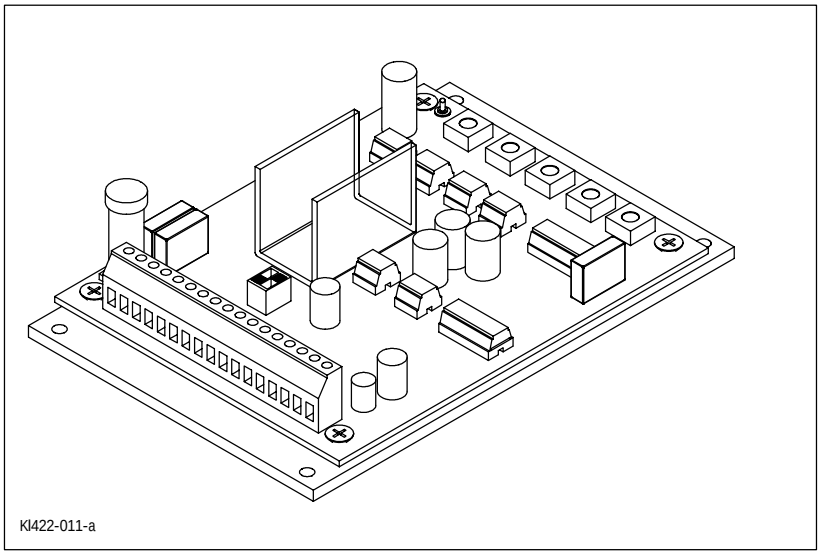
393 017 GB

magneta

Operating Instructions



KI422-011-a

Control unit type 14.422 for magnetic particle clutches and brakes

Read these Operating Instructions before using the equipment!

Manufacturer and site:

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Year of manufacture: see packaging label

This operating manual is valid for the control units

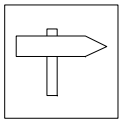
Type	14.422.01.042	Built-in unit without transformer with the corresponding transformer
Type	14.422.04.230	Unit in case

Packaging label

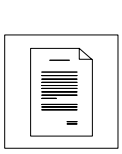
Layout

Field	Contents			Example
1	Assembly site		Barcode no.	magneta D-AERZEN
2	Designation		Material no.	REGELGERÄT Nr. 152611
3	Type			Typ:14.422.01.042 CE
4	Supply voltage	Supply frequency		42V - 50/60Hz
5	Techn. Data	No. of items	Date of manufacture	max. 2A 1 Stück 71015

BA 14.9003
3. Edition: 11/99



Contents



1 Preface and general information

1.1 About these Operating Instructions

- These Operating Instructions are provided to ensure safe working on and with the Control unit type 14.422. They include safety notes that must be followed.
- All persons that work on and with the control units must have these Operating Instructions available while they are working, and must observe the relevant notes and instructions.
- The Operating Instructions must always be complete and in a perfectly legible condition.

1.1.1 Terminology used

Drive system

For drives with control units in conjunction with other drive components, the terms ”drive system” is used.

1.2 Items supplied

- The items supplied with the Control unit type 14.422.01.042 are:
  - 1 control unit, type 14.422
  - 1 setpoint potentiometer
  - 1 rotary knob for setpoint pot.
  - 1 scale (0 - 100%)
  - 1 Operating Instructions
- The items supplied with the Control unit type 14.422.04.230 are:
  - 1 control unit, type 14.422
  - 1 setpoint potentiometer
  - 1 knob for setpoint pot.
  - 1 scale (0 - 100%)
  - 1 transformer, type 14.422.02.230 (230V)
  - complete and built into case
  - 1 Operating Instructions
- Immediately on reception, check that the contents of the delivery match the accompanying delivery documentation. mag**n**eta will not recognize any warranty for defects that are claimed at a later date. Claim for:
  - visible transport damage immediately to the supplier,
  - visible defects/incomplete equipment immediately to mag**n**eta.

1.3 Control unit type 14.422

1.3.1 Labelling

- magneta control units are uniquely identified by the contents of the nameplate.
- CE-labelling: conforms to the EC-Directive ”Low-Voltage”

1.3.2 Application as directed

- Control units must only be used under the conditions that are described in these Operating Instructions.

Control units

- are components
  - for the activation of magnetic particle clutches and brakes,
  - for building into a machine,
  - or for combination with other components in a machine.
- are electrical equipment, to be mounted in control cabinets or similar closed spaces.
- fulfill the safety requirements of the EC-Directive ”Low Voltage”.
- are not themselves machines in the sense of the EC-Directive ”Machines”.
- are not domestic equipment, but intended to be used exclusively as industrial components.

Drive systems with control units

- conform to the EC-Directive ”Electromagnetic Compatibility”, if they are installed according to the instructions for the CE-typical drive system.
- can be operated
  - from public and private supply networks,
  - in industrial, commercial and residential areas.
- The user is responsible for ensuring the compliance with EC-Directives in the particular machine application.

Any other use shall be deemed inappropriate!

1.3.3 Legal conditions

Liability

- The information, dates and instructions in the Operating Instructions were up to date at the time of printing. No rights or warranty for equipment that has already been supplied may be derived from the information, diagrams, or descriptions.
- The notes on process methods and extracts from circuit diagrams in this operating manual are only suggestions. The applicability to a specific application must be checked in each case. No liability is accepted by magneta as to the suitability of any of the procedures or circuit recommendations included here.
- No liability will be accepted for damage or disturbance caused by:
  - ignoring this operating manual,
  - unauthorized alterations to the equipment,
  - operator errors,
  - incorrect working on or with the control unit.

Warranty

- Guarantee conditions: see magneta GmbH & Co KG conditions of sales and delivery.
- Report any claims under guarantee to magneta immediately on discovery of the defect or fault.
- The guarantee is void in all cases where liability cannot be established.

2 Safety information

2.1 Persons responsible for safety

Operator

- The operator is any natural or legal person who uses the drive system or in whose name the drive system is used.
- The operator or the person entrusted by the operator with the responsibility for safety must ensure
  - that all relevant regulations, instructions and laws are observed,
  - that only qualified personnel work on and with the control unit,
  - that the operating manual is available to the personnel for all actions where it is appropriate,
  - that unqualified persons are prevented from working on or with this fast-operating unit.

Qualified personnel

Qualified personnel are persons who, as a result of their education, training and experience, as well as knowledge of the relevant standards and regulations, safety standards and operating condition, have the authority of the person responsible for the safety of the plant to perform the particular tasks required, being able to recognize and avoid possible dangers.
(Definition of qualified personnel according to IEC 364)

2.2 General safety notes

- These safety notes do not make any claim to be complete. In the event of problems or queries, please contact magneta.
- The control unit corresponds to the state of the art at the time of delivery, and is fundamentally safe in operation.
- A control unit may create a hazard for personnel, for the equipment itself and for other property of the operator, if
  - unqualified persons work on or with the control unit,
  - the control unit is used in a manner that is not approved.
- The notes on process methods and extracts from circuit diagrams in these Operating Instructions are only suggestions. The applicability to a specific application must be checked in each case.
- The control units must be incorporated in to the plan in such a way that when they are properly installed and used in an approved manner in fault-free operation, they fulfill their function and do not create any hazard for personnel. This applies also to their interaction with the rest of the system.
- Take additional measures to make sure that the consequences of faulty operation are limited and cannot cause hazards for personnel or property:
  - electrical or non-electrical protective devices (interlocks or mechanical lock-outs)
  - system-wide measures.
- Only operate the control unit when it is in perfect order.
- Alterations or changes to the control unit are forbidden,(see Chap. 1.3.3 Liability and guarantee).

2.3 Residual hazards

Personal protection

The capacitors and various other components can still have dangerous voltages on them for up to 3 minutes after switching off the supply power.

2.4 Layout of the safety notes

- All safety notes in this operating manual have a standard layout:

Signalword

Note text

- The pictogram depicts the nature of the hazard.
- The keyword indicates the severity of the hazard.
- The text of the note describes the hazard and gives instructions on how it can be avoided.

Warning of personal hazards

Pictograms used	Keywords	
 Warning of dangerous electrical voltage	**Danger!**	Warns of **an immediate threat of danger .** Results of ignoring the danger: Death or severe injuries.
 Warning of a general hazard	**Warning!**	Warns of a **possibly very dangerous situation .** Possible consequences if ignored: Death or very serious injuries.
	Caution!	Warns of a **possibly dangerous situation .** Possible consequences if ignored: light or minor injuries.

Warning of damage to property

Pictograms used	Keywords	
	**Stop!**	Warns of **possible damage to property .** Possible consequences if ignored: Damage to the drive system/equipment or surroundings.

Other notes

Pictograms used	Keywords	
	**Tip!**	Indicates a general, useful tip. If you follow it, the handling of the control unit or drive system will be easier.

3 Technical Data

3.1 Product Description

3.1.1 Application

The built-in power supply ensures that a constant current flows, despite variable coil temperature. This keeps the torque constant.

In certain applications, a control of the voltage can be achieved through a simple switch on the controller board (Chap. 4.3.2).

3.1.2 Features

The 14.422 control unit is used to activate magnetic particle clutches and brakes. The excitation current can be controlled by a dancer or floating potentiometer, or by a control voltage. The desired torque or excitation current is set by the setpoint potentiometer.

Since the device operates with a 24V nominal ouput voltage, but the input voltage depends on the mains supply voltage, the control unit must be connected to the AC supply through a transformer.

3.2 Ratings

Characteristic		Values
Supply voltage	V	42 V 50/60 Hz
Output current	I_{AN}	2 A
Output voltage	V_{AN}	24 V
Output voltage range	V_A	0 , 1 V to 30 V
Voltage tolerance		+ 5% to -10%
Board consumption	I_{self}	120 mA
Run-up/down time	T_i	0.5 to 20 sec
Setpoint potentiometer 1 W	R	10 kOhm
Nominal tacho voltage	V_{TN}	0 ... 5 V to 0 ... 100 V (set on the pot. U_{set})
Nominal set voltage	V_{LN}	
Ambient temperature	T_{amb}	0 ... 45 °C
Fusing (single)	S_i	FF 4A
Supply transformer	P	100 VA
	V	230/42 V
Enclosure (unit in housing)		IP 22

Stop!
When the unit is built into a case, ensure that there is adequate air flow. The maximum ambient temperature of 45 °C must be observed!

3.3 Dimensions

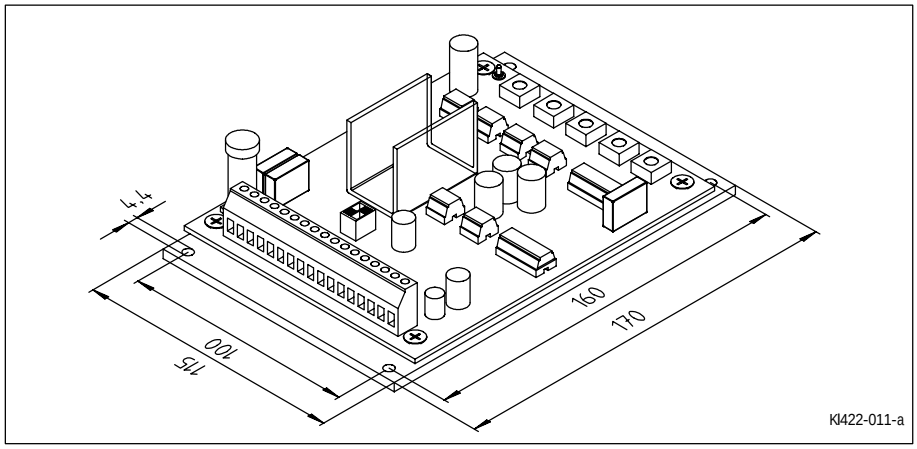


FIG 1 Controller board; dimensions in mm

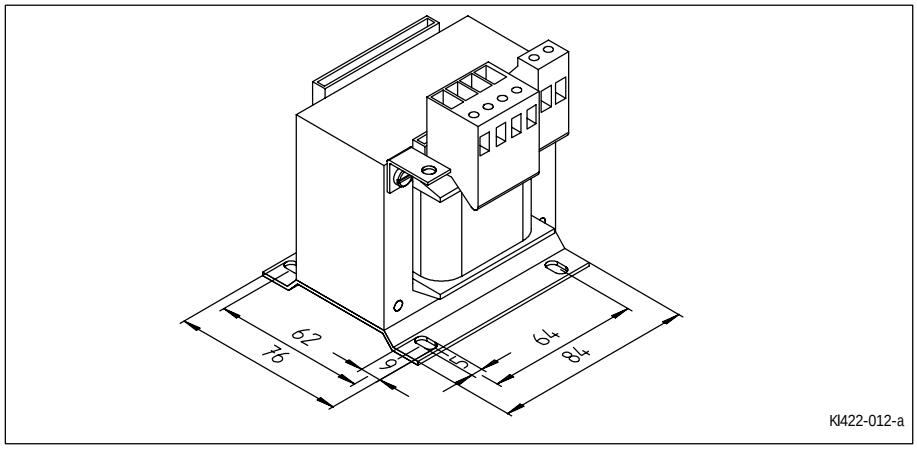


FIG 2 Transformer; dimensions in mm

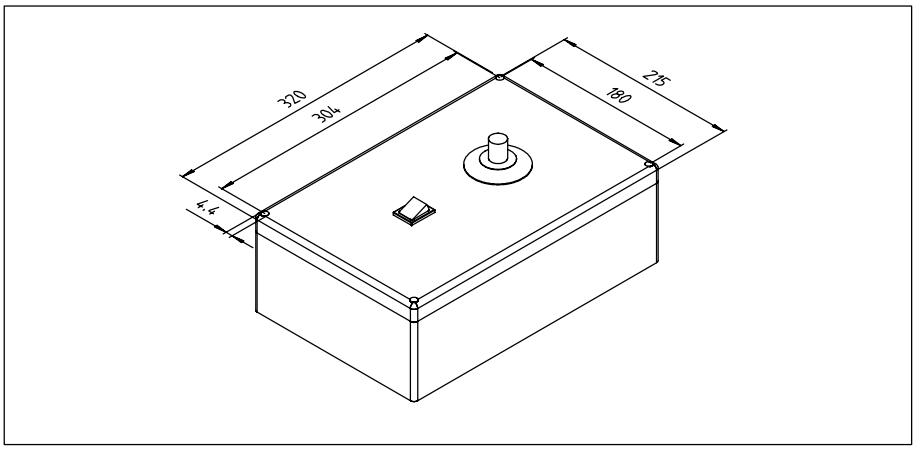


FIG 3 Case; dimensions in mm

3.4 Signal flow chart

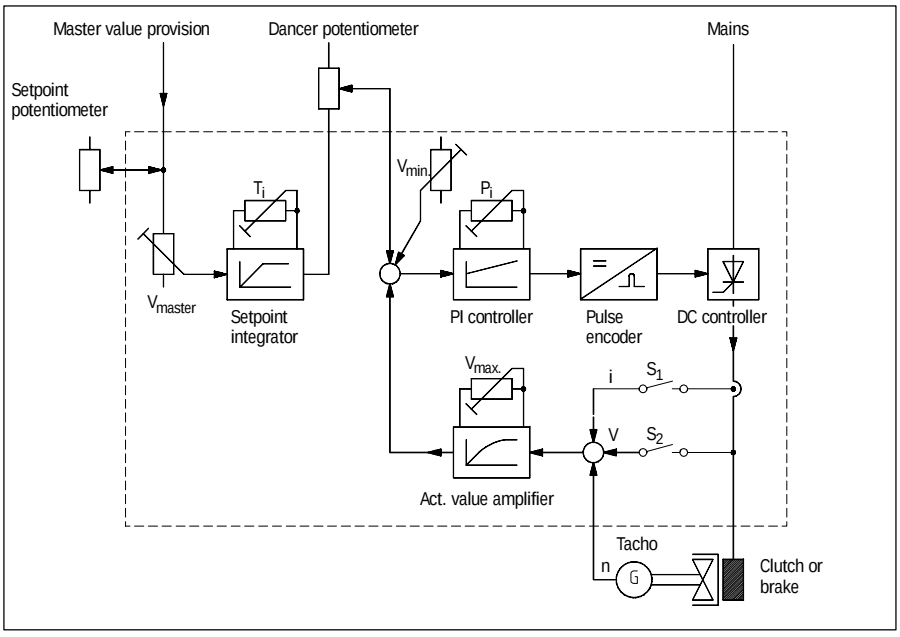


FIG 4

4 Installation

Stop!
Before the installation, check that the ratings for the control unit (Chap.3.2) suit the requirements of the machine.

4.1 Mechanical installation

Tip!
The control unit can be installed in any position.

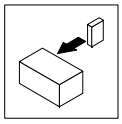
1. It must be fixed to a flat surface by 4 cheese head screws.
2. Ensure that the flow of cooling air is not impeded.
3. If the cooling air is contaminated (dust, fluff, fatty vapors, aggressive gases etc.), so that the functioning of the control unit could be affected, then take appropriate measures, (e.g. provide a separate air flow, build in filters, clean regularly etc.).
4. Do not exceed the permissible ambient temperature range in operation: 0 to 45 °C.

4.2 Electrical connection

Notes on installation to meet EMC requirements can be found in Chap. 4.2.3

4.2.1 Personal protection

Warning!
Only make the electrical connection while the equipment is de-energized (all voltages disconnected)!



- Personal protection to DIN VDE 0100 with r.c.c.b. devices:

The control units include an internal mains rectifier. An earth fault can result in a DC that prevents a traditional fault-current device from tripping. We therefore recommend the use of "universal-current sensitive" r.c.c.b. devices.

- When dimensioning the trip current, please take note that capacitive compensation currents in the shielding leads and interference suppression filters during operation may cause spurious tripping.
- Remarks on the use of universal-current sensitive r.c.c.b. devices:
  - The German Committee K 226 has decided on the recommendation in the standard pr EN 50 178 (previously VDE 0160) for the use of universal-current sensitive r.c.c.b. devices.
  - The final decision on the use as a standard will be made by the CENELEC/CS (European Committee for Electrotechnical Standardization) in Brussels. Further information on the use of universal-current sensitive r.c.c.b. devices can be obtained from the manufacturers of these devices.

Warning!

Faulty fuses should only be replaced while the equipment is de-energized, and only by the specified type! The control unit may carry dangerous voltages for up to 3 minutes after the power has been disconnected.

4.2.2 Power connection

- When dimensioning the cross-section of the supply leads, take account of the current consumption of the control unit and the voltage drop under load.
- The possible conformity with other standards (e.g. VDE 0113, VDE 02898 or similar) is the responsibility of the user.
- Observe the max. permissible tightening torques for the screws in the terminal strips:

  M = 0.7 to 0.8 Nm

4.2.3 Installation of a CE-typical drive system

General notes

- The electromagnetic compatibility of a machine depends on the method and the care taken in the installation. The following must be observed:
  - Layout
  - Filtering
  - Shielding
  - Earthing
- If the installation is different, then it will be necessary to test that the machine or system keeps within the EMC limits for conformity with the EMC-Directive. This will be necessary, for instance:
  - if unshielded cables are used.

Stop!

Conformity with the EMC-Directive in the machine application is part of the responsibility of the application.

- If the following measures are observed, you can be sure that the drive system will not cause any EMC problems while the machine is operating, and the EMC-Directive will be fulfilled.

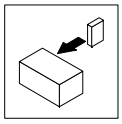
Tip!

If equipment that does not meet the CE-requirements for interference immunity to EN 50082-2 is operated in the vicinity of the control unit, then this equipment may affect the functioning of the control unit.

4.2.4 Shielding

Shield the control cables:

- Connect up the shielding for analog control cables at one end,
- Connect the shielding of the control cables by the shortest route to the shield terminals provided on the control unit.



If control units are used in residential areas:

- An additional damping of 10 dB must be provided by the shielding, to limit radiated interference. This can usually be achieved by installation in normal closed and earthed metallic control cabinets or housings.

4.3 Operating modes

4.3.1 Current control

Current control can be used to regulate the excitation current of a magnetic particle clutch or brake.

The desired torque or excitation current is set with the setpoint potentiometer. The excitation current can also be determined by a dancer potentiometer or a master voltage. The minimum or maximum output current can be set by the trimmers V_{min} or V_{max} . V_{min} should be set no less than 0,1 V.

If current control is required (the normal setting of the unit as delivered), then set switch 1 of the programming switch to the ON-1 position and switch 2 to be open (OFF-0 position).

Programming switch S1 **ON-position (1)**

Programming switch S2 **OFF-position (0)**

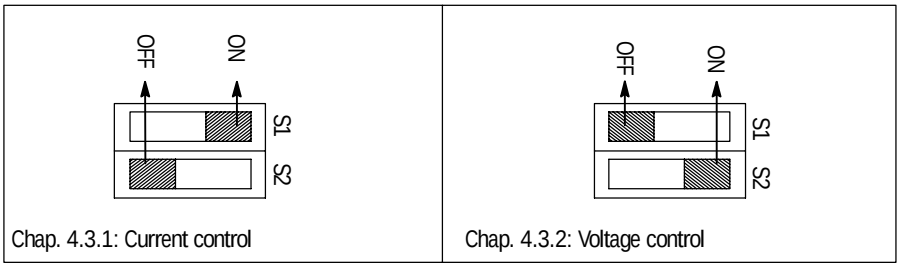
4.3.2 Voltage control

In some applications a controlled output voltage is required. In this case, switch 1 must be open and switch 2 must be closed.

The setting of the output voltage is made as described in Chap. 4.3.1

Programming switch S1 **OFF-position (0)**

Programming switch S2 **ON-position (1)**



Chap. 4.3.1: Current control

Chap. 4.3.2: Voltage control

FIG 5 Programming switch S1 and S2

4.3.3 Speed control with tachometer feedback

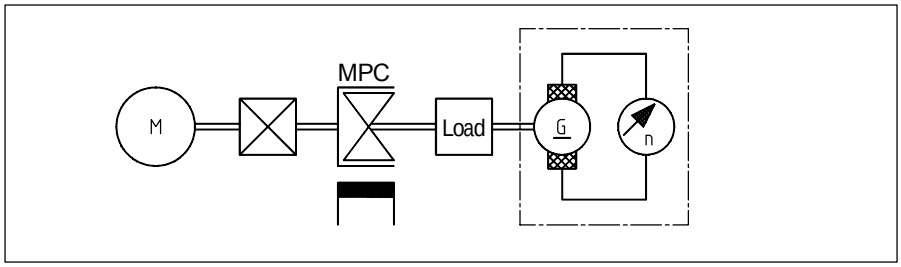


FIG 6

If the 14.422 unit is connected to a magnetic particle clutch, then the speed of a load can be regulated. To be able to regulate the speed it is a condition that the torque curve for the load does not have any dips or pull-out points (i.e. no turning points). No speed control is possible over such a range. The minimum and maximum speeds must be selected to avoid any overshooting of the speed caused by dips or pull-out points. If the permissible control range is not observed, the result will be an uncontrollable speed behaviour.

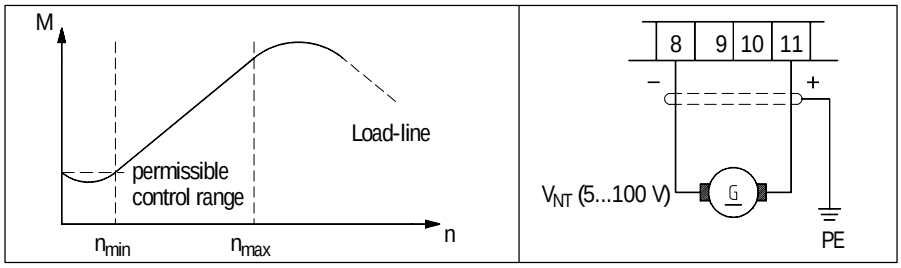
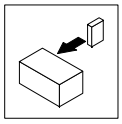


FIG 7 Connection of the tacho-generator

The tachometer voltage is connected to the unit via the terminals 11(+), 8(-), and both contacts of the programming switch must be open.

Programming switch S1	**OFF-position (0)**
Programming switch S2	**OFF-position (0)**



Speed control with tachometer feedback results in large time constants in the control loop, making it necessary to add capacitors to the controller. Solder terminals are provided on the p.c.b. for this purpose. The value that is required for C22 is largely dependent on the flywheel effect of the load. The required capacitors are > 10 μF rated for at least 25 V. 22 μF can be taken as a typical value.

If electrolytic capacitors are used, then two capacitors with the same value must be wired in series on the board, with opposing polarities. If a bipolar capacitor is used, then bridge two of the solder terminals with a wire link.

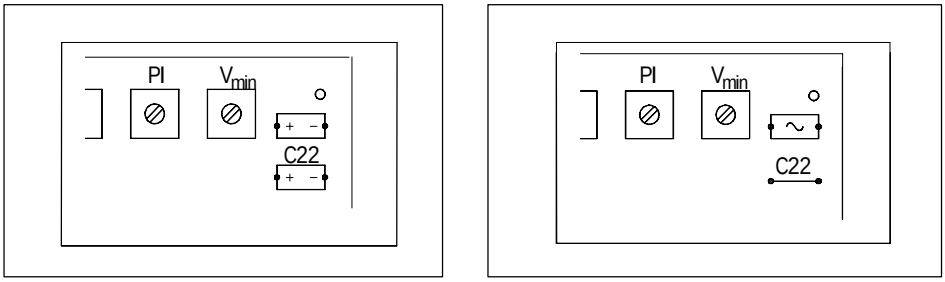


FIG 8 Electrolytic capacitors Bipolar capacitors

Adjust the PI potentiometer for optimum speed response, without oscillation.

If it is not possible to achieve operation without oscillation by using the PI trimmer, then increase the value of C 22 in the control circuit until the drive runs smoothly.

4.3.4 Torque control

For torque control, the same wiring diagram and component values are used as for speed control (Chap. 4.3.3). A torque sensor is attached instead of a tachometer.

4.3.5 Master-voltage operation

A master voltage can be connected to provide the setpoint, instead of the setpoint potentiometer. The master voltage is applied to the terminals 6(+), 5(-). The nominal master voltage should be in the range 0 to 5 V or 0 to 100 V. The master voltage is adjusted by using the trimmer V_{master} on the unit (see adjustment instructions).

If the unit is operated without an isolation transformer, then the master voltage must be isolated from the mains supply voltage.

V_{min} should be set no less than 0.1V.

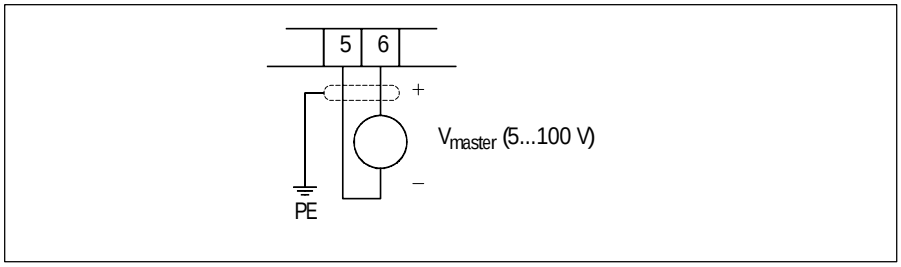


FIG 9

Various voltage sources are available on the market, i.e. 0-5 V; 0-10 V; 0-24 V etc. up to 0-100 V. These sources must be adapted to the unit by means of the V_{master} potentiometer.

The setting range of the output voltage of the unit is thus affected by the source.

Example: Input voltage 5 V max. ≙ max. output voltage

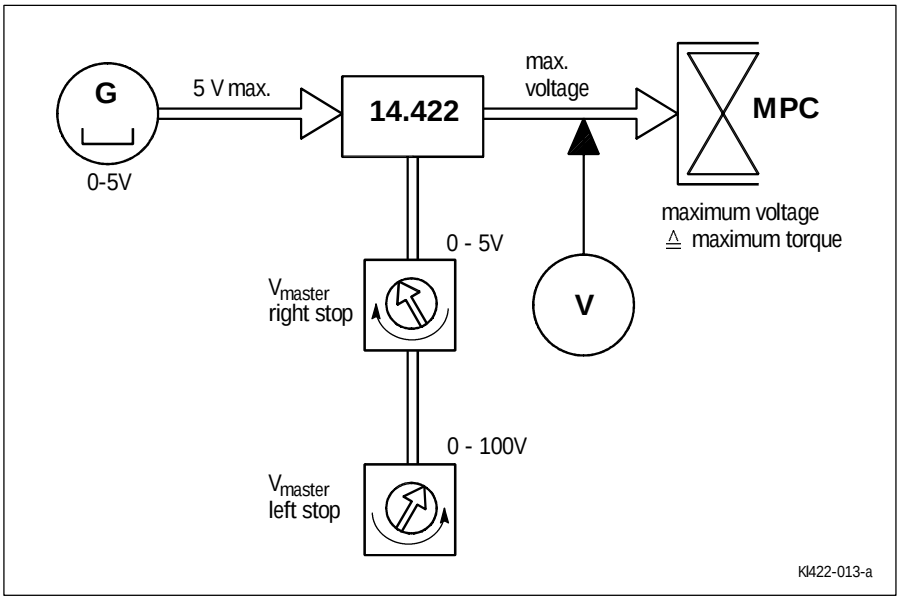


FIG 10

4.3.6 Control not isolated / not floating

If the control voltages are not isolated (i.e. not floating), then each control device must be supplied via its own isolating transformer. If the controls are floating, then several control devices may be connected to the same transformer.

4.4 Switching operation

Warning!

The load circuit must only be switched while the current is zero!

When the "controller inhibit" switch is closed, no trigger pulses will be produced (output voltage = 0 V).

4.5 Setpoint integrator

In the event of a setpoint step, the output voltage will respond at a rate that can be set by the trimmer T_i . The run-up/down times can be set from 0.5 to 20 secs.

4.6 Temperature protection

A thermostat in the magnetic particle brake or clutch will switch the unit off independently when the selected limit temperature for the housing is reached.

After the fault has been cleared and the MPC/MPB has cooled down, the unit can be switched on again by pressing briefly on the controller inhibit. After a short interruption of the supply voltage the unit will also be ready to operate again.

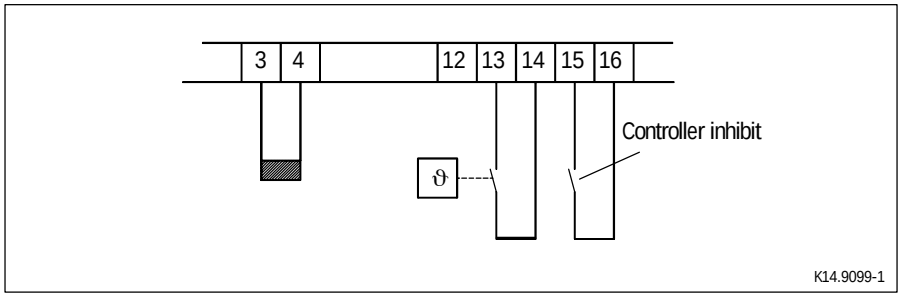
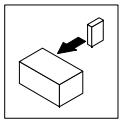


FIG 11 Connecting a temperature sensor (thermostat) to an MPB



By wiring up an external relay, the temperature switch-off can be used to create a display signal. In this case, a make-contact of the relay d_1 (FIG 12) must be connected across the terminals 13 and 14. The relay has 40 V= applied when the temperature switch-off has operated. Relays with a lower coil voltage must be wired via a suitable series resistor.

Stop!

Temperature protection of an MPC must only be made with an isolating transformer! The wiper (pulse) contact of the MPC, which is connected to the thermostat, must be connected to terminal 3 of the controller. On the MPC from mag**n**eta this is the inner slip ring.

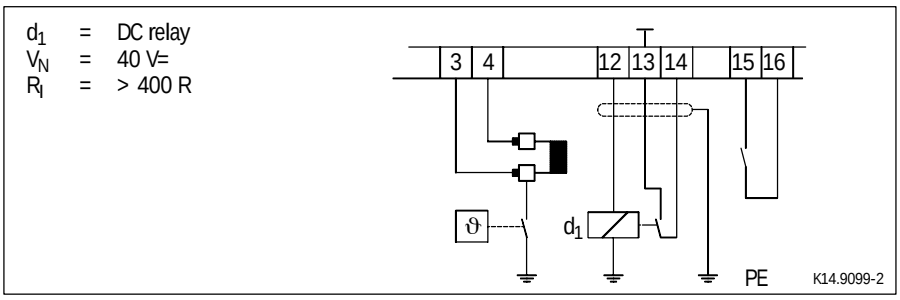


FIG 12 Connecting a temperature sensor/thermostat to a magnetic particle clutch

Tip!

Fix the potentiometer by screwing it to the PE.

5 Commissioning

5.1 Installation note

Stop!
If the unit is built into a case, care must be taken to ensure adequate ventilation. The ambient temperature must not exceed 45 °C. Control cables must be shielded, and connected to PE at one end.

5.2 Connection diagram

5.2.1 Connection diagram for the built-in control unit

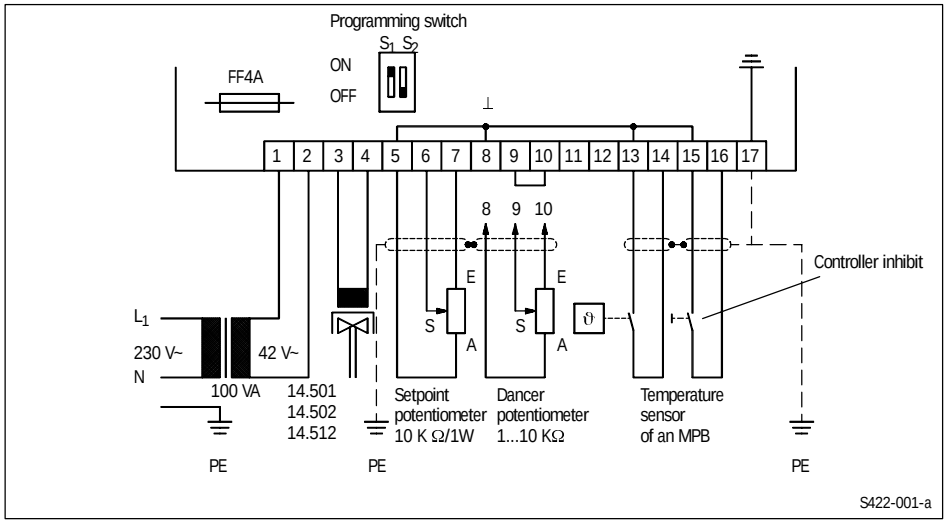
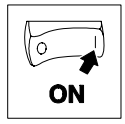


FIG 13 Connecting the temperature sensor for a magnetic particle brake 14.512



5.2.2 Connection diagram of the control unit in a case

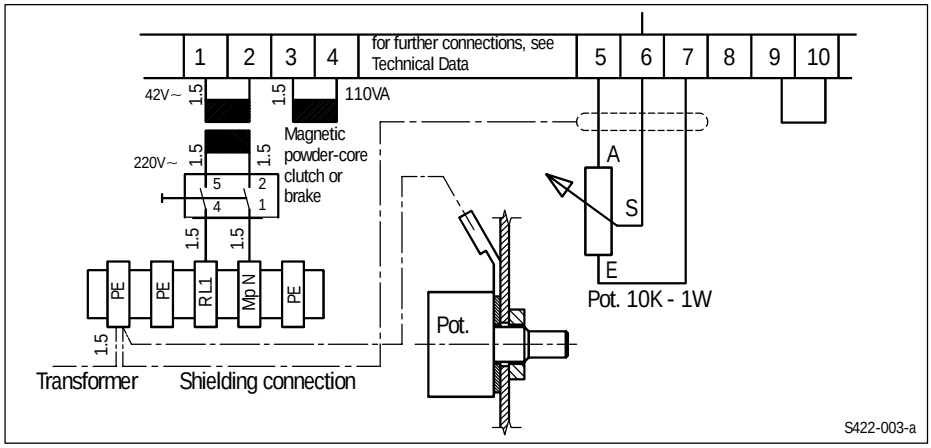


FIG 14 Connection diagram for the control unit in a case

Stop!
Temperature protection of an magnetic particle clutch must only be made with an isolating transformer! The wiper (pulse) contact of the magnetic particle clutch, which is connected to the thermostat, must be connected to terminal 3 of the controller. For magnetic particle clutches from magneta this is the inner slip ring.

5.3 First switch-on

Stop!
Before switching on the control unit, check that the wiring is complete and free from any short-circuits or earth shorts!

Check that the available supply voltage is within the permissible range for the control unit (see Chap. 3.2 Ratings).

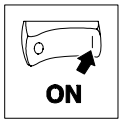
5.4 Notes on adjustments

See Chap. 5.5 (adjustments and component layout)

1. Trimmer V_{master} and T_i at left stop
2. Trimmer V_{max}, V_{min} and PI in middle position
3. The following must be set with:

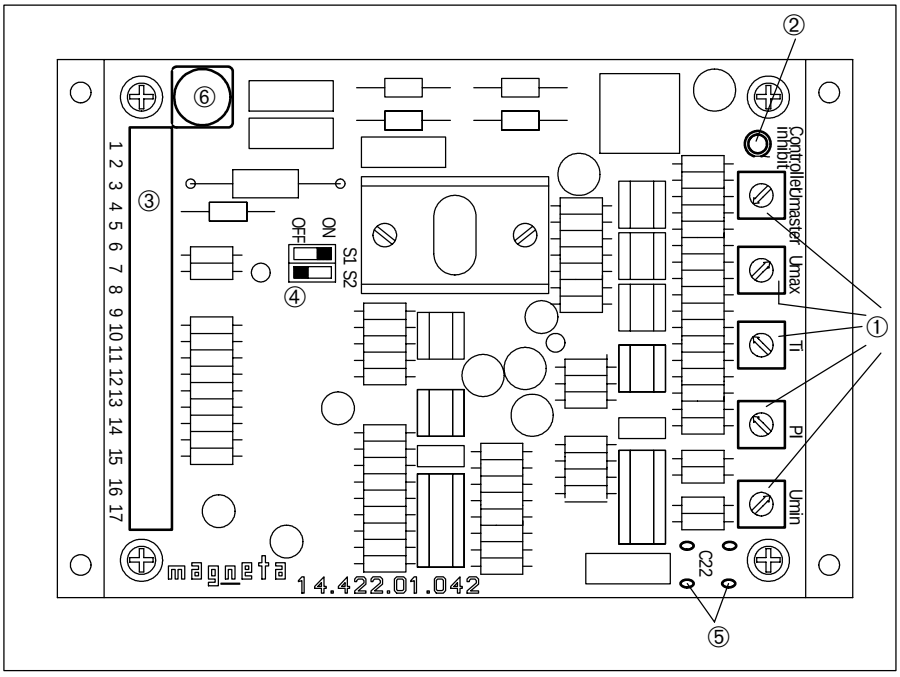
Operating mode	Programming switch	
	S1 - position	S2 - position
Current control	ON - (1)	OFF - (0)
Voltage control	OFF - (0)	ON - (1)
Speed control / torque control	OFF - (0)	OFF - (0)

4. Attach the tachometer voltage to terminals 11 (+) and 8 (-).
5. Solder in capacitor C22, with value 22 µF/25 V (as required for speed/torque control).
6. If a dancer potentiometer is used, the link between 9 and 10 must be removed. The link must be inserted for all other operating modes.
7. Switch on supply power.
8. For setpoint provision from a setpoint potentiometer, trimmer V_{master} must be set to the right stop.
9. With master-voltage control, trimmer V_{master} must be rotated to the right (with the master voltage at a maximum), until a voltage of 9 V appears between the terminals 10 (+) and 8 (-).
10. Adjust the setpoint potentiometer to the middle position (or the master voltage to the mid-range value).
11. Turn trimmer $V_{min.}$ until the desired mimimum value for the output is reached.
12. Turn trimmer V_{max} until the desired maximum value for the output is reached.
13. Set the setpoint potentiometer to the left stop (or the master voltage to zero).
14. Turn trimmer V_{min} until the desired minimum value for the output is reached.
15. Set the setpoint (and dancer potentiometer, if present) to the right stop.
16. Turn trimmer V_{max} until the desired maximum value for the output is reached.
17. Repeat the adjustments, as described for the steps 13-16, as often as required, since the trimmers V_{min} and V_{max} affect each other.
18. The ramp-up/down time for the output is set by trimmer T_i . Turning the trimmer to the right increases the ramp-up/down time.



19. The control-loop dynamic response for speed control with tachometer feedback is set by the PI trimmer. The PI trimmer must be adjusted to optimize the speed response while avoiding oscillation in operation.

5.5 Adjustment and component layout



① Potentiometer
② Controller inhibit
③ Terminal strip
④ Programming switch
⑤ Solder points for torque and speed control
⑥ Fuse

5.6 Test circuit

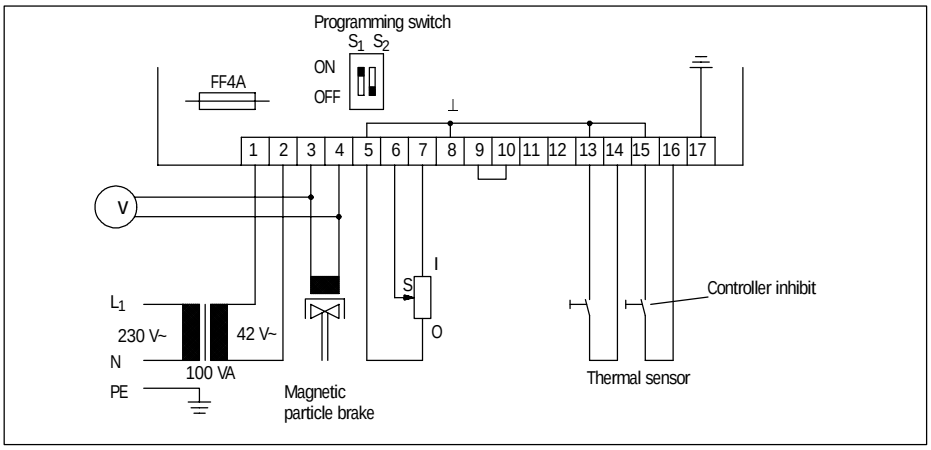


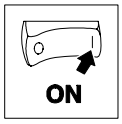
FIG 15

5.6.1 Connection

1. Switch off supply power!
2. Connect up unit according to the test circuit.
3. Connect link between terminals 9 and 10.
4. The switch ”Controller inhibit” between terminals 15 and 16 must be open.
5. The switch for the temperature protection between terminals 15 and 16 must be open.

5.6.2 Basic setting

1. Programming switch S1 = “ON”
   Programming switch S2 = “OFF”
2. Setpoint potentiometer = Right stop
3. V_{master} = Right stop
4. $V_{max.}$ = Right stop
5. T_i = Left stop
6. P_I = Middle position
7. $V_{min.}$ = Left stop



5.6.3 Test phase

Setting	Effect
Switch on supply power	Measuring instr. indication: - output voltage = maximum value
V_{master} - left stop	Measuring instr. indication: - 0 V
V_{master} - right stop $V_{max.}$ set to - 24 V Setpoint pot. - left stop (0%) $V_{min.}$ - set 0.1 V to 1 V	The desired voltage can now be set by the setpoint potentiometer.

Setpoint pot. = right stop

Setting	Effect
Operate the thermal proctection	Output voltage = 0 V Controller inhibit lights up
Operate the controller inhibit	The output voltage rises to the value set by the setpoint potentiometer.
T_i = right stop - adjust the setpoint pot.	The output voltage follows, with a delay.

T_i = left stop

6 Maintenance

- The control units do not require any maintenance, provided that the prescribed conditions of operation are observed.

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EC-Declaration of Conformity

for the purpose of the

EC Low-Voltage Directive (73/23/EEC))

amended by: CE-mark Directive (93/68/EEC))

The following products were developed, designed, and manufactured in compliance with the above-mentioned EC Directive under the sole responsibility of

magneta GmbH & Co KG, Dibbetweg 31, D-31855 Aerzen

The products are intended for assembly into a machine or for assembly with other elements to form a machine. Commissioning is prohibited until it is proven that the whole machine corresponds to the EC directive.

Product:	**Type:**
Magnetic particle brakes	14.512□□
Magnetic particle clutches	14.501□□ 14.502□□
Control units	14.222□□

Applied standards and regulations:

EN 60529	10/91	Rotating electrical machines
DIN VDE 0470	11/92	
DIN VDE 0580,	10/94	Electromagnetic devices

Aerzen, January 4, 1999

(Ogrodowski)

Declaration of Conformity / Manufactuer's Certification

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Manufacturer´s Certification

We herewith certify that the below listed products are intended for assembly into a m achine or for assembly with other elements to form a machine. Commissioning of the machine is prohibited before it is proven that it corresponds to the EC regulation 98/37/EC.

Product:	**Type:**
Magnetic particle brakes	14.512□□
Magnetic particle clutches	14.501□□ 14.502□□
Control units	14.422□□

Applied standards and regulations:

EN 60529	10/91	Rotating electrical machines
DIN VDE 0470	11/92	
DIN VDE 0580	10/94	Electromagnetic devices

Aerzen, January 4, 1999

(Ogrodowski)