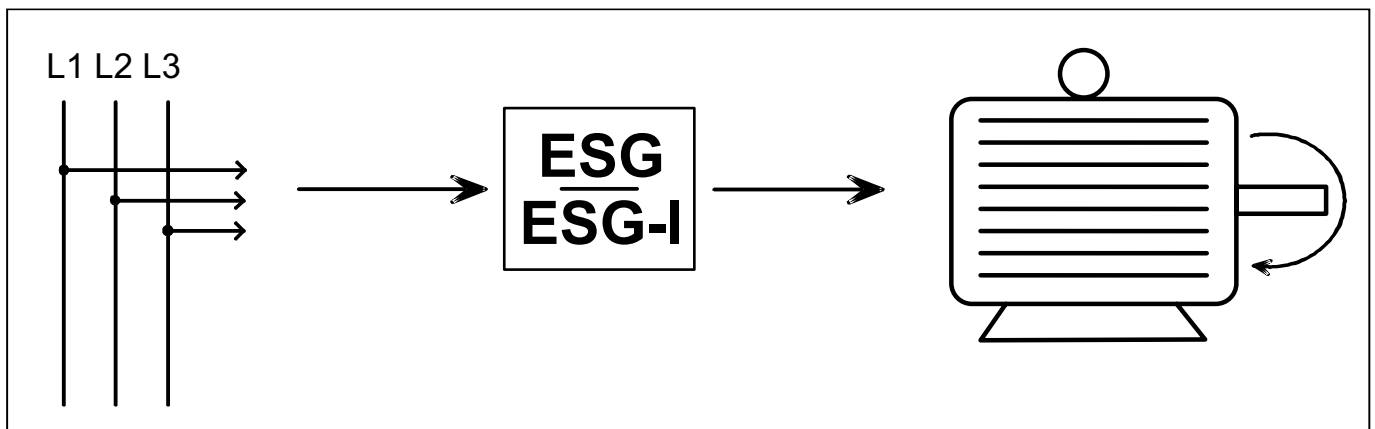




Start-up instructions

Electronic soft-starter Type: ESG..., ESG-I...



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1. General information

The electronic motor-control devices ESG..., ESG-I... were developed for smooth and gentle start-up and running of three-phase slip-ring or squirrel-cage induction motors. The electronic starting and running is basically effected by controlling the motor's electric potential with the help of thyristors.

In order to achieve a proper control or regulation process, three basic options are available:

a) Variable voltage gradient (Standard usage): Starting and running is in this case effected by controlling motor voltage from zero to its final value within a time period that can be set by the user (p. 12).

b) Current-limiting regulation: Running is controlled by electronic regulation of motor voltage. In this case the motor is accelerated with constant voltage to its rated speed (p. 14,15).

c) Odometer regulation (Acceleration independent of load): With this regulation, linear acceleration to rated speed is accomplished. A tachogenerator or an electronic revolution counter is necessary (actual-value counting by means of a tachogenerator or impulse counter).

A large number of special solutions are available in addition to the presented function modules.

The electronic starting device ESG..., ESG-I... is assembled modularly. It consists of three basic components:

- power element with cooling system and thyristor switching facility
- control unit with electronic starting and control system
- function module to determine starting method (current limitation, regulation by odometer or voltage gradient)

2. Installation of the soft-starter ESG..., ESG-I...

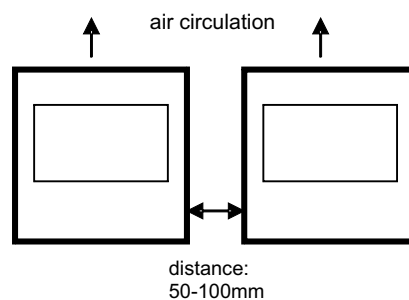
The built-in device according to with IP 23, must be mounted in a housing or switchboard panel. Take care that cooling is adequate (using separate ventilation, for example). The temperature must not exceed 50° C. The device is to be mounted on a vertical surface so that the ventilation duct from the cooler is also vertical. The devices should be installed in a relatively dry and dust-free space in order to function properly without any difficulties.

Further conditions for the operating area:

- protection from dust and moisture
- protection from aggressive atmosphere
- free from vibration
- stable power conditions (especially at plants with large initial demand: $P > 55 \text{ kW}$)

No other components or construction units should be placed closer than 50-100mm from the device, so that airflow ventilation is not affected.

The housing equipment (see IP 54) can be installed at operating locations which are not protected from dust and moisture.



Wiring the Device:

Make mains connections (L1, L2, L3) via fused circuit breakers with the usual safeguards. Simply connect the device to the motor supply lines; it doesn't matter whether the motor is star or delta wired. The wiring for power supply and the wiring for control must be laid in separate conduits or shielded ducts. It is essential that the electrical installation comply with general stipulations of the VDE (German Electrical Engineers Association), specifically (VDE 0100, VDE 0113, VDE 160).

3. Operation

To begin with, all electrical connections are to be made according to the accompanying wiring diagrams: L1, L2, L3, T1 (U), T2 (V), T3 (W). The electronic smooth-starting devices must be connected to the power supply in accord with VDE specifications so that they can be disconnected from the mains using a suitable switching means (i. e., master switch, contactor, protective power switch).

Conduit installation:

The mains power supply and motor power supply, as well as the control wiring, are to be in separate ducts or conduits. In order to avoid malfunctions it is advisable to install the electronic signal wiring separate from the power supply and/or protective control wiring and either to twist the feed and return signal lines or to use shielded control lines.

Fuses:

The mains fuse protection is dependent on the recommended or employed power-transmission cross-section, and must be carried out in accordance with DIN 57100, Part 430/VDE 0100 and part 430/6.81. Up until Type ESG 90, ESG-I 90, the devices possess no auxiliary semiconductor fuses. Suitable types may be selected from the table (see Appendix). Starting with type ESG 110, ESG-I 110, semi-conductor fuses for thyristor protection have been wired in series with them.

Supervisory module (optional):

The optional "Supervisory module" permits electronic control in regard to current excess, short circuits, asymmetric power distribution and motor temperature and provides a simultaneous LED indication corresponding to each malfunction report. The control electronics synchronously de-energizes the power driver portion. A start order (RESET) can return the device to operation as soon as the malfunction is eliminated.

4. Meaning of the clamp connections

Clamp connections on the function module:

These connections are found on all function modules with the same numeration. Auxiliary clamp connections are illustrated in each set of specific start-up instructions (see instructions for the standard module, current limiter, Tacho-Regulation or other modules).

Generally speaking, two variants for initiating soft-start are possible:

Standard activation:		
1-2	starting and continuous operation	closed
	ramp-down	open
3-4	n.c.	

Activation with memory function		
1-2	starting and continuous operation:	short impulse
3-4	starting and continuous operation:	closed
3-4	Auslauf	geöffnet

Special function		
5-6	closing of power unit:	closed
5-6	ramp-up, continuous operation, ramp-down:	open

Clamp connections on the control and monitoring panel:

L1-N or 10-12	connection to 230V/50-60Hz (standard) option: any other voltages can be realized upon request
14-15-16	output switch terminal S1
17-18-19	output switch terminal S2
20-21-22	output switch terminal "Fault"
23-24	input for PTC-resistor (thermal report sensor)

5. Technical features of the control- and monitoring panel

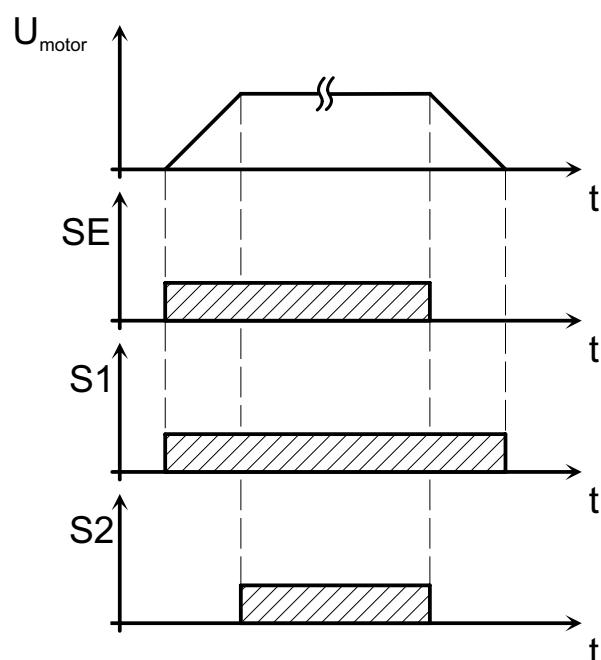
The Control panel of the electronic smooth-starting devices ESG..., ESG-I... possesses various control and safety functions. As standard equipment, this panel is supplied with 230V/50-60 Hz via the clamps L1 and N, by which an internal DC voltage of 15 V is produced. On this control panel (Euro-format) is found a 100 x 75 mm interchangeable function sub-panel which determines the behavior of the device when in operation

Explanation of the LEDs on the control and function panel:

LED 1 (red)	Meaning: Temperature exceed of cooling or power element
	Reason: Overload, to high current, to high switching frequency. The threshold value of turning off is at 75° C.
LED 2 (red)	Meaning: Phase failure
	Reason: One or more phases are not connected with the mains connections L1, L2, L3 (Check the contacts!)
LED 3 (red)	Meaning: Temperature exceed of the load (PTC)
	Reason: Overstressing of the load
LED 4 (green)	Meaning: Auxiliary voltage connected (device in operation)

If there is none of the explained malfunctions, all red LEDs have to go out by activating the device (e.g. by connecting the contacts 1-2 / reset procedure).

LED „SE“	Activation
LED „S1“	switching facility S1 actuated (contacts S1 and LED S1 are activated synchronously)
LED „S2“	switching facility S2 actuated (contacts S2 and LED S2 are activated synchronously)



6. Switching suggestions

Using soft-starters of type ESG..., ESG-I... allows a great number of application possibilities which are all based on the initial conception. As examples, we demonstrate three fundamental connection diagrams which should give a survey of the device's integration in existing plants or those in the planning stage.

It always depends on the user how the device should be installed in order to achieve the greatest effectiveness. The devices up to and including ESG 22, ESG-I 22 are designed for continuous operation, meaning that bridging (bypassing) the power driver portion is not necessary.

For higher-performance devices ($P > 22 \text{ kW}$) a bypass after a favorable full-run must be activated (i. e., S2 contact).

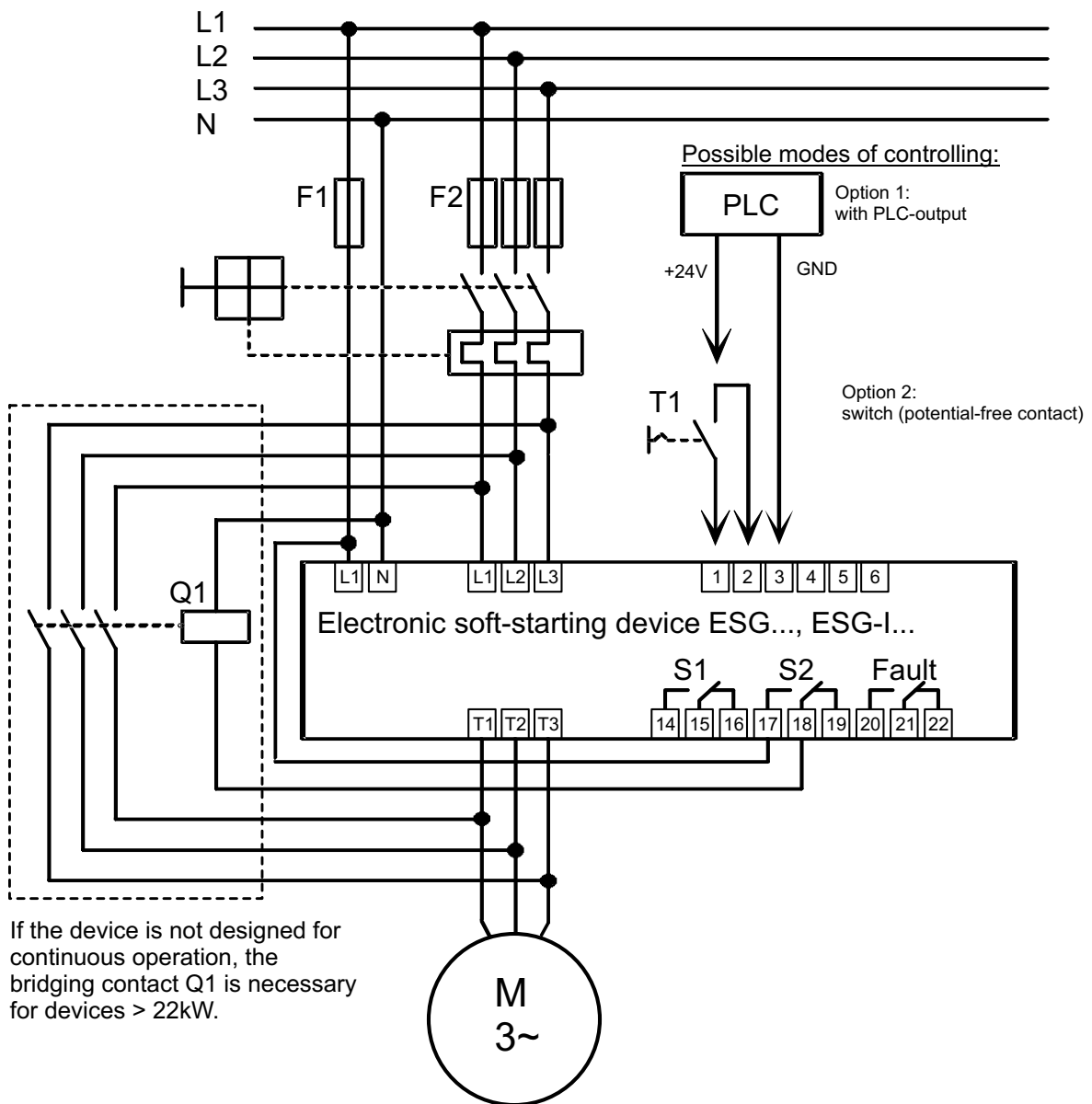
Soft-start devices can also be supplied for continuous operation on request (option "D").

Switching variations:

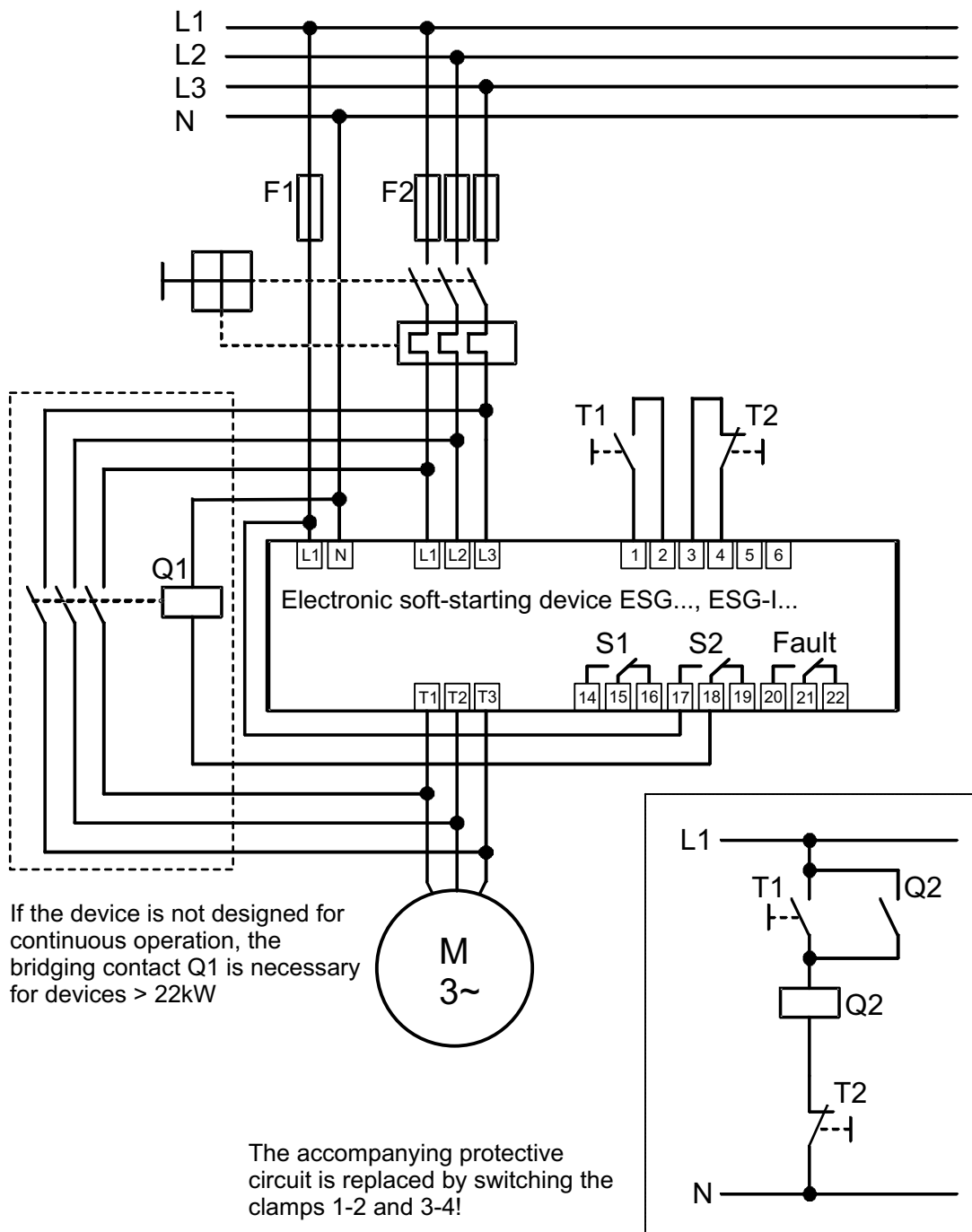
A1	Fundamental electrical connection and starting-running activation via T1 or by means of an PLC output. By opening T1 ramp-down or switching off the device is initiated (minimal configuration). Page 8
A2	Activation of ESG, ESG-I via T1 and T2. A short impulse with T1 (T2 closed) stores the "Start" command. In this version, by then briefly opening T2, ramp-down or switching off is initiated. Page 9
A3	Activating the ESG, ESG-I via the main contactor. Page 10

ATTENTION! Be sure to see that the control voltage is turned on after or at the same time as the load voltage; otherwise the "phase malfunction" indication will be activated. This malfunction report can be cancelled by turning on the control voltage once again, or by bridging the clamps 1-2 (RE-SET function or respectively, start activation).

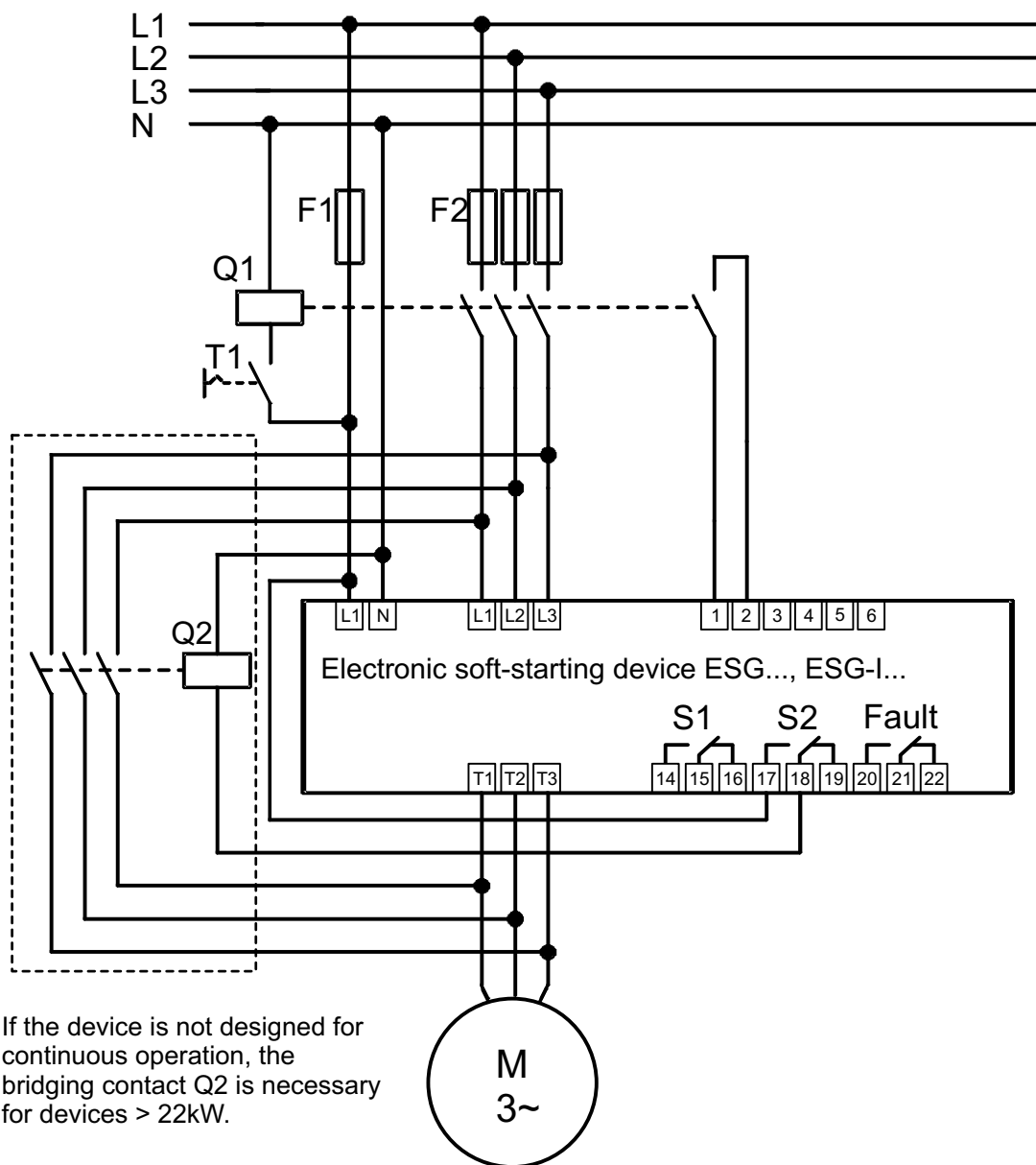
Switching suggestion A1 (standard)



Switching suggestion A2

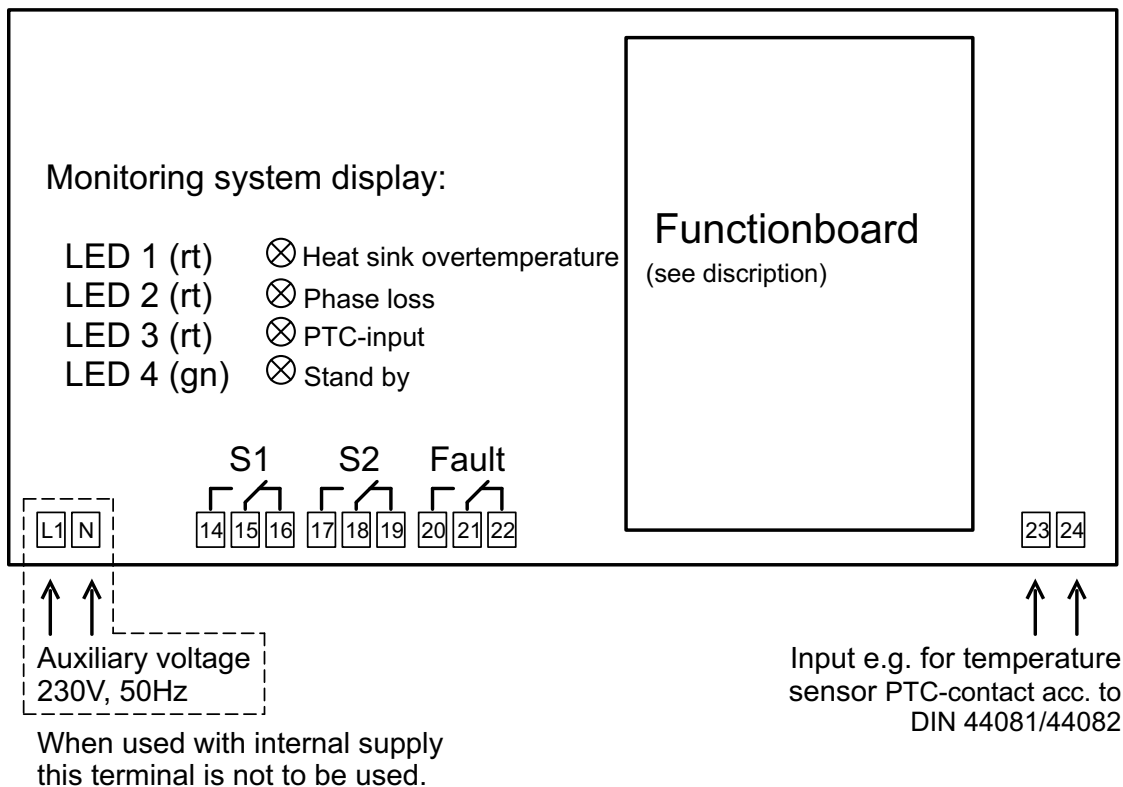


Switching suggestion A3



By actuating switch T1 contact Q1 switches on 3-phase power to the soft-starter device and closes the starting contact.

7. Control and monitoring diagram

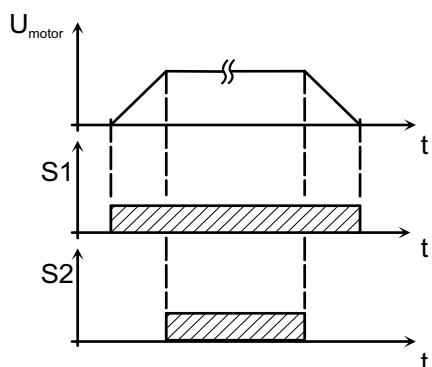


Meaning og the LED indications:

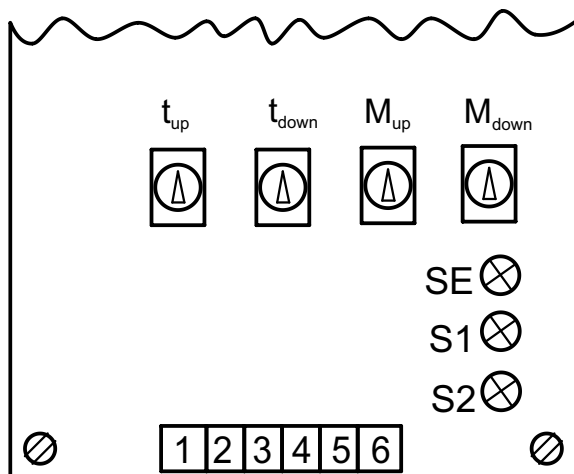
LED 1	temperature exceedance of heat sink
LED 2	phase failure
LED 3	temperature exceedance of motor
If one of the listed malfunctions occurs, it will be recorded and the trouble report activated (clamps 20-21-22).	
LED 4	auxiliary voltage on

Auxiliary voltage S1 and S2:

Optional interchangeable alternating contacts activated as per switching status shown. Switching status simultaneously indicated by LEDs "S1", "S2" on the function module. LED "SE" indicates the starting process (power rating: 5A, 250V/AC).



8. Time control function module



t_{up}	adjustment of ramp-up time	$0,5s-t_{max}$
M_{up}	adjustment of starting torque	0-100%
t_{down}	adjustment of ramp-down time	$0,5s-t_{max}$
M_{down}	adjustment of run-down torque (t_{max} is set to 45s by default but can be modified arbitrarily)	0-100%
S_z	extra equipment	

Clamp connections:

Soft-start is activated by closing (bridging) the terminal connections 1-2. They must remain bridged until smooth running or smooth cutoff is achieved.

Another activation possibility can be realized with the help of connections 3-4. To do this, 3-4 must be bridged. Then a brief impulse between connections 1 and 2 initiates start-up.

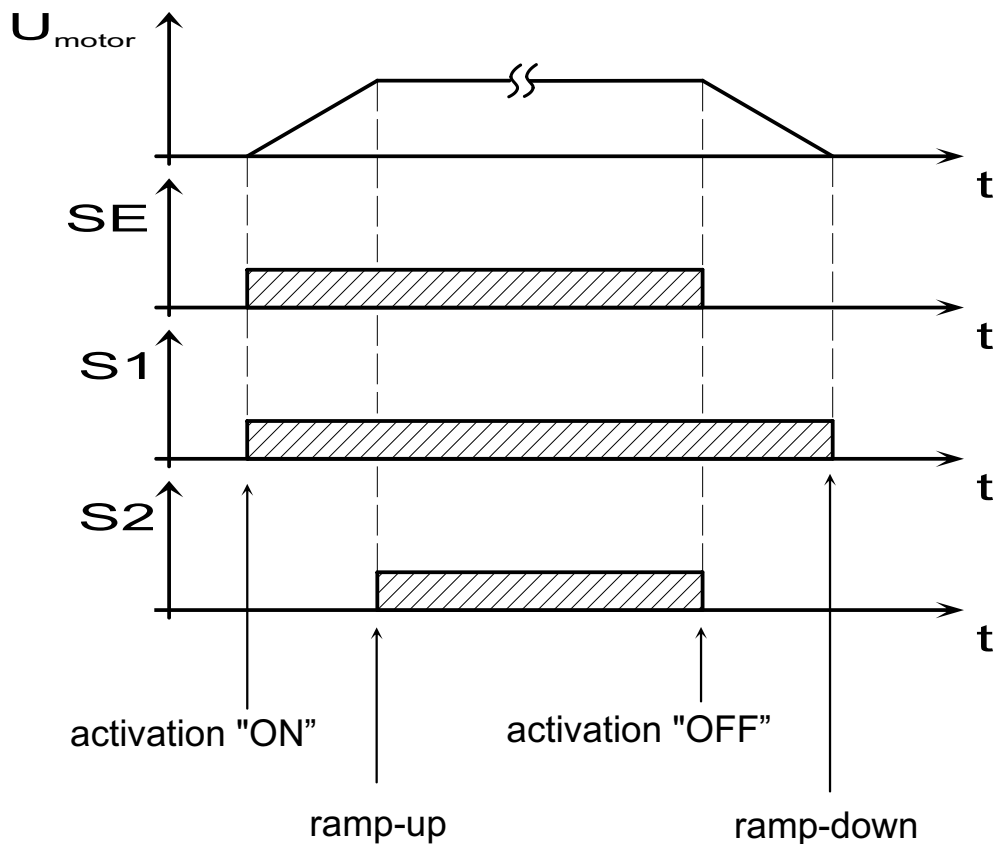
Opening clamps 3 – 4 effects slowdown to stop.

Bridging the supplementary input clamps 5 – 6 turns off the power unit.

ATTENTION! This supplementary input is only intended as a special function. After closing clamps 5-6 the previous function is consequently activated again. Therefore start contacts 1 and 2 have to be opened when opening 5-6.

Time sequence of the switching functions:

SE, S1 and S2 as well as LEDs SE, S1 and S2:



SE: The “SE” LED lights when device is activated. For this the clamps 1 and 2 must be bridged. When the “SE” lights, the activation period is simultaneously indicated.

S1: The “S1” LED is active during the entire period of operation. At the same time the S1 contacts (14,15) are closed (for reporting purposes). Appearance of the function message “current limiting” signifies the application of electronic regulation. This LED can blink each time potential is applied.

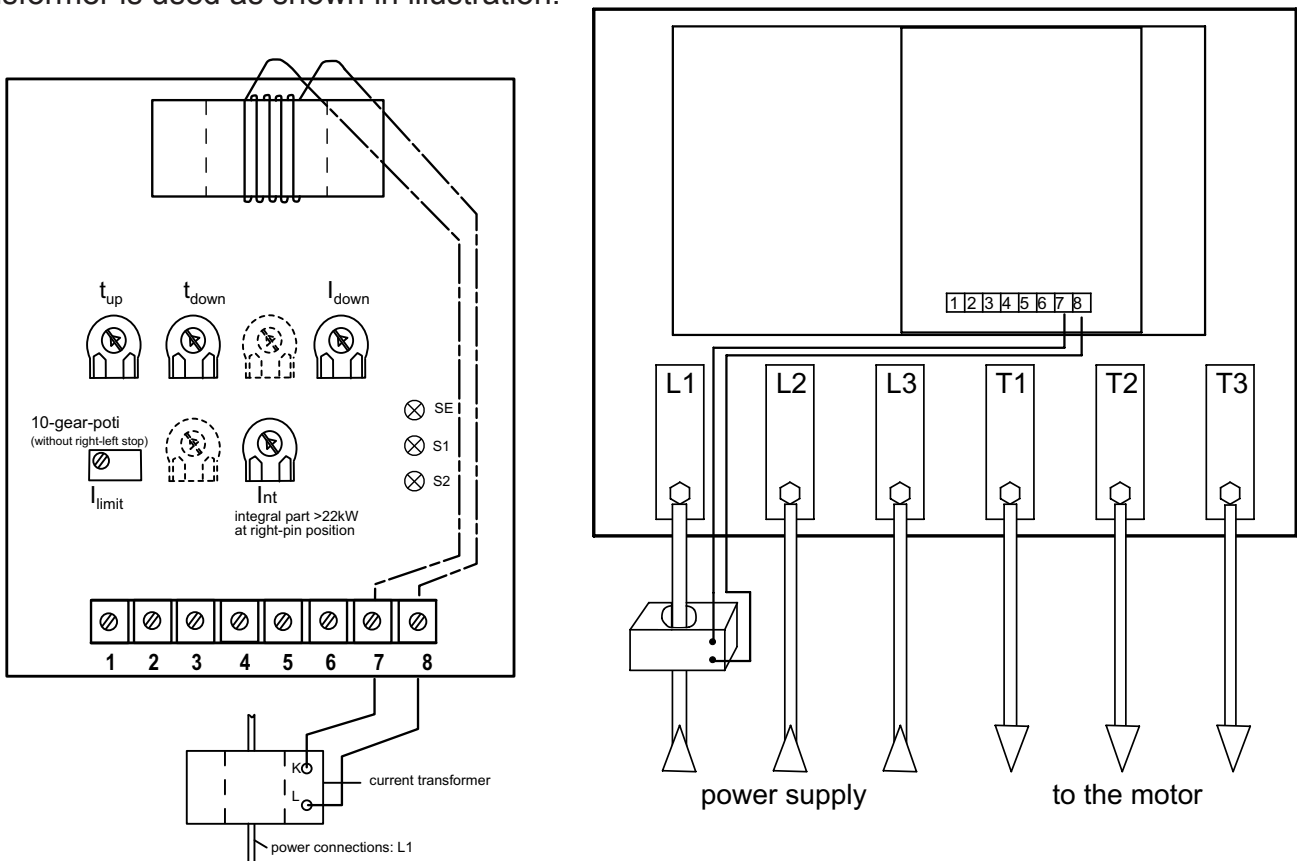
S2: The “S2” LED shows the close of full-speed running. When this LED lights full-speed running is terminated. The auxiliary contacts 17 and 18 are simultaneously closed. (These contacts can be used for switching on bridging protection, for example).

9. Current limitation

The “current-limiting” function panel serves to limit the starting current and to increase the starting period from start to full speed.

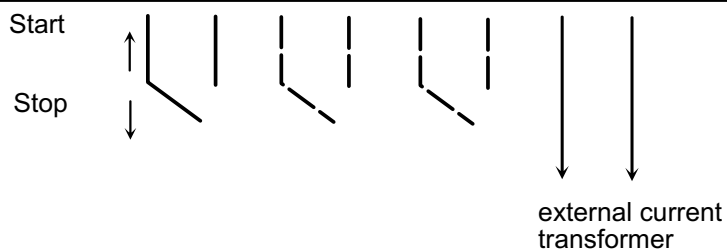
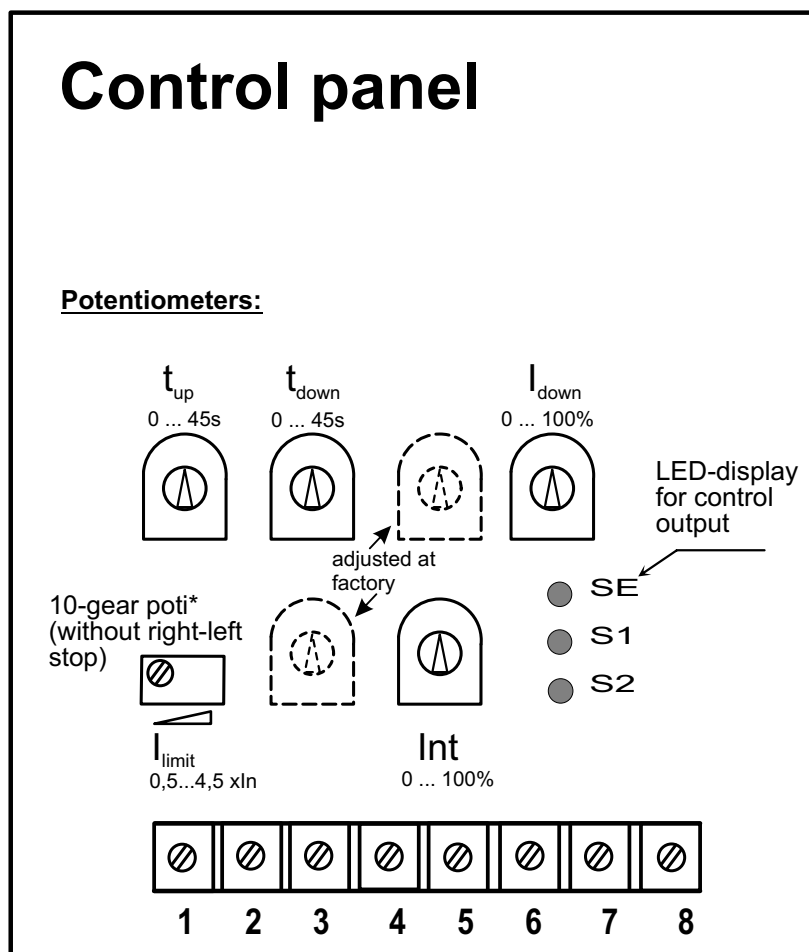
First of all, all electrical connections as described in the corresponding passages must be performed. For power regulation, the actual values of motor current and voltage must be determined by a current converter.

An arbitrary phase (L1, for example) can be utilized to fix and record the actual value of motor current. For the very first initial start-up, the dimmer or potentiometer must first be set at its leftpin position. The dimmer for the integral portion must be at its far-right pin position. If starting is now activated, the S1 LED indicator will flash. Now the dimmer must be turned slowly to the right to increase motor current until the motor starts to run. When electronic regulation is applied, the S1 indicator blends into steady illumination. By altering the integral portion, the regulator can react faster to current changes; however, under certain conditions this may cause uneven running. This adjustment should be carried out several times. Up to and including 7.5 kW, power control is effected by an internal transformer which must be led via the circuit L1. For ratings greater than 7.5 kW an external transformer is used as shown in illustration.



Activation of smooth start takes place when clamps 1 – 2 are closed (bridged). These must remain bridged until smooth slowdown and stop or switching off takes place. Another possibility for activation can be attained with the help of clamps 3 – 4. In this case, clamps 3-4 must be bridged. A brief impulse across clamps 1-2 initiates starting. By opening clamps 3 – 4 slowdown to stop is performed. Shutting off the power unit is achieved by closing the auxiliary input clamps 5 – 6. Clamps 7-8 are used for the connection of an external current transformer.

Function module "current limiting"



Potentiometers:	
t_{up}	ramp-up time (0-45s)
t_{down}	ramp-down time (0-45s)
I_{down}	ramp-down current
I_{limit}	adjustment of current limitation
Int	integral dimension (in order to avoid uneven runs, the poti has to be set to its far-right pin position for motors > 11kW)

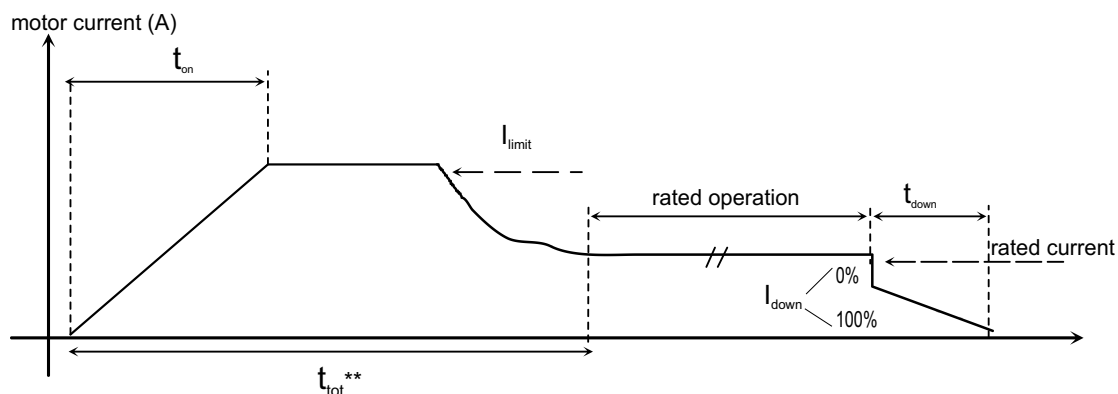
Clamp connections:	
1-2	start input
3-4	store function for impuls input on 1 and 2
5-6	Abschaltung übergeordnet

Standard activation:	
ramp-up	1 and 2 closed
ramp-down	1 and 2 closed

LED-indications	
SE	activation (Start)
S1	output terminal switch S1 (active at t_{tot} , rated operation and t_{down})
S2	output terminal switch S2: active during rated operation

at the same time with LEDs S1 and S2 the corresponding auxiliary clamps are activated

Generell possibilities of adjusting:



** Annotation: The overall ramp-up time (t_{tot}) also depends on the current I_{limit} .

10. Technical data

Power supply	230V/50Hz standard
Mains power	3-phase 230V – 500V AC (+/-15%)
Mains frequency	48-62Hz
Rotary field	self-synchronizing
Kind of protection	open design: IP23
Moisture class	E according to DIN 40040
Built-in device	VDE 0558
Built-in features	vertical, electrical connections below
Service condition indicators	LEDs (SE, S1, S2, U _n)
Ambient temperature	0-55°C
Storage temperature	-25°C-70°C
Current limitation	0,5-4,5 of I _n
Failure indication	phase failure, temperature of heat sink, lack of voltage, thyristor defect
Control options	for current, voltage, rotational speed
Regulations	DIN 40050, VBG4, DIN VDE 0160, DIN IEC 38, VDE 0110
CE-regulations	EMC Directive 2014/30/EU LVD 2014/35/EU
Installation altitude	up to 1000m above sea level at rated load, 1% current reduction per 100m
Test voltage	according to VDE 0160 Tab. 6
Over voltage category	ÜIII according to VDE 0160 5.7 (05/88)
Pollution degree	1, IEC 664
Connection	clamps or bus bars

Errors and technical modifications excepted (Date: 2016/05)

Options:

- braking module
- supervisory control module
- auxiliary voltage for 110V/400V/440V/500V AC or 24V/48V DC
- continuous operation for devices ESG 22 to ESG 90, ESG-I 22 to ESG-I 90
- model IP54
- analog control (0-10V, 4-20mA)
- Scontrol module for special ramp requirements
- creep-mode operation
- universal module (ESG – M..)
- interface RS 232
- bus connections for Interbus, Can-Bus and Profibus
- control using light conductors
- current monitoring in order to avoid short circuit (fast switch-off)

11. Survey of the individual types

Type	Motor power [kW]	Max. starting current [A]	Rec. semi-conductor fuses [A]	Mains fuse [A]	Rec. cross-section [mm ²]	Weight [kg]	Frame size	Dimensions WxHxD [mm]
ESG 2,2/ESG-I 2,2	2,2	15	12	10	1,5	1,3	A	200x140x115
ESG 3/ESG-I 3	3,0	25	16	10	2,5	1,4	A	200x140x115
ESG 4/ESG-I 4	4,0	35	30	16	2,5	1,5	A	200x140x115
ESG 5,5/ESG-I 5,5	5,5	55	35	16	2,5	2,8	B	260x205x170
ESG 7,5/ESG-I 7,5	7,5	70	50	20	4	2,8	B	260x205x170
ESG 11/ESG-I 11	11,0	90	63	25	6	3,0	B	260x205x170
ESG 15/ESG-I 15	15,0	120	80	35	10	3,0	B	260x205x170
ESG 18,5/ESG-I 18,5	18,5	155	100	35	16	3,0	B	260x205x170
ESG 22/ESG-I 22	22,0	200	160	63	16	3,5	B	260x205x170
ESG 30/ESG-I 30	30,0	240	160	63	25	8,0	C	360x250x170
ESG 37/ESG-I 37	37,0	280	200	100	35	8,5	C	360x250x170
ESG 45/ESG-I 45	45,0	350	300	100	35	8,5	C	360x250x170
ESG 55/ESG-I 55	55,0	420	350	125	50	9,0	C	360x250x170
ESG 75/ESG-I 75	75,0	600	400	160	70	9,5	C	360x250x170
ESG 90/ESG-I 90	90,0	700	450	200	95	10,5	C	360x250x170
ESG 110/ESG-I 110	110,0	750	500	250	120	18,0	D	360x445x240
ESG 140/ESG-I 140	140,0	920	630	300	150	18,0	D	360x445x240
ESG 160/ESG-I 160	160,0	1250	710	350	240	41,0	E	600x540x346
ESG 200/ESG-I 200	200,0	1400	800	400	300	41,0	E	600x540x346
ESG 250/ESG-I 250	250,0	1800	1000	400	300	42,0	E	600x540x346
ESG 315/ESG-I 315	315,0	2100	1100	630	2x185	42,0	E	600x540x346
ESG 355/ESG-I 355	355,0	2800	1250	630	2x240	44,0	E	600x540x346
ESG 400/ESG-I 400	400,0	3200	1400	1250	2x300	51,0	F	850x725x495
ESG 560/ESG-I 560	560,0	4500	1600	1250	2x350	53,0	F	850x725x495

Errors and technical modifications excepted (Date: 2016/06)

The given values are in reference to a rated operating voltage of 3x400 V. The values given for overload are valid for an ambient temperature of 40°C maximum and an installation altitude of 1000m maximum. The ratings given deal with values for standard motos according to IEC 72 and UNE 20106.

12. Current transformer for ESG-I

Accessory for soft-start device type: ESG-I current limiting module

Accessory for soft-start device type: ESG-M universal module

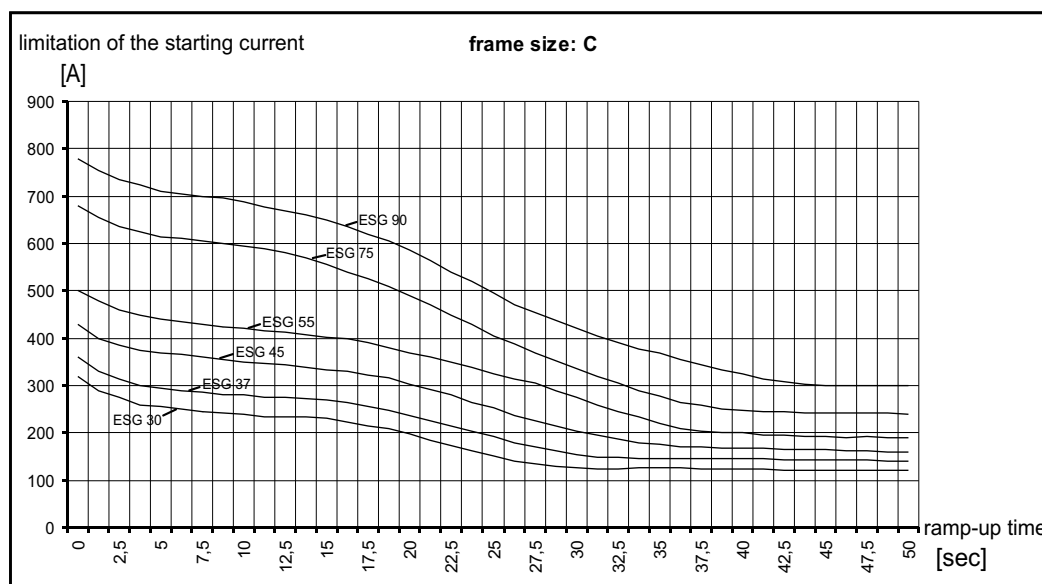
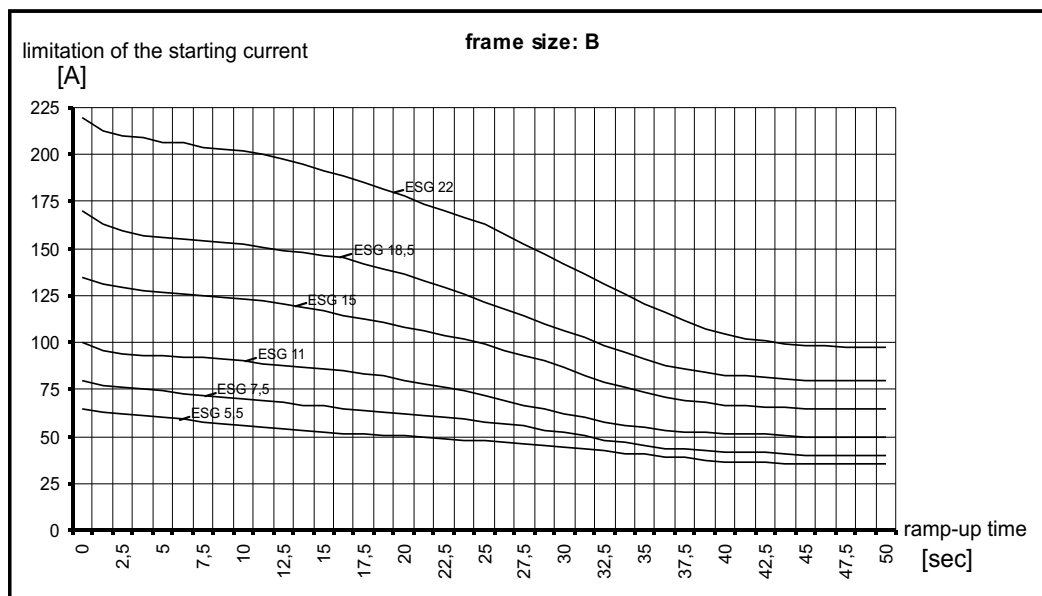
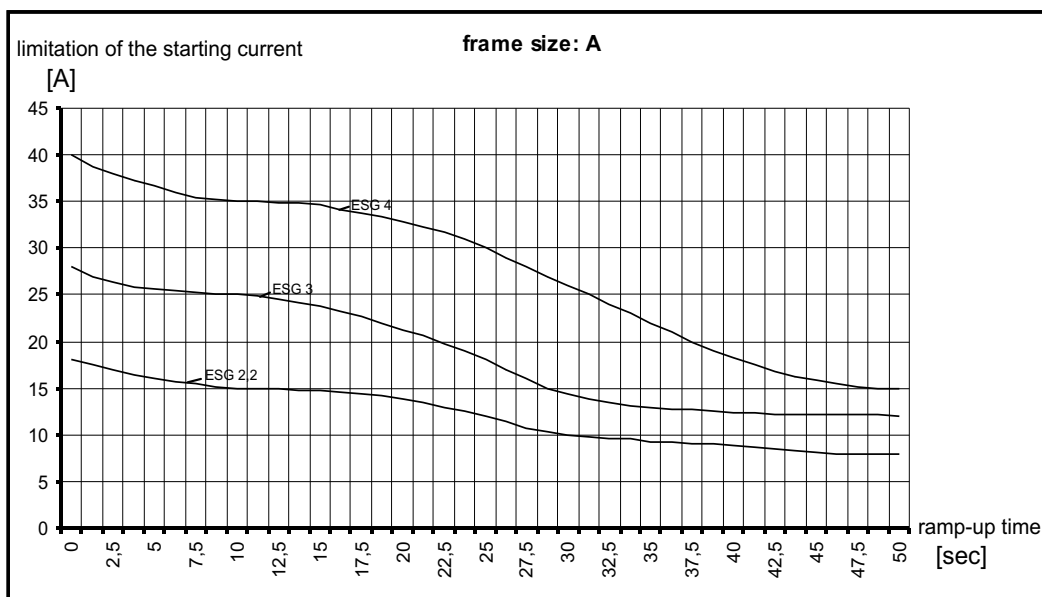
This accessory is necessary for types ESG-I .. and ESG-M... starting with a 7,5 kW power rating. For lower ratings a transformer is an integral part of the regulator panel.

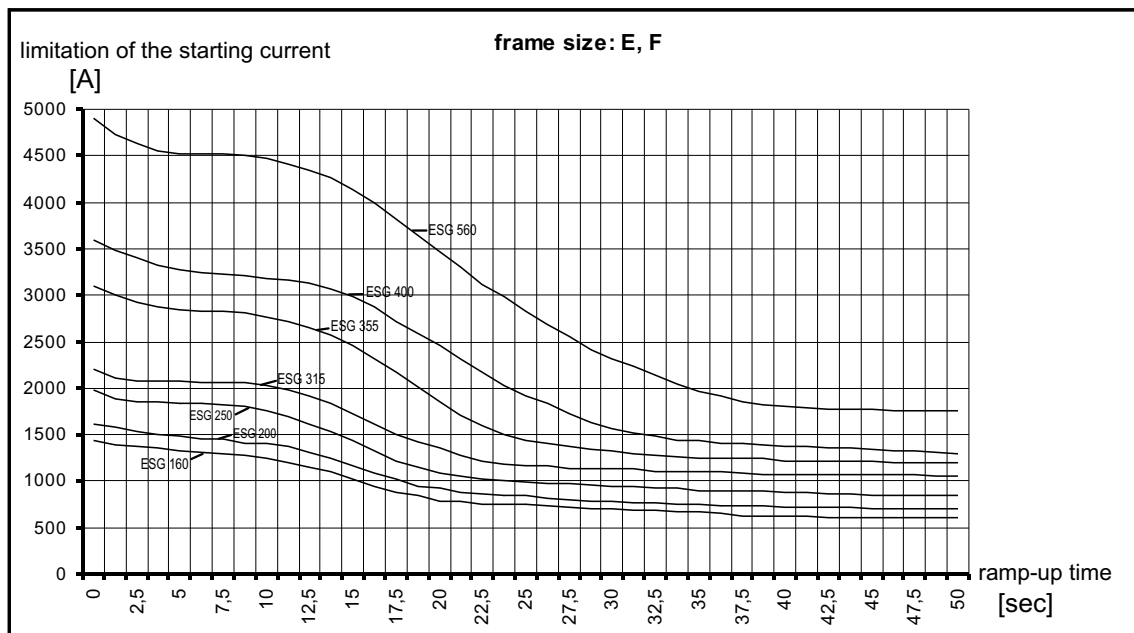
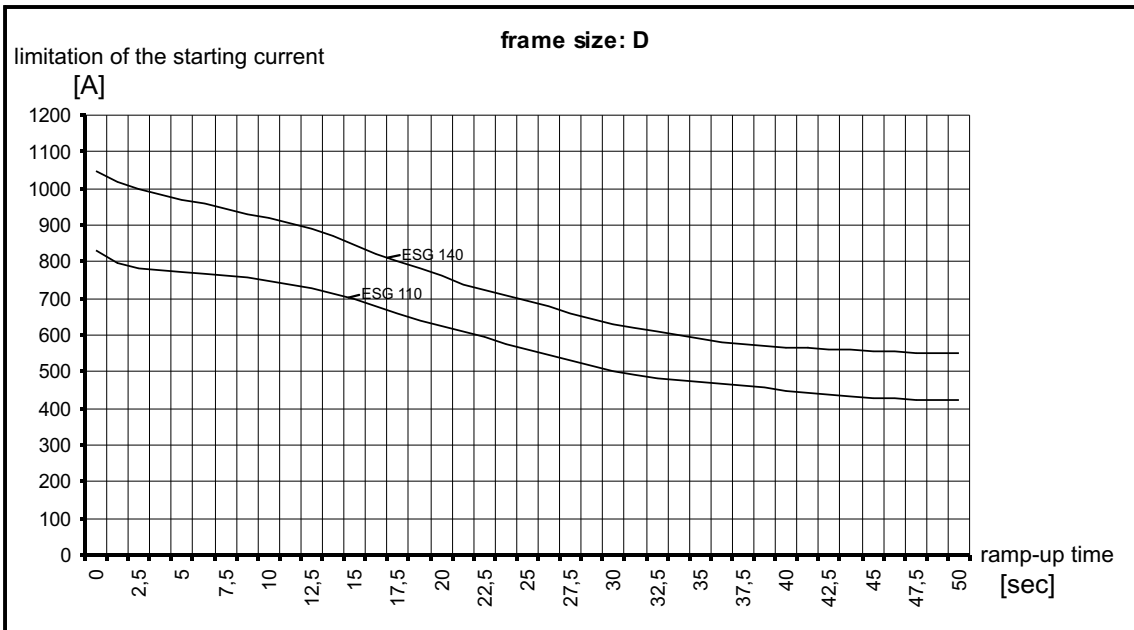
Type	Motor-power [kW]	ESG-I respectively ESG-M	item ESG-I	item ESG-M
STW 50:5	7,5	ESG-... 7,5	1	1
STW 75:5	11,0	ESG-... 11	1	1
STW 75:5	15,0	ESG-... 15	1	1
STW 100:5	18,5	ESG-... 18,5	1	1
STW 100:5	22,0	ESG-... 22	1	1
STW 200:5	30,0	ESG-... 30	1	1
STW 200:5	37,0	ESG-... 37	1	1
STW 200:5	45,0	ESG-... 45	1	1
STW 200:5	55,0	ESG-... 55	1	1
STW 300:5	75,0	ESG-... 75	1	1
STW 400:5	90,0	ESG-... 90	1	1
STW 400:5	110,0	ESG-... 110	1	1
STW 400:5	140,0	ESG-... 140	1	1
STW 500:5	160,0	ESG-... 160	1	1
STW 750:5	200,0	ESG-... 200	1	1
STW 1000:5	250,0	ESG-... 250	1	1
STW 1000:5	315,0	ESG-... 315	1	1
STW 1200:5	355,0	ESG-... 355	1	1
STW 1500:5	400,0	ESG-... 400	1	1
STW 2000:5	560,0	ESG-... 560	1	1

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

Available current transformers can also be utilized, for example those employed for indicating motor current. For this they should be wired in series into the switching indicator circuit. The power transformer supplied with the ESG can also be installed for this purpose.

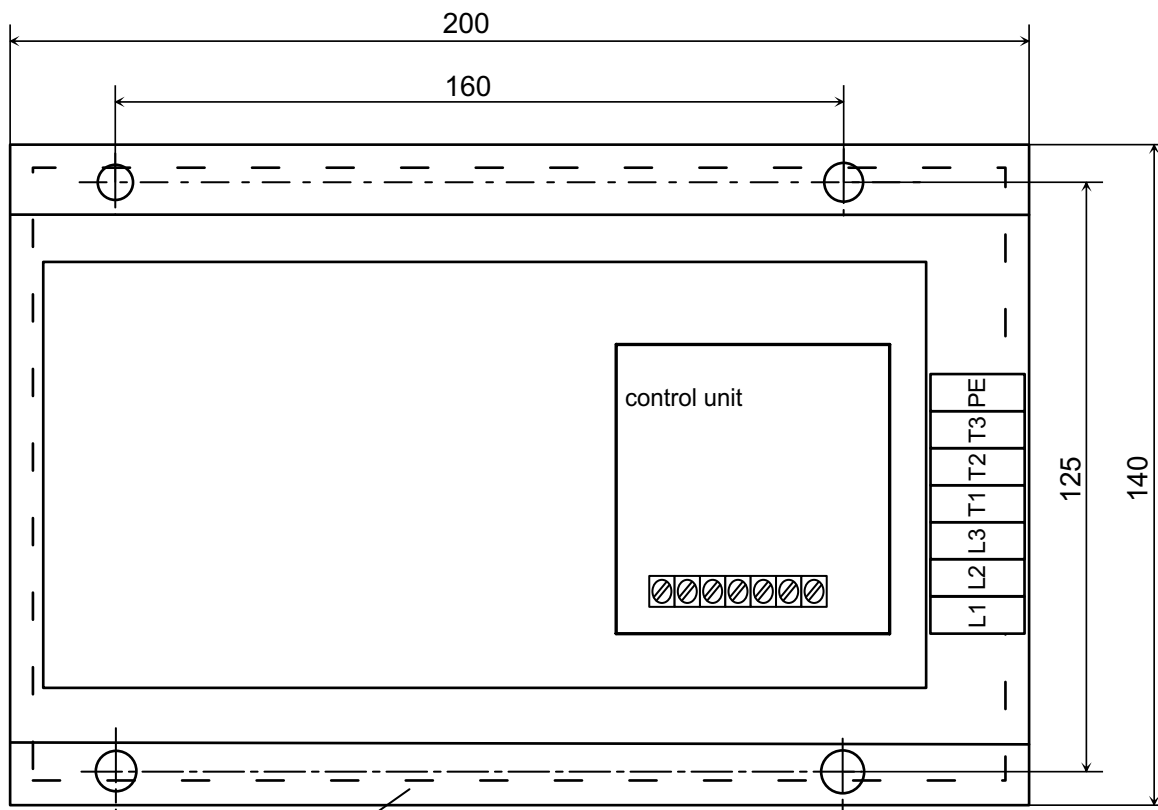
13. Load characteristics



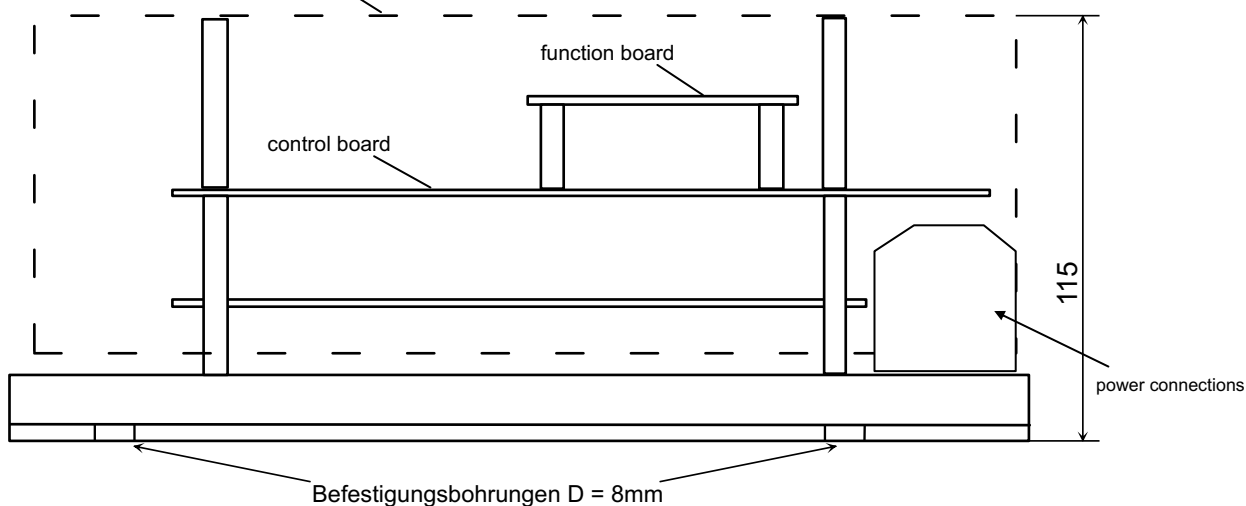


14. Frame sizes


Frame size: A



removable protection cover

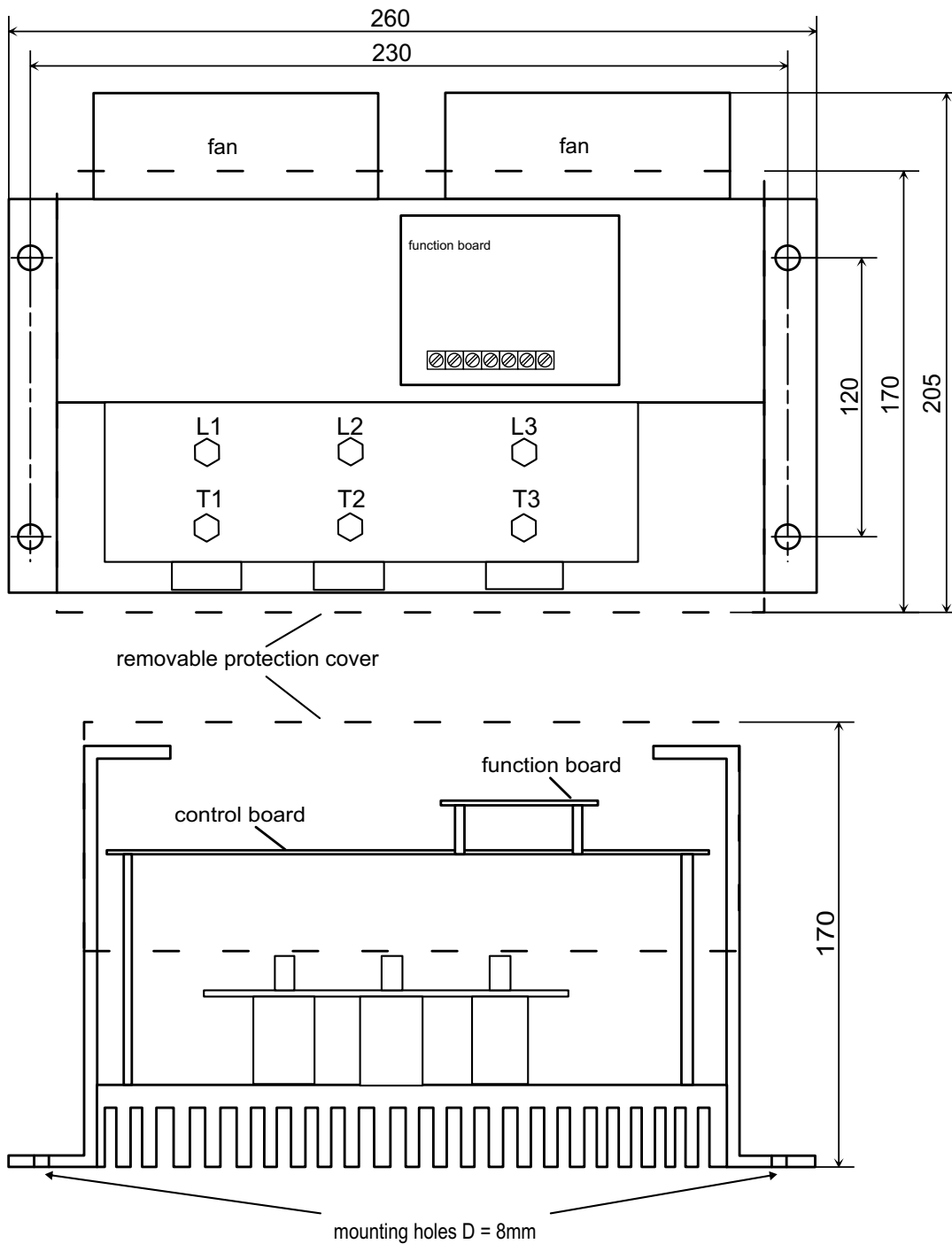


power connections (L1...T3): depending on the type (ESG / ESG-I 2,2; 3; 4 frame size A)

	date	name	 Elektroniksysteeme GmbH Eichelreuth 13 D-83224 Grassau Tel.: 08641/598360 Fax.: 08641/598364
worked:	2008/08/12	F. St.	
date:	baugröße-esg-A.des		soft-start device ESG... ESG-I... frame size A


Due to ongoing technical development and modifications we reserve the right to deliver products which might be slightly different from those described above.

Frame size: B

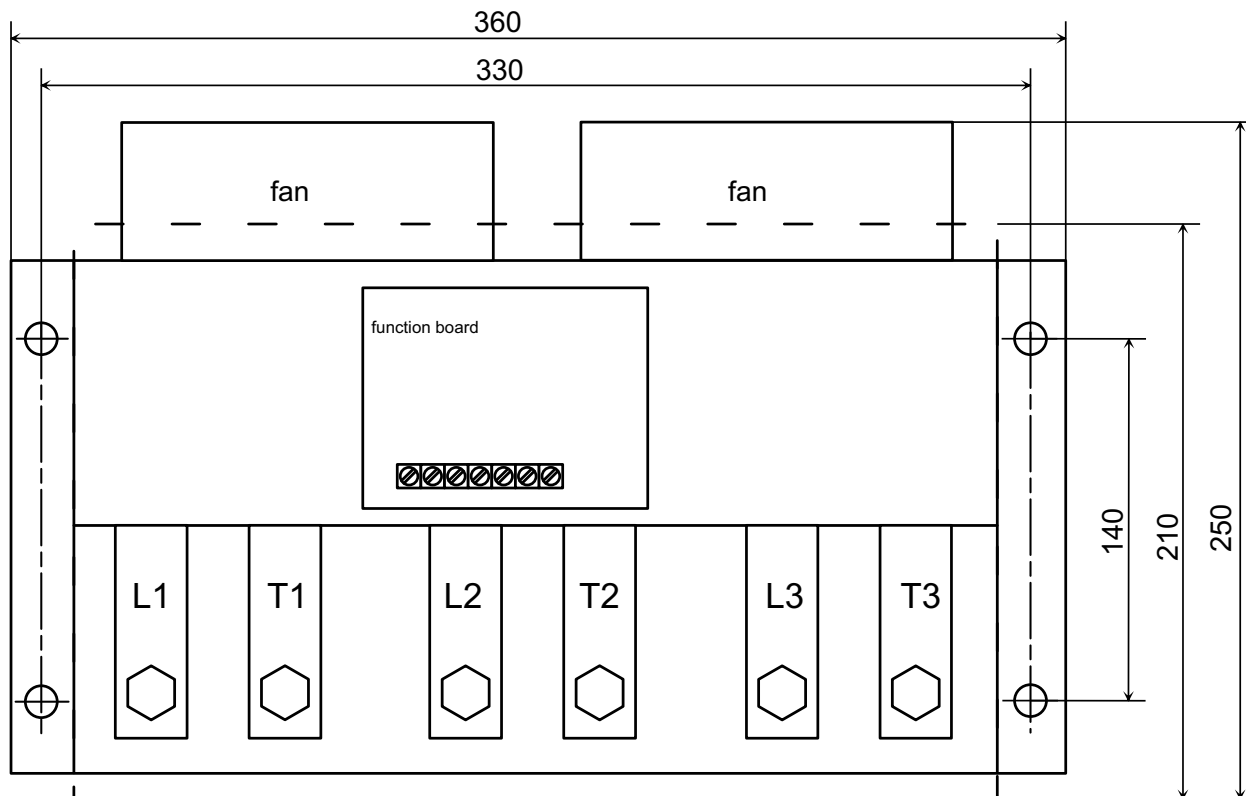


power connections (L1...T3): 1,5 bis 6mm²
 (ESG / ESG-I 5,5; 7,5; 11; 15; 18,5; 22 frame size B)

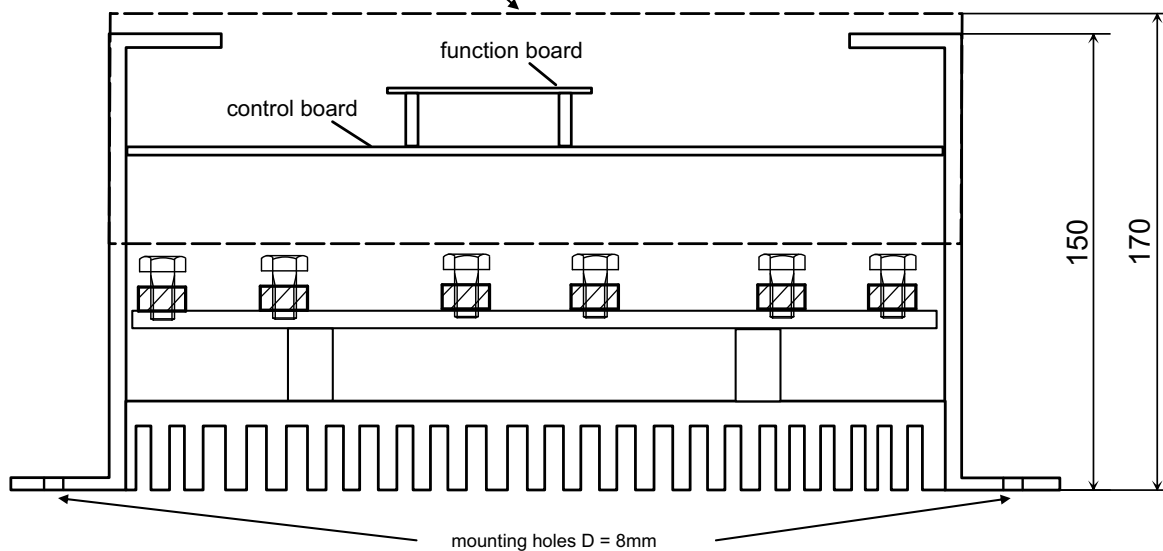
Due to ongoing technical development and modifications we reserve the right to deliver products which might be slightly different from those described above.

	date	name	 Elektroniksysteme GmbH Eichelreuth 13 D-83224 Grassau Tel.: 08641/598360 Fax.: 08641/598364
worked:	2008/08/12	F. St.	
date:	baugröße-esg-B.des		soft-start device ESG... ESG-I... frame size B

Frame size: C




removable protection cover

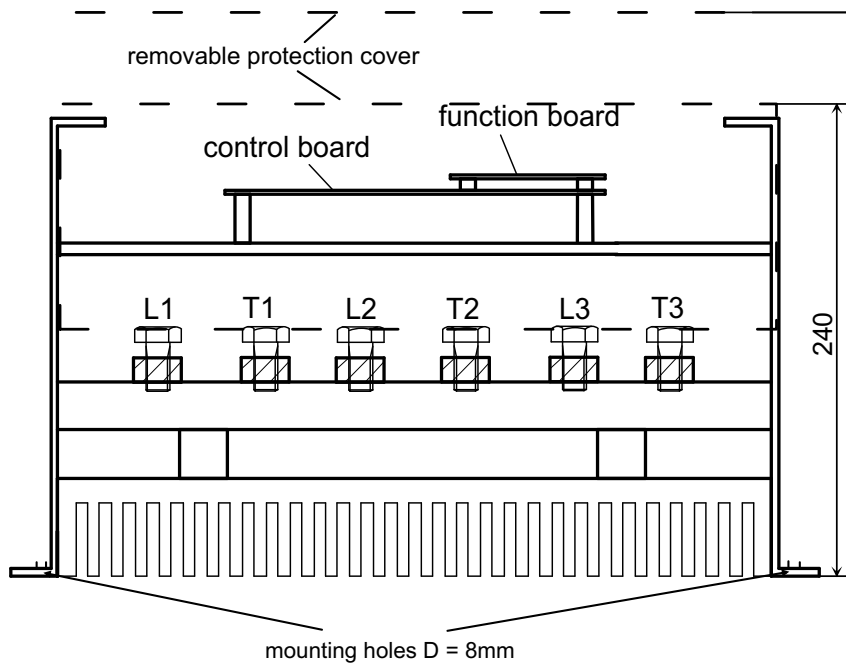
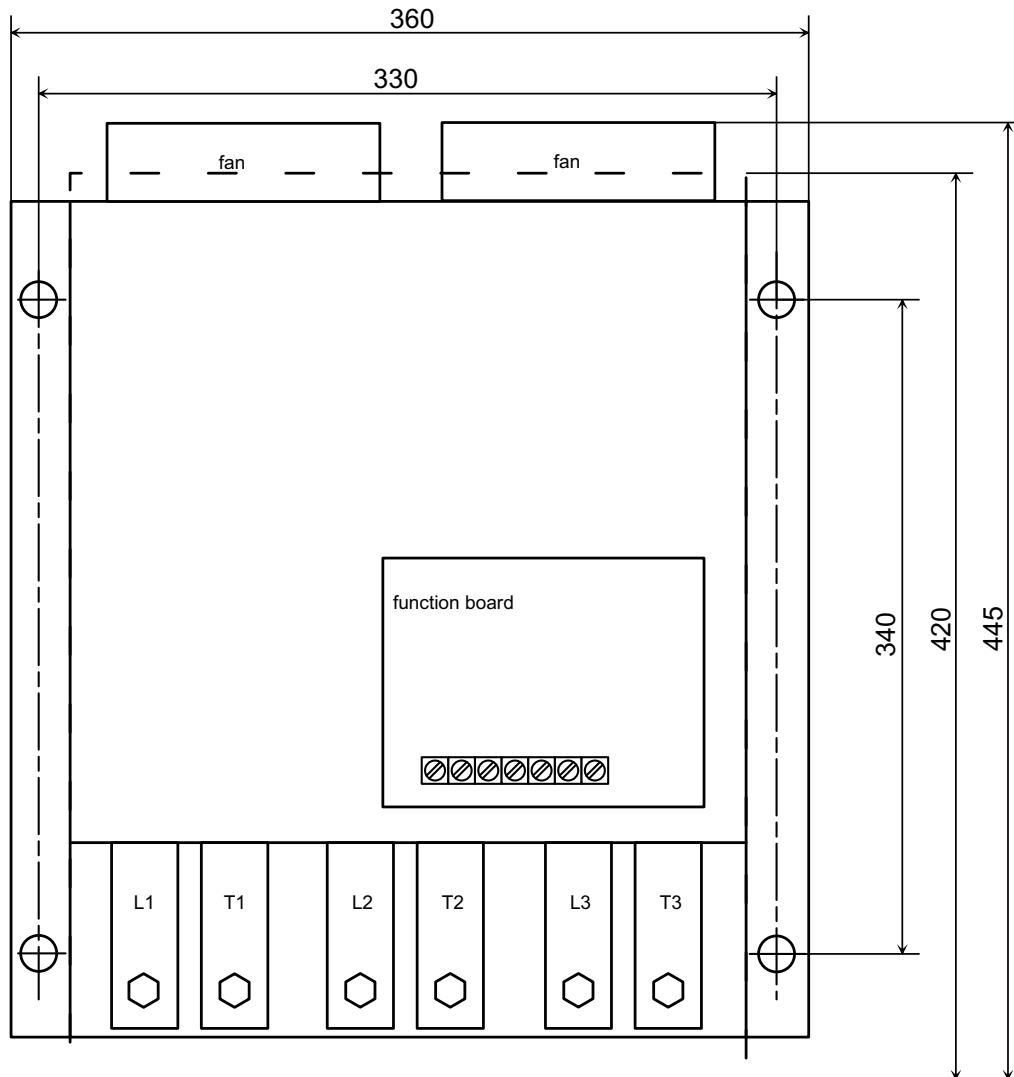


power connections (L1...T3): M8
(ESG / ESG-I 30; 37; 45; 55; 75; 90 frame size C)


Due to ongoing technical development and modifications we reserve the right to deliver products which might be slightly different from those described above.

date:	2008/08/12	name:	F. St.	 Elektroniksysteme GmbH Eichelreuth 13 D-83224 Grassau Tel.: 08641/598360 Fax.: 08641/598364
worked:				
date:	baugröße-esg-C.des			soft-start device ESG... ESG-I... frame size C

Frame size: D

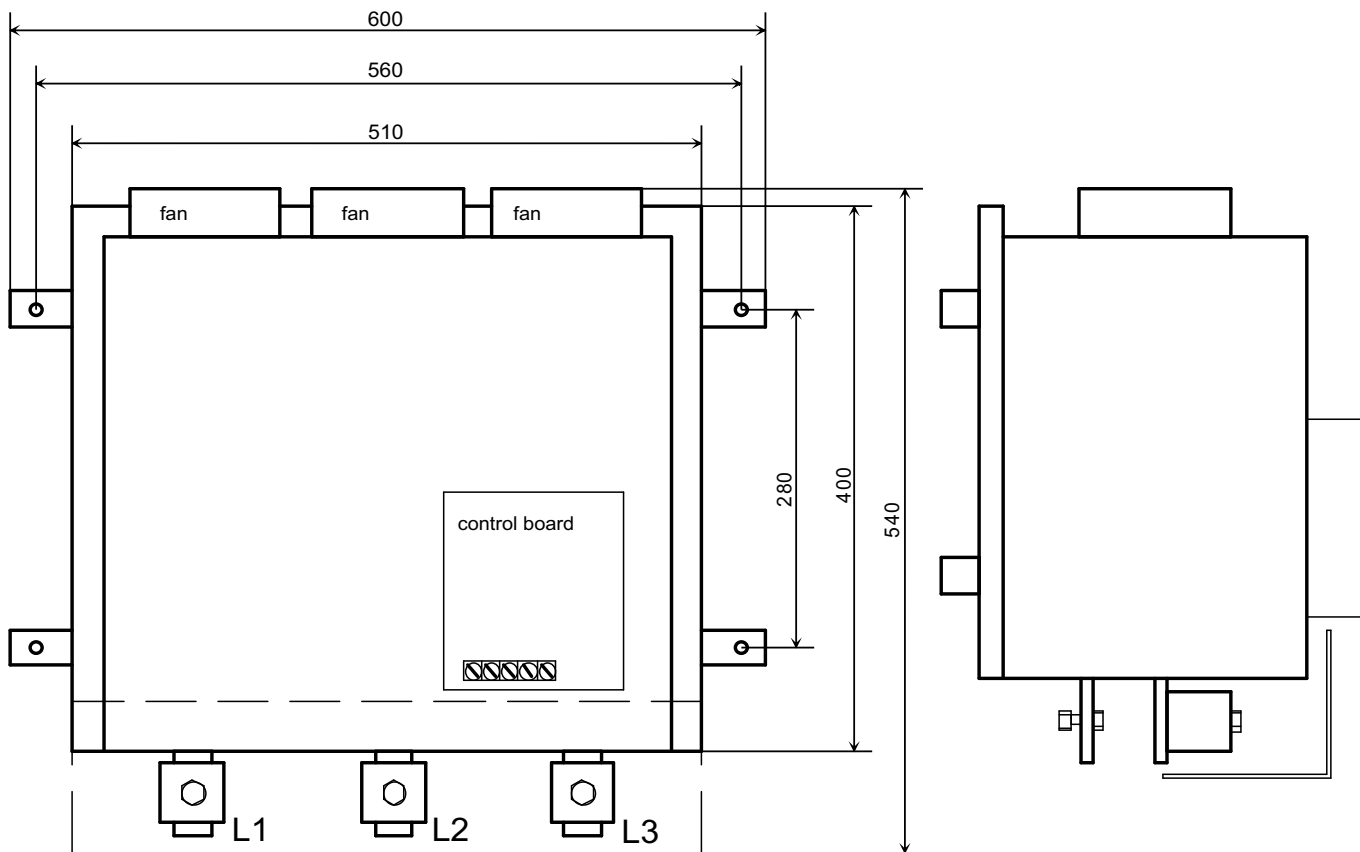


power connections (L1...T3): M8
(ESG / ESG-I 110; 140 frame size D)

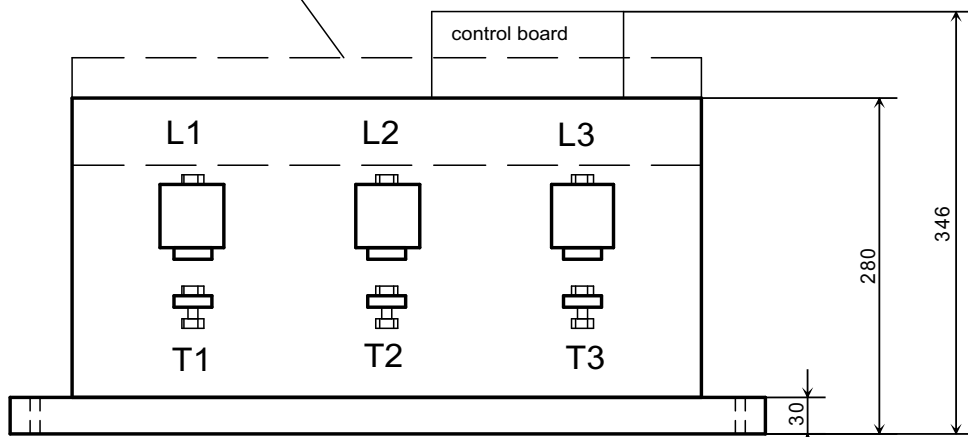
date:	2008/08/12	name:	F. St.	 Elektroniksysteme GmbH Eichelreuth 13 D-83224 Grassau Tel.: 08641/598360 Fax.: 08641/598364
worked:				
date:	baugröße-esg-D.des			soft-start device ESG... ESG-I... frame size D

Due to ongoing technical development and modifications we reserve the right to deliver products which might be slightly different from those described above.

Frame size: E




removable protection cover



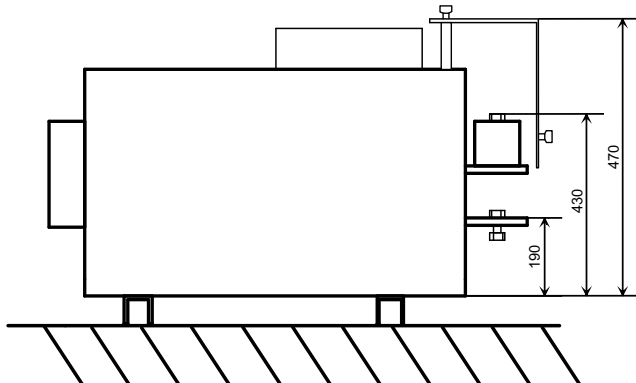
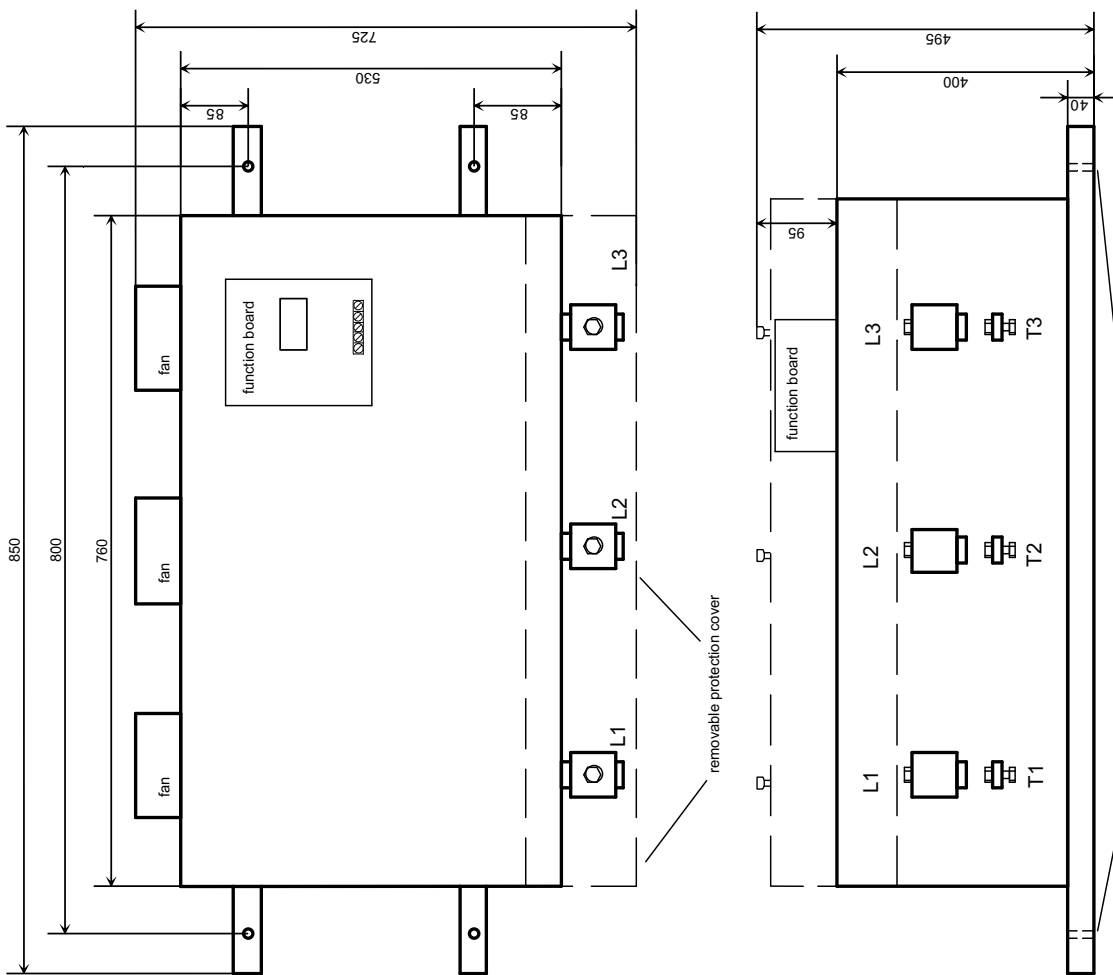
mounting holes D = 9mm

power connections (L1...T3): M10 / M8
 (ESG / ESG-I 160; 200; 250; 315; 355 frame size E)

Due to ongoing technical development and modifications we reserve the right to deliver products which might be slightly different from those described above.

date:	2008/08/12	name:	F. St.	 Elektroniksysteeme GmbH Eichelreuth 13 D-83224 Grassau Tel.: 08641/598360 Fax.: 08641/598364
worked:				
date:	baugröße-esg-E.des	soft-start device ESG... ESG-I... frame size E		

Frame size: F



Elektroniksysteme GmbH Eichleiruth 13 D-83224 Grassau Tel.: 08641/593630 Fax.: 08641/593634	
RS	
soft-start device ESG... ESG-I... frame size F	
worked:	name
	F. St.
date:	baugröße-esg-f.dwg

power connections (L1...T3): M12
(ESG / ESG-I 400; 560 frame size F)

Due to ongoing technical development and modifications we reserve the right to deliver products which might be slightly different from those described above.