MD5

MD5-5
MD5-3
Power control unit for 2/3 axles

Doc.No.211.226/DGB

MD5-5231.00

serial numbers

GGS4

MOTOR RACK 1	9000215
motor rack 2	9000992
motor rack 3	899966

Ident-Nr.:

Revisionsstand:

Edtion: March 1988

Technische Dokumentation
Technical Documentation
Documentation Technique

BERGER LAHR

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Date: Tue, 28 May 2002 15:40:44 -1000 (HST)
From: Chris Yamasaki <yamasaki@jach.hawaii.edu>
To: Erik Starman <e.starman@jach.hawaii.edu>
Subject: switches

Erik,

The switch settings are as follows:
(from left to right)
CGS4 middle rack: the dip switches are set with #1 to the right
#2,3 &4 to the left
For the potentiometers: First module is set to 1
Second module is set to 0
Third module is set to 4

Michelle rack: Image inject, extract, spare (2 modules installed)

Dip switches are set 1,3 to the right
2,4 to the left
Potentiometer is set to 0 for the modules

Michelle rack: Cal unit (3 modules)

Dip switches are 1,3 to the right
2,4 to the left

Potentiometers are all set to 0

Chris

TABLE OF CONTENTS

1 DESCRIPTION

1.1 General information

The compact control unit MD 5-X controls BERGER LAHR 5-phase stepping motors. MD 5-X serves as a link between the external control units and the 5-phase stepping motor.

Fig. 1-1 shows the interrelation of the MD 5-X and the peripheral equipment.

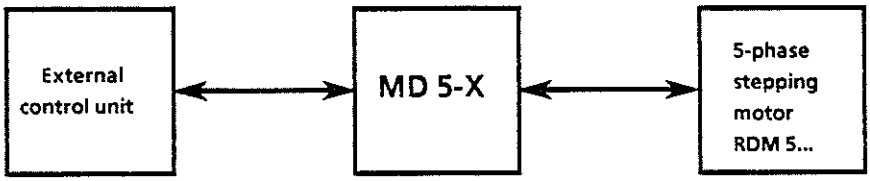


Fig. 1-1 Control system with MD 5-X

External control unit, such as

- POSAB 2000
- Oscillator card D 538
- PLC D638

1.2 Structure and accessories

1.2.1 Structure

The MD 5-X is a 2- or 3-axle unit which incorporates the following assemblies:

- Power supply unit (M 011.07/08)
- Power control card (D 380.1X or D 550.0X)
- Motherboard D 560.30

Fig. 1-2 shows the rear view of the MD 5-X with the corresponding connections.

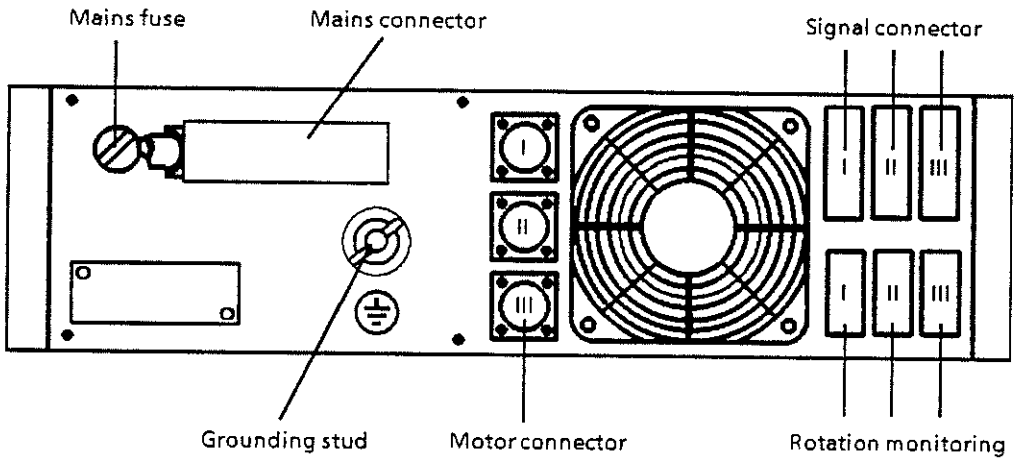


Fig. 1-2 Rear view of MD 5-X

1.2.2 Standard accessories

The standard accessories are delivered with the equipment.

The accessories for MD 5-5230.00 include:

Amount MD 5-XX20.00	Amount MD 5-XX30.00	Designation	Order no.
1	1	Grounding strip	H 6-920-6
1	1	Fuse 0.8 A	N 1- 636-
2	2	Fuse 6.3 A	N 1- 636-
2	2	Fuse 8.0 A	N 1- 636-
1	1	Fuse 12.5 A	N 1- 636-
1	1	Connector spring 20	N 4- 657- 3
1	1	Connector housing	N 4- 657-30
2	3	Connector lock	N 4- 673-158
22	33	Connector pin 1	N 4- 673-170*
2	3	Connector hood	N 6- 673-187
1	1	Plate T	211.15-00-38
1	1	Plate T	211.15-00-39
2	3	Coupling ring	211.15-00-45
2	3	Washer B	211.15-00-46
2	3	Washer B	211.15-00-47
4	6	Strain relief clamps	211.15-00-48
2	3	Washer B	211.15-00-49
2	3	Clutch disk	211.15-00-56
2	3	Coupling ring	211.15-00-57
4	6	Strain relief clamps	211.15-00-63
1	1	Screw driver	260.35-00-08
2	3	Connector pin 25	N 4-673-53
1	1	Manual	211.226/DGB

* Note: Tools of AMP Co.: - pliers order no. 169422-1
- dismounting tool order no. 725840-1
- spare tubes order no. 725841-1

1.2.3 Further accessories

The following accessories can be ordered separately:

Designation	Order no.
Signal cable, 12-wire	H2-928-30
Motor cable, 10-wire, 0.75 mm^2	H6-928-14
Motor cable, 10-wire, 1.5 mm^2	H6-928-26
Screw connections suitable for motor cable H6-928-26 and BERGER LAHR 5-phase stepping motors with terminal box	N9-750-51

BERGER LAHR 5-phase stepping motors as ordered by you.

1.3 Technical data

1.3.1 Dimensions and power rating

Dimensions	see fig. 1-3
Weight	21 kg
Device adaptable to the following mains voltages	120 VAC ± 10% 220 VAC ± 10% 240 VAC ± 10%
Mains frequency	50 ... 60 Hz
Power consumption	max. 1300 VA
Power loss of MD 5-52XX of MD 5-31XX	max. 290 W max. 150 W

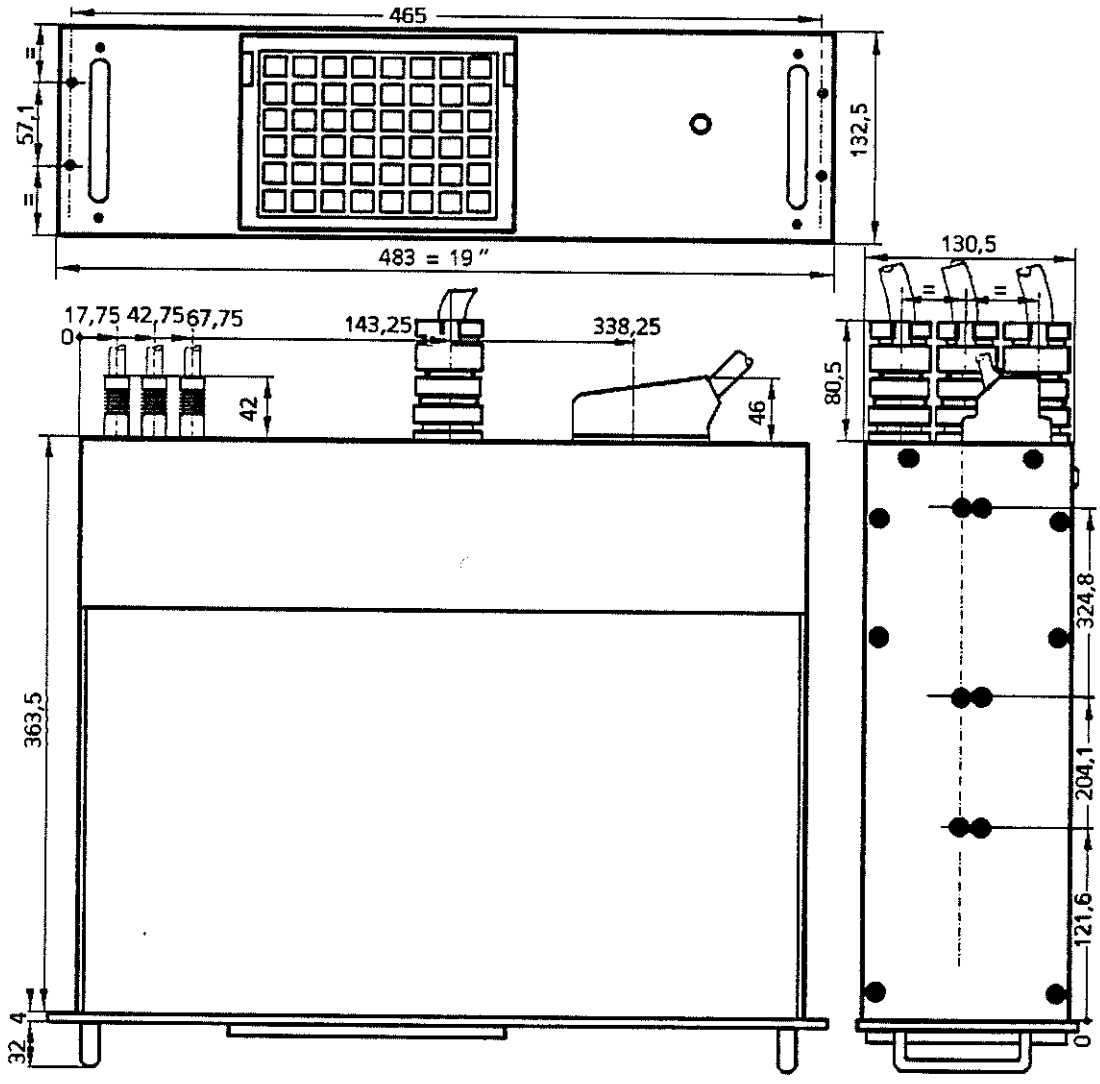
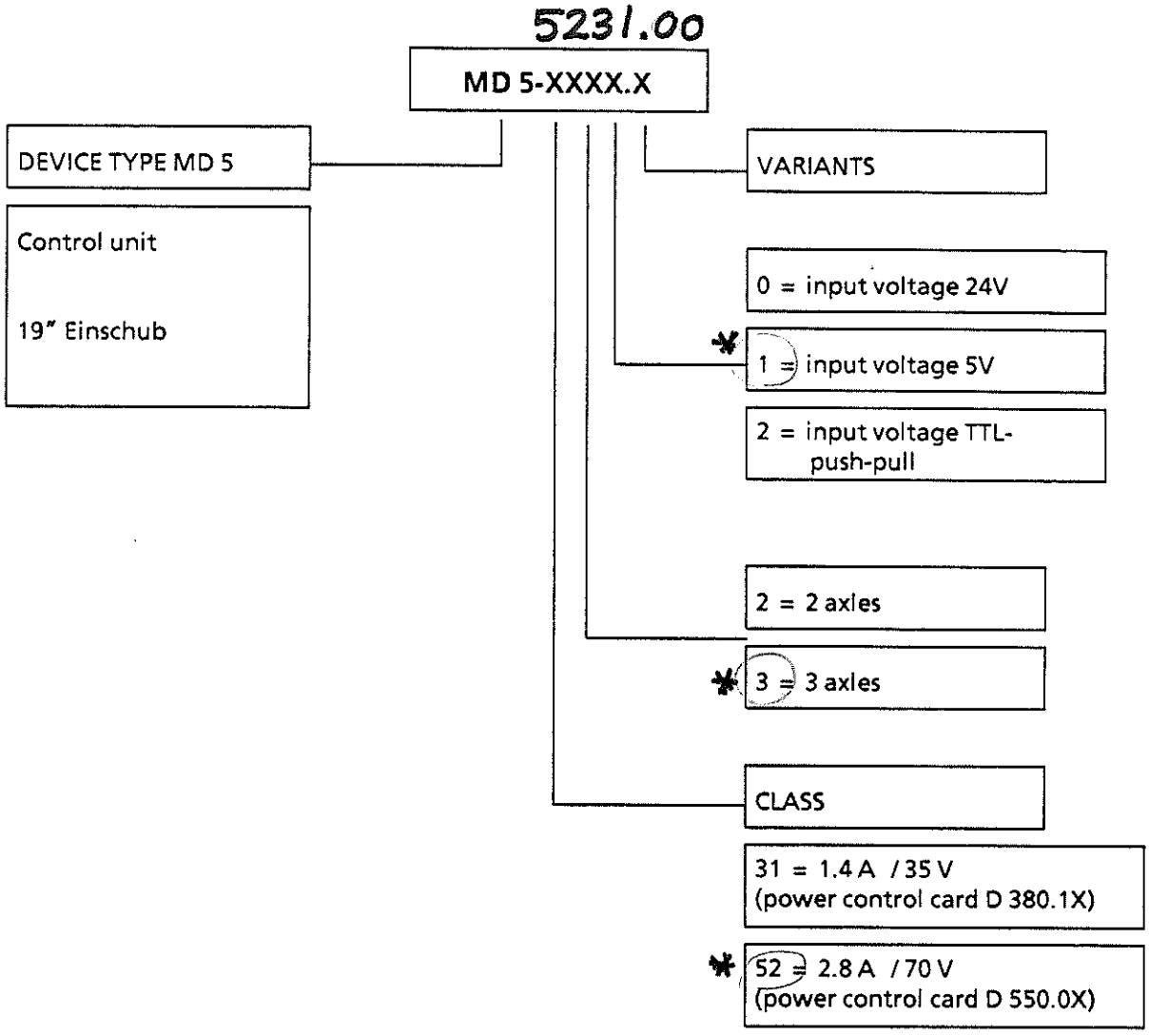


Fig. 1-3 Dimensions

1.3.2 Type code

The assemblies of the MD 5-X are evident from the type code. The individual figures have the following meaning:



1.4 Technical description

Figure 1-4 shows the block circuit diagram of the control unit MD 5-X.

The individual assemblies assume the following functions:

The power supply module M011.07/08 can be connected to the different mains voltages. This is accomplished by connecting straps in the mains connection. With the aid of the transformer and subsequent bridge rectification the DC-voltage for the stepping motor and the electronic circuits is generated.

The power control card controls the BERGER LAHR 5-phase stepping motor. Depending on the type of motor in use, either power control card D 380.1X (phase current up to 1.4A) or D 550.0X (phase current up to 2.8A) must be used (see 1.3 "Technical data").

The motherboard D 560 is the connecting card between the individual plug-in cards and the plug connections at the rear.

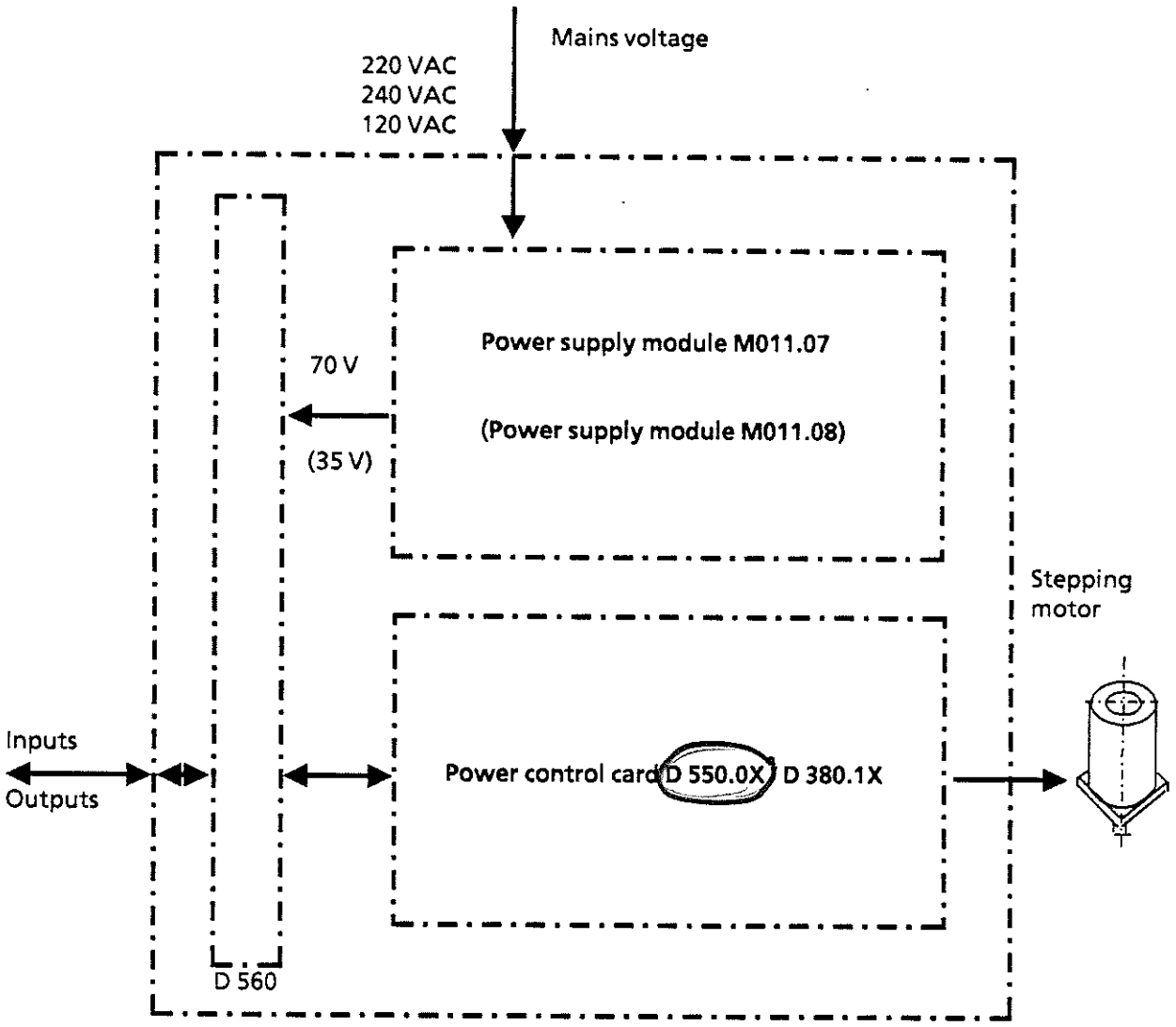


Fig. 1-4 Block circuit diagram

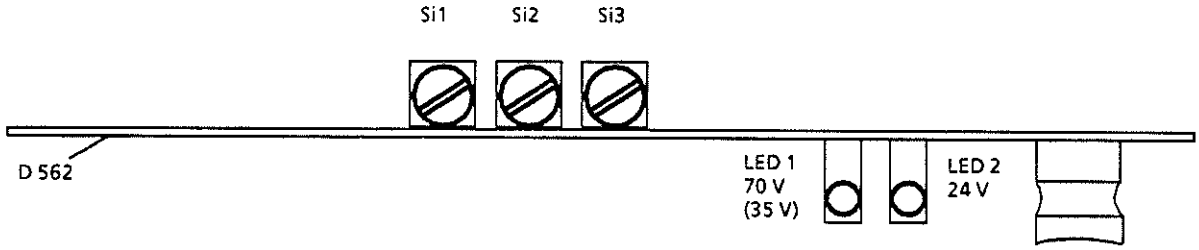
1.4.1 Power supply module

The power supply module M011.07/08 is connected to the mains voltage via the 20-pole mains connection.

Access to the primary fuse is provided at the back of the equipment.

Mains fuse for	MD5-52	MD 5-31
120 VAC	T12.5A	T10A
220 V/240 VAC	T6.3A	T5A

The secondary fuses are accessible after removing the front panel.



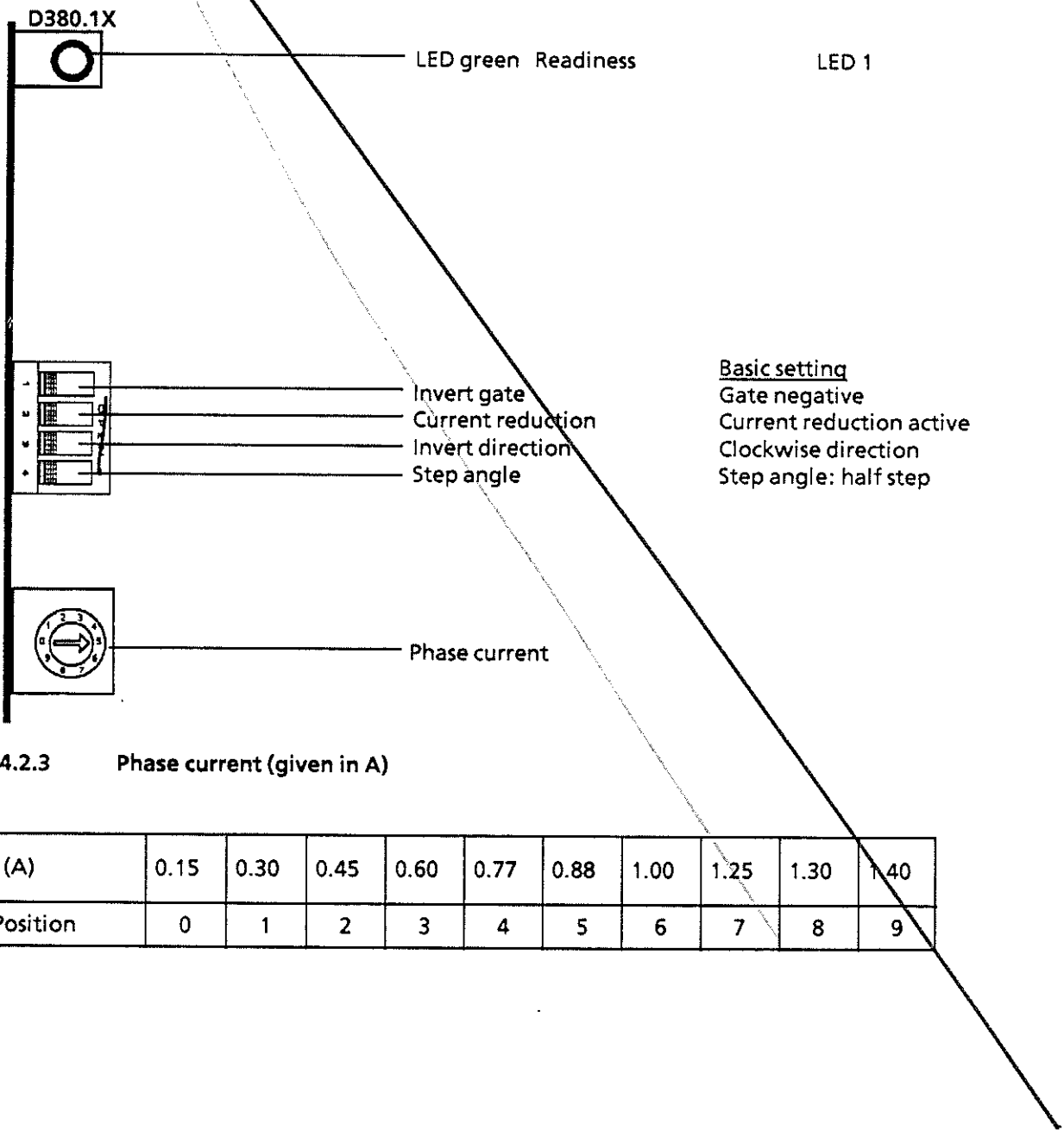
Secondary fuses	MD 5-52	ELECTRIC CIRCUIT	MD 5-31	ELECTRIC CIRCUIT
Si1	T0.8A	Electronics	T0.8A	Electronics
Si2	10A 250V T8.0A	70V motor	T10A	35V motor
Si3	10A 250V T8.0A	70V motor	T10A	35V motor

1.4.2 Power control card D 380.1X

1.4.2.1 Operational data

Operating voltage	24 - 36 VDC ± 10%
Phase currents adjustable	0.2 - 1.4 A
Indication of readiness	LED green

1.4.2.2 Display and programming switches



1.4.2.3 Phase current (given in A)

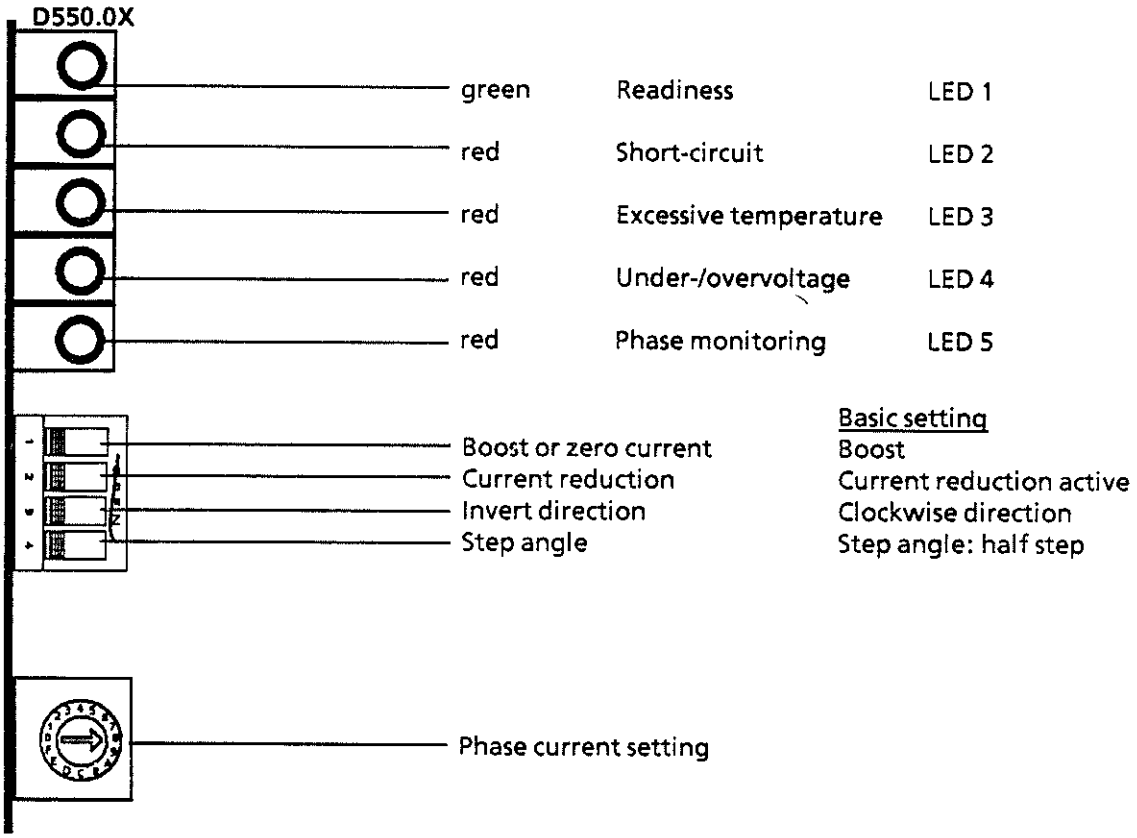
I (A)	0.15	0.30	0.45	0.60	0.77	0.88	1.00	1.25	1.30	1.40
Position	0	1	2	3	4	5	6	7	8	9

1.4.3 Power control card D 550.0X

1.4.3.1 Operational data

Operating voltage	35 - 70 VDC
Phase currents adjustable	0.55 - 2.8 A
Indication of readiness	1 LED green
Indication of malfunctions	4 LEDs red

1.4.3.2 Display and programming switches



1.4.3.3 Phase current (given in A)

I (A)	0.55	0.70	0.85	1.00	1.15	1.30	1.45	1.60	1.75	1.90
Position	0	1	2	3	4	5	6	7	8	9

I (A)	2.05	2.20	2.35	2.50	2.65	2.80				
Position	A	B	C	D	E	F				

1.5 Types of signals

The following galvanically isolated signals are used for MD 5-X at the 25-pole connector.

1.5.1 Active-high signals for MD 5-X

For admissible input voltage refer to chapter 1.6.3.

Connector pin		Meaning
+	-	Polarity
4	17	ZERO CURRENT / BOOST
3	16	GATE
2	15	SENSE OF ROTATION NEG., POS.
1	14	PULSE

1.5.2 Potential-free contacts

The relay contacts may be used for indicating readiness or malfunctions.

Potential-free relay contact (changeover contact) V = 30 VAC/36 VDC
max. I = 0.2A
P = 5 VA

Connector pin	Meaning
9	9 - 22 closed - not ready
22	Switch contact
10	10 - 22 closed - ready

1.6 Effects of the signals

1.6.1 Function of the signal inputs and effect on the motor with MD 5-31

Signal input	Signal input current	Signal input no current	Switch position (1)
Pulse	upon current flow edge, the motor performs a step	in case of no current, the motor does not perform a step	
Direction (1)	CCW rotation	CW rotation	"OFF"
	CW rotation	CCW rotation	"ON"
Gate (1)	Pulse input blocked	Release pulse input	"OFF"
	Release pulse input	Pulse input blocked	"ON"

(1) The effect of the direction and gate signal may be reversed by a sliding switch (see 2.1.4.2).

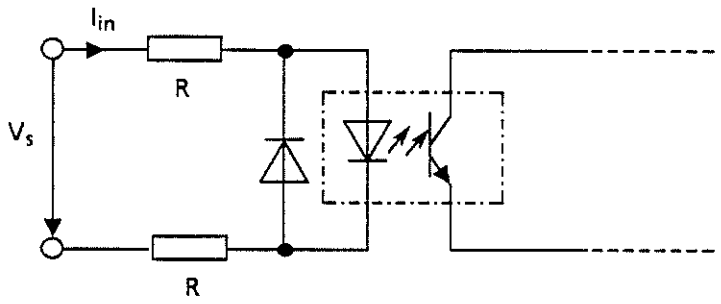


Fig. 1-5 Optocoupler input

1.6.2 Function of the signal inputs and effect on the motor with MD 5-52

Signal input	Signal input current	Signal input no current	Switch position (1) (2)
Pulse	upon current flow edge, the motor performs a step	in case of no current, the motor does not perform a step	
Direction (1)	CCW rotation CW rotation	CW rotation CCW rotation	"OFF" "ON"
Gate	Pulse input blocked	Release pulse input	"OFF"
Zero current/ boost (2)	Phase current = 0 Phase current = I_{nom} x 1.2	Adjusted phase current is valid	"OFF" "ON"

(1) The effect of the direction and gate signal may be reversed by a sliding switch (see 2.1.4.2).

(2) The zero current or boost function may be selected via a sliding switch (see 2.1.4.2).

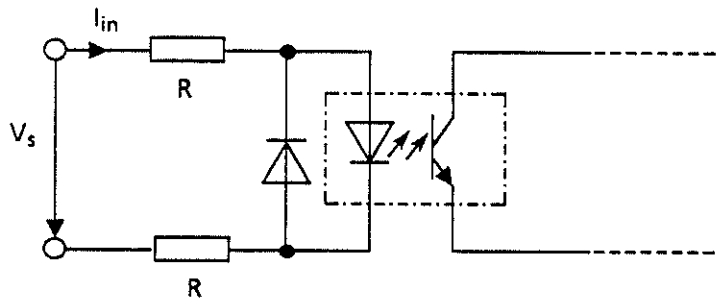


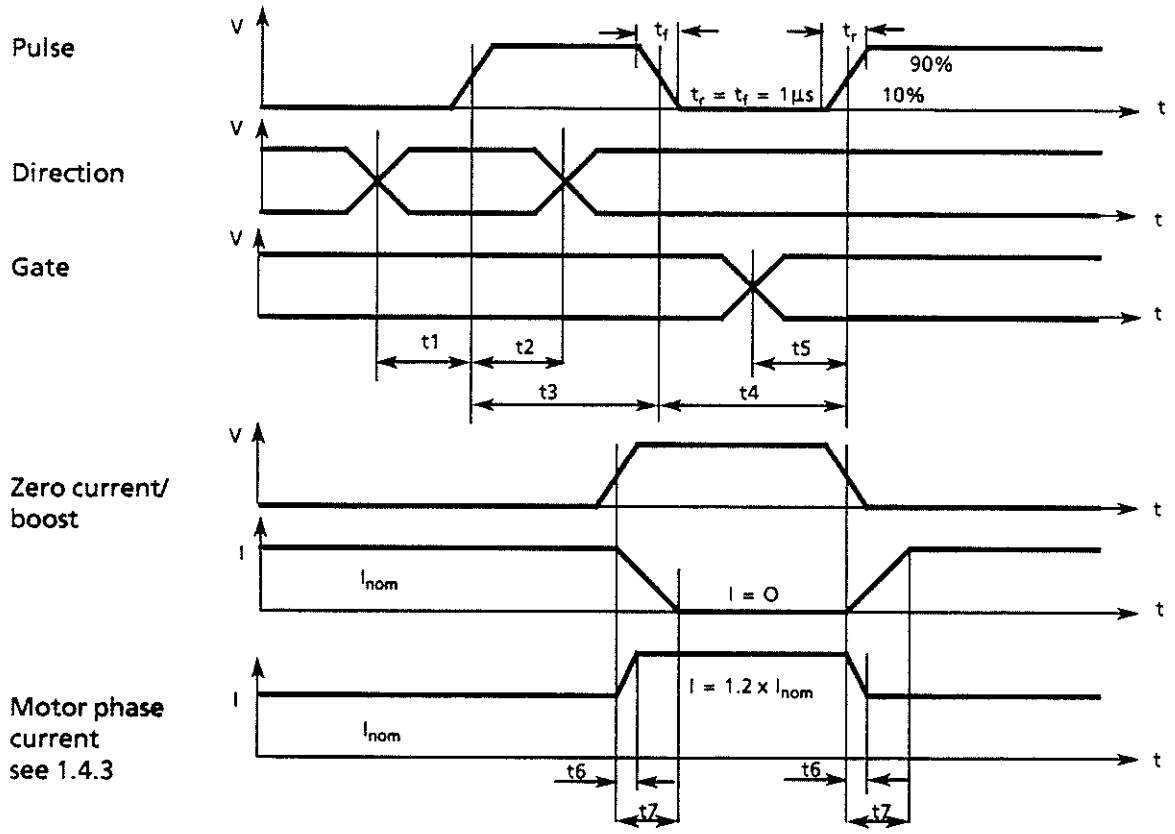
Fig. 1-6 Optocoupler input

1.6.3 Static data of the signal inputs (optocoupler inputs)

MD5-5231

	MD 5-XXX0			MD 5-XXX1			MD 5-XXX2		
	min.	typ.	max.	min.	typ.	max.	min.	typ.	max.
Input voltage	20V	24V	30V	4V	5V	7V	TTL-push-pull level		
Input current		12mA	15mA		20mA	25mA		35mA	40mA
Input resistance		2000Ω			240Ω			100Ω	

1.6.4 Levels and effects of the signals



t1: Preparation time for direction signal	0 µs
t2: Hold time	5 µs
t3: Pulse duration	5 µs
t4: Pulse interval	5 µs
t5: Preparation time for gate signal	50 µs
t6: Response time of motor current to boost	30...100 µs
t7: Response time of motor current to zero current	100...300 µs

2 OPERATION

2.1 Installation

2.1.1 Cables

2.1.1.1 Recommended signal cables

BERGER-LAHR cable
Order no. H6-928-30

Signal cable for RS 422

Cross-section 0.24 mm² AWG 24
Screening: copper braiding with strand
Outside diameter 9.4 mm, PVC-sheating

Supplier: BERGER LAHR GmbH
Max. length delivered: 1000 m
Max. laid length: 300 m

Belden (US)

UL-approved signal cable
Type 9833 for RS 422

Cross section 0.25 mm² AWG 24
7 x 2 wires, twisted in pairs
Screening: copper braiding with strand
Outside diameter 9.4 mm, PVC-sheating

Supplier: Firma Elkab, 7700 Singen
Delivered lengths: 30.5 m - 152.4 m - 304.8 m
Max. laid length: 300 m

2.1.1.2 Recommended motor cable

Numbered cable by BERGER LAHR
Order no. H6-928-14

Cross-section 0.75 mm² (24 x 0,2)
5 x 2 wires twisted in pairs
Screening: copper braiding with strand 75 mm²
Outside diameter approx. 14 mm
PVC-sheating
Oil resisting

Supplier: BERGER LAHR GmbH
Max. length delivered: 1000 m

Numbered cable by BERGER LAHR
Order no. H6-928-26

Cross-section 1.5 mm² (30 x 0,25)
5 x 2 wires twisted in pairs
Screening: copper braiding with strand 0.75 mm²
Outside diameter approx. 16 mm
PVC-sheating
Oil resisting

Supplier: BERGER LAHR GmbH
Max. length delivered: 1000 m
Max. laid length: 100 m

The actual motor output depends on the cable length and cable cross-section.

ATTENTION

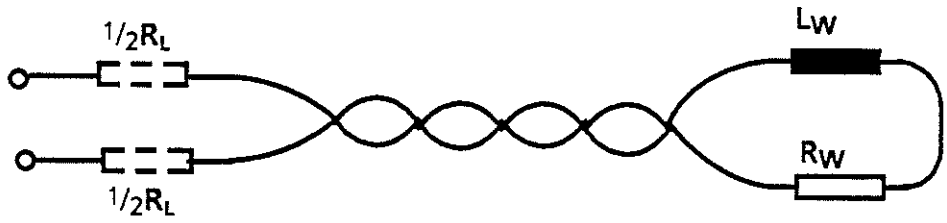
When laying other cables, the noise immunity may be reduced. Therefore make sure that the cable is screened and the wires are twisted in pairs.

2.1.1.3 Table for selecting the line cross-section

Cable length	Cable cross-section			
	0.75 mm²	1.0 mm²	1.5 mm²	2.5 mm²
10 m	0.46	0.34	0.23	0.14
25 m	1.15	0.86	0.58	0.34
50 m	2.30	1.72	1.15	0.69
100 m	4.60	3.45	2.30	1.38
	Cable resistance R_L (Ω)			

The cables are to be selected according to the following criteria:

- The cable cross-section should not be less than 0.75 mm².
- The motor cable length should not be more than 100 m.
- The resistance of a line should not exceed the motor winding resistance.



$$R_L \leq R_W$$

R_L = Line resistance
R_W = Winding resistance
L_W = Winding inductance

Winding resistances of BERGER LAHR 5-phase stepping motors:

Type RDM	554/ 50	564/ 50	566/ 50	566/ 50H	569/ 50	569/ 50H	596/ 50	596/ 50H	599/ 50	599/ 50H	5913/ 50
R_W/Ω	5.0	2.5	4.0	1.4	2.3	0.85	2.1	0.43	3.5	0.7	1.0

Order no. of motor cable: H6-928-14 = 0.75 mm²
Order no. of motor cable: H6-928-26 = 1.50 mm²

Suitable screw connection: PG 16
Special version, order no.: n9-700-51

Example: RDM 5913/50 R_W = 1.0 Ω

The maximum laid length of the cable H6-928-14 (cross-section = 0.75 mm²) is approx. 22 m.

The maximum laid length of the cable H6-928-26 (cross-section = 1.50 mm²) is approx. 45 m.

2.1.1.4 Laying of cables and interference suppression

In order to avoid interference the following must be observed:

- Lay motor cables and signal cables in different ducts.
  When laying the cables in parallel it is recommended to keep a distance of at least 0.2 m.

- Lay the motor and signal cables at a proper distance to high-voltage current cables.
  Recommended minimum distance is 0.2 m.

- Connect the ground stud M5 with low resistance at the rear of the unit via a copper braiding in order to achieve maximum interference immunity for the unit to observe the limit values of radio shielding according to VDE 0871 (complying with the limits for a class B device).

2.1.2 Mains connection

2.1.2.1 Jumper connection

The jumpers must be connected according to the mains voltage present (see fig. 2-1):

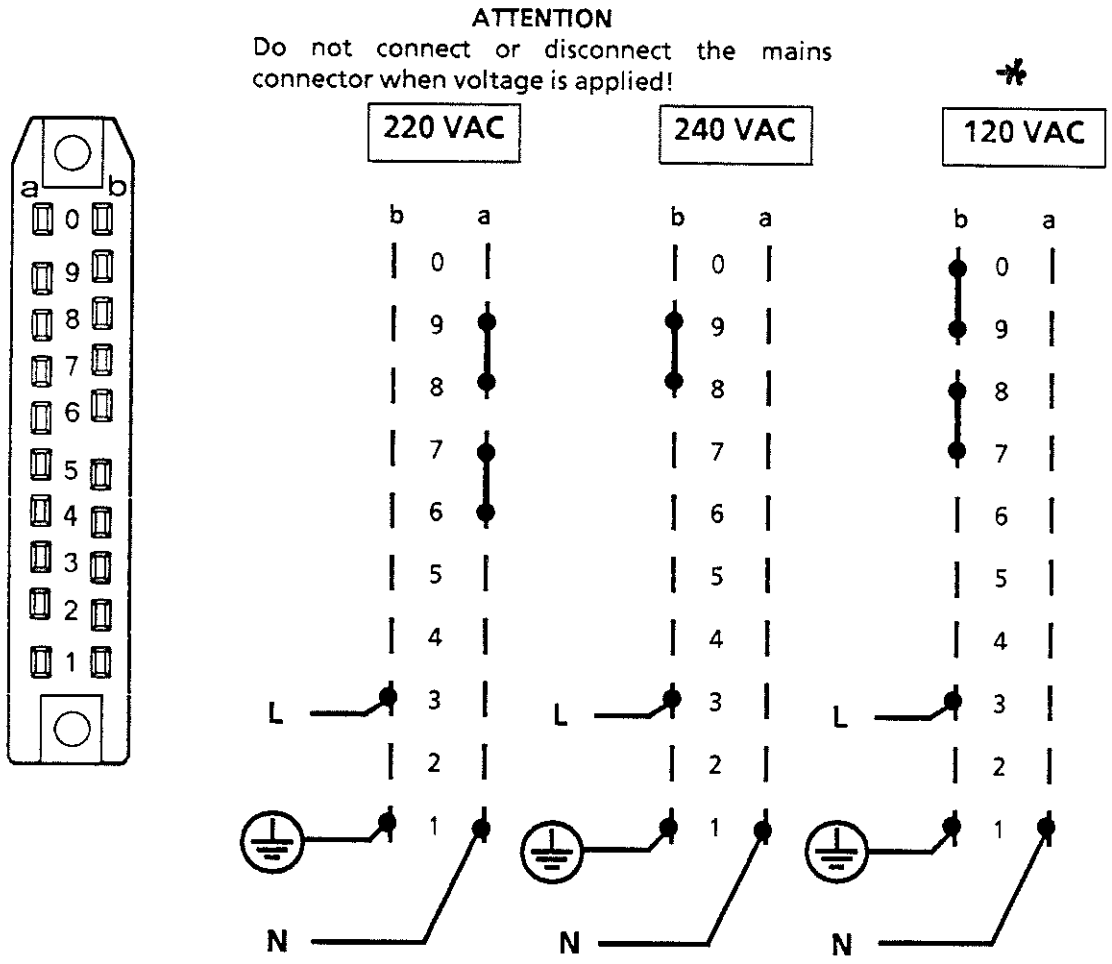


Fig. 2-1 Mains connection - soldering side

2.1.2.2 Mains fuse

The mains fuse at the rear of the unit must be checked with regard to the mains voltage present.

Mains voltage	**MD 5-52** Nominal current of the fuse	**MD 5-31** Nominal current of the fuse
120 VAC	T 12.5 A	T 10A
220 VAC	T 6.3 A *	T 5A *
240 VAC	T 6.3 A	T 5A

* provided ex works

2.1.3 Motor connection

2.1.3.1 Preparing the motor cable

The motor cable is to be prepared according to the following figure.

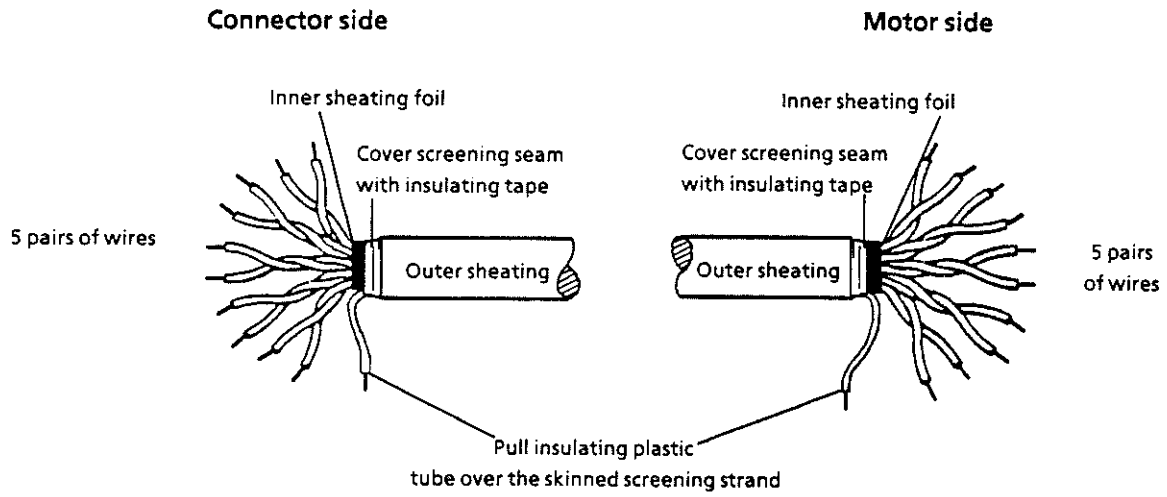
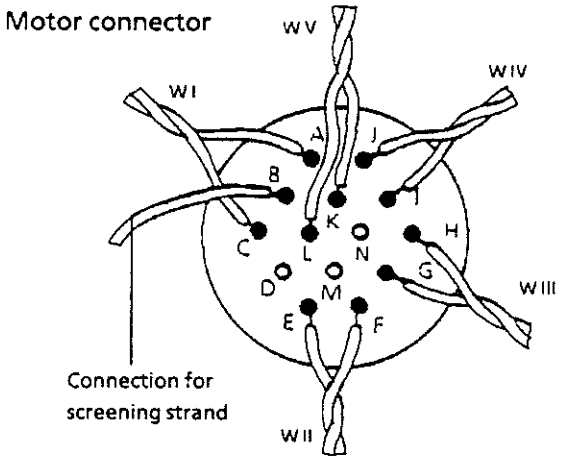


Fig. 2-2 Preparing the motor cable

2.1.3.2 Motor cable connection

The motor cable is to be connected to the connector and motor terminal box according to the following figure.



Motor version		Connector Pin
with terminal box Cable no.	with strand Colour	
0	violet	L
9	brown	K
8	black	J
7	grey	I
6	green	H
5	orange	G
4	red	F
3	blue	E
2	white	C
1	yellow	A

Motor windings = WI ... WV

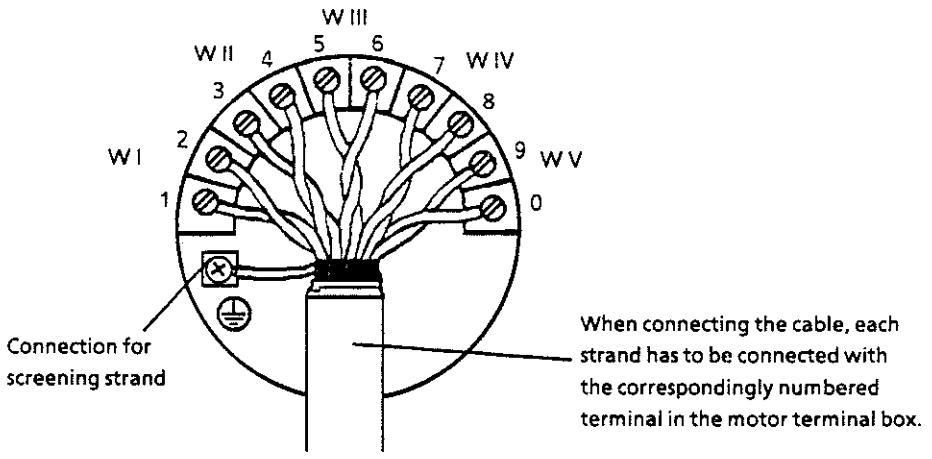


Fig. 2-3 Motor cable connection

Rock 1	I	1 IROT	II	1 FIL 1	III	3	FIL 2	
Rock 2	I	1 CUF	II	1 SLIT	III	5	GRATING	
Rock 3	I	1 TRANS	II	1 FOCUS	III	4	CAL	

PHASE CURRENT COLD SETTINGS Feb 12 1992

2.1.4 Power control card settings

In order to set the values on the power control card the front panel must be detached (see "Technical data").

2.1.4.1 Motor phase currents

The phase currents have to be set with the rotary coding switch of the power control card D 380.1X or D 550.0X according to the type of stepping motor in use.

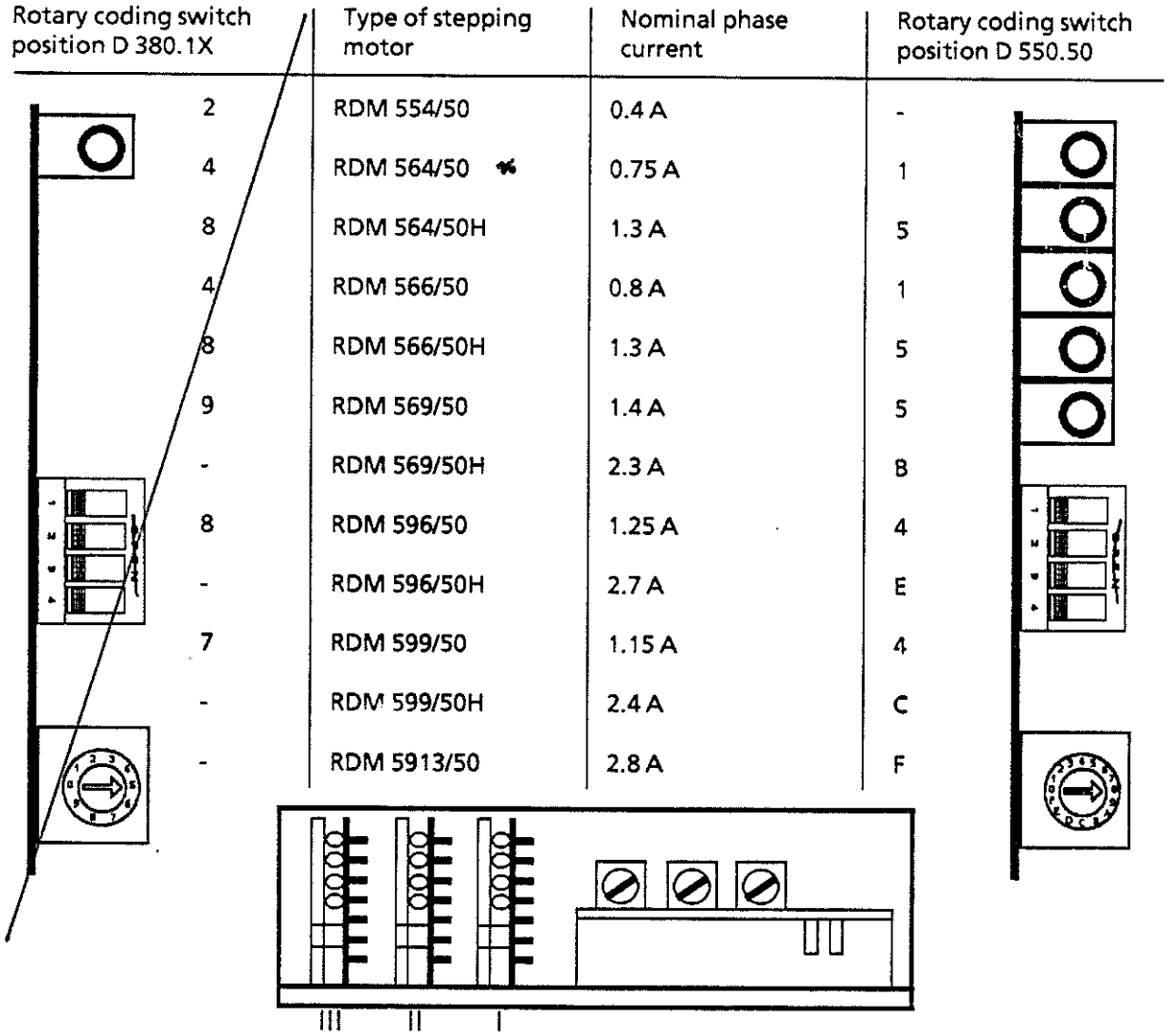
ATTENTION

The maximum nominal phase current must not be exceeded.

NOTE

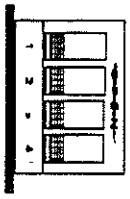
The current can be set to a lower value, which results in a torque reduction approximately proportional to the phase current.

Rotary coding switch position D 380.1X	Type of stepping motor	Nominal phase current	Rotary coding switch position D 550.50
2	RDM 554/50	0.4 A	-
4	RDM 564/50	0.75 A	1
8	RDM 564/50H	1.3 A	5
4	RDM 566/50	0.8 A	1
8	RDM 566/50H	1.3 A	5
9	RDM 569/50	1.4 A	5
-	RDM 569/50H	2.3 A	B
8	RDM 596/50	1.25 A	4
-	RDM 596/50H	2.7 A	E
7	RDM 599/50	1.15 A	4
-	RDM 599/50H	2.4 A	C
-	RDM 5913/50	2.8 A	F



2.1.4.2 Programming functions

The toggle switches of the control card D 380.1X or D 550.0X allow programming different functions. It must be noted that the function of switch 1 is different on the two power control cards.



Switch 1: (invert gate on D 380.1X)

Switch position	OPEN	CLOSED
Signal input current	pulse input blocked	release pulse input
Signal input inactive	release pulse input	pulse input blocked

Switch 1: (zero current/boost on D 550.0X)

Switch position	OPEN	CLOSED
Signal input inactive	I_{nom} phase current	I_{nom} phase current
Signal input current	no current (zero-current mode)	I_{nom} x 1,2 (boost mode)

Switch 2: (current reduction)

	OPEN		CLOSED	
Pulse frequency	<10 Hz	>10Hz	<10 Hz	>10Hz
Motor current I	I_{nom}	I_{nom}	I_{nom} x 0,7	I_{nom}

Switch 3: (direction reversal)

Switch position	OPEN	CLOSED
Direction reversal	OFF	ON

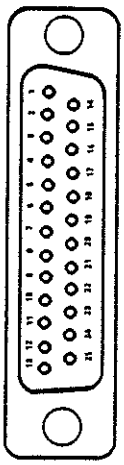
Switch 4: (step angle)

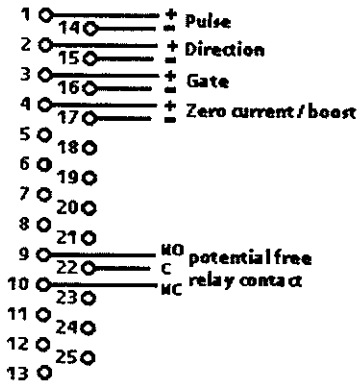
Switch position	OPEN	CLOSED
Step angle	Full step 500 steps per rotation ($\propto$ = 0,72°)	Half step 1000 steps per rotation ($\propto$ = 0,36°)

2.1.5 Signal inputs/outputs

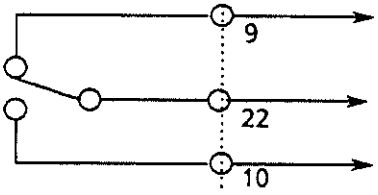
- Signal connector (3 x per axle 1...3), 25-pole "Sub-D", viewed from the soldering side

- Signal cable screening is effected on the transmitter side.





The relay contacts may be used for the indication of readiness or malfunctions.
- Block circuit diagram for internal relay contact

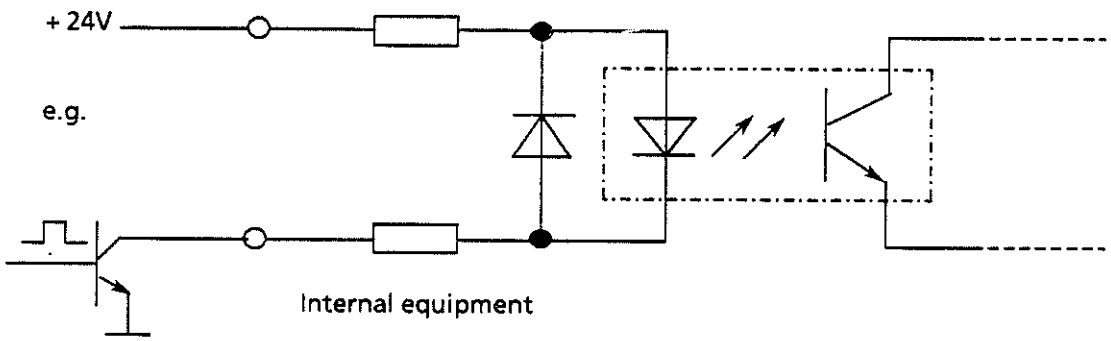


Technical data of the relay

V_{max} ~	30V
V_{max} =	36V
I_{max}	0.2A
P_{max}	5VA

9 - 22 closed unit not ready
10 - 22 closed unit ready

The optocoupler inputs are designed for 24 VDC or 5 VDC or TTL-push-pull. The current is internally limited by pre-resistors.
- Block circuit diagram for optocoupler inputs



The "zero current or boost" function is not available for MD 5-31.

2.1.6 Installation of the unit

The possibilities of fastening the telescopic rails are evident in fig. 1-3.

2.1.6.1 Cooling the unit

When installing the unit ensure that:

- cool air is able to enter uninhibitedly at the front of the unit
- warm air is able to exit uninhibitedly at the rear of the unit.

	MD 5-52	MD 5-31
Ambient temperature	max. 50°C	max. 50°C
Motor phase current	max. 2.8A/phase	max. 1.4A/phase

2.1.7 Check list

Before starting the unit the following conditions must be fulfilled in order to ensure trouble-free operation.

Conditions	Details see
Has the equipment been set to the mains voltage present?	2.1.2
Is air able to enter and exit?	2.1.6
Has the right type of motor been installed?	
Have the signal and motor cables been laid at a proper distance to each other?	2.1.1
Has the signal connector been wired correctly?	2.1.5
Has the motor connector been connected correctly for all five phases? **ATTENTION** Never plug-in or remove the motor connector with the unit switched on (contact erosion owing to arcing).	2.1.3
Have the motor currents been set on the card D 380.1X/ D 550.0X according to the table? **ATTENTION** The maximum phase current of the 5-phase motor in use must not be exceeded.	2.1.4
Have the other switches on the card D 380.1X/D 550.0X been set correctly?	2.1.4

card may be damaged.

2.2 Operation

Upon applying the mains voltage, the MD 5-X is ready for operation and responds to the following control signals:

- Step angle
- Step frequency
- Sense of rotation
- Phase current

The following external digital control units may be connected for the generation of the control signals:

POSAB 2000
3-channel oscillator card D 538
1-channel oscillator card D 638
Processor control unit
PLC

2.3 Terminology

Explanation of terminology in alphabetical order:

Acceleration $^{Hz}/_{ms}$	Acceleration time of the stepping motor from the start/stop frequency to the maximum frequency set.
Boost	Temporary increase of the set phase current to I_{Phase} x 120%. **Observe the maximum permissible heating of the motor!**
Clockwise rotation of SM	Positive rotation as seen from the motor shaft (flange side).
Counterclockwise rotation of SM	Positive rotation as seen from the motor shaft (flange side).
D 380.1X/D 550.0X	Constant-current control card for a BERGER LAHR 5-phase stepping motor.
D 538 0638	Oscillator card for setting the frequencies, acceleration and deceleration
Delay time t_f	Period of delay of the SM from the maximum frequency set to the start/stop frequency.
Excessive temperature	The maximum permissible temperature is exceeded.
Fall time t_f	Duration of the falling signal edge.
5-Phase-stepping motor (5-phase-SM)	Refer to BERGER LAHR prospectus No. 350.
Full step	On 5-phase-SM this means 500 steps/revolution corresponding to 0.72°/step i.e. double the step angle of half step.
Gate	Pulse input can be disabled with this function.
Half step	On 5-phase-SM this means 1000 steps/revolution corresponding to 0.36°/step, i.e. the step angle is halved compared with full step operation.
Hold time t_h	Minimum time a direction or other signal is waiting to be served after the active pulse edge
Overload	The permissible current of the control card is exceeded.
Overvoltage	The nominal voltage exceeds the permissible tolerance.
Phase current	The current which flows through one winding of the SM.
Pulse duration t_p	The time span of one pulse waiting to be served.

Revolutions min^{-1}	Calculated from step frequency x $\frac{\text{step angle x 60}}{360°}$
Rise time t_r	Duration of the rising signal edge.
Setup time tsu	Minimum time a direction or other signal is waiting to be served before the active pulse edge.
SM	Stepping motor
Start-/stop frequency	Maximum control frequency with which the motor can start and stop safely without stepping errors with a certain load, consisting of friction and acceleration of rigidly connected centrifugal masses.
Step	Process in which the motor shaft of the SM executes a movement corresponding to one step angle.
Step angle in degrees	The nominal angle through which the motor shaft of the SM rotates per each control pulse.
Step frequency f_s in steps/s	Number of steps executed by the motor shaft of the SM in one second on constant control frequency.
Undervoltage	The nominal voltage falls short of the permissible tolerance.
Zero phase current	Motor is not supplied with current - no holding moment.

2.4 Malfunctions

2.4.1 Check list CL1

Malfunctions without error message	Possible cause	Recommended action to eliminate the error
Motor does not start	Incorrect signal connection	Check signal connection
	Electric equipment does not work properly	Check electric equipment
Motor does not perform the desired function	Incorrect switch position on D 380.1X/D 550.0X	Check switch position on D 380.1X/D 550.0X
	Start-stop frequency too high	Set start-stop frequency to a lower value
Motor does not start Motor does not reach the required maximum frequency	Acceleration ramp too steep	Set the acceleration ramp in the control circuit to a lower value
	Driven load too sluggish	Check driven load: - ensure easy running - adapt driven load - reduce the required max. frequency
	Built-in motor type is not suitable	- choose a more powerful motor
Motor does not run smoothly	Motor cable defective	Check motor cable
	Motor defective	Replace motor
	Power amplifier defective	Replace power amplifier
Positioning error	Incorrect control signals	Check signal control

2.4.2 Check list CL2

For diagnosis and elimination of errors on the D 380.1X card the following applies:

o green LED = operative
o red LED = malfunction

For diagnosis and elimination of errors on the D 550.0X card the following applies:

1	green	o - card ready
2	red	o - overload
3	red	o - excessive temperature
4	red	o - under-/overvoltage
5	red	o - phase interruption

Error message	Possible cause	Recommended action to eliminate the error
No LED lights up	Mains fuse defective	Check fuses
	Malfunct. in the power supply unit	
LED 2 lights up	Motor wrongly connected	Check motor connection
	Cable defective	Check cable
	Motor defective	Check motor
	A strong disturbing pulse has occurred	Observe distance between the cables
LED 3 lights up	Ambient temperature too high Ventilation adequate?	Make sure that air can enter and exit unin-hibitedly
LED 4 lights up	Mains voltage too high/ too low?	Check mains connection
	D 550.0X defective?	Replace D 550.0X
LED 5 lights up	Wire break in the motor cable Cold soldering joint at motor cable or connector	Check motor connection

3 MAINTENANCE

3.1 Maintenance work

Depending on the degree of air pollution:
- Check air filter mat on the front panel periodically
- Replace if very dirty

3.1.1 Replacing fuses

The primary fuse can be accessed at the rear of the equipment.

Mains fuse for	MD 5-52	MD 5-31
120 VAC	T12.5A	T10A
220 V/240 VAC	T6.3A	T5A

3.2 Replacing cards

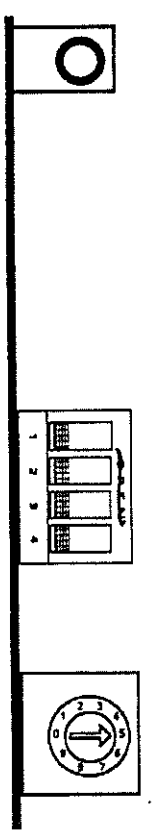
3.2.1 Replacing the control card D 380.1X

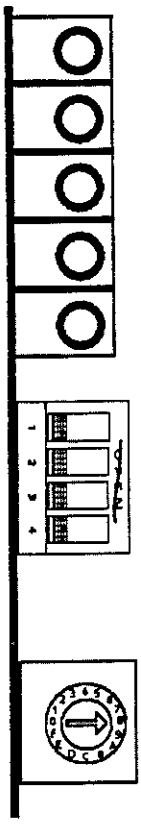
After having replaced the control card D 380.1X, verify before switching it on again that the rotary switch position and the sliding switch position correspond with the type of stepping motor in use.

3.2.2 Replacing the control card D 550.0X

After having replaced the control card D 550.0X, verify before switching it on again that the rotary switch position and the sliding switch position correspond with the type of stepping motor in use.

Rotary switch position D 380.1X	Type of stepping motor	Nominal phase current	Rotary switch position D 550.0X
2	RDM 554/50	0.4 A	-
4	RDM 564/50	0.75 A	1
8	RDM 564/50H	1.3 A	5
4	RDM 566/50	0.8 A	1
8	RDM 566/50H	1.3 A	5
9	RDM 569/50	1.4 A	5
-	RDM 569/50H	2.3 A	B
8	RDM 596/50	1.25 A	4
-	RDM 596/50H	2.7 A	E
7	RDM 599/50	1.15 A	4
-	RDM 599/50H	2.4 A	C
-	RDM 5913/50	2.8 A	F





NOTE
Mark switch positions set.

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Improvements

MD 5-X device documentation

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for 2/3 axles

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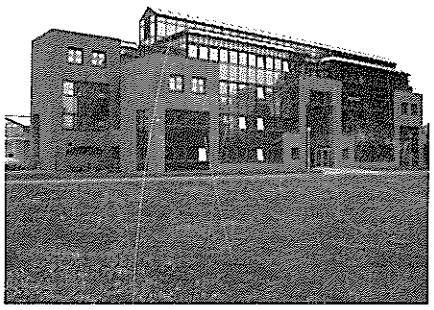

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