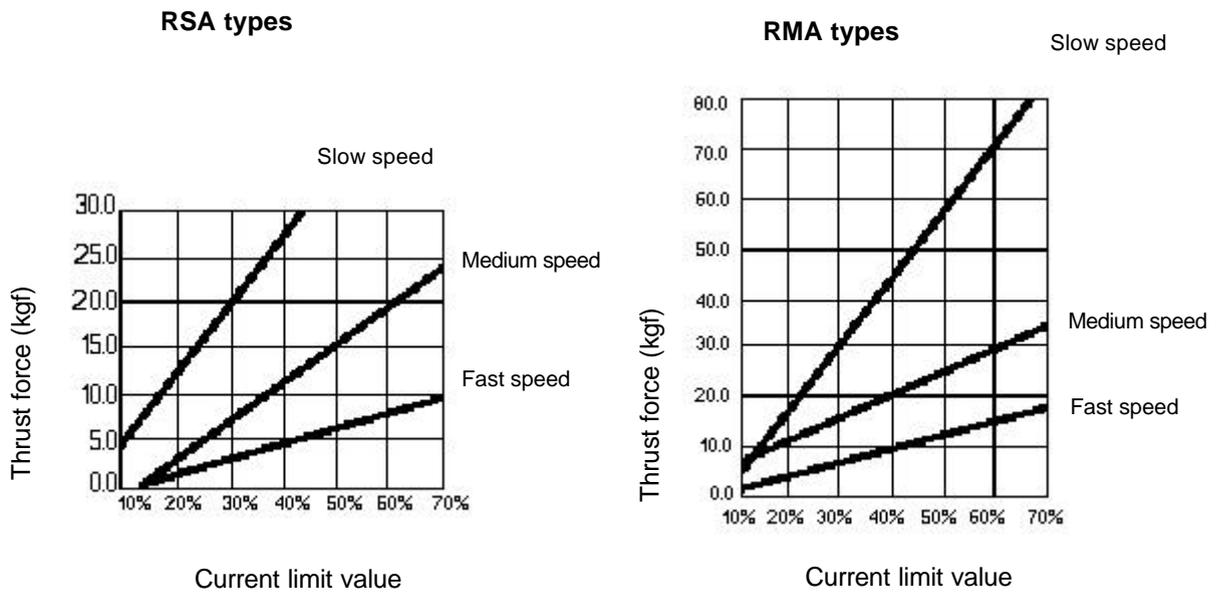


Fig. 5-1 Ratio of current limit value / thrust force

	TYPE					
	S5	S6	SS - SSR	SM - SMR	RSA	RMA
Slow speed	max. 40 %	max. 50 %	max. 70 %	max. 70 %	max. 45 %	max. 65 %
Medium speed	max. 40 %	max. 50 %	max. 70 %	max. 70 %	max. 70 %	max. 70 %
High speed	max. 40 %	max. 50 %	max. 70 %	max. 70 %	max. 70 %	max. 70 %

Table 5-2 Ratio of current limit value / thrust force

## 5.2 Positioning Mode

### 5.2.1 Positioning Mode (thrust force = 0)

The thrust path is determined by the input for the positioning width in the positioning table. The creep speed during the thrust movement is fixed and cannot be changed (75 RPM).



**WARNING**

#### Running-on time of axis

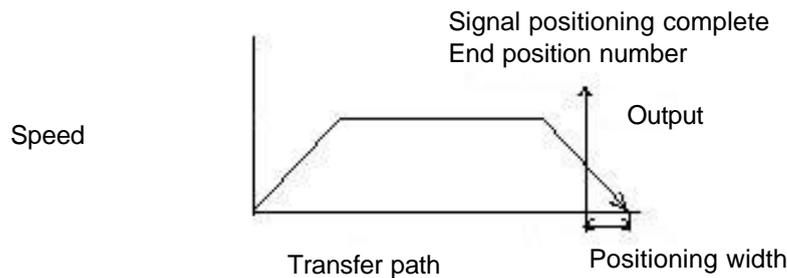
The axis moves the workpiece further on, even when the thrust force in % has been reached. The moving axis can cause death or severe injury to people.

Ensure there are no persons or items in the working area of the robot prior to starting the axes!

Be aware of the running-on time!

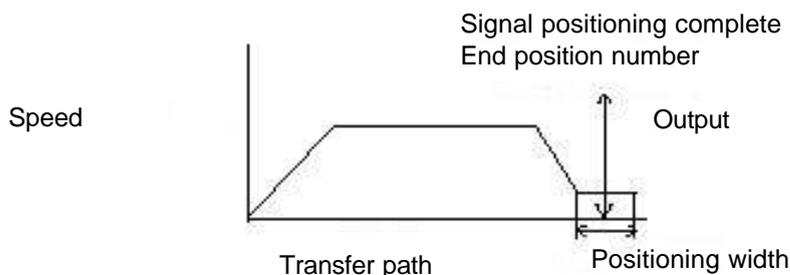
#### Transfer path:

The output positioning complete is switched on when the distance to the end position (1) defined with the positioning width has been reached. At this point, the end position no. outputs are activated.



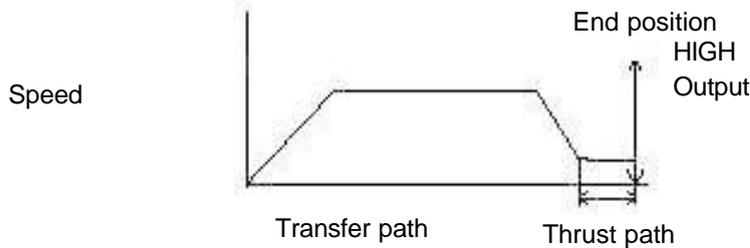
#### 1. In successful thrust mode:

After reaching the end position (1), the axis continues to move at a speed of 75 revolutions per minute (RPM). While the axis pushes the workpiece further, the adjusted current consumption of the motor is finally reached (corresponding to value entered for thrust force). In this moment, the output positioning complete is switched on. And at this point, the end position number outputs are activated. (parameter)



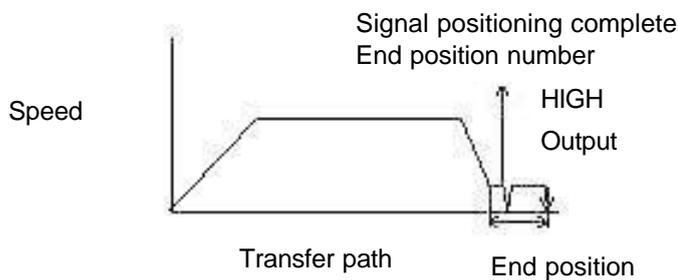
## 2. If the thrust mode fails (no workpiece to push):

After having reached the end position (1), the axis continues to move at a speed of 75 revolution per minute (RPM). If the current consumption of the motor does not reach the current limit value, the output positioning complete is not switched on even if the axis has reached the end position. In this case, only the end position number outputs turn on.



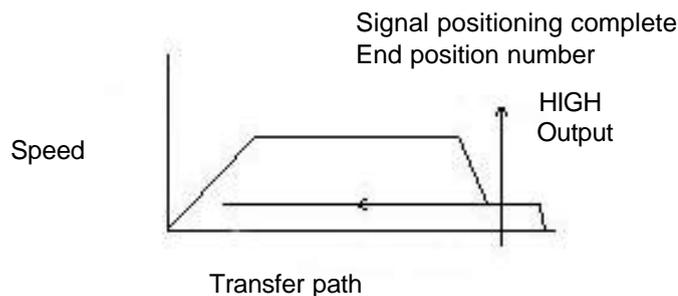
## 3. If the workpiece slips while being pushed:

- If the workpiece slips in the direction of thrust:  
If the output positioning complete has switched on and the workpiece continues to move in the direction of thrust, the axis follows the workpiece until the end position is reached. The output positioning complete switches on, but the end position number outputs do not alter their condition.



- If the workpiece slips against the direction of thrust:  
(The actuator moves backward, as the workpiece exerts counterpressure.)  
If the thrust force exerted by the actuator is lower than the counterpressure, and is therefore forced back after the output positioning complete has switched on, the axis is forced back until the thrust force and the counterforce are in balance. The output positioning complete switches on but the position number outputs do not alter their condition.

Note: If needed, set the "Thrust time". The default values is 255 ms.



**4. If the input value for the thrust path is faulty:**

If an incorrect thrust path is entered, as shown in the figure below, only the distance will be incorrect (positioning complete thrust path x 2). Pay attention to this.

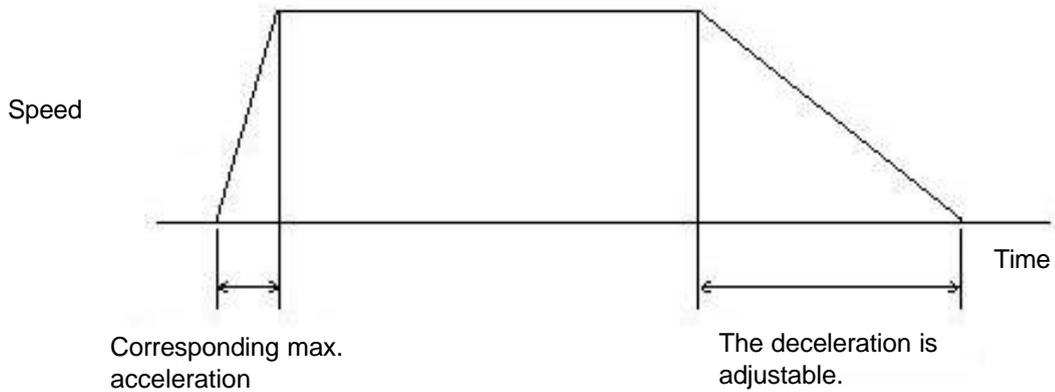
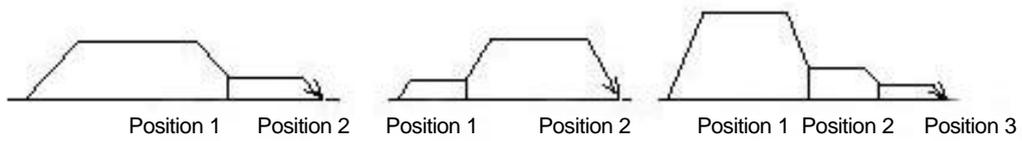
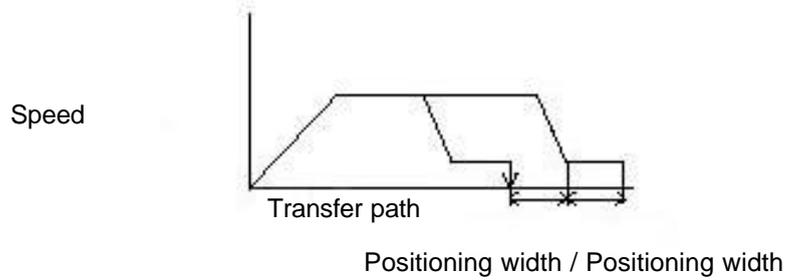


Fig. 5-2 Positioning mode (thrust force = 0)

## 5.2.2 HOLD Input = $\overline{\text{HOLD}}$

The  $\overline{\text{HOLD}}$  input is used for temporary stop. The axis stops when the external input signal is set ( $\overline{\text{HOLD}}$  input). Like all safety relevant inputs, the signal is processed as a normally closed contact (inverted logic). When the  $\overline{\text{HOLD}}$  input is switched off, the axis stops immediately and only moves again when the  $\overline{\text{HOLD}}$  input is switched back on. While  $\overline{\text{HOLD}}$  is activated a new position may be entered.

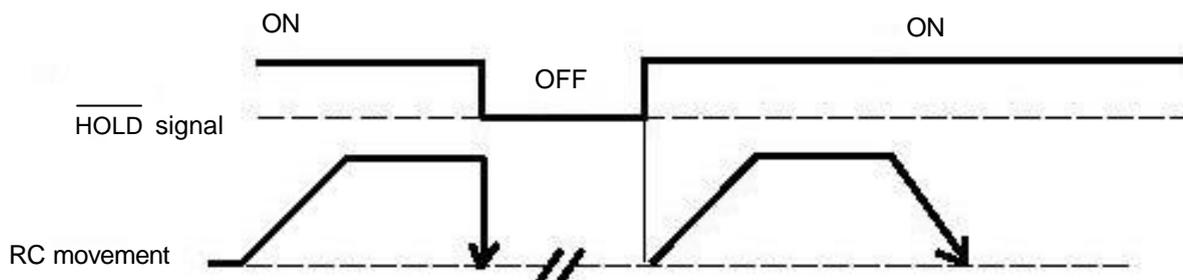


Fig. 5-3  $\overline{\text{HOLD}}$  input



If you enter a new position number while the axis halts, the actuator moves to it afterwards.

### NOTE

## 5.2.3 Signal Output Zone

During movement along a programmed range, the zone signal is output (adjustable to a specified range). If the zone parameters have been entered, the zone signal is switched on as soon as the slider enters the adjusted range, and remains switched on until it exits the zone.

The zone range can be freely positioned along the transfer path.

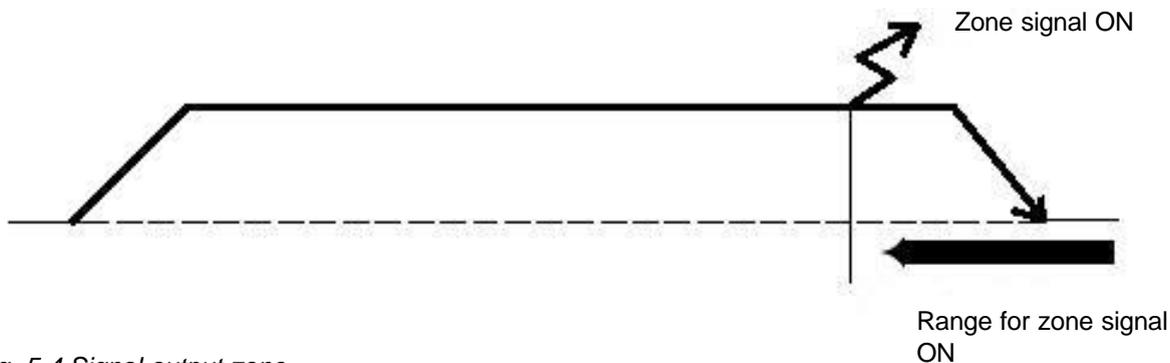


Fig. 5-4 Signal output zone

### 5.2.4 Homing



#### NOTE

Homing is carried out automatically as soon as a start signal is output after switching on the controller.

Thereafter the actuator moves to the position number entered.

## 6 Practical Application

### 6.1 Power-Up



#### WARNING

#### Moving axes

Moving axes can kill or severely injure a person.

Ensure there are no persons or items in the working area of the robot prior to starting the axes!



#### NOTE

#### Power-Up

If the parallel I/O inputs are activated already before the main power is switched on or are activated simultaneously with power-up, the parallel outputs may assume an unstable status for approximately 1 ms during power-up. This may cause malfunction.

Activate signals only after the controller has booted and the end position signals have been set!

#### Procedure:

1. Connect the motor/brake cable and the encoder cable to the controller.
2. Connect the master PLC to the I/O contacts.
3. When connecting more than one axis, address each by using the address switch. For details, please refer to the "Technical Data" section under address switch settings.
4. Supply main power (24V) onto the controller terminal board.
5. Connect the I/O supply (24 V).
6. Apply +24 V to HOLD input.
7. Normally the LEDs READY and RUN will now be on. If there is an error, the LEDs ALARM or EMG will be on.  
Compare the alarm list beginning on page 8-1.

This completes the preparations for operation.

**Status "Movement Possible"**

1. The servo is switched on, when supply power is turned on. Once the power-up preparations are complete, the output "positioning complete" switches on.
2. The relationships between the outputs  $\overline{\text{ALARM}}$  and  $\overline{\text{EMG}}$  and the operating condition are shown in the diagram below:

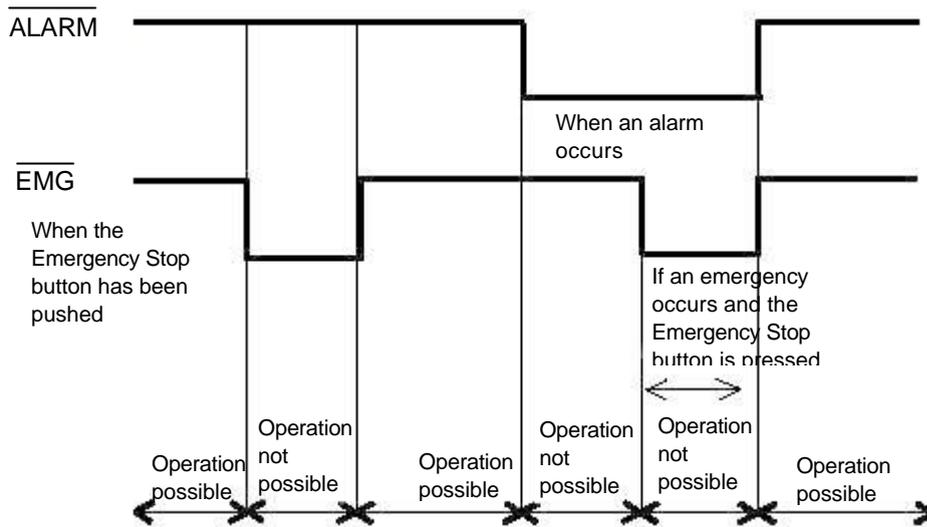


Fig. 6-1 Status "movements possible"

**6.2 Movements upon Power-Up**

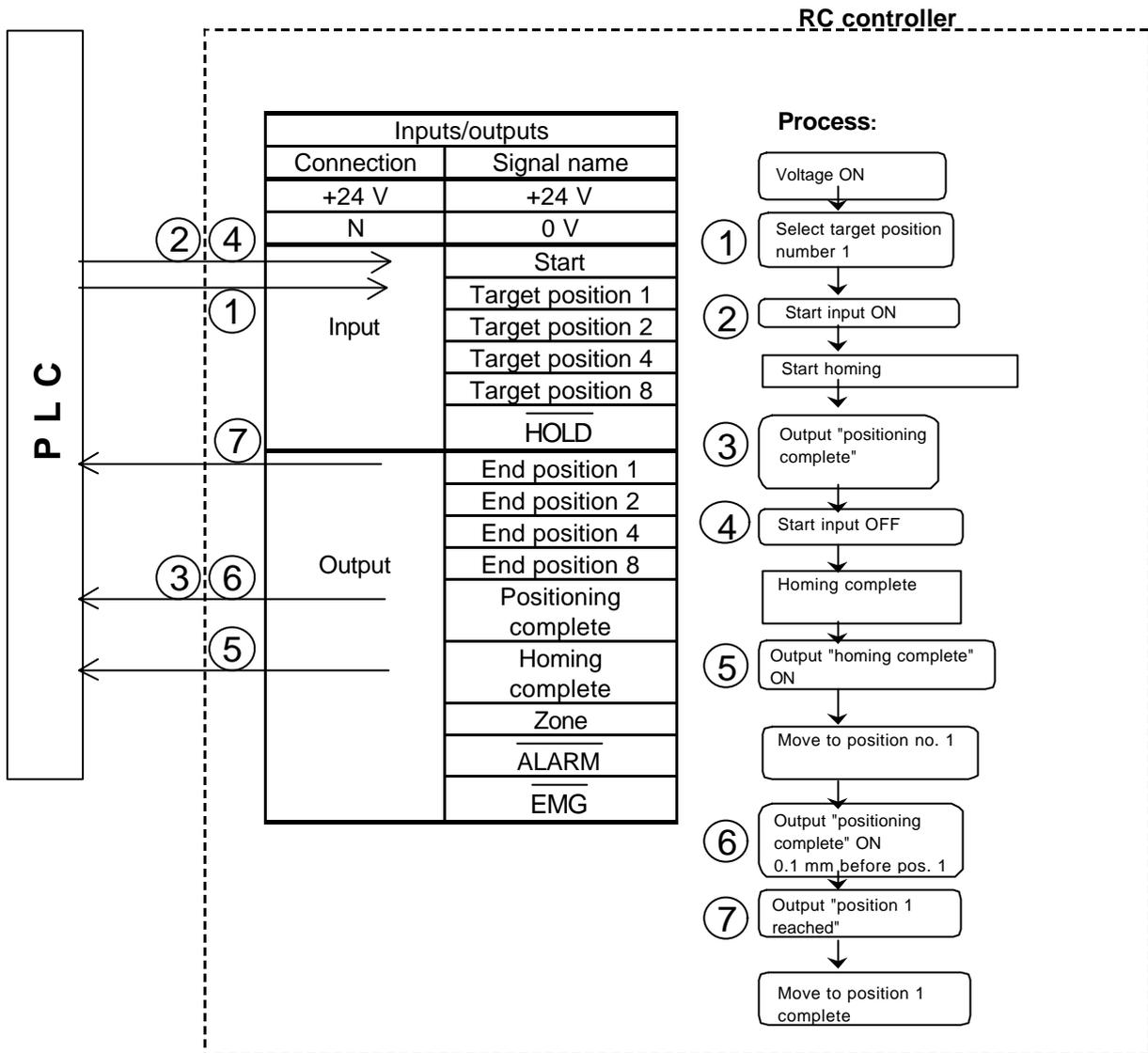
Movement example:

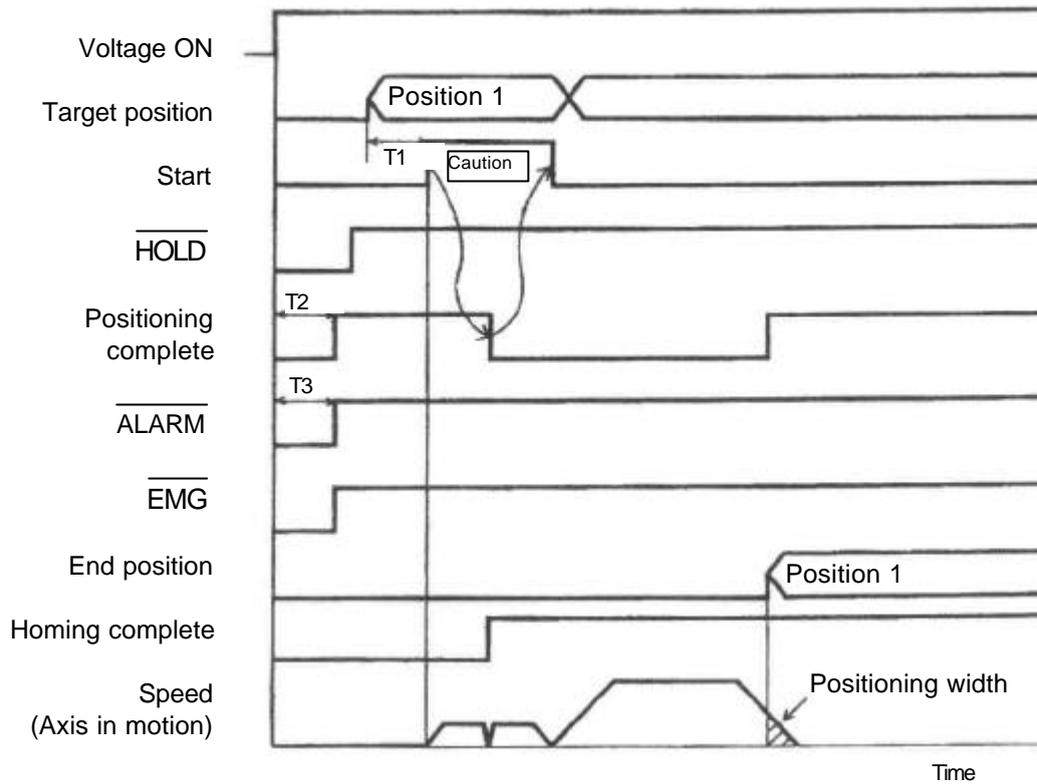
After power-up, a movement from home to 150 mm is performed at a speed of 200 mm/s.

**Positioning table (the columns with dark lines indicate the relevant input values)**

NO.	POSITION in mm	SPEED in mm/sec	ACC./DEC. in G	THRUST FORCE in %	POSITIONING WIDTH in mm	ACC. AT MAX. VALUE 0 or 1
0	*	*	*	*	*	*
1	150	200	0.3	0	0.1	0
.						
.						
.						

Table 6-1 Positioning table, example





## NOTE

### Start signal

The output "positioning complete" switches OFF, when the start signal is switched on.

The start signal must not be switched off, before the output "positioning complete" is switched off!

Unless „HOLD“ input is switched on , the axis does not move.

After power-up and completion of the preparations for operation, the output "positioning complete" switches ON.

- |                 |  |
|-----------------|--|
| T1: over 5 ms   | Time from target position select to start input ON.        |
| T2: over 250 ms | Time from power-up to preparations for operation complete. |
| T3: over 50 ms  | Time from power-up to alarm output ON.                     |

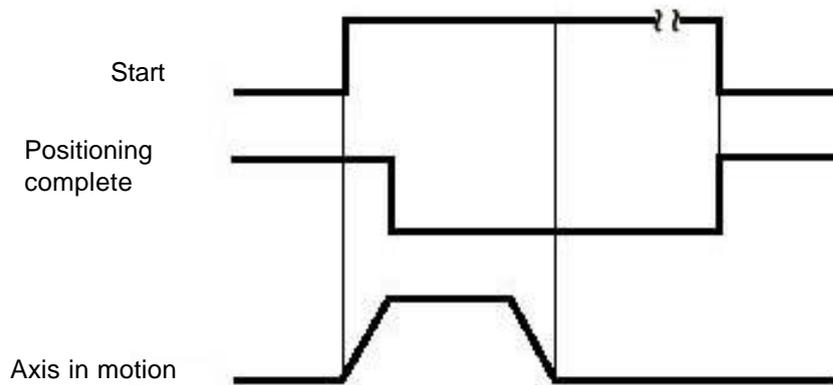


**NOTE**

**Start signal**

As the diagram below shows, the output "positioning complete" will not switch back ON, if the start signal remains ON, even after the actuator movement has stopped.

The start signal must not be switched off, before the output "positioning complete" is switched off!



### 6.3 Positioning Mode

**Positioning Mode (Movement from one point to another)**

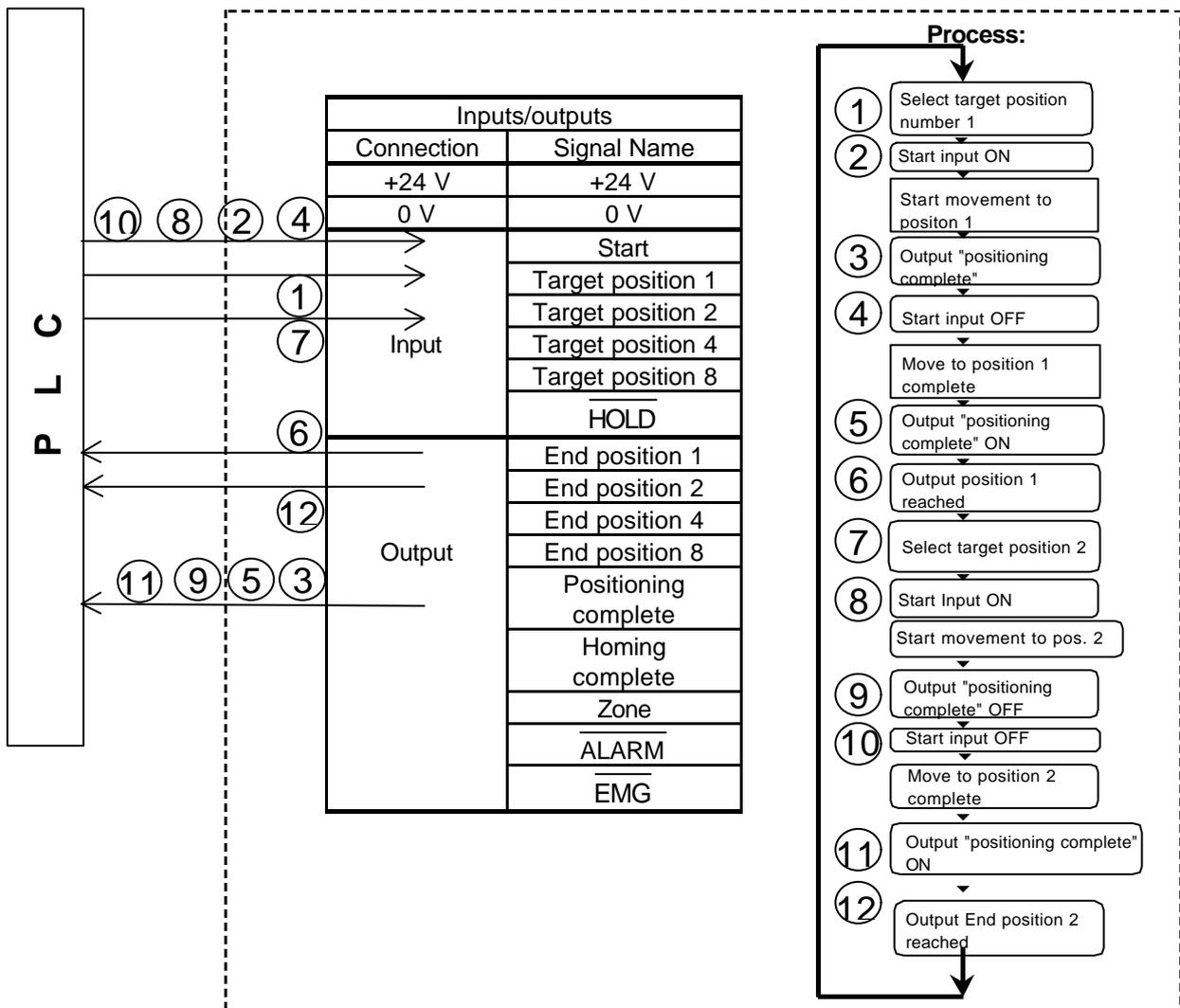
Movement example: Movement from one point to another. Define 250 mm away from home as position 1, and 100 mm from home as position 2. Set the speed to 200 mm/s for position 1, and 100 mm/s for position 2. For both positions, set the positioning width to 0.1 mm.

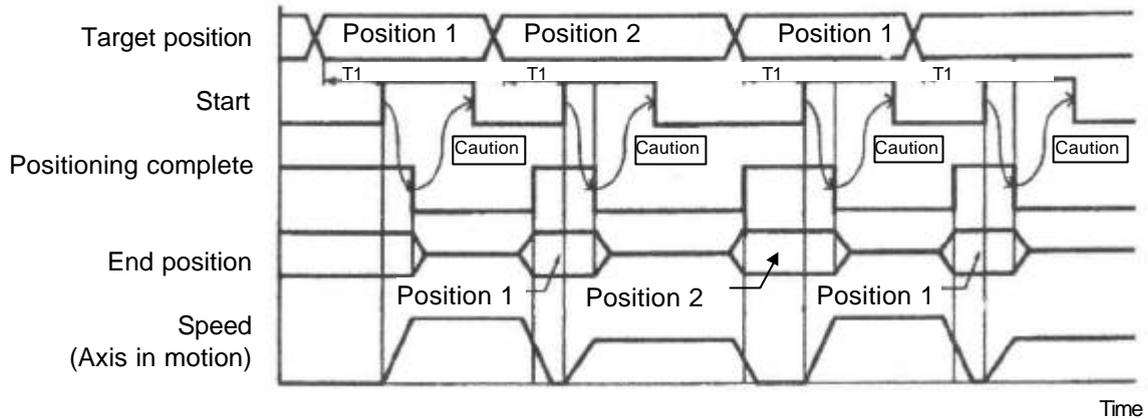
**Positioning table (the columns with dark lines indicate the relevant input values)**

NO.	POSITION in mm	SPEED in mm/sec	ACC./DEC. in G	THRUST FORCE in %	POSITIONING WIDTH in mm	ACC. AT MAX. VALUE 0 or 1
0	*	*	*	*	*	*
1	250	200	0.3	0	0.1	0
2	100	100	0.3	0	0.1	0
.						
.						
.						

Table 6-2 Positioning table, example

**RC controller**





T1: over 5 ms Time from target position select to start signal ON



**NOTE**

### Start signal

The output "positioning complete" switches OFF, when the start signal is switched on.

The start signal must not be switched off, before the output "positioning complete" is switched off!

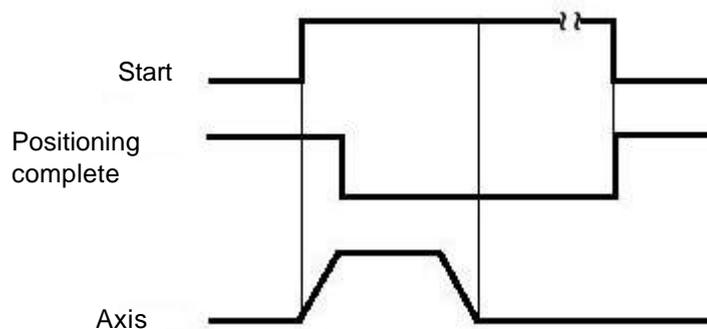


**NOTE**

### Start signal

As the diagram below shows, the output "positioning complete" will not switch back ON, if the start signal remains ON, even after the actuator movement has stopped.

The start signal must not be switched off, before the output "positioning complete" is switched off!



### 6.4 Thrust Mode

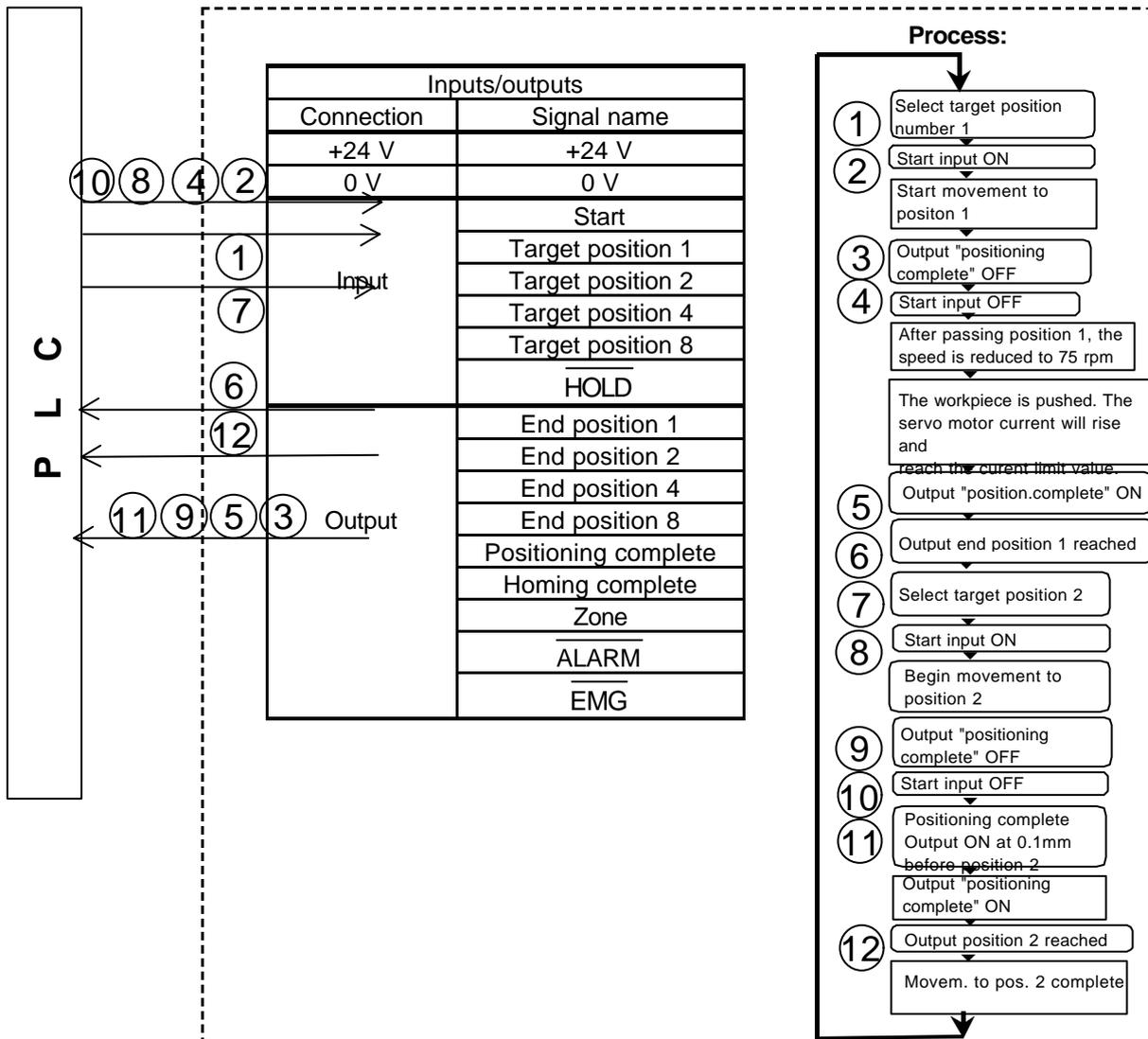
Movement example: Movement in thrust mode. Define 280 mm from home as position 1 and 100 mm from home as position 2. Move to position 1 in thrust mode.

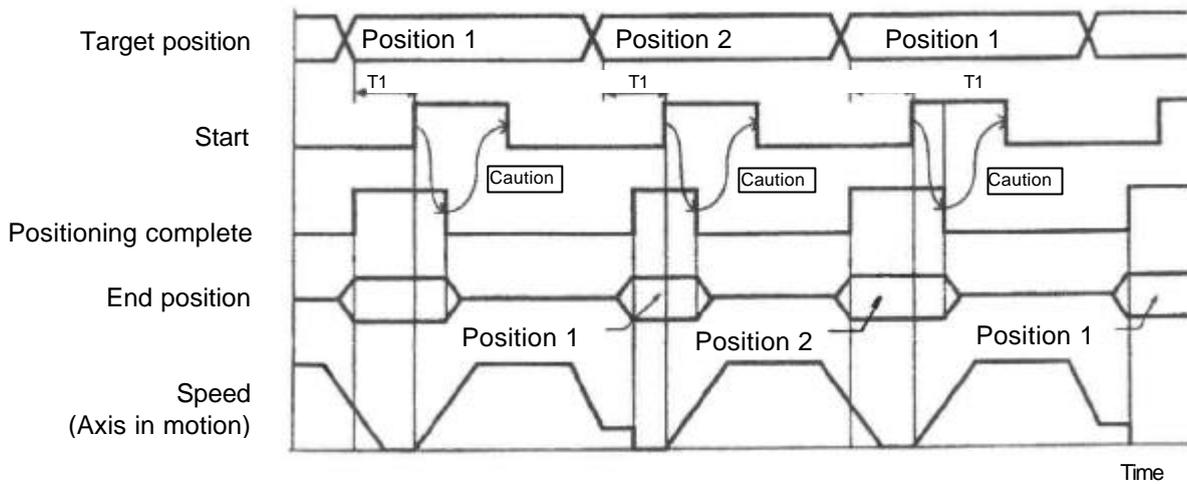
Use the thrust mode to move to position 1 (movement to the end opposite the motor). Set the maximum thrust path to 20 mm and the current limit value for the servo motor to 50 %.

Positioning table (the columns with dark lines indicate the relevant input values)

NO.	POSITION in mm	SPEED in mm/sec	ACC./DEC. in G	THRUST FORCE in % of motor current	Transfer path with thrust in mm	ACC. AT MAX. VALUE 0 or 1
0	*	*	*	*	*	*
1	280	200	0.3	50	20	0
2	100	100	0.3	0	0.1	0
·						
·						
·						

#### RC controller





T1: over 5 ms Time from target position select to start signal ON



**NOTE**

### Start signal

The output "positioning complete" switches OFF, when the start signal is switched on.

The start signal must not be switched off, before the output "positioning complete" is switched off!

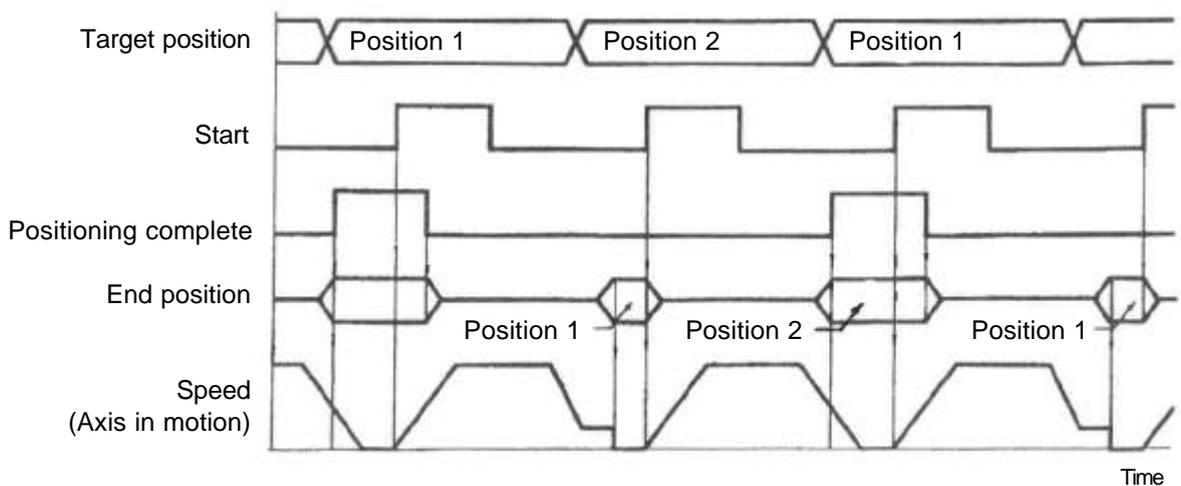


**NOTE**

### Output "positioning complete"

If the thrust movement is completed although the set motor current has not been reached, the output "positioning complete" is not switched on, but only the outputs for the end position.

See the diagram below!



### 6.5 Speed Change During Movement

**Movement example:** During movement the speed is to be decreased at a set point. Define 150 mm from home as position 1 and 200 mm from home as position 2. Define position 1 as switch-over position. Move to position 1 at a speed of 200 mm/s and from position 1 to position 2 at 100 mm/s.

**Method:** In this case two movements will be carried out in direct sequence. First the axis moves to position 1, then from position 1 to position 2. However, to ensure the movement will not stop at position 1, the positioning inputs for position 2 and the start input must be set before position 1 is actually reached. To achieve this, set a sufficient positioning width for position 1. The signal position 1 reached will be immediately followed by the start signal for position 2 (the target position select must be set during the movement to position 1).

Positioning table (the columns with dark lines indicate the relevant input values)

NR.	Position in mm	Speed in mm/sec	Acc./Dec. in G	Thrust force in %	Positioning width in mm	Acc. at max. value 0 or 1
0	*	*	*	*	*	*
1	150	200	0.3	0	10	0
2	200	100	0.3	0	0.1	0
.						
.						
.						

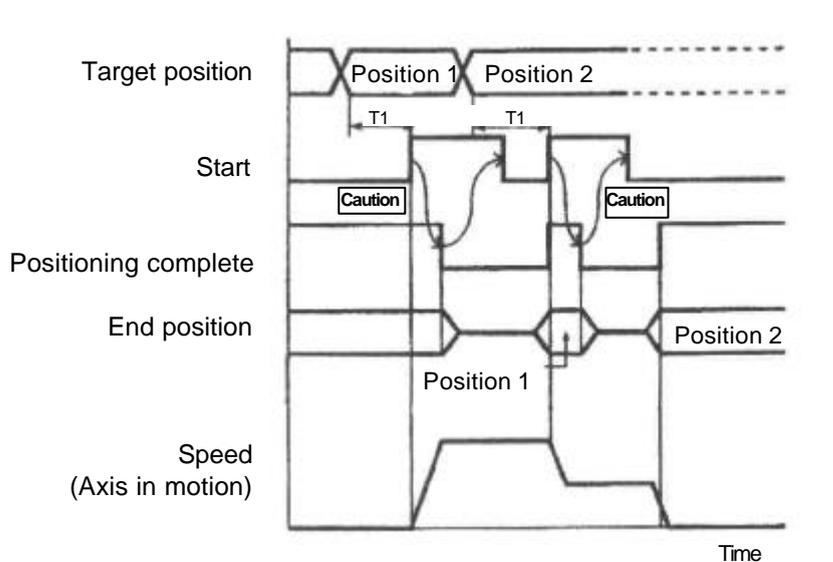


NOTE

**Start signal**

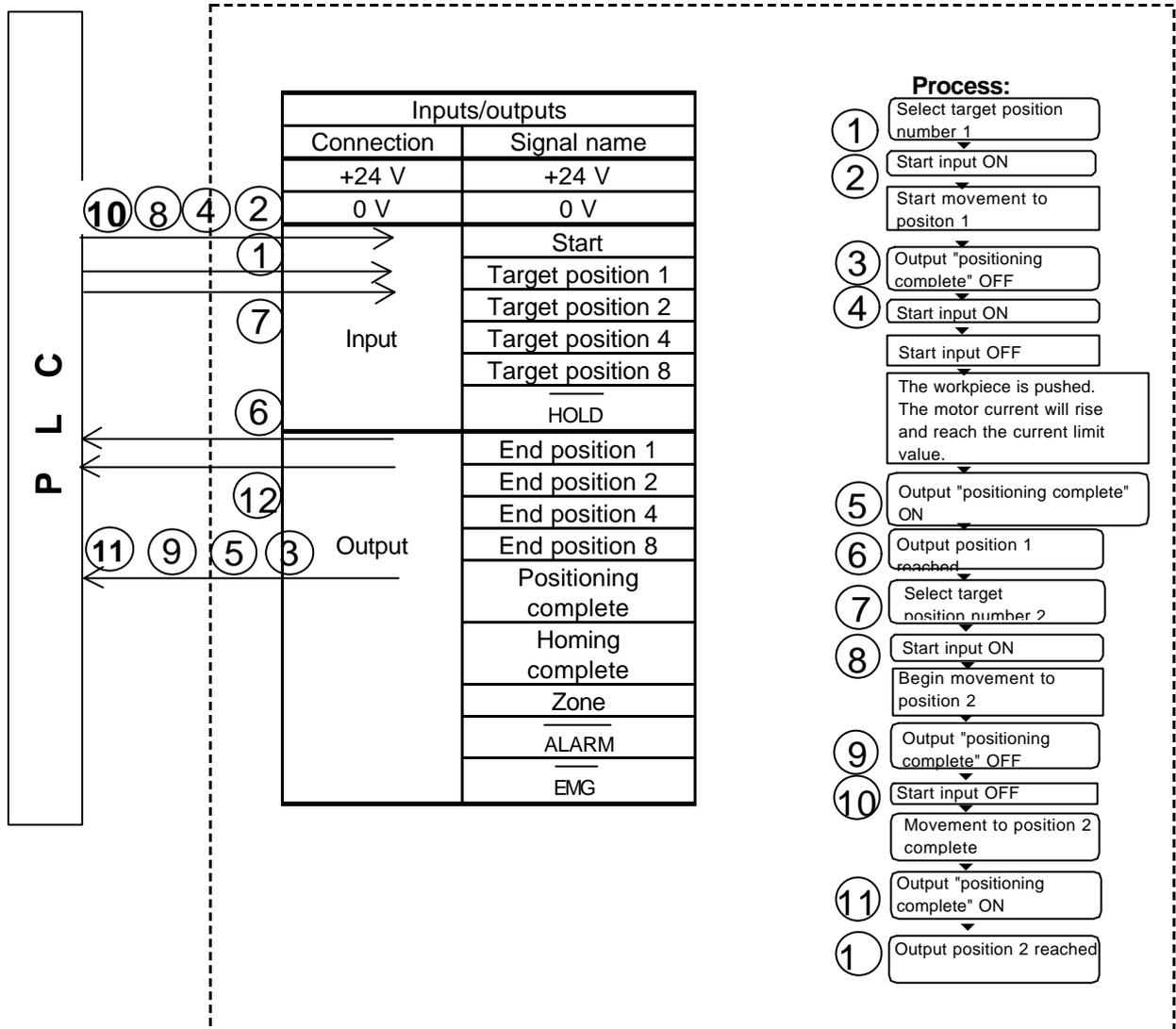
The output "positioning complete" switches OFF, when the start signal is switched on.

The start signal must not be switched off, before the output "positioning complete" is switched off!



T1: over 5 ms time between target position select and start signal ON.

## RC controller



## Movements with differing Acceleration and Deceleration Values

**Movement example:** The actuator moves at 200 mm/s to position 1 which is located 150 mm from home. The acceleration is set to maximum, the deceleration is set to 0.1 G adapted to the load transferred.

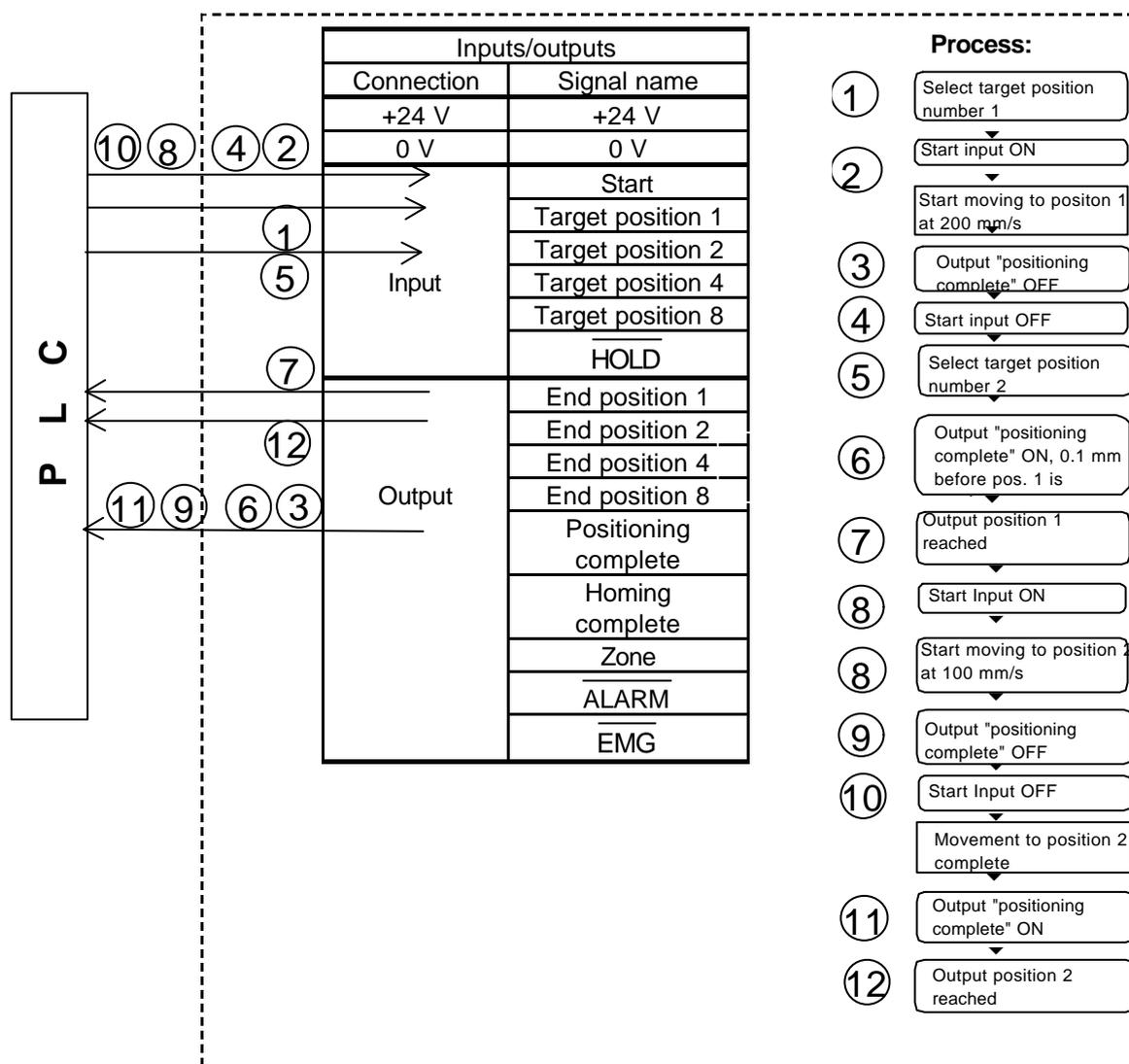
**Method:** If you enter "1" in the column "acceleration at max. value" in the positioning table, the acceleration will reach the maximum that is possible with the given load.

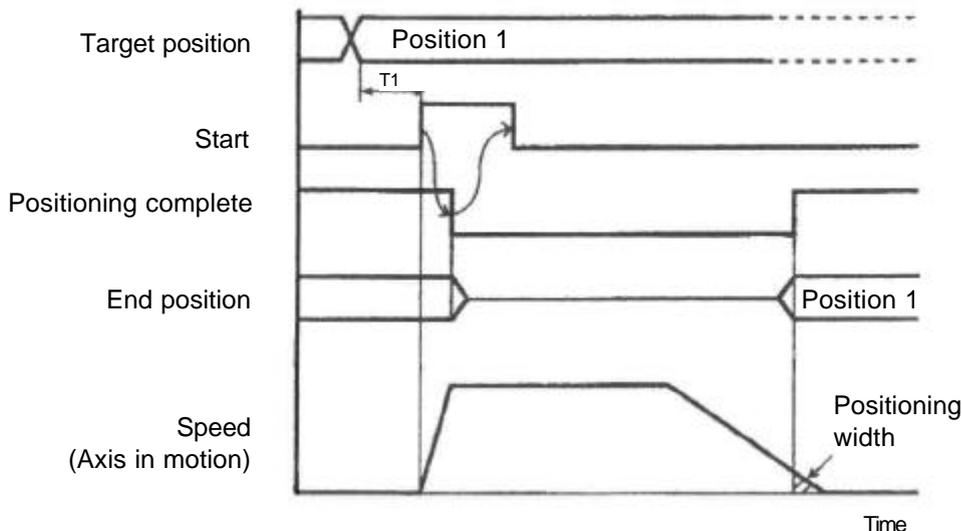
Deceleration is controlled by the value entered in the column Acc./Dec. .

Positioning table (columns with dark line indicate the relevant input values)

No.	Position in mm	Speed in mm/sec	Acc./Dec. in G	Thrust force in %	Positioning width in mm	Acc. at max value 0 or 1
0	*	*	*	*	*	*
1	150	200	0.1	0	0.1	1
.						
.						

### RC controller





T1: over 5 ms Time from target position select to start signal ON.



**NOTE**

### Start signal

The output "positioning complete" switches OFF, when the start signal is switched on.

The start signal must not be switched off, before the output "positioning complete" is switched off!

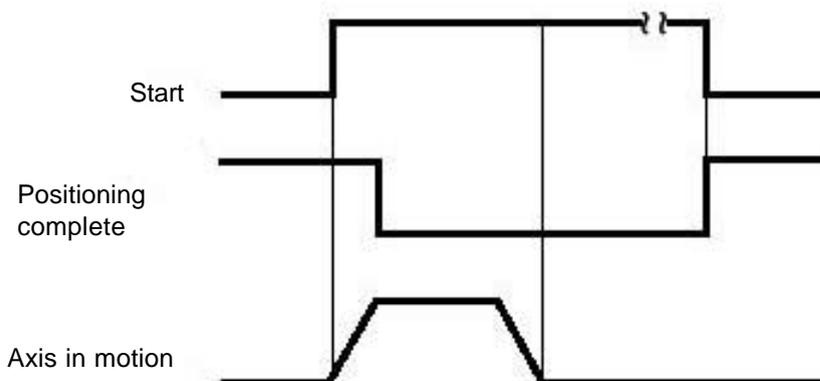


**NOTE**

### Start signal

As the diagram below shows, the output "positioning complete" will not switch back ON, if the start signal remains ON, even after the actuator movement has stopped.

The start signal must not be switched off, before the output "positioning complete" is switched off!

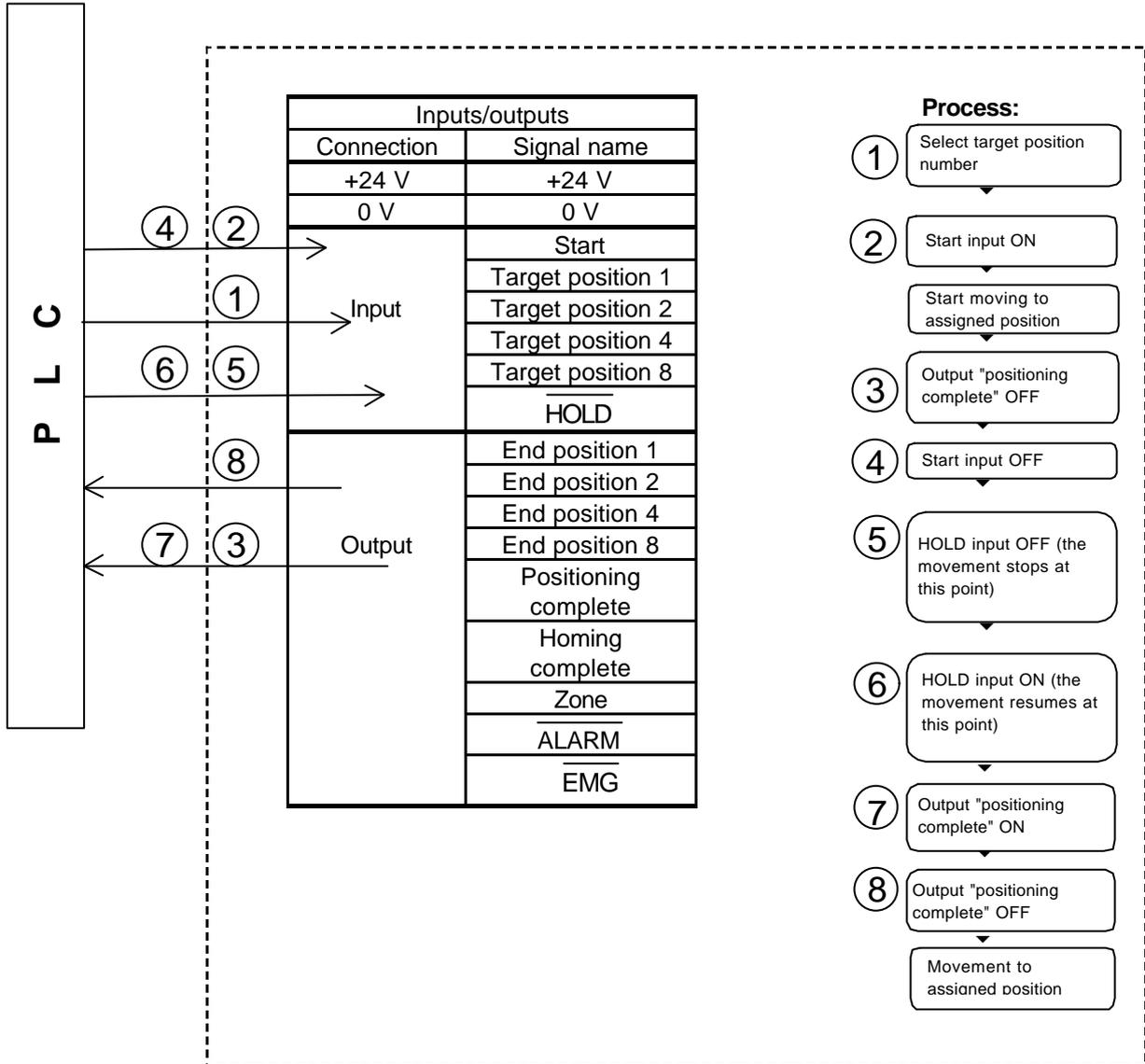


### 6.6 $\overline{HOLD}$ Input = $\overline{HOLD}$

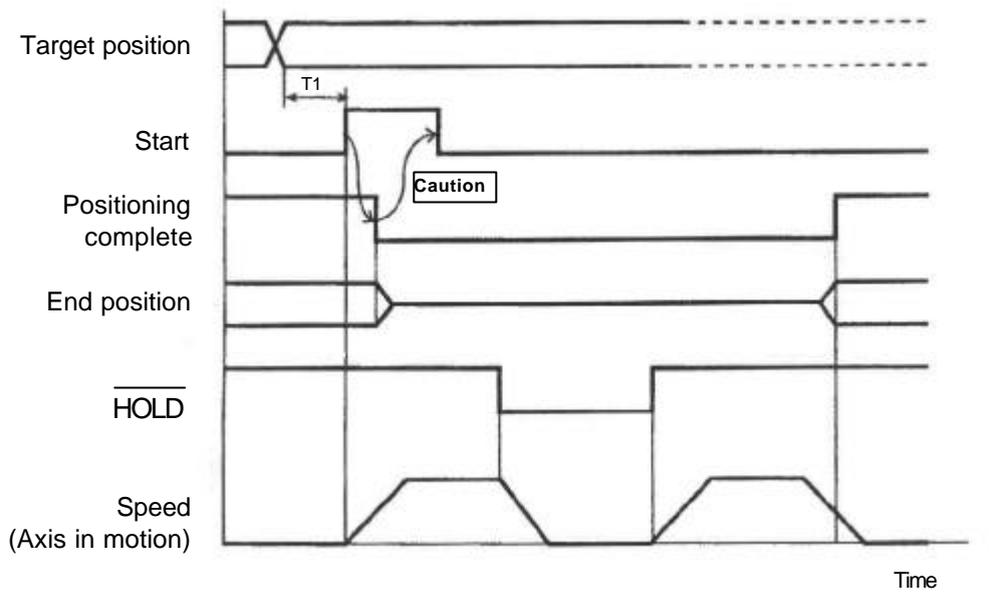
**Movement example:** Stop axis movement.

**Method:** use  $\overline{HOLD}$  input.

RC controller



While  $\overline{HOLD}$  is LOW a new position may be entered.



T1: over 5 ms time from target position select to start signal ON.



## NOTE

### Start signal

The output "positioning complete" switches OFF, when the start signal is switched on.

The start signal must not be switched off, before the output "positioning complete" is switched off!

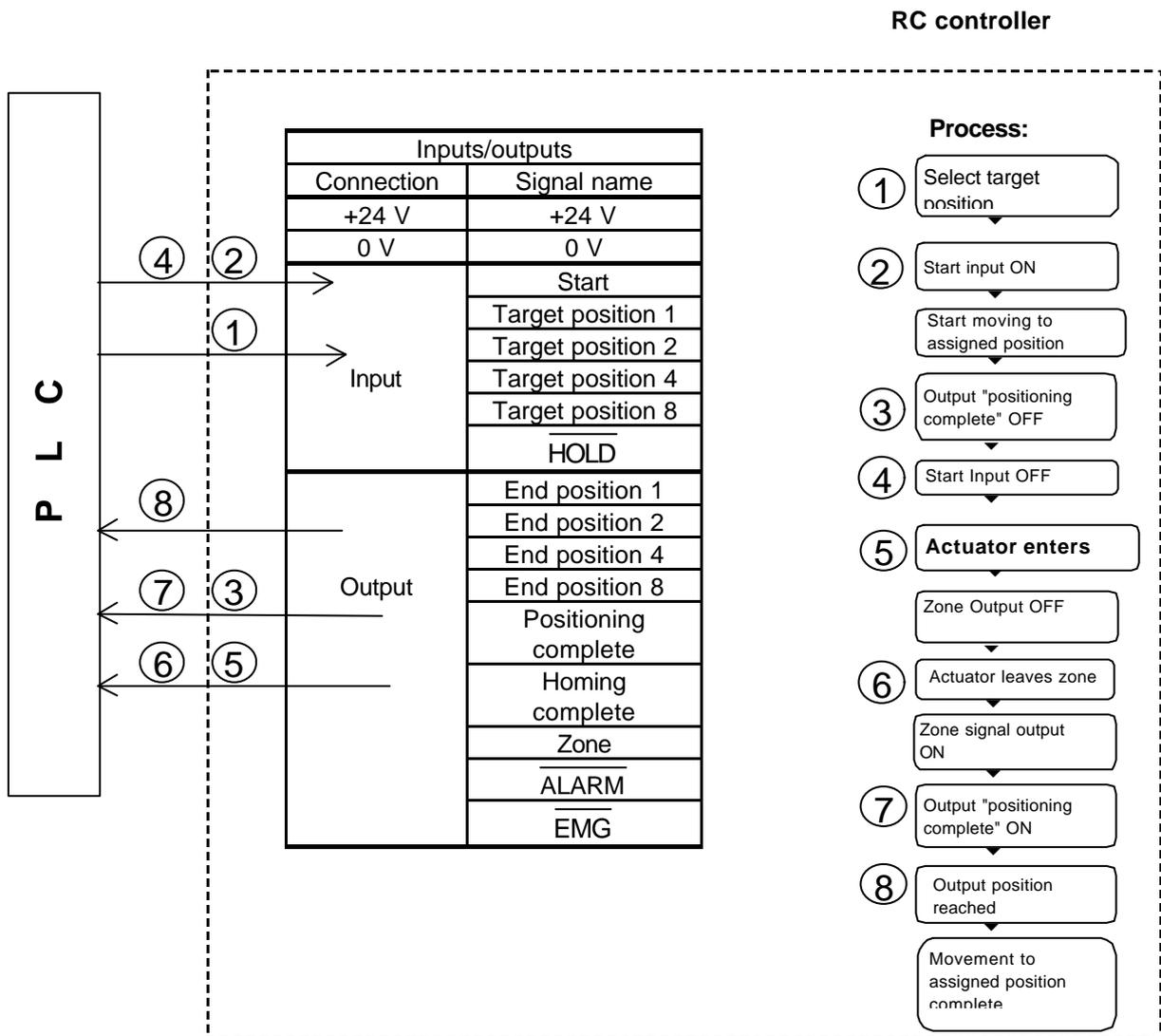
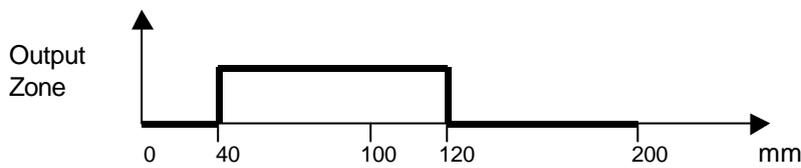
### 6.7 Zone Signal Output

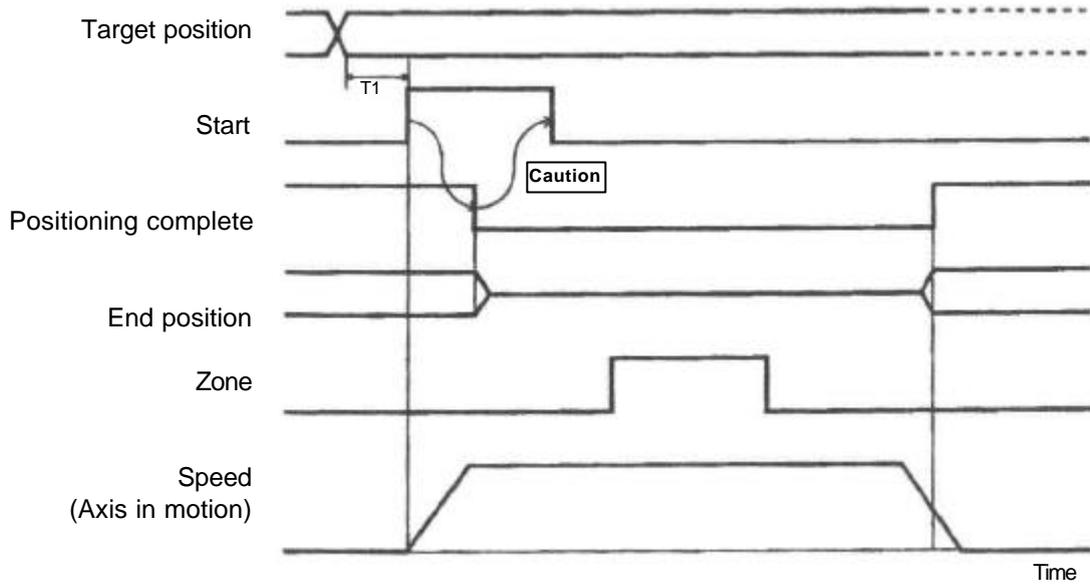
**Movement example:** During the motion, the actuator passes a zone that begins at 40 mm from home (zone output ON) and reaches until 120 mm from home (zone output OFF) - (40 mm zone output ON to 120 mm zone output OFF).

**Method:** Zone output boundaries are set with the parameters zone + and zone -. Only one zone can be programmed per axis.

Input as the following:

Zone -	120 mm
Zone +	40 mm





T1: over 5 ms time between target position select and start signal ON.



**NOTE**

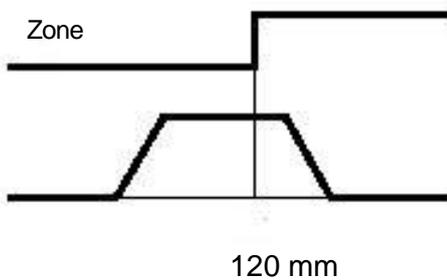
### Start signal

The output "positioning complete" switches OFF, when the start signal is switched on.

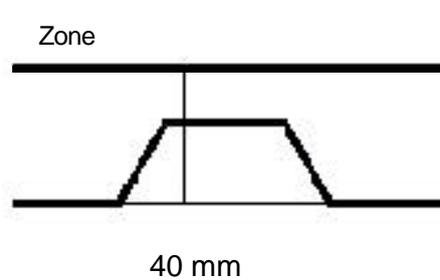
The start signal must not be switched off, before the output "positioning complete" is switched off!

Definition of other zones (examples):

Zone beyond 120 mm



Zone below 40 mm



Zone +	Maximum path
Zone -	120 mm

Zone +	40 mm
Zone -	0 mm



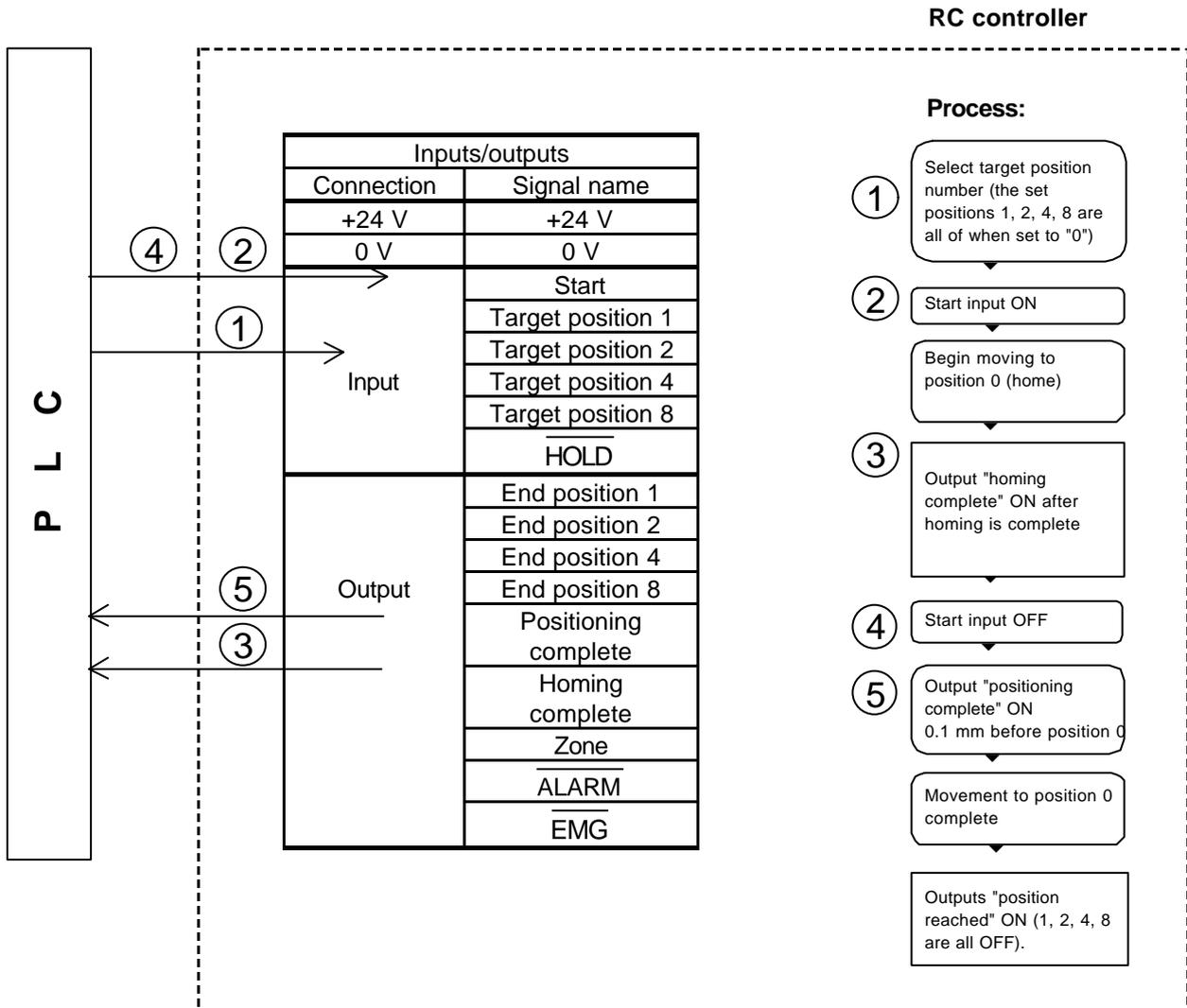
### 6.8 Homing

**Movement example:** At the I/O level you cannot select homing alone. Homings are made only when the controller is commanded to move to a position and homing has not been carried out prior to this.

**Method:** Define a position that is 0 mm away from home. The actuator moves to this point after homing and, therefore, this point then is identical with home.

Positioning table (the columns with dark lines indicate the relevant input values)

No.	Position in mm	Speed in mm/sec	Acc./Dec. in G	Thrust force in %	Positioning width in mm	Acc. at max. value 0 or 1
0	0	100	0.3	0	0.1	0
1	*	*	*	*	*	*
.						
.						





## Homing

Note that the actuator moves beyond the position 0 during homing.

### NOTE

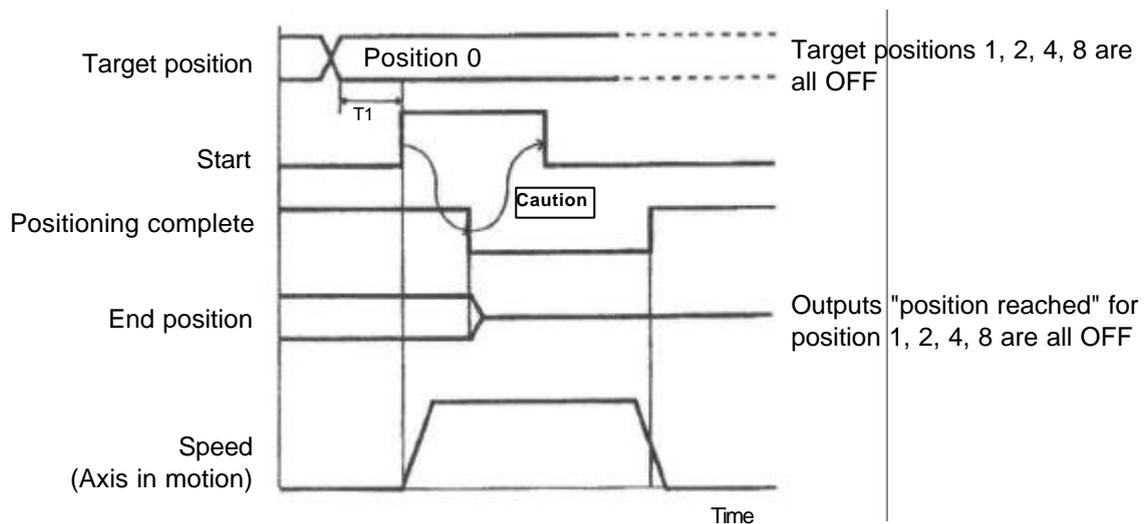


## Input of target positions, start signal

The output "positioning complete" will not switch back ON, if the start signal remains ON, even after the actuator movement has stopped. The target positions 1, 2, 4, and 8 are all OFF.

### NOTE

See the diagram below!



T1: over 5 ms time from target position select to start signal ON



## Start signal

The output "positioning complete" switches OFF, when the start signal is switched on.

The start signal must not be switched off, before the output "positioning complete" is switched off!

### NOTE

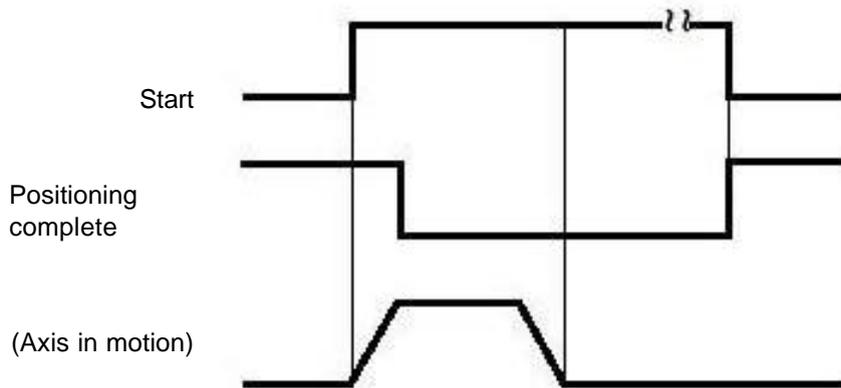


**NOTE**

**Start signal**

As the diagram below shows, the output "positioning complete" will not switch back ON, if the start signal remains ON, even after the actuator movement has stopped.

The start signal must not be switched off, before the output "positioning complete" is switched off!

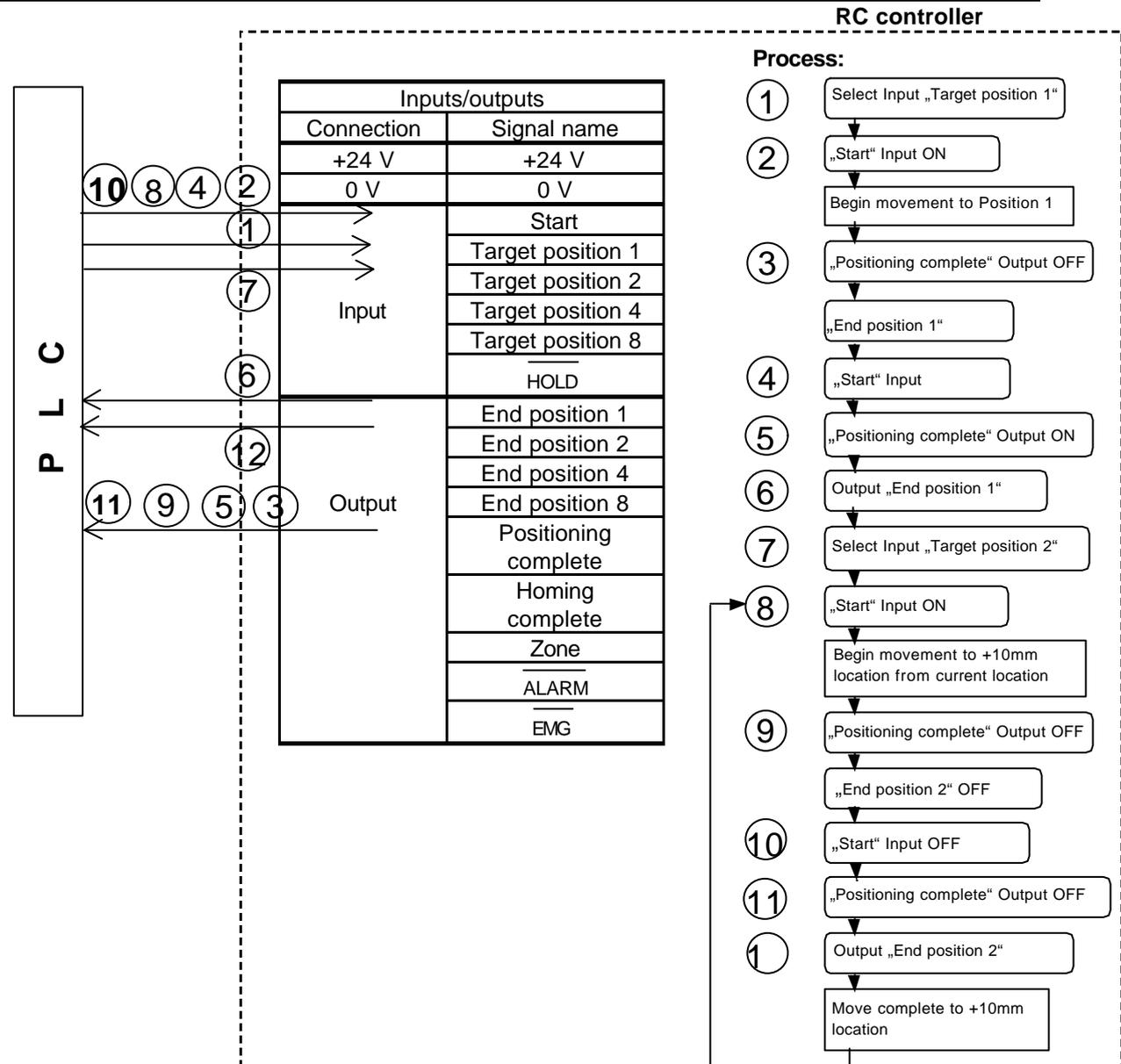


### 6.9 Pitch Movement According to Relative Coordinate Assign

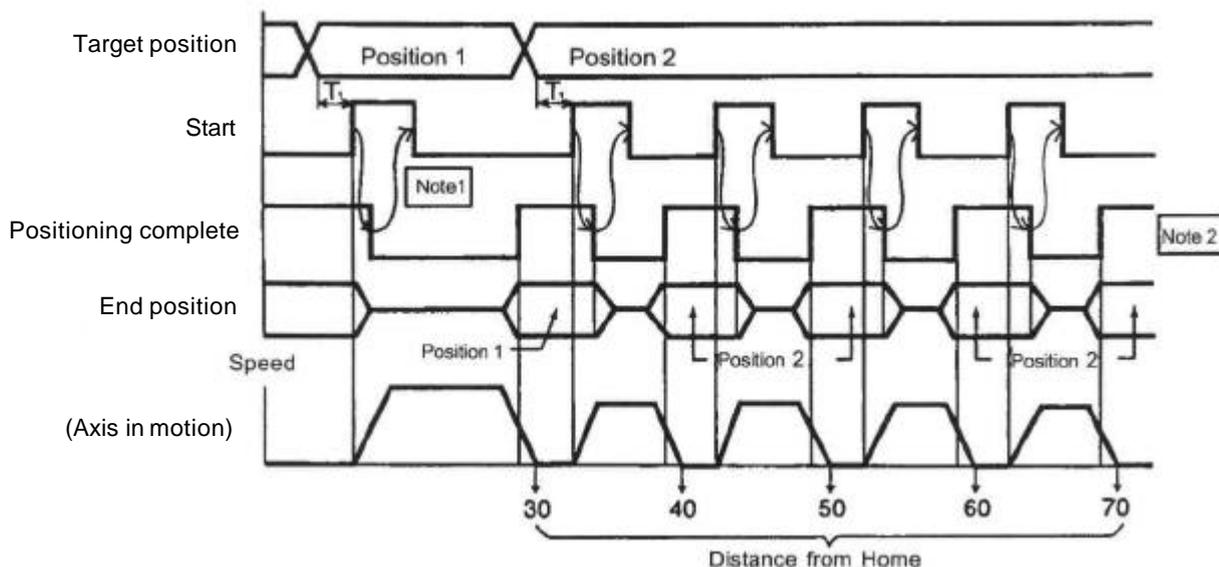
**Movement example:** Move from home to 30mm location (Position No. 1), and from there, move the actuator at a pitch of 10mm (Position No. 2). The speed from home to the 30mm location is set at 100mm/sec, and the speed is 20mm/sec at the pitch of 10mm.

Positioning table (columns with dark lines indicate input insert)

No.	Position in mm	Speed in mm/sec	Acc./Dec. Speed in G	Push Power in %	Positioning Width in mm	Acc. Only MAX. Value 0 or 1	Abs / Inc 0 or 1
0	*	*	*	*	*		*
1	30	100	0,3	0	0,1	0	0
2	10	20	0,3	0	0,1	0	1
.	.	.	.	.	.	.	.







**Start signal**

Once the "Start" signal turns ON, the "Positioning complete" output turns OFF.

Please execute "Start" signal OFF only after confirming that the "positioning complete" output has turned OFF.

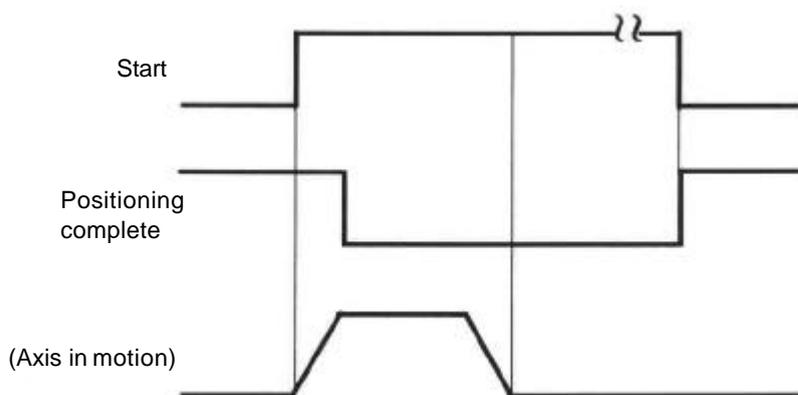
**NOTE**



**Start signal**

As the diagram below shows, if you leave the "Start" input ON, even if the axis completes movement, positioning output will not turn ON.

**NOTE**





**Start signal**

In case of soft limit exceeds upon consecutively executing relative movement, the “Positioning complete” signal will not output. In addition, the alarm output will not change. Therefore, allow sufficient time for time check.

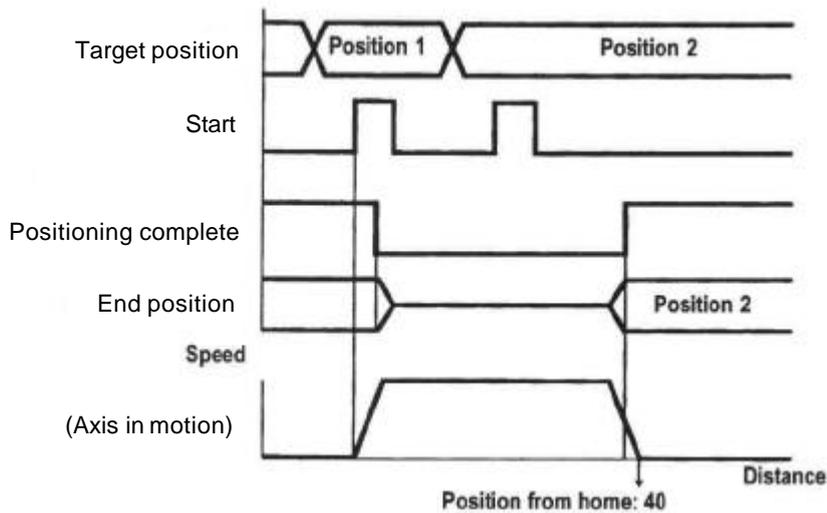
**NOTE**

**6.10 Caution Regarding Relative Coordinate Assign**

**6.10.1 Caution During Positioning Movement**

In case „Start“ input and select input of position number of relative coordinate during positioning movement are executed, moves to the position in which a relative value was added onto the initial position (in case the relative value is negative, moves to the position reduced from the initial position).

**Example:** when „Start“ input of position 2 is executed during moving to position 1, moves to the position 40mm from home.

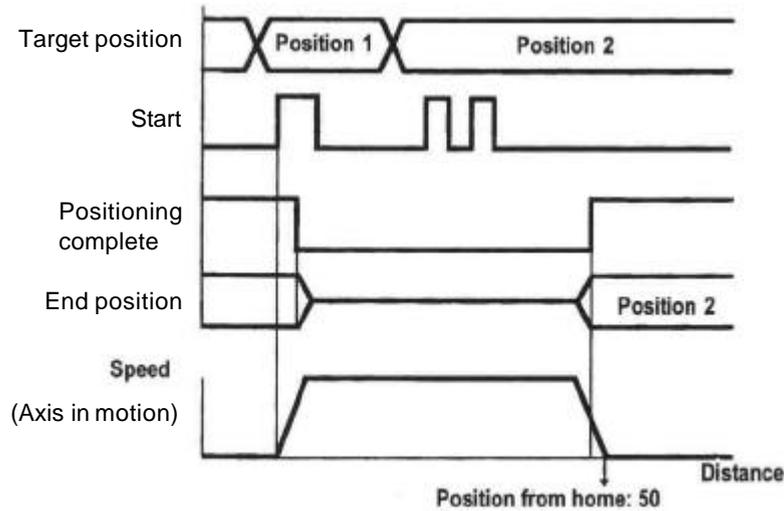


No.	Position in mm	Speed in mm/sec	Acc./Dec. Speed in G	Push Power in %	Positioning Width in mm	Acc. Only MAX. Value 0 or 1	Abs / Inc 0 or 1
0	*	*	*	*	*		*
1	30	100	0,3	0	0,1	0	0
2	10	100	0,3	0	0,1	0	1
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.

In addition, when „Start“ input towards the position number of the relative coordinate is executed numerous times during positioning movement, moves to the position in which „Relative value x number of startsignals“ was added onto the initial position.



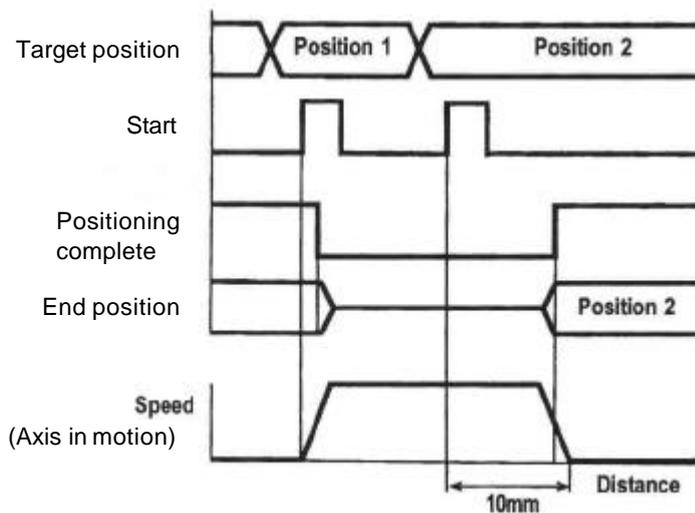
**Example:** in case start input of position 2 is executed twice during moving towards position 1, moves to the position at approximately 50mm from home (1x Pos.1 = 30mm + 2x pitch of 10mm).



## 6.10.2 Caution During Push Movement

In case „Start“ input and select input of position number of relative coordinate during push movement are executed, moves from the input position to the position in which a relative value was added. Thus, end point can not be defined.

Example: in case start input of position 2 is executed during movement towards Position 1 of the Push Mode, moves to the position that is 10mm away from the input position.



No.	Position in mm	Speed in mm/sec	Acc./Dec. Speed in G	Push Power in %	Positioning Width in mm	Acc. Only MAX. Value 0 or 1	Abs / Inc 0 or 1
0	*	*	*	*	*		*
1	50	100	0,3	0	0,1	0	0
2	10	100	0,3	60	0,1	0	1
.	.	.	.	.	.	.	.



### 6.10.3 Accumulation Error Due to Consecutive Relative Transfer

The position data only recognizes in multiple of minimum resolution. The minimum resolution is specified according to lead and number of encoder pulse. Therefore, an error may occur between the value input in the position and the transfer load of the actuator. When a relative movement is executed consecutively, this error will accumulated.

The maximum error range per each actuator type is listed in the table below:

RC Model Type	Speed Type	Lead mm	Maximum Error Range mm
RC-S5 -S6 -SS (R)	L	3	0.00375
	M	6	0.0075
	H	12	0.015
RC-SM -SMR	L	5	0.00625
	M	10	0.0125
	H	20	0.025
RC-RSA -RSW -RSI -RSW -RSGB -RSGS -RSGD	L	2.5	0.003125
	M	5	0.00625
	H	10	0.0125
RC-RMA -RMW -RMI -RMW -RMGB -RMGS -RMGD	L	4	0.005
	M	8	0.01
	H	16	0.02

**Example:** when relative movement is executed for ten times consecutively using the RC-SM-H type, an error of a maximum of  $0.025 \times 10 = 0.25\text{mm}$  may occur against the final position.

To eliminate the accumulation error, you will need to first execute Absolute Value Coordinate Assign before exceeding the allowable value and then, eliminate the accumulate error.

### 6.10.4 Ball Screw Accuracy

The accuracy for the ball screw used for the RC is JIS specified C10.

## 7 List of Parameters

Parameters must be changed exclusively by authorised operators.



**CAUTION**

### Parameter changes

**Wrong machine parameters can cause damage to property or injury of people.**

**Allow only authorised operators to change parameters!**

### Notes concerning change of parameters:

Please be aware of the following:

- Modification of the home direction parameter will result in the automatic deletion of all position data.
- Homing in reverse is not possible on push-rod type actuators (Types RS and RM).
- The home direction is reversed on actuators with side-mounted motor (0: correct 1: reversed).
- Parameter changes will become operative only after the controller has been switched off and back on or after a reset has been triggered by the PC software.

NO	NAME	FUNCTIONS
1	Zone Output Position + (mm)	Maximum value for boundary of zone output
2	Zone Output Position - (mm)	Maximum value for boundary of zone output
3	Soft limit + (mm)	Max. transfer path of axis (mm)
4	Soft limit - (mm)	Min. transfer path of axis (default value: 0 mm)
5	Home direction (0:opposite 1:default)	Determines the home direction
6	Push recognition time (msec)	If the set percentage of the thrust force is reached for this time, the output "positioning complete" switches ON.
7	Servo gain selection	Sets the servo gain number
8	Default speed (mm/sec)	Speed initial value of the position data table
9	Default ACC/DCC (G)	Acceleration/deceleration value initial of the position data table
10	Default position band value (mm)	Default value for the positioning width entered in the positioning table.
11	Default MAX ACC	Maximum acceleration
12	Positioning current limit (%)	Current limit for positioning
13	Home current limit (%)	Current limit for homing

Table 7-1 List of parameters

## 8 List of Alarms / Error Messages

Operating errors may occur.



**CAUTION**

### Resolving errors

Incorrect remedy of errors can result in severe or light injury, damage to the system or the environment.

Allow only specialists to resolve errors!

### 8.1 List of Alarms

When an alarm occurs, the ALARM LED on the controller will blink. The meaning of the alarm can be determined by the combination of the I/O output status and the position reached output.



**NOTE**

### Alarm ON

It may not be possible to reset the alarm.

Switch the power supply to the controller off and back on.  
Check the controller and the encoder cable for damage!

### Alarm output

1: ON 0: OFF

	END POSITION NUMBER				
	8	4	2	1	
1					Normal
0	0	1	1	0	Wrong EEPROM data setting
0	0	1	1	1	Alarm in connection with communication and/or program structure
0	1	0	0	0	Servo Malfunction
0	1	0	0		Overcurrent in output section
0	1	0	1	0	Alarm in connection with other electrical abnormalities
0	1	1	0	1	No shaft encoder found
0	1	1	1	1	Corruption of EEPROM data

Table 8-1 List of alarms

## 8.2 Error Messages

If an error occurs in the application of the PC software or the teaching pendant, an error message is displayed.

CODE	ERROR DESCRIPTION	SOLUTION
05A	Transmission error	Communication error: <ul style="list-style-type: none"> <li>• Look for sources of interference.</li> <li>• Check all serial connections and cables.</li> </ul>
05B	Frame error during transmission	
05D	Start text error	
05E	End text error	
07F	BCC error	
061	FNCCHR, W addressing error	Correctly format strings sent via the serial interface.
062	1 Operand error	Wrong data command (possibly a command not allowed for this controller type)
063	2 Operand error	<ul style="list-style-type: none"> <li>• Wrong data command (possibly a command not allowed for this controller type)</li> <li>• If another controller is used, a speed that is higher than 2000 rpm has been initialised, contradicting with the settings of SW-7-ON, SW-8-OFF.</li> <li>• Rejection of wrong data (possibly a command not allowed for this controller type)</li> </ul>
064	3 Operand error	Request for execution not allowed, rejection (possibly due to external POP command)
070	RUN OFF, transmission command	
071	No homing, PTP	
073	Servo ON, error reset	
074	Communication error	
075	During homing, motion command	If release is not possible while the power supply is switched on, do the following <ul style="list-style-type: none"> <li>• edit parameters or</li> <li>• initialise controller.</li> </ul>
0B0	Bank 30 error (parameters)	<ul style="list-style-type: none"> <li>• Edit parameters or</li> <li>• initialise controller.</li> </ul>
0B1	Bank 31 failure (positions)	If release is not possible while the power supply is switched on, do the following <ul style="list-style-type: none"> <li>• edit parameters ⇒ switch controller off and back on.</li> <li>• or initialise controller. ⇒ You may have to set the parameters correctly.</li> </ul>

## List of Alarms / Error Messages

CODE	ERROR DESCRIPTION	SOLUTION
0BA	Commutation error 1	Check: <ul style="list-style-type: none"> <li>• Is the load within the limit value?.</li> <li>• Does the external power supply work correctly: ⇒ check motor shaft encoder cable.</li> </ul>
0B9	Commutation error 2	
0BB	ORG - search C error	Abnormal Z-phase
0BC	ORG - search A, B errors	Abnormal Z- and B-phase
0BD	Speed prior to ORG search error	The axis moves faster than allowed already during homing.
0C0	Too high speed	<ul style="list-style-type: none"> <li>• Reduce load or</li> <li>• reduce parameters for speed and acceleration/deceleration.</li> </ul>
0C1	Servo error	
0D0	Overvoltage in main supply	Check main supply.
0C3	Overvoltage in load circuit	Check <ul style="list-style-type: none"> <li>• load or</li> <li>• reduce parameters for speed and acceleration/deceleration.</li> </ul>
0D1	Deviation overflow	Check mechanic binding.
0E9	Signal A missing	Check <ul style="list-style-type: none"> <li>• shaft encoder and</li> <li>• shaft encoder cable.</li> </ul>
0EA	Signal B missing	
0EB	Signal C missing	
0EC	Supply voltage missing	
0F8	Fixation memory failure	Initialise controller.
20D	$\overline{\text{HOLD}}$ LOW	Hold input active, movements impossible

Table 8-2 Error messages

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