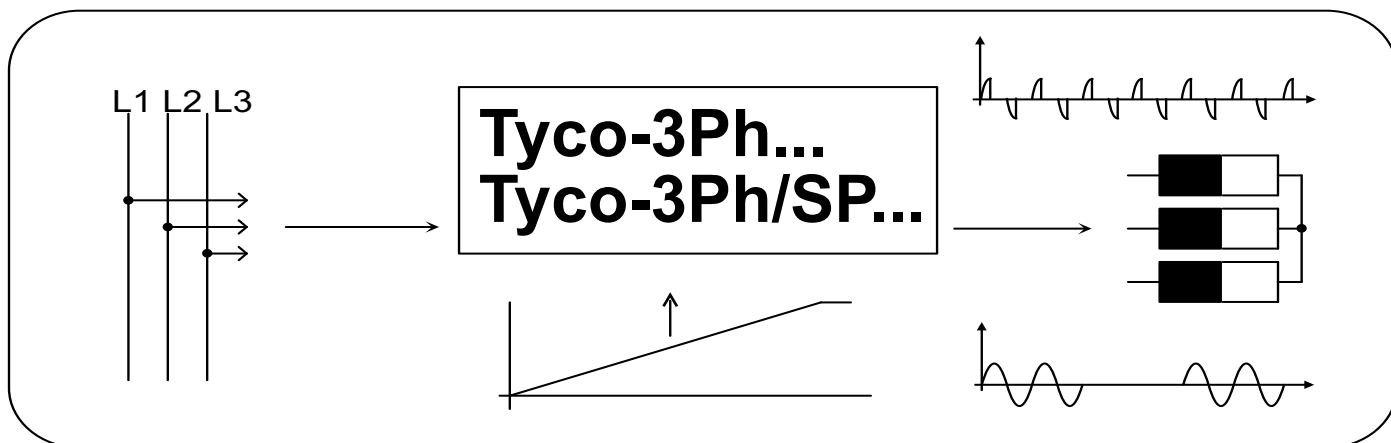




Start-up Instructions

Thyristor controller Type: Tyco-3Ph, Tyco-3Ph/SP



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1. General information

The situations in which thyristor controllers have to be employed can be found in all the areas where greater resistor and inductive loads have to be controlled (e.g. industrial heating systems, tems, plastics processing, transformers, infrared elements, etc.)

Because of its modular, compact assembly and the controlling with a continuous control signal these power controllers have to be regarded as a perfect final controlling device for the industrial power controlling.

The power device of the thyristor controllers consists of six thyristor moduls, an isolated heat sink and the control unit. On account of the use of function modules the adaptation to any application is one of the largest advantages of these devices.

Type description:

Tyco-1Ph...	alternating current power controller, phase angle control for single phase systems
Tyco-1Ph/SP...	alternating current power controller for burst firing control
Tyco-3Ph...	three phase controller, phase angle control for three phase systems
Tyco-3Ph/N...	three phase controller, phase angle control for three phase systems with neutral point connnnection (option)
Tyco-3Ph/SP...	three phase controller for burst firing control
Tyco-3Ph/SP/N...	three phase controller for burst firing control with neutral point connection (option)

Construction:

The thyristor controller agrees with VDE 0558 part 1 and VDE 0160 table 4.

The thyristor controller Tyco-3Ph... is assembled modularly. It consists of three basic elements:

- power element with cooling system and thyristor modules
- control unit with firing and control board (diagnostic display, control outputs, etc.)

2. Installation of the thyristor controller Tyco-3Ph, Tyco-3Ph/SP

The thyristor controller (IP 40) should be mounted vertically in a housing. The upper and lower side of the heat sink have to be kept free to allow cooling air to circulate freely. Controllers must be mounted on a flat surface to ensure that cooling air is channelled to the heat sink. The thyristor configuration is indifferent to the order of the supply phase rotation. It is the user's responsibility to ensure that the nominal values of the thyristor unit are compatible with the conditions of installation and operation before commissioning the the thyristor unit.

Additional points must be considered when mounting the unit:

- Vibration free environment
- Protection against hazardous environments
- Protection against dust and humidity

Please avoid to mount other components in distance of 100mm around the controller as the cooling system can be affected.

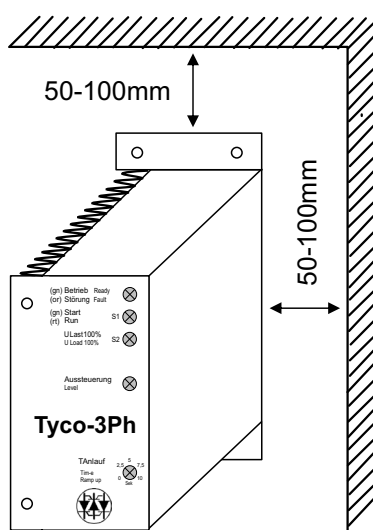
The housing design according to IP 54 (Option) can be fixed in places which are not protected from dust and humidity.

Wiring the device:

The mains connections L1, L2, L3, (N) have to be connected by using a disconnecting switch and usual fuses.

The connection for mains cable and the connections for controlling have to be laid in channels and protector tubes.

The electric installation always has to comply with the essential protection requirements of the European Low Voltage Directive 73/23/EEC dated 19/02/73 and 93/68/EEC Directive 22/07/93.



3. Operation

To begin with, all electrical connections have to be established according to the circuit diagrams L1, L2, L3, (N), T1, T2, T3.

The thyristor control has to be connected to the mains according to the electric regulations (Low Voltage Directive) so that they can be separated by disconnecting switches (e.g. load interrupter, contactor etc.) from the mains. Cabling must be performed by personnel who are qualified to work low voltage electrical equipment. Before any connection or disconnection, make sure that the power and control cables and wires are isolated from the voltage sources.

Recommended connection:

The mains connections, the connection to the load and the control connections have to be laid in separate cables.

In order to avoid faults the electronic control connections should be separated from the power wires and/or contactor control wires and one should twist the control wires.

In order to reduce risks related to the effects of electromagnetic interference depending on the installation of the product please consider the rules for electromagnetic compatibility.

Fuses:

The net-lateral security depends on the recommended and/or the used cross-section of a wire and has to be made according to DIN 57100 part 430/VDE 0100 part 430/6.81 (Low Voltage Directive).

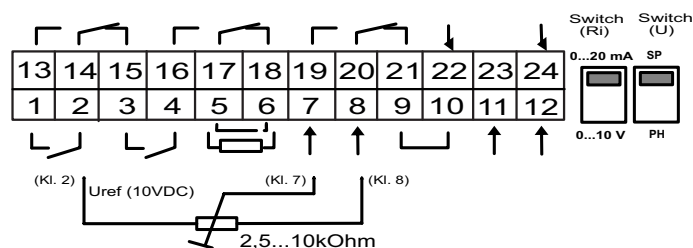
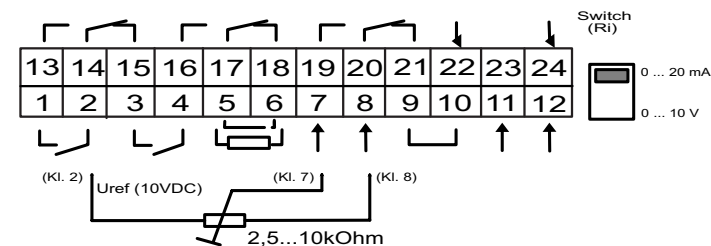
Common information:

Thyristor units for phase angle (Tyco-1Ph... and Tyco-3Ph...) are produced to control resistor and inductive loads. The controlling of the devices is achieved by using continuous signals (0-10V or 0-20mA). The phase control angle and/or the switch on-off relation at burst firing control (Tyco-1Ph/SP... and Tyco-3Ph/SP...) will be continuously controlled by the control unit in order to receive a sufficient linearity between thyristor controller input and power output.

Apart from these series we also produce three-phase thyristor units, which cover the upper current range to 1600A. These devices are also available within a short time.

4. Meaning of the clamp connections

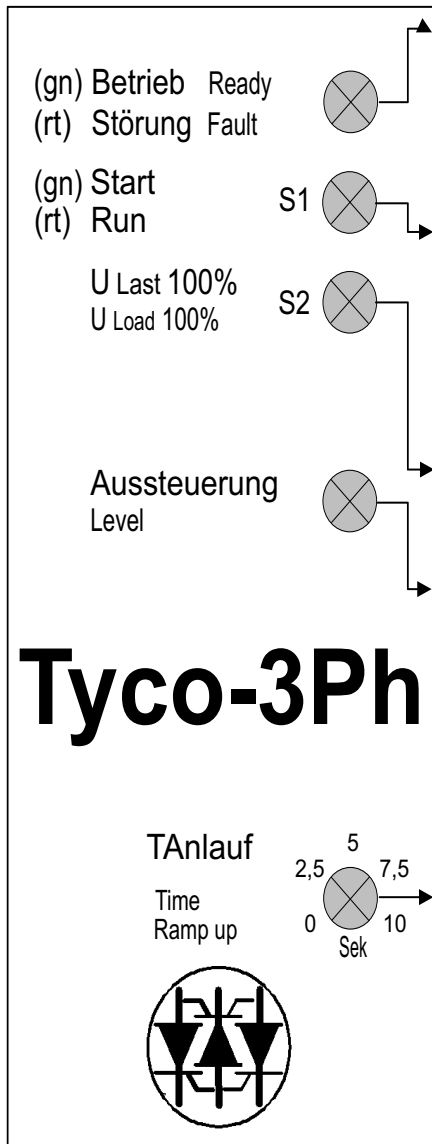
Clamps	Function	State	Description of the functions
1-2	start	closed	softstart and operation will be activated
		open	stand-by, ready for operation
3-4	reset (key)	actuated	reset faults (e.g: over-temperature, PTC-input, phase failure, low voltage)
5-6	PTC-input	X	switch off of power unit on overload (release of PTC or bridge is open)
	bridge		connection without PTC-sensor
7	U_{control} -input	0-10V, 0-20mA, 2,5-10k Ω	input of voltage and current signal and potentiometer adjustment
8	ground (GND)	X	for using of current, voltage, inverse, PWM and potentiometer input
9-10	inhibited		closed
		open	inhibit of power unit
11	inverse input	10-0V	input of inverse voltage signal (option)
12	PWM-input	5V/5-10kHz	input for impule signal ($v_t = 0-1$)
13-14-15	fault relay output	13-14 closed	switching at fault
16-17-18	relay output S2	16-17 closed	switching at 100% U_{Load}
19-20-21	relay output S1	19-20 closed	switching if voltage at T1, T2, T3 > 0V
22-24	auxiliary voltage	230V/50-60Hz	internal voltage supply
23	not connected	X	



Option:

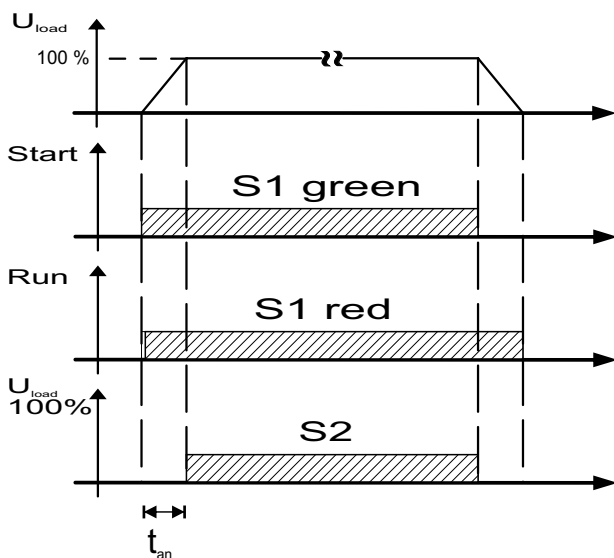
Switching mode (phase angle or burst firing control) by the help of "Switch (U)"

5. Description of the front side



LED 1	green	ready for use as soon as auxiliary voltage is on terminals (22-24)
	red	lights at fault and outputs T1, T2, T3 will be switched off
LED 2	green	lights as soon as connection 1-2 (start) are bridged
	red	lights as soon as voltage on T1, T2, T3 > 0V
LED 3 (S2)	yellow	lights as soon as load voltage has reached 100%
LED 4	yellow	lights depending on the level of the load voltage

T_{ramp up}	serves for adjusting the softstart time 0-10s (on PWM-controlling: 0-5s)
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switching function S1 was accomplished (connectors S1 and LED S1 (red) are activated at the same time)

switching function S2 was accomplished (connectors S2 and LED S2 are activated at the same time)

Indicating LEDs during operation:

Pos.	LED 1	LED 2 (S1)	LED 3 (S2)	LED 4	State	Control voltage	S1-relay output (at the same time with LED 2)	S2-relay-output (at the same time with LED 3)
1	green	*	*	*	<ul style="list-style-type: none"> auxiliary voltage at ter. 22 and 24 device is ready for use 	0V	ter. 20-21 closed	ter. 17-18 closed
2	green	green	*	*	<ul style="list-style-type: none"> "Start" is enabled (ter. 1 and 2 connected) 	0V	ter. 20-21 closed	ter. 17-18 closed
3	green	red	*	yellow 0-100%	<ul style="list-style-type: none"> device is ready for use "Start" is enabled U_{Load} amounts to 0-100% LED 4 lights depending on the input voltage 0-100% 	0-100%	ter. 19-20 closed	ter. 17-18 closed
4	green	red	yellow	yellow 100%	<ul style="list-style-type: none"> device is ready for use "Start" is enabled U_{Load} is 100% LED 4 lights 100% 	100%	ter. 19-20 closed	ter. 16-17 closed
5	green	red	yellow	yellow 100%	<ul style="list-style-type: none"> device is ready for use "Start" was disabled (ter. 1 and 2 open) LED 2 (S1) lights red for a short moment LED 2, 3, 4 die out 	100%	at the beginning ter. 19-20 are closed; as soon as LED 2 (S1) dies out, ter. 20-21 are closed	at the beginning ter. 16-17 are closed; as soon as LED 3 (S2) dies out, ter. 17-18 are closed
6	green	red	*	yellow 100-0%	<ul style="list-style-type: none"> device is ready for use "Start" was disabled (ter. 1 and 2 open) LED 2 (S1) lights red for a short moment LED 2 and 4 die out 	0-100%	at the beginning ter. 19-20 are closed; as soon as LED 2 (S1) dies out, ter. 20-21 are closed	ter. 17-18 closed

* no change

Indicating LEDs at fault:

Pos.	LED 1	LED 2 (S1)	LED 3 (S2)	LED 4	State	Control voltage	S1-relay-output	S2-relay-output	Fault	Solution
7	red	*	*	*	<ul style="list-style-type: none"> device is ready for use fault signal is flashing 	0-100%	ter. 20-21 closed	ter. 17-18 closed	<ul style="list-style-type: none"> PTC released ter. 5-6 open temperature exceedance of heat sink overload too high load current ambient temperature exceedance one or more phases are not connected with the net L1, L2, L3 undervoltage 	<ul style="list-style-type: none"> check ter. 5 and 6 for proper connection (e.g. bridge, PTC-sensor, contacts) cool down the device check load check power input switch-off temperature threshold is at approx. 85°C check connections L1, L2, L3 check mains voltage device reacts to mains voltage smaller than 300V
8	red	green	*	*	<ul style="list-style-type: none"> device is ready for use "Start" is enabled fault signal is flashing 	0-100%	ter. 20-21 closed	ter. 17-18 closed	cf. pos. 7	cf. pos. 7
9	green	green	*	*	<ul style="list-style-type: none"> device is ready for use "Start" is enabled 	0-100%	ter. 20-21 closed	ter. 17-18 closed	no operation	check ter. 9 and 10 (closed)

* no change

6. Meaning of the control inputs

Controlling with voltage signal:

Switch (Ri)	set 0-10V (Ri>50kΩ)	
Clamp:	7	input signal (0-10V)
	8	GND

Controlling with current signal:

Switch (Ri)	set 0-20mA	
Clamp:	7	input signal (0-20mA)
	8	GND

Controlling with potentiometer 2,5-10kΩ:

Switch (Ri)	set 0-10V (Ri>50kΩ)	
Clamp:	2	reference voltage (10V, supply voltage for potentiometer)
	7	sliding contact
	8	GND

Controlling with inverse signal (option):

Switch (Ri)	set 0-20mA	
Clamp:	11	signal input 10-0V
	8	GND

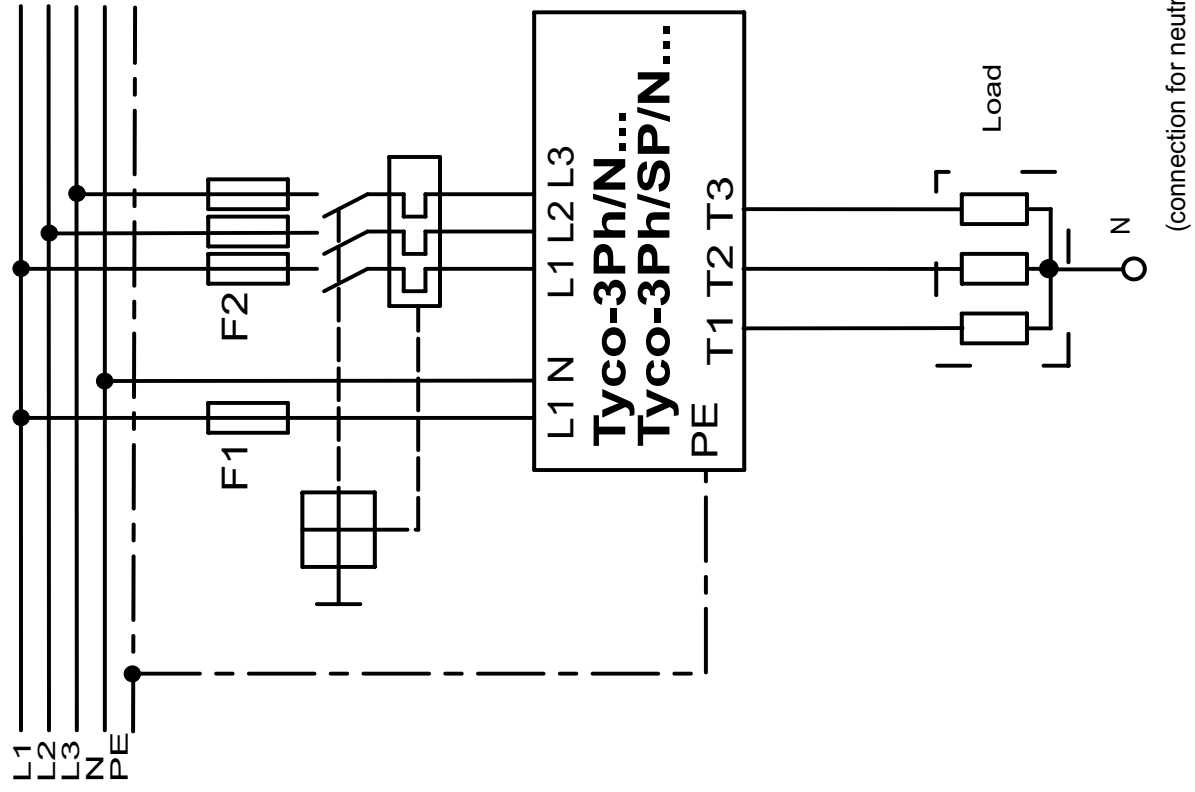
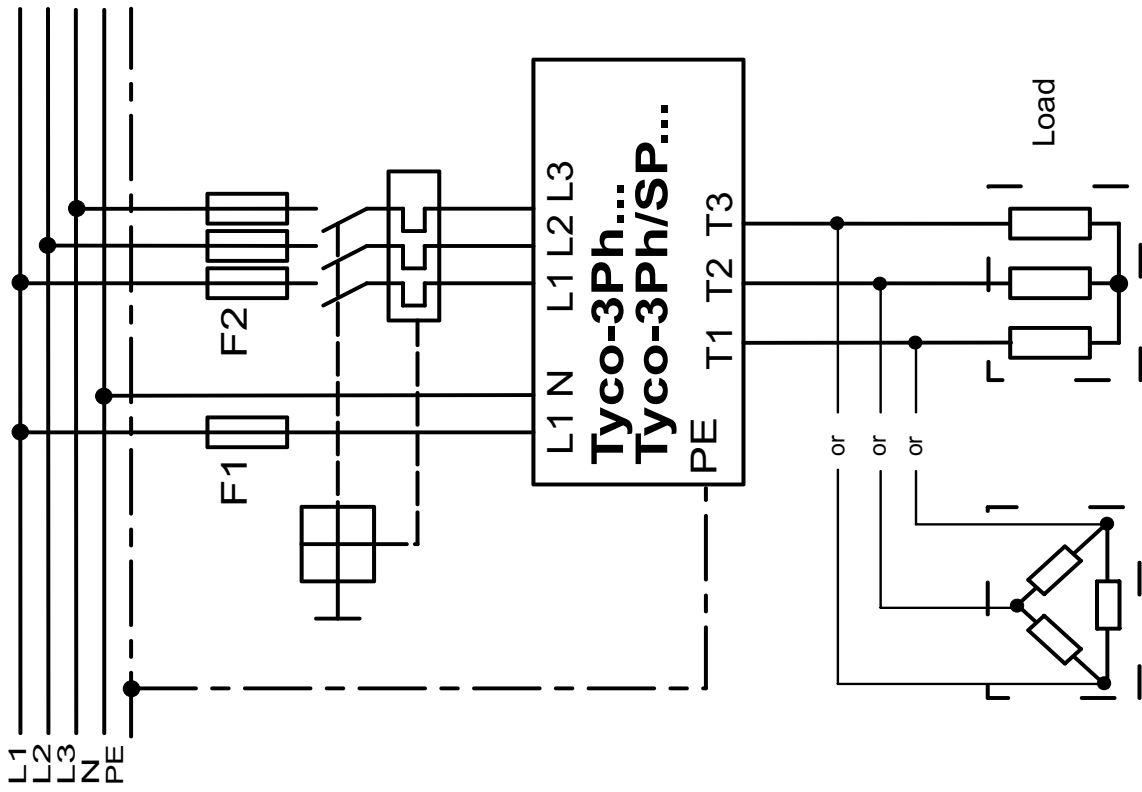
Controlling with PWM:

Switch (Ri)	set 0-20mA	
Clamp:	12	signal input 5V, 5-10kHz
	8	GND

Annotation:

When using PWM controlling the softstart time can be set within the interval of 0-5s.

7. Basic circuits



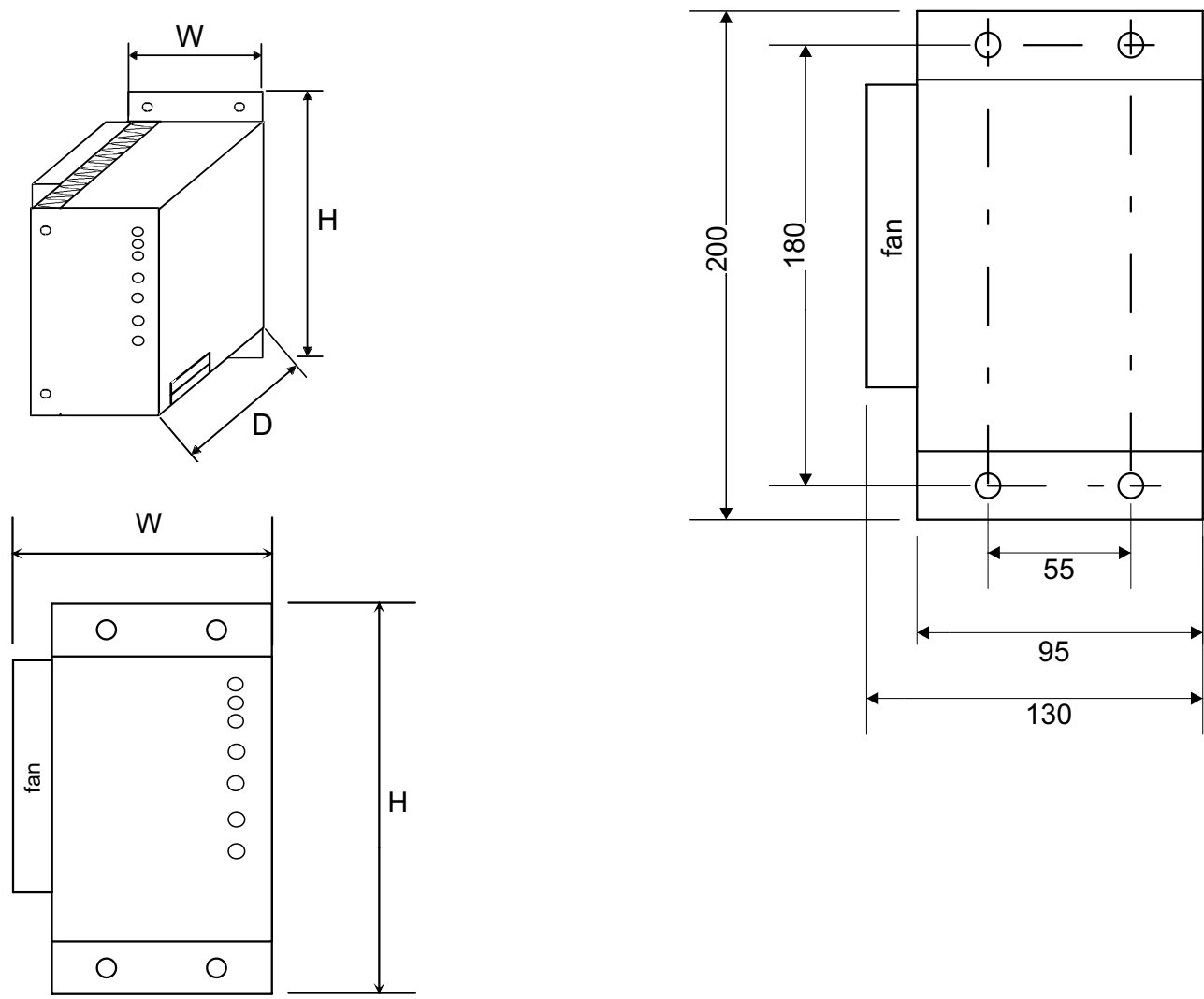
8. Survey of the individual types

Type *	Max. load current [A]	Rec. semi-conductor fuses [A]	Mains fuse [A]	Rec. cross-section [mm ²]	Max. power [kW]	Weight [kg]	Dimensions WxHxD [mm]
Tyco-3Ph 05	5	10	16	1,5	3	1,45	130x200x135
Tyco-3Ph 15	15	25	25	2,5	10	1,65	130x200x135
Tyco-3Ph 25	25	30	32	4	16	1,85	130x200x135
Tyco-3Ph 35	35	40	50	6	23	1,95	130x200x135
Tyco-3Ph 50	50	60	80	10	33	1,95	130x200x135

Errors and technical modifications excepted (Date: 2008/08)

* The given details also apply to the version with burst firing control Tyco-3Ph/SP...

The given values refer to the operation voltage of 3x400V AC. The values given for overload refer to a surrounding temperature exceed of max. 50°C and an installation altitude of 1000m. Semiconductor fuses can be ordered optionally.



9. Technical data

	Tyco-3Ph 05	Tyco-3Ph 15	Tyco-3Ph 25	Tyco-3Ph 35	Tyco-3Ph 50
Voltage of power circuit	400V AC +/- 15% (optional: 110V, 230V, 500V)				
Rated controller current	5A	15A	25A	35A	50A
Auxiliary voltage	230V AC (optional: internal auxiliary voltage)				
Frequency	45-65Hz, self-synchronizing				
Input	<ul style="list-style-type: none"> • 0-10V • 0-20mA • potentiometer: 2,5-10kΩ • 10-0V inverse input (option) • 5V/5-10kHz input for PWM 				
Input resistance	switchable input resistance: 500 Ω , 50k Ω				
Protetction system	phase failure control and temperature exceedance control (red LED "Fault" and switch-off)				
LED-Display	operation, "Start", "Run", "100% U _{load} ", "Fault", level				
Possible adjustments	softstart time: 0-10s, on PWM controlling: 0-5s				
Control outputs	<ul style="list-style-type: none"> • fault condition: ter. 13,14 closed; Load: 2A, 230V AC, AC1; • S1-relay output: ter. 19,20 closed; Load: 2A, 230V AC, AC1; • S2-relay output: ter. 16,17 closed; Load: 2A, 230V AC, AC1; 				
Power terminals	<ul style="list-style-type: none"> • L1, L2, L3 input voltage • T1, T2, T3 output voltage 				
Kind of controlling	phase angle (optional: burst firing control)				
Power loss	1,1W/A				
Operating temperature	0-50°C				
Storage temperature	-10-70°C				
Humidity	5-95% relative humidity, not condensing				
Enviroment	dry and non-conducting environments				
Max. altitude	1000m				
Weight	1,45kg	1,65kg	1,85kg	1,95kg	1,95kg
Protection	IP 40				
Installation	vertically, power terminals below				
Dimensions (WxHxD)	130x200x135mm				
Mounting	for screw mounting in a housing				
CE-marking	DECLARATION OF CONFORMITY 73/23/EEC (low voltage directive), EMC Directive 89/336 EU for industrial environments				
Regulations	VDE 0160, EN 60204				

Errors and technical modifications excepted (Date: 2008/08)