

Instruction Manual for 1-Phase 1Q-Power Controller Temvar GE_3

TABLE OF CONTENTS

1	SAFETY AND APPLICATION NOTES FOR DRIVE CONVERTERS.....	2
2	DEVICE DESCRIPTION	3
2.1	General.....	3
2.2	Device Construction	3
2.3	Ambient Conditions	4
2.4	System Power Relationships.....	4
3	PRODUCT OVERVIEW	5
3.1	Device Table.....	5
3.2	Dimensions of Devices and Chokes.....	6
4	DEVICE CONNECTION.....	7
4.1	GEI3/_ Current Control Option	7
4.2	GEI3/_ Voltage Control Option	7
4.3	GEI3/_ Speed Control Option.....	8
4.4	Terminal Allocation.....	8
4.5	Assembly	9
4.6	Mechanical Construction	10
5	OVERVIEW DIAGRAMS	11
5.1	Basic Unit	11
5.2	Option Board Current Controller.....	13
5.3	Option Board Voltage Controller.....	14
5.4	Option Board Speed Controller	16
6	INSTALLATION.....	18
6.1	Danger Notice.....	18

Updated edition: A0338_13 – date of last revision: November 6, 2017/BIE-KB



1

D 96.091101E SAFETY AND APPLICATION NOTES FOR DRIVE CONVERTERS

(according to the 72/73/EC Low-voltage Guideline)

25.10.96/HX/PT/BLY

1. General

Depending on their protection class, drive converters may have non-isolated and live conductors, possibly moving or rotating parts, and hot surfaces.

There is danger of severe personnel or equipment damage if the required cover is inadmissibly removed, the unit is used in an inadmissible application, improperly installed or operated.

Refer to the documentation for further information.

All work concerning transportation, installation, and commissioning as well as maintenance is to be performed by **qualified expert personnel** (take also note of the IEC 364 and/or DIN VDE 0100 and national accident prevention regulations).

Expert personnel for electrical devices

Personnel, which is based on his/her professional training, experience and knowledge of the applicable standards and capable to judge the tasks to be performed and to recognize possible sources of danger.

Personnel trained for electro-technical operation

Personnel informed by the expert personnel for electrical devices regarding the tasks assigned to him/her and the possible danger occurring at improper actings and who is trained if required and instructed about the required safety mechanisms and protective measures.

2. Intended use

Drive converters are components supposed to be included into electrical equipment or machines.

When installing the drive converter into a machine, its commissioning (i. e. taking up its intended operation) is prohibited until it is ascertained that the machine conforms to the regulations described by the EC guideline 93/44/EC (Machine Guideline). Take note of EN 60204.

Commissioning (i. e. taking up its intended operation) is only allowed if the Electromagnetic Compatibility guideline (89/336/EC) is observed.

The drive converters fulfill the requirements of the 73/23/EC Low-voltage Guideline. Drive converters are subject to the harmonized standards of the prEN 50178/DIN VDE 0160 in association with EN 60439-1/VDE 0660 part 500 and EN 60146/VDE 0558.

The specifications and the data concerning the connection conditions are stated on the rating plate and in the documentation of the component. Meeting these data and conditions is compulsory.

3. Transport and storage

The notes regarding transport, storage and appropriate operation must be observed.

Climatic conditions must be complied to as detailed by prEN 50178.

4. Setting up

Setting up and cooling of the devices must be made according to the rules described in the corresponding documentation.

Drive converters are to be protected against inadmissible stress. Particularly, no components may be twisted and/or no isolation distances may be changed. Touching of electrical components and contacts is to be prevented.

Drive converters include components which can be damaged by electrostatic discharge. When handled improperly, these components can be easily damaged. Electrical components may not be damaged or destroyed by using mechanical force (this may endanger health).

5. Electrical connection

The valid national accident prevention regulations (e. g. VGB4) must be observed when working on drive converts which are connected to the supply voltage.

The electrical setup has to be performed according to the relevant regulations (e. g. conductor diameter, fusing, protective conductor connection). Furthermore, the documentation contains notes concerning this subject.

Notes relevant to a proper EMC-conforming setup (e. g. screening, earthing, arrangement of filters, and cable routing) are to be found in the documentation of the drive converters. These notes must always be observed even when working with drive converters with the CE mark. The manufacturer of the plant or of the machine is responsible for the observance of the required limit values as defined by the EMC regulations.

6. Operation

If applicable, plants fitted with drive converts must be equipped with additional monitoring and safety devices according to the currently valid safety regulations, e. g. law concerning work equipment, accident prevention regulations, etc. Modifications of the drive converters using the operating software are admissible.

Touching of equipment parts that are subject to voltage in operating conditions and of wire connections is not allowed directly after disconnecting the supply voltage. There is the danger of still charged capacitors! For this, all relevant safety markings on the drive converter must be observed.

During operation, covers and doors must be kept shut.

7. Maintenance

The manufacturer's documentation must be observed.

These safety notes must be kept in a safe place!

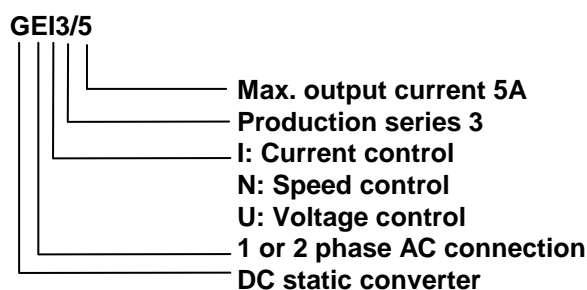
2 DEVICE DESCRIPTION

2.1 General

The GE_3 series of 1-phase DC power controllers are compact static converters for closed-loop rotational speed, voltage, or current control. There is a special plug-in card for each of the three types of control. The basic unit is the same for all three variants.

The conceptualization of the device is distinguished by its compact design. Thanks to its enclosed, galvanized housing, wiring-free internal construction, and comprehensive filtering the unit exhibits extremely high electromagnetic compatibility.

The main current connection spans a range from 230 to 500V $\pm 10\%$ without switch-over. The electronics power supply for all devices is 230V 50/60 Hz. The electronics power supply is not required to be synchronized with the main current. The essential characteristics of the device can be taken from its type designator. Example:



2.2 Device Construction

The power section consists of a semi-controlled dual pulse bridge circuit with a free-wheeling arm in typical modular construction.

The connection terminals on the front panel are divided into three groups:

- Main power terminals X1
- Control terminals basic unit X2
- Closed-loop control terminals X3

Closed-loop controller pcb

This board is plugged into the unit from the front. All settings made using potentiometers or plug-in sockets are accommodated on this module.

The following options are available:

- Controller board I: with current controller, 2 fixed setpoint values, 1 external setpoint value input, current sensor output.
- Controller board U: with current controller, voltage controller, voltage converter 500/10 V.
- Controller board N: with current controller, speed controller, field rectifier.

Open-loop controller pcb

This main circuit board can only be accessed by disassembling the unit. There is nothing on this circuit board that needs to be adjusted for start-up. The following circuit groups are located on this circuit board.

- A) Rectifier and inverter limitation
- B) Current determination
- C) Firing pulse generation
- D) On-off switching logic during system power loss
- E) Firing pulse output stage
- F) Electronics power supply
- G) Over-voltage damping



Danger

This power controller is subject to dangerous voltages even when the main circuit breaker switch of the device is open. The open-loop controller subassembly contains many dangerous, high-voltage circuits.

Failure to adhere to the instructions in this operating manual can lead to death, serious bodily injury, and material damage.

2.3 Ambient Conditions

The specified device's rated currents are valid up to a maximum ambient temperature of 40°C. Once this has been exceeded, a reduction of 1% per degree Celsius in the device's rated (or nominal) current must be taken into consideration. The absolute temperature limit is 55°C. Heat accumulation above the device is to be avoided. The devices have IP 00 degree of protection, i.e. they should be housed in enclosed electrical control cabinets or switch boxes. Ambient air must be kept free of electrically conductive dust particles and chemically active vapors. Vibration can ruin the devices.

2.4 System Power Relationships

The devices operate in a voltage range of from 230 to 500V \pm 10%. For use with 60Hz power supply, the JP1 jumper must be placed onto the open-loop controller PCB. The device is ready for operation approx. 100ms after switching on the electronics power and the main power. The closed-loop controllers and pulse generation are inhibited for that amount of time. The "ready" indication only stays lit after this time. Closed-loop controller enable is internally inhibited until the main current has been switched on.

The devices require a system power supply with $U_K = 4\%$ (for device rated current). This is achieved by interposing the recommended commutating chokes ED10-40.

An auxiliary or secondary voltage of 230V \pm 10%, 50/60Hz is needed for the electronics supply.

3 PRODUCT OVERVIEW

3.1 Device Table

Type	Input Current/Fuse		Output Current	Power Loss	Ambient Temperature	Input Choke
GE_3/2,5	2,8 A	4 A	2,5 A	20 W	40°C	ED 5
GE_3/5	5,5 A	10 A	5 A	30 W	40°C	ED 5
GE_3/10	11 A	16 A	10 A	40 W	40°C	ED10
GE_3/20	22 A	25 A	20 A	70 W	40°C	ED20

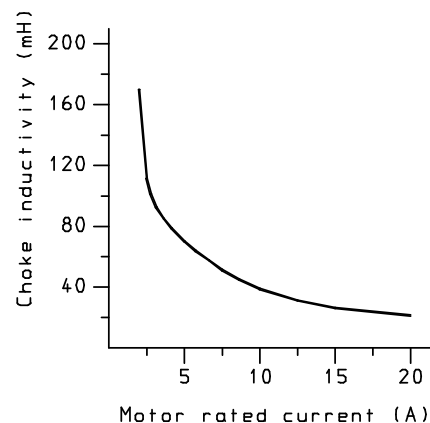


For 1-phase terminal, 1 x ultra-rapid semiconductor fuse
 For 2-phase terminal, 2 x ultra-rapid semiconductor fuses

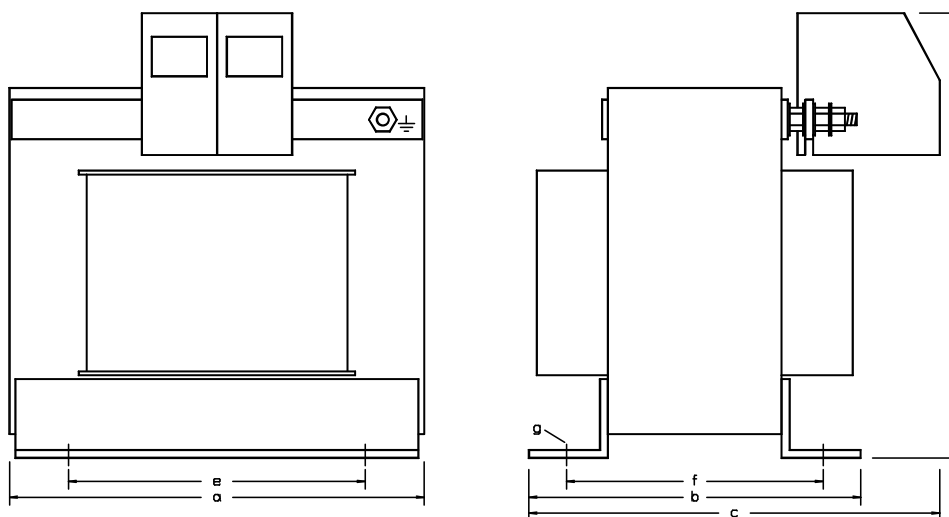
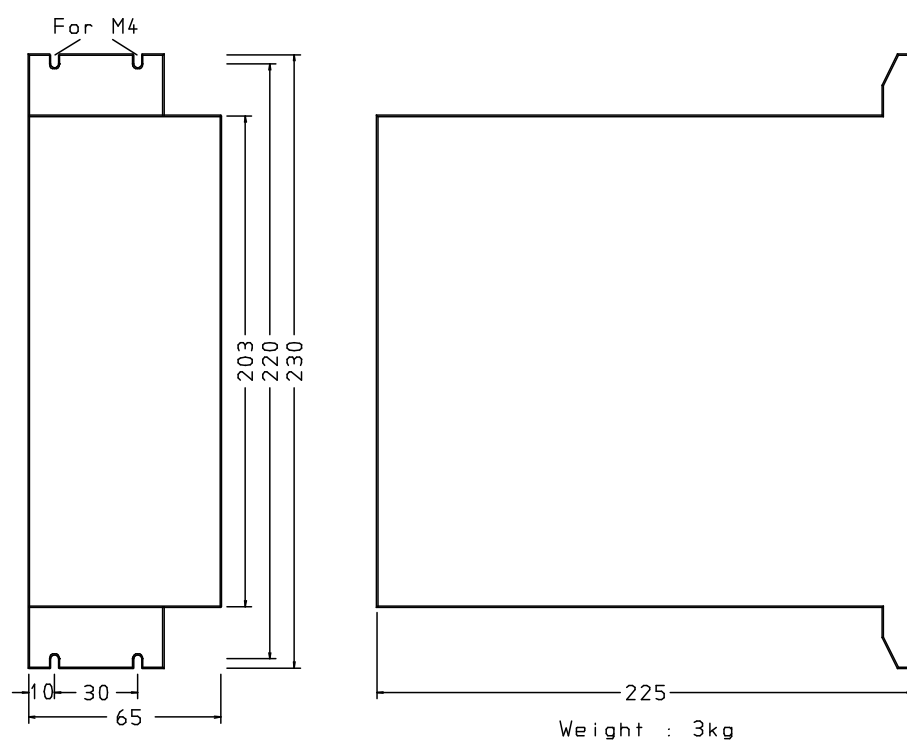
Common Data:

Supply voltage Main current : 230-500V ±10% / 48 - 63Hz
 Output voltage : max. 0,8 x Input voltage
 Supply voltage Electronics : 230V ±10% / 0,2A

The required DC smoothing choke conforms to the motor rated current, construction style, and rated speed, and can be approximated from the curve shown to the right. The values given are recommended values and must be agreed with the motor manufacturer in isolated instances.



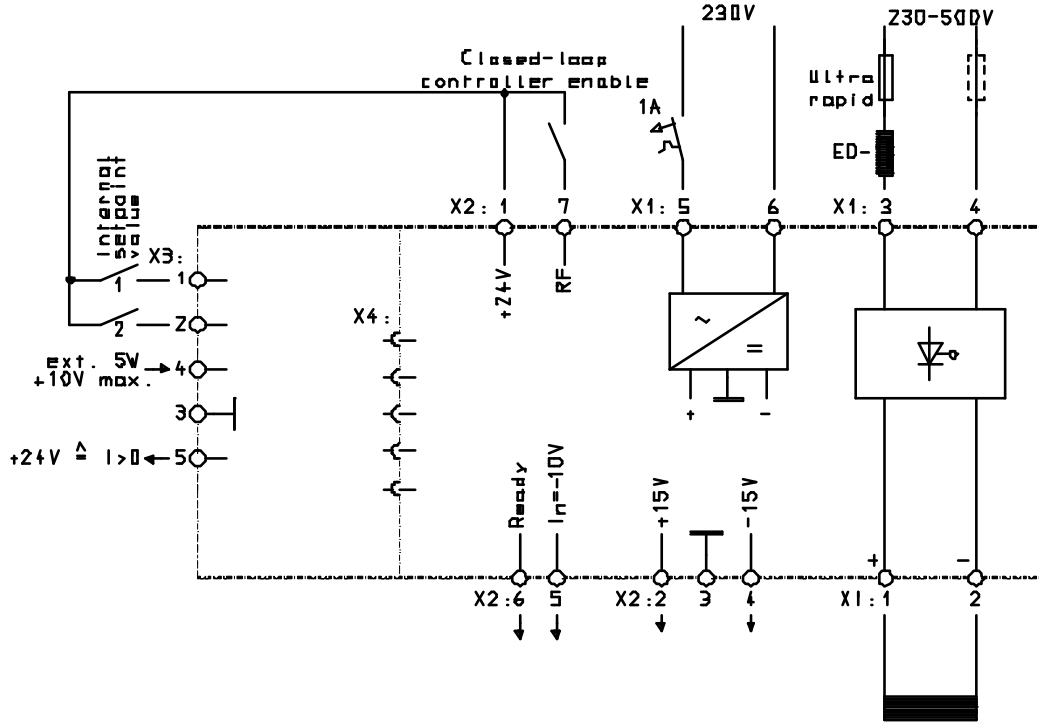
3.2 Dimensions of Devices and Chokes



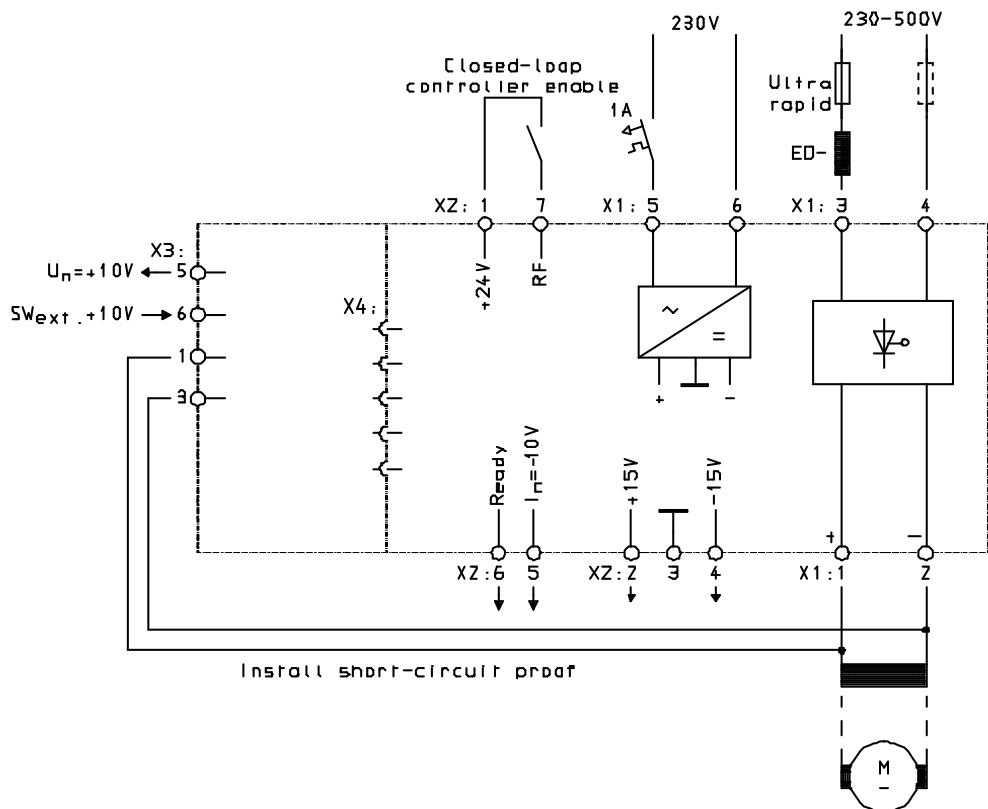
Commutating choke		a	b	c	d	e	f	g
Type	Rated current	mm	mm	mm	mm	mm	mm	mm
ED 5	5 A	67	49	79	72	44	38	3,6
ED10	10 A	84	76	106	90	64	63,5	4,8
ED20	20 A	96	88,3	118,3	106	84	72,6	5,8

4 DEVICE CONNECTION

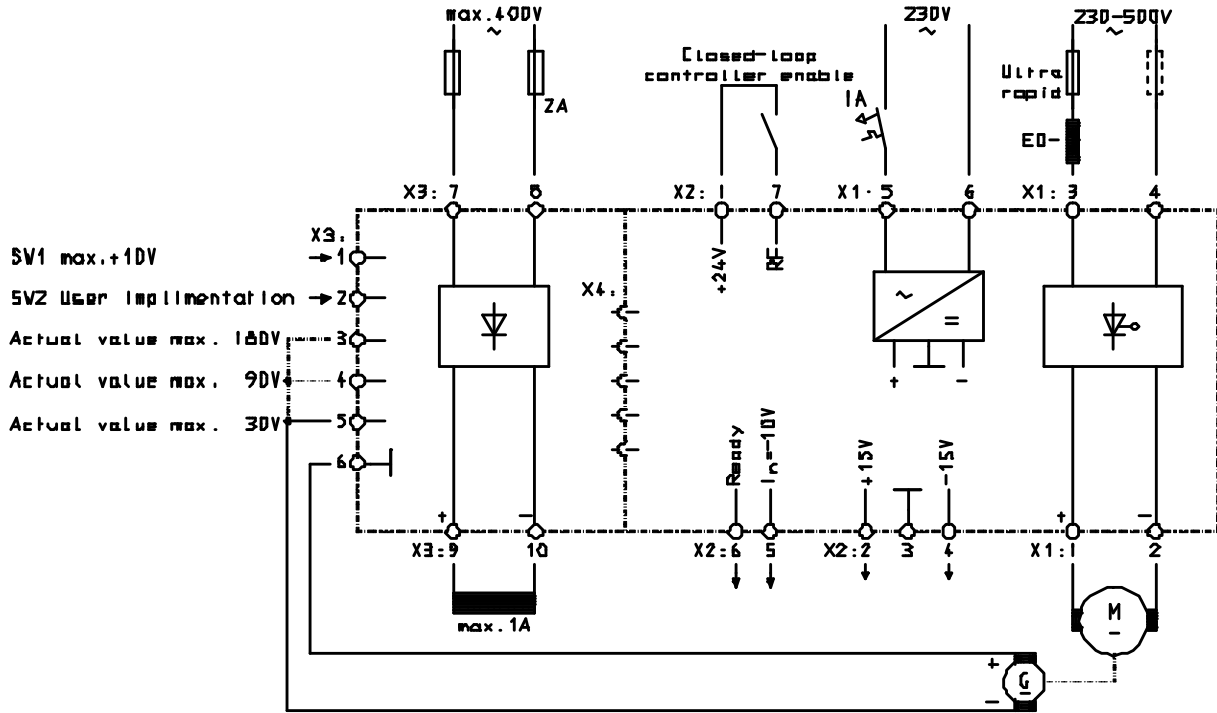
4.1 GEI3/_ Current Control Option



4.2 GEI3/_ Voltage Control Option



4.3 GEI3/_ Speed Control Option



Danger

Improperly connecting the device can cause it to be damaged or destroyed.

4.4 TERMINAL ALLOCATION

X1: Main current screw terminals 6mm²

1	DC output +
2	DC output -
3	Main power supply 1 or 2 PH
4	Main power supply
5	Electronics supply 1 PH
6	Electronics supply

X2: Basic electronics unit - plug-in screw terminals 2.5mm²

1	+24V auxiliary voltage, maximum permitted load 50mA
2	+15V auxiliary voltage, maximum permitted load 30mA
3	0V
4	-15V auxiliary voltage, maximum permitted load 30mA
5	Measurement output - unit rated current = -10V, maximum permitted load 5mA
6	Ready signal - Ready = +24V, maximum permitted load 30mA
7	Closed-loop controller enable - Controller enabled = +24V, input current 5mA

X3: Plug-in screw terminals 2.5mm²

Circuit board current control option

1	Controller input for internal setpoint value 1. +24V = setpoint value on
2	Controller input for internal setpoint value 2. +24V = setpoint value on
3	0V
4	Input for external setpoint value, maximum +10V - Ri = 44K
5	Current sensor output +24V = I>0

Circuit board voltage control option

1	Input maximum $\pm 500V$. Input resistance 6M
2	Free
3	Input maximum $\pm 500V$. Input resistance 6M
4	Free
5	Measurement output at maximum input voltage = $\pm 10V$ - Ri = 440R
6	Setpoint value input - maximum +10V - Ri = 68K

Circuit board speed control option

1	Main setpoint value, maximum +10V - Ri = 44K
2	Auxiliary setpoint value , effect with R11 can be determined
3	Speed setpoint value, maximum - 180V - Ri = 44K
4	Speed setpoint value, maximum - 90V - Ri = 25K
5	Speed setpoint value, maximum - 30V - Ri = 10K
6	0V
7	Field rectifier input, maximum 400V AC
8	Field rectifier input, maximum 400V AC
9	Field rectifier output, maximum 1A +
10	Field rectifier output, maximum 1A -

4.5 Assembly



Danger

Improper lifting can lead to bodily injury or material damage.

Only lift the device with the appropriate gear and using appropriately qualified personnel.

Device fitting must be conducted in accordance with the safety regulations (e.g. DIN, VDE) and all other relevant governmental or local regulations. Sufficient grounding, wire sizing, and appropriate short-circuit protection must be present in order to ensure operational safety.

4.6 Mechanical Construction

For reasons of electromagnetic compatibility (EMC), the devices have a galvanized steel housing. For the same reason, a galvanized mounting plate is recommended, along with connecting the ground lead to a copper bus connected to the mounting plate via a broad, conductive surface area (see construction suggestions).

In order to ensure an unimpeded flow of cooling air, an interval of at least 100mm above and below the device must be kept clear of obstruction.

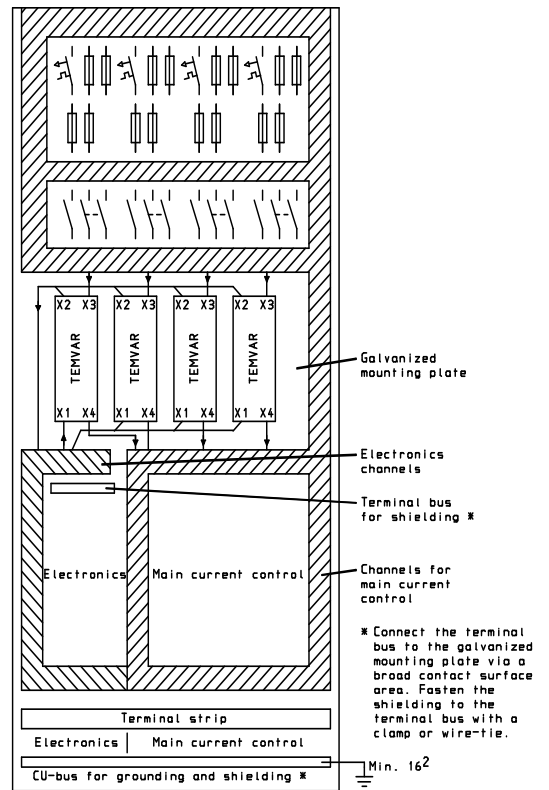
Failure to maintain this interval will result in the device overheating!

The main current fuses must be ultrafast semiconductor fuses.

Wiring Notes

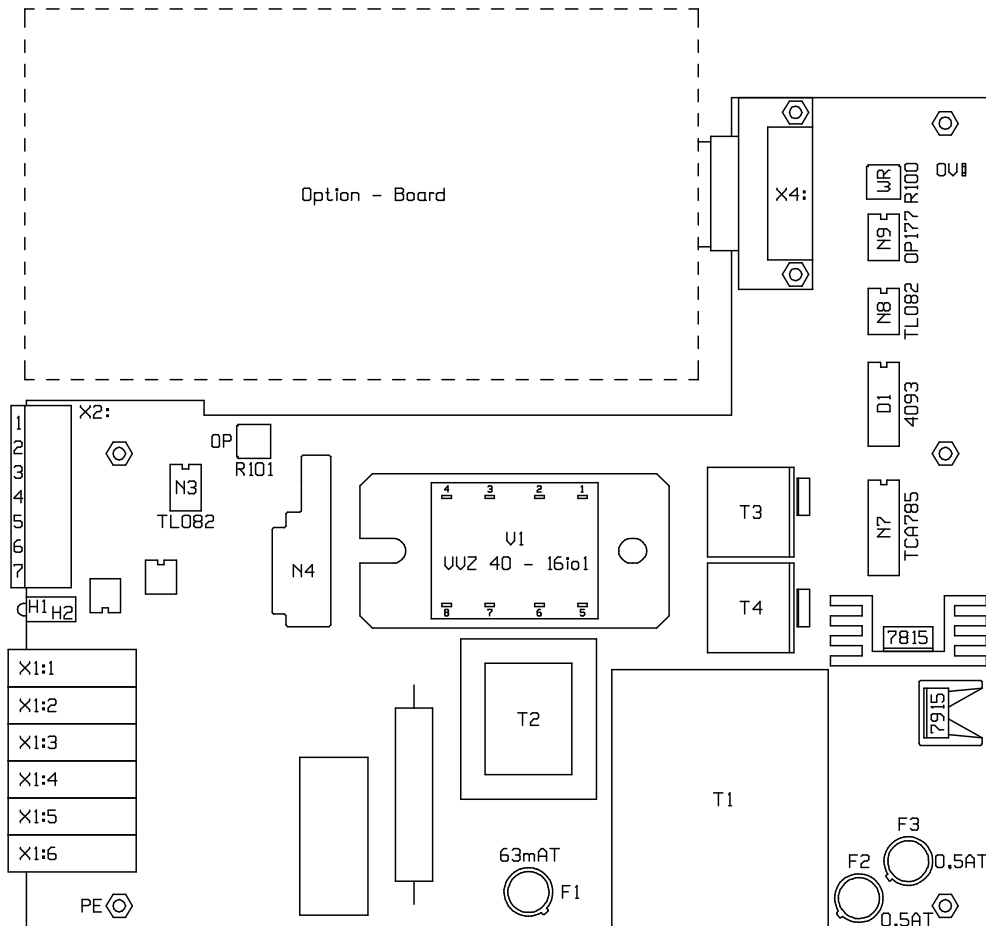
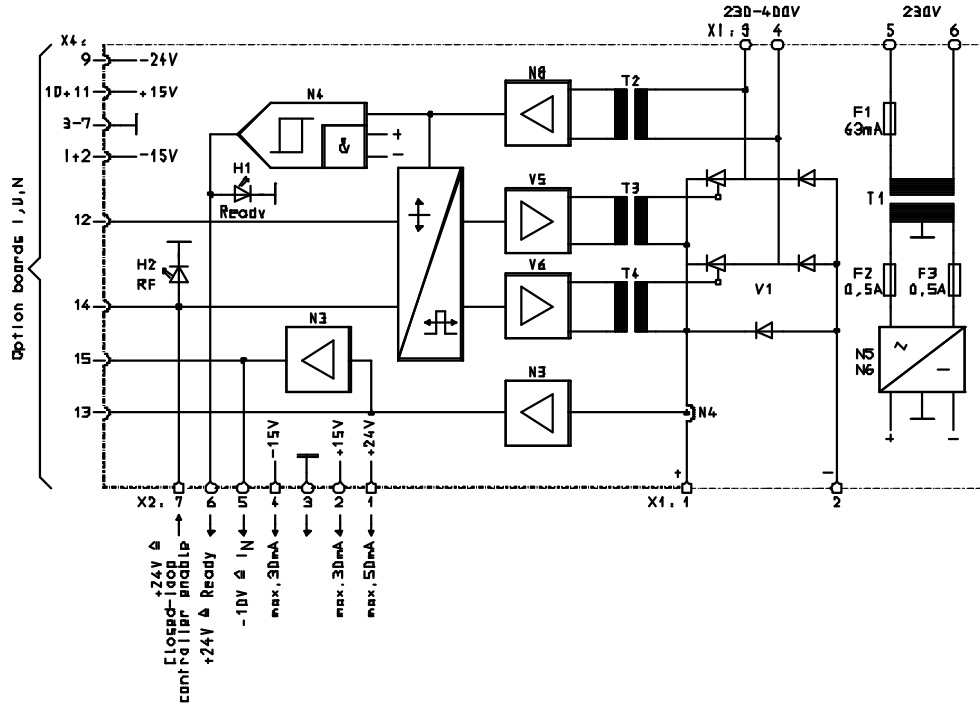
All leads connected to terminal strips X1 and X2 must be shielded. The shielding should be firmly attached using terminals, clips, or binders, across a broad contact surface on the bus bar provided for that purpose. Analog signal leads should only be grounded at one point. Leads with binary control signals can be grounded at several points. The wiring paths should be kept short and the electronics wiring should be strictly isolated from the main current wiring. (see the construction suggestions).

The closed-loop controller ground should be connected to the protective ground system by a short 2.5² litz wire.



5 OVERVIEW DIAGRAMS

5.1 Basic Unit

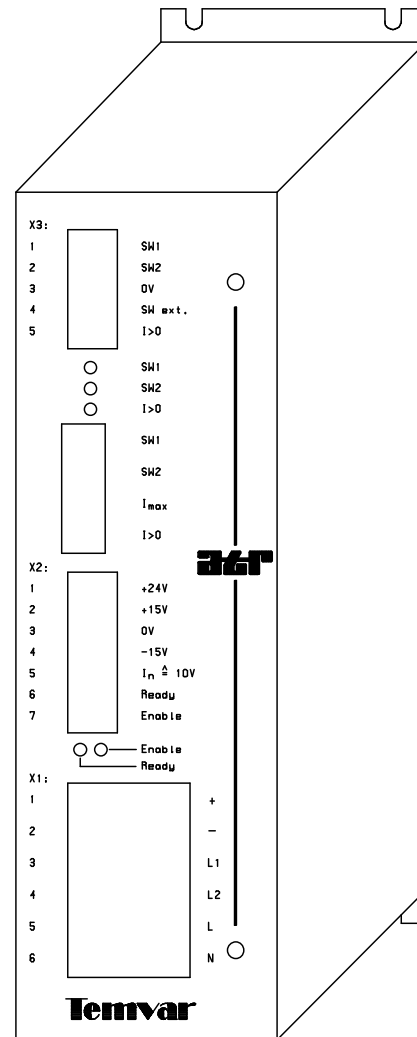


Temvar GE_3

The basic unit consists of the open-loop controller board with the terminal strips X1 (fixed connection) and X2 (plug-in).

The electronics fuses type TR5-T (Wickmann) F1 = 63 mA and F2/3 = 500 mA are located on this board. The compact thyristor block type VVZ40-16io1 is soldered directly to the open-loop control board.

The option board with the terminal strip X3 has to be plugged in above the open-loop controller board.



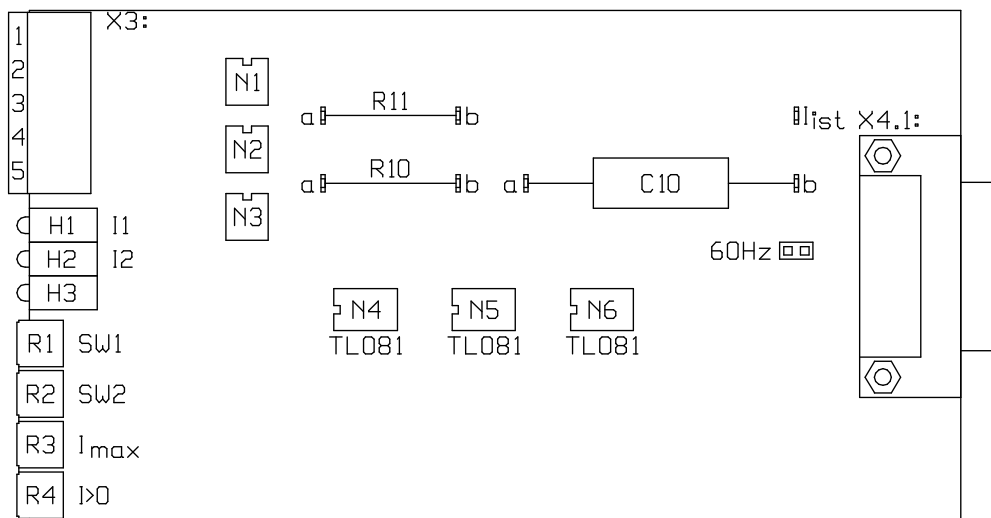
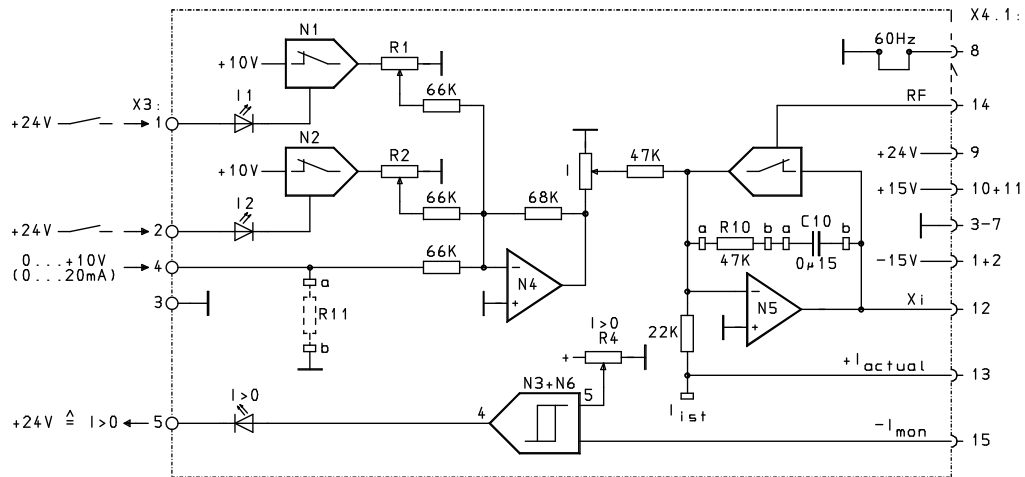
Danger

This power controller is subject to dangerous voltages even when the main system circuit breaker is open. The open-loop controller PCB contains many dangerous, high-voltage electrical circuits.

Failure to adhere to the instructions in this operating manual can lead to death, serious bodily injury, and material damage.

5.2 Option Board Current Controller

The device has the order designation GEI3/- with this option

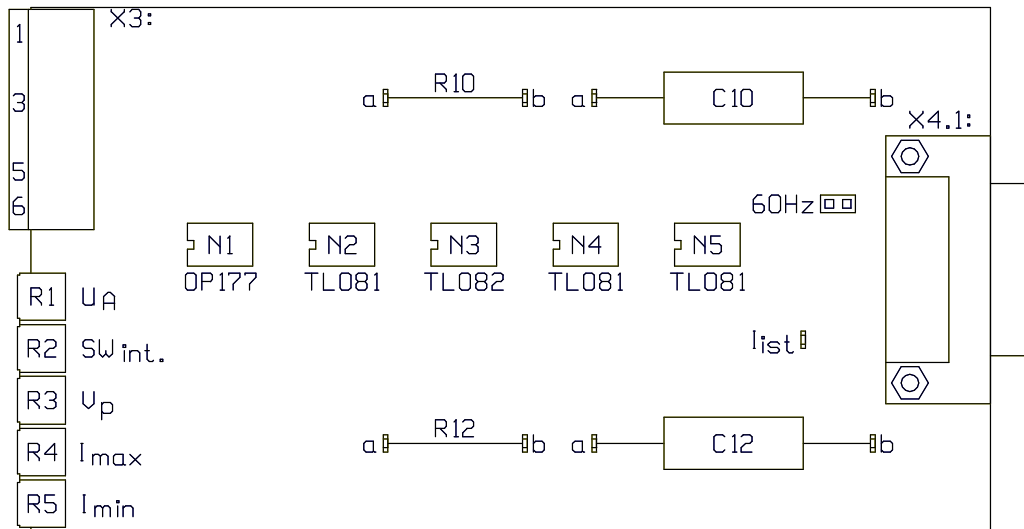
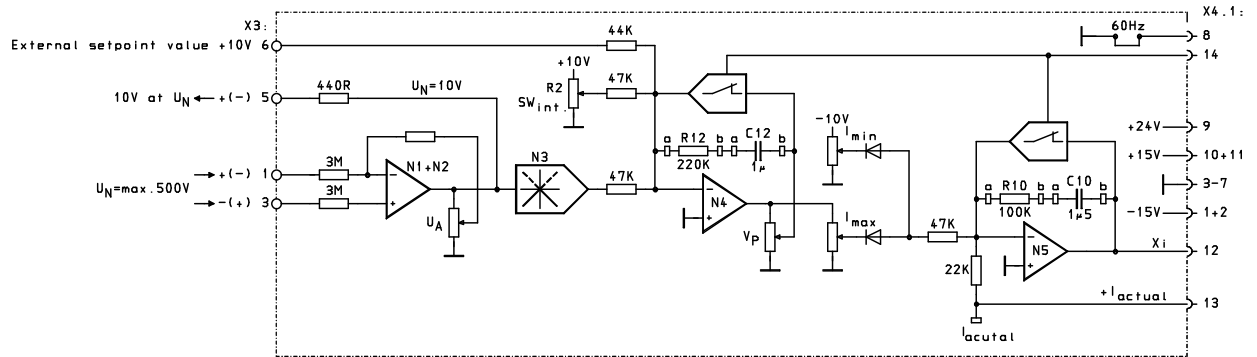


Two setpoint values I1 and I2 are selected with a 24V signal. When both are selected at the same time, the setpoint values set using the potentiometers R1 and R2 are added. The maximum possible current is set using the potentiometer „I_{max}“. Setting the potentiometer to the right stop means unit rated current. A voltage of +10V applied to the external setpoint value input X3:4 means unit rated current. This input can also be used for a 0 to 20mA standard signal when a 500 ohm resistor is soldered in component position R11.

The resistor R10 (Vp) and the capacitor C10 (Tn) are used to optimize the current controller N5 over the controlled system. For this it is necessary to measure the actual current value with an oscilloscope at solder tag „I_{IST}“. The check-back signal I>O can be set to between 2% and 100% of the unit rated current using the potentiometer „I>O“. It can thus be set as operation signal, minimum, or maximum monitoring.

5.3 Option Board Voltage Controller

The device has the order designation GEU3/- with this option



The actual voltage value is applied to the terminals X3:1+3. The polarity is only important for the measurement at X3:5. For closed-loop control, the actual voltage value is rectified in N3. The potentiometer „U_A“ is used to set 10V at X3:5 for maximum input voltage, so long as this is at least 100V and not more than 500V. In the case of a fixed setpoint control, a setpoint value of 0 to +10V is applied to terminal X3:6. If an armature voltage dependent field control is implemented, the cut-out point at which the field suppression should become active is set using potentiometer „R2“. Right stop means cut-out point at the previously standardized rated current.

The maximum current, motor rated current, or rated excitation is set using the potentiometer „I_{max}“.

Especially in the case of armature voltage dependent field suppression, a current which is never exceeded independently of the requirement of the voltage controller N4, is set using the potentiometer „I_{min}“.

Optimizing Current Controller N5

The closed-loop current controller N5 can be matched to the controlled system using the resistor R10 (Vp) and the capacitor C10 (Tn). For this it is necessary to measure the actual current value with an oscilloscope at solder tag „I_{ST}“. A well-optimized current controller simplifies the optimization of the voltage controller.

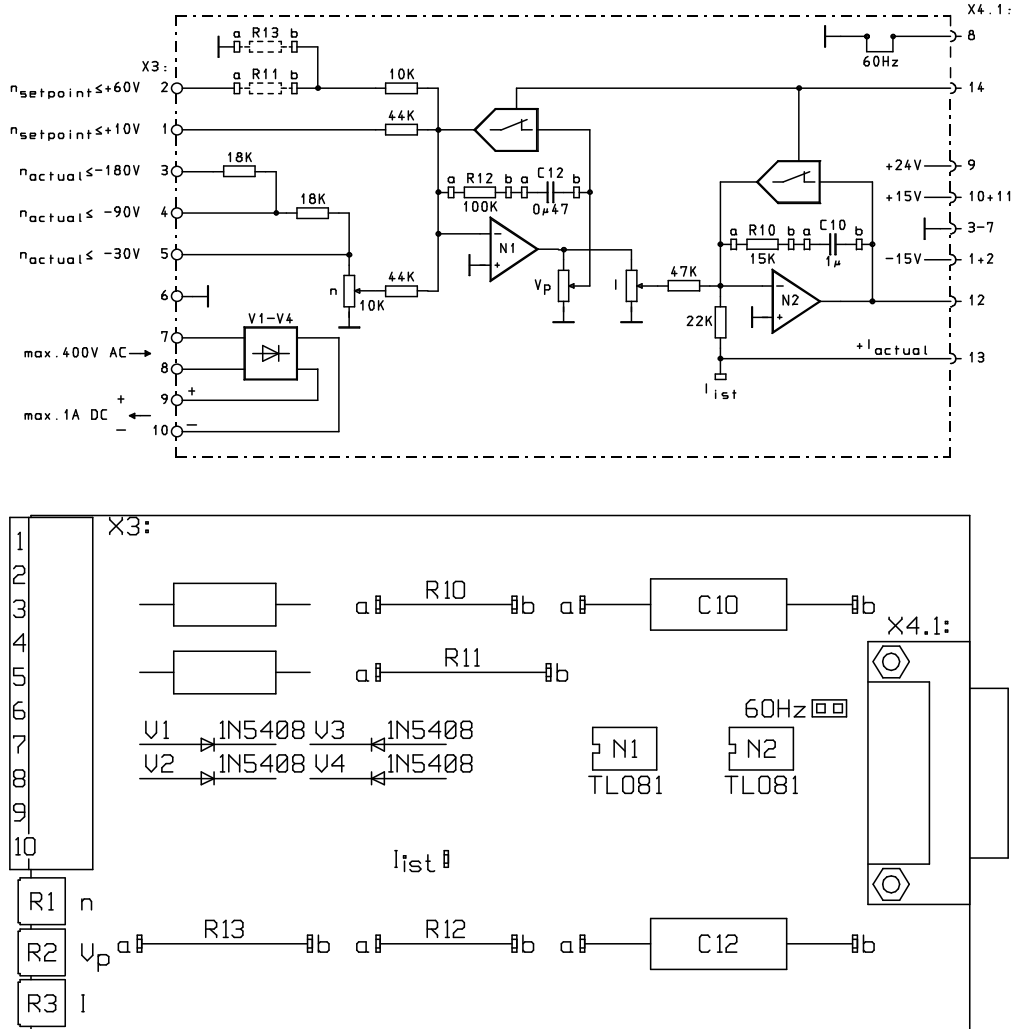
Optimizing Voltage Controller N4

The closed-loop voltage controller N4 is normally optimized for the controlled system using the potentiometer „Vp“. Right stop means larger P-amplification, and thus a „harder“ control. This, however, increases the danger of control oscillations. The coarse approximation to the controlled system can be carried out using the resistance R12 (Vp) and the capacitor C12 (Tn). Increasing R12 and decreasing C12 means harder control. **Danger:** high-frequency voltage oscillations.

Decreasing R12 and increasing C12 means softer control. **Danger:** slow voltage deviations. With an armature voltage dependent field suppression, a controller set too hard will lead to oscillation of the field current. A controller set too soft will allow the armature voltage to oscillate.

5.4 Option Board Speed Controller

The device has the order designation GEN3/- with this option



The main setpoint value at terminal X3:1 is standardized to between 0 and +10V. Input X3:2 is used for any other setpoint value, and R11 is fitted with an appropriate value. This input can also be used for a 0 to 20mA standard signal when position R13 is fitted with a 100 ohm resistor and position R11 is fitted with a wire. The actual speed value matching is carried out using the potentiometer „n“ in a setting range from 1:4. Right stop means higher speed.

The maximum current is matched to the motor using potentiometer „I“. This is normally set to the rated motor current. Right stop means unit rated current. Left stop means 0A.

The potentiometer scaling is linear, mid-point means 50% of the unit rated current. In general, it is sufficient to judge the maximum possible current according to the potentiometer setting.

A rectifier bridge is located on this board to supply the motor exciter winding. The rectifier has a maximum supply voltage of 400V. The maximum permitted load is 1A.

Optimizing Current Controller N2

The closed-loop current controller N2 can be matched to the controlled system using the resistor R10 (Vp) and the capacitor C10 (Tn). For this it is necessary to measure the actual current value with an oscilloscope at solder tag „I_{ST}“. A well-optimized current controller simplifies the optimization of the voltage controller.

Optimizing Speed Controller N1

The closed-loop speed controller N1 is normally optimized for the controlled system using the potentiometer „Vp“. Right stop means larger P-amplification, and thus a „harder“ control. This, however, increases the danger of control oscillations. The coarse approximation to the controlled system can be carried out using the resistance R12 (Vp) and the capacitor C12 (Tn). Increasing R12 and decreasing C12 means harder control. **Danger:** short speed oscillations. Decreasing R12 and increasing C12 means softer control. **Danger:** slow speed deviations.

6 INSTALLATION

6.1 Danger Notice

When this device is operated, certain parts of it are automatically under dangerous voltages, which can lead to serious bodily injury or death. The following precautionary measures must be followed to minimize the risk of injury or death.

1. Only qualified personnel which are familiar with the device and the information supplied are permitted to assemble and operate the device, to seek and rectify faults and carry out repairs.
2. The device must be fitted in accordance with safety regulations (e.g. DIN, VDE) and all other relevant national or local regulations. The device must be properly grounded, with adequate wire sizing, and corresponding short-circuit protection, to ensure that a high level of operating safety is maintained.
3. During normal operation, all covers and doors must remain closed.
4. Before carrying out checks and maintenance work, it must be ensured that the a.c. power supply is switched off and locked.
Both the power controller device and the motor are live before the a.c. power supply is switched off. Voltage is present even if the contactor of the power controller is open.
5. If measurements have to be made when the power supply is switched on, contact with the electrical connection points must be avoided at all times. Remove all jewellery from wrists and fingers. Ensure that the testing equipment is in full and safe working order.
6. When working on the live machine, stand on insulated flooring, i.e. make sure that there is no ground connection.
7. Follow the instructions given in this manual closely and observe all danger, warning and caution advisories.
8. This list is not a comprehensive list of all measures required for the safe operation of the machine. If you require further information or if particular problems arise, please contact the manufacturer.