Thyristor power controller

B DI1002 V1.0
Manual/Operating instructions

1 Introduction

Before you put the thyristor controller into operation, please read these operating instructions. Keep them in safe place accessible for all users. We would appriciate any suggestions for the improvement of these operating instructions you may wish to send us.

☞ If in the course of putting the thyristor controller into operation any problems arise, please do not carry out any adjustments to the device. If you do, you run the risk of loss of entitlement to make claims under the guarantee!

In that case we would ask you to get in touch with us.

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☞ In the case of return shipments of electronic sub-assemblies or printed circuit boards, the provisions for the protection of electrostatically endangered components are to be observed. For transportation use only ESD packaging intended for this purpose.

Please note that no liability can be accepted for damage or loss caused by ESD.

ESD = electrostatic discharge

2 Use

This thyristor power controller was developed for use for the control of gas discharge reflector lamps. Various equipment features of the control electronics are adapted to the process control of plasma arc discharges. As a matter of principle, the thyristor power controller is suitable for all of the usual phase control applications with resistive and inductive consumer load.

3 Operating mode

The thyristor power controller works according to the principle of the voltage-time area control with adjustable power range and adjustable current range.

4 Control system

The thyristor power controller works according to the principle of the voltage-time area control and is suitable for operation on resistive and inductive loads. During the control process, mains voltage fluctuations have no influence on the section to be controlled. This is ensured by an active power meter at the consumer load. The device has three analogue inputs for standard signals (voltage or current), via one channel the set value for the power to be set being specified. The second channel permits the specifying of a maximum power which must not be exceeded. The third channel makes it possible to specify a current. The control section contains two separate controllers for power and current, the controller to which, due to the process, a limiting task has been assigned, by means of a transfer circuit automatically takes over control of the section. The thyristor power controller is switched on with 24 volts control voltage on the pulse release control contact, with the resetting of the pulse release also the integral action components of the controllers and the setpoint value integrator are discharged. Two potential-free contacts are available for fuse breakage and excess temperature. The thyristor power controller measures the genuine effective values of voltage and current on the consumer load as well as the genuine active power. All three variables can be output simultaneously as

standard signals via three analogue channels (voltage or current) and be used for process visualization or for feeding to a higher-priority process control system.

5 Design

The power section consists of two anti-parallel connected thyristors, the heat sink and the control electronics. In order to measure and record the consumer voltage and the consumer current, a voltage transformer and a current transformer (included in the scope of supply) must be connected externally. This circuit topology is necessary because, for the operation of a gas discharge reflector lamp, non-linear inductivities have to be connected between the thyristor power controller and the gas discharge reflector lamp.

6 Regulations for CE conformity

The following standards and regulations form the basis and are observed to the extent that they are applicable:

Emitted interference

Basic specification DIN EN 61000-6-4

Radio interference voltage at the power supply terminals
EN 55011 Class A

Interference field strength
EN 55011 Class A

Noise immunity

Basic specification DIN EN 61000-6-2

Discharge of static electricity
EN 61000-4-2 4 KV CD, 8 KV AD

High-frequency electromagnetic fields
EN 61000-4-3 80 – 1000 MHz, 10 V/m 80 % AM, KHz

Fast transients
EN 61000-4-4 2 KV, 5/50 ns, 5KHz alternating current mains input

Surge voltages/surge currents
EN 61000-4-5 1.2/50 (8/20) Tr/Th in µs 4 KV unsym. / 2 KV sym

Conducted high frequency
EN 61000-4-6 0.15 – 80 MHz, 10 V, 80 % AM, I KHz

Voltage dips
EN 61000-4-11 30 % reduction, 10 ms 60 % reduction, 100 ms

Voltage interruptions
EN 61000-4-11 95 % reduction, 5000 ms

Electrical safety

Electronic equipment for use in power installations
EN 50178

Protection from electric shock
EN 50274

7 Accessories

If the thyristor power controller is not used for operation on a gas discharge reflector lamp, as an accessory a fast semi-conductor fuse can be used. The fuse can be used with an appropriate holder on a standard rail or screwed

onto the built-on plate. The arrangement of the fuse outside of the thyristor power controller facilitates fuse replacement in the event of a fault.

For operation of the thyristor power controller on a gas discharge reflector lamp the semi-conductor fuse is not necessary if inductors and transformers from Diez are used as the ballast. These are rated in the technical calculation in such a way that a maximum current rise upon consumer short-circuit is not exceeded.

For easy visualization of the electrical variables on the consumer load, the software package ***DIMO*** is available. With Dimo the voltage, current and active power at the consumer load can be observed, and represented as a y-t diagram and saved. The saved curves can be measured with the cursor.
Dimo is not necessary for the commissioning of the thyristor power controller, it is used merely for easy process visualization.

8 Important installation notes

Safety notes

- ☞ For the choice of the lead and cable material, for installation and for electrical connection of the thyristor power controller, the regulations of VDE 0100 "Provisions concerning the construction of electric power installations with rated voltages below AC 1000 volts" or the respective national regulations are to be observed.

- ☞ The electrical connection must be carried out only by specialist personnel.

- ☞ If during work live parts can be touched, the device must be disconnected from the mains at all terminals.

Earthing

- ☞ The earthing is to be effected in accordance with the regulations of the responsible utility company.

Interference suppression

- ☞ The electromagnetic compatibility is in compliance with the standards and regulations listed.

Wiring

- ☞ Load and control lines are to be installed separately. For the protection of the lines appropriate fuses are to be provided.
- ☞ Compare the data stated on the rating plate (voltage and current) with the equipment data.
- ☞ Set encoding switch for analogue inputs and analogue outputs.
- ☞ Connect the power supply for the control electronics in accordance with the terminal connection diagram to terminals "L1" and "L2".
- ☞ The electronic switch (2 anti-parallel connected thyristors) is between the connections "U1" and "U2"
- ☞ The power supply for the control electronics and the load voltage must have the same phase angle (synchronization)

Closing sequence

- ☞ The power supply for the power and control circuits must be switched on at the same time.
  The power supply for the control circuit (L1, L2) may only be switched on earlier if the pulse release input has not yet been set and running up of the controllers without consumer load is prevented.

  That is particularly important during operation of transformer load and with resistive loads with a large hot-cold resistive ratio.

In general the pulse release should only be set when all power supplies have been switched on. That permits safe control over the point in time at which the electric power starts on the consumer load.

Filtering and interference suppression

☞ To avoid radio interference as naturally arises during generalized phase operation, electrical operating equipment and units have to have radio interference suppression. The control electronics of the thyristor power controller are in compliance with the EMC requirements.
Sub-assemblies for generalized phase operation, however, do not in themselves serve any application purpose. They are only a functional unit of an overall plant. Therefore the constructor of a unit must suppress any interference in this unit with the help of suitable filters. Interference suppressor filters are offered as sub-assemblies ready for connection by companies specializing in this field.

Place of installation and climatic conditions

☞ As far as possible the place of installation should be free of vibrations and closeness to strong electromagnetic fields should be avoided if at all possible.
The ambient temperature at the place of use must be 0 … 45 degrees Centigrade at a relative humidity of < 75 %.
As a matter of principle the thyristor power controller is intended for use in dry rooms. The preferred fitting direction is vertical because of the better convection. Care must be taken to ensure adequate ventilation of the switch cabinets.

The thyristor power controller is not suitable for use in explosion-hazard areas.
The place of installation must be free of aggressive media.

9 Designation of the control terminals

internal X101

X5 monitoring
Temperature-monitoring 1 2 3 4

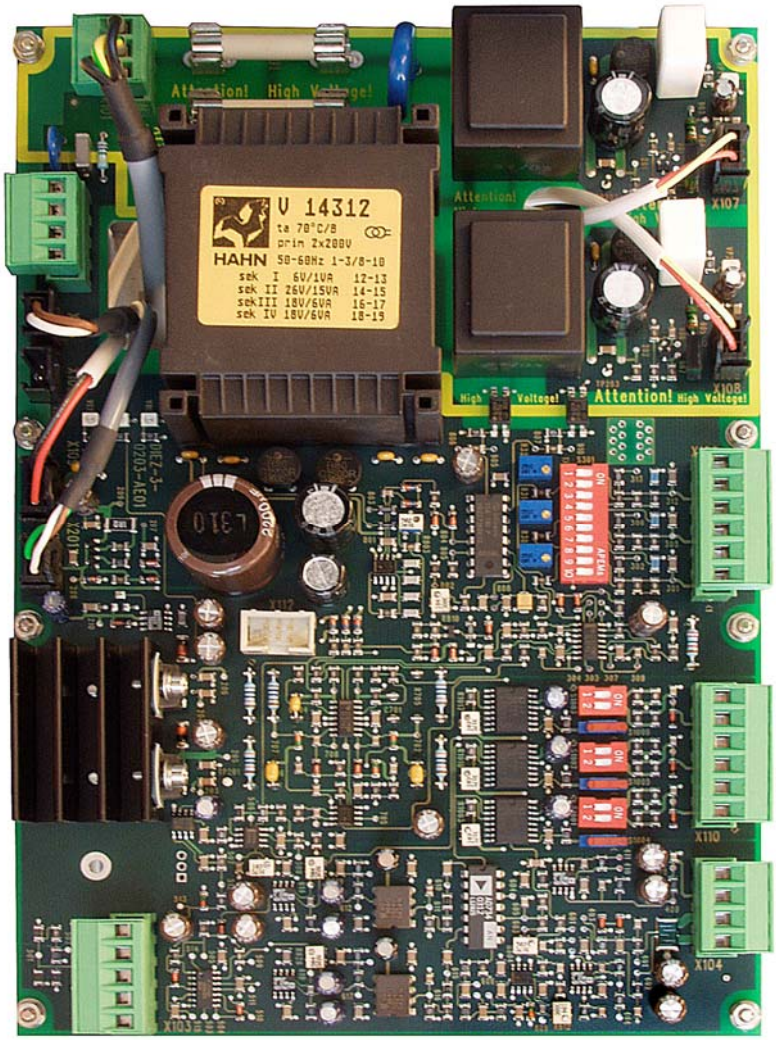
internal X105

internal X106

internal X109

internal X201

X3 ref/run/stop
10 volts ref. 1
GND 2
Pulse relaese 3
GND 4
24 volts ref 5



X107 internal

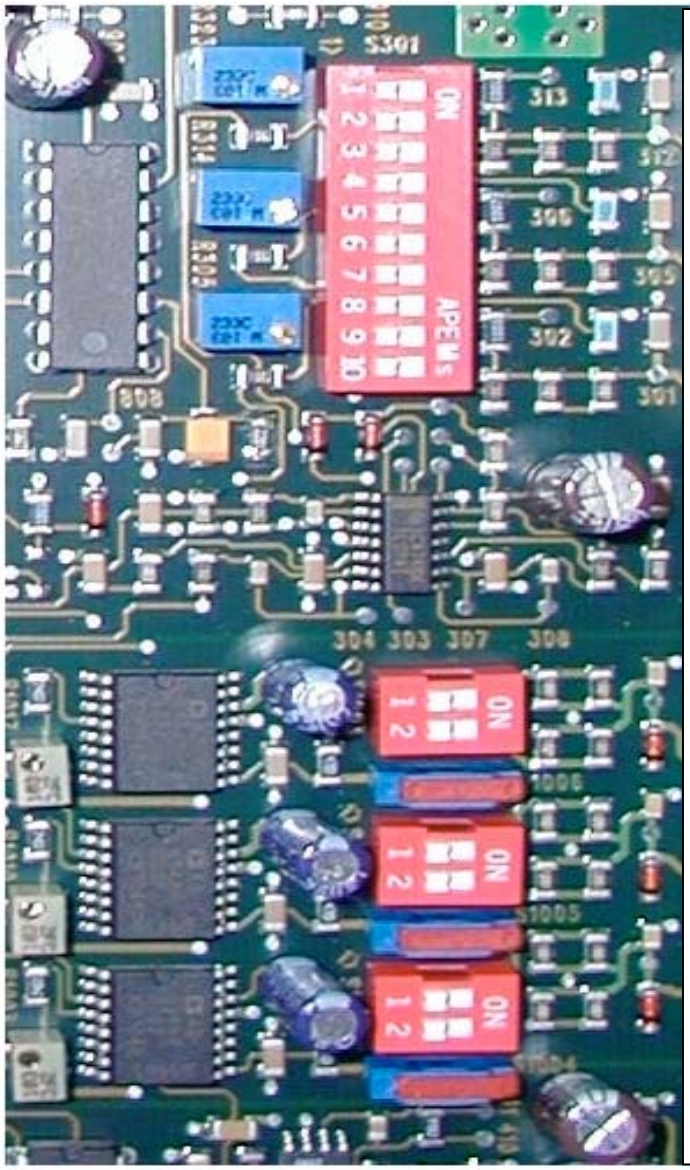
X108 internal

X2 analogue in
6 GND
5 Imax
4 GND
3 Pmax
2 GND
1 Preq.

X10 analogue out
6 GND
5 Current
4 GND
3 Voltage
2 GND
1 Power

X4 C/V transformers
4 b
3 a
2 l
1 k

10 Encoding switch and potentiometer



1 Imax A Pot Imax
2 Imax B
3 Imax C
4 Pmax A Pot Pmax
5 Pmax B
6 Pmax C
7 Psoll A
8 Psoll B Pot Preq
9 Psoll C
10 Actual value monitoring ON/OFF

1 Iout A
2 Iout B

Iout life zero ON/OFF

1 Uout A
2 Uout B

Uout life zero ON/OFF

1 Pout A
2 Pout B

Pout life zero ON/OFF

Encoding switch for analogue inputs

Table for Imax encoding switch

Imax A	Imax B	Imax C	Function
0	0	0	0-10 volts
0	1	0	0-5 volts
1	0	0	0-20 mA
0	0	1	Specification via pot on the printed circuit board

Table for Pmax encoding switch

Pmax A	Pmax B	Pmax C	Function
0	0	0	0-10 volts
0	1	0	0-5 volts
1	0	0	0-20 mA
0	0	1	Specification via pot on the printed circuit board

Table for Preq encoding switch

Imax A	Imax B	Imax C	Function
0	0	0	0-10 volts
0	1	0	0-5 volts
1	0	0	0-20 mA
0	0	1	Specification via pot on the printed circuit board

Actual value monitoring encoding switch

ON :	special mode of operation for inductor parallel operation (transition inductor)
OFF:	Normal setting for all usual applications

Encoding switch for analogue outputs

Table for Iout encoding switch

		life zero OFF	life zero ON
IoutA	Iout B	Function	Function
0	0	0-20 mA	4-20 mA
0	1	0-10 volts	2-10 volts
1	0	0-10 volts	2-10 volts
1	1	0-5 volts	1-5 volts

Table for Uout encoding switch

		life zero OFF	life zero ON
UoutA	Uout B	Function	Function
0	0	0-20 mA	4-20 mA
0	1	0-10 volts	2-10 volts
1	0	0-10 volts	2-10 volts
1	1	0-5 volts	1-5 volts

Table for Pout encoding switch

		life zero OFF	life zero ON
PoutA	Pout B	Function	Function
0	0	0-20 mA	4-20 mA
0	1	0-10 volts	2-10 volts
1	0	0-10 volts	2-10 volts
1	1	0-5 volts	1-5 volts