

Relay S

Thyristor power controller



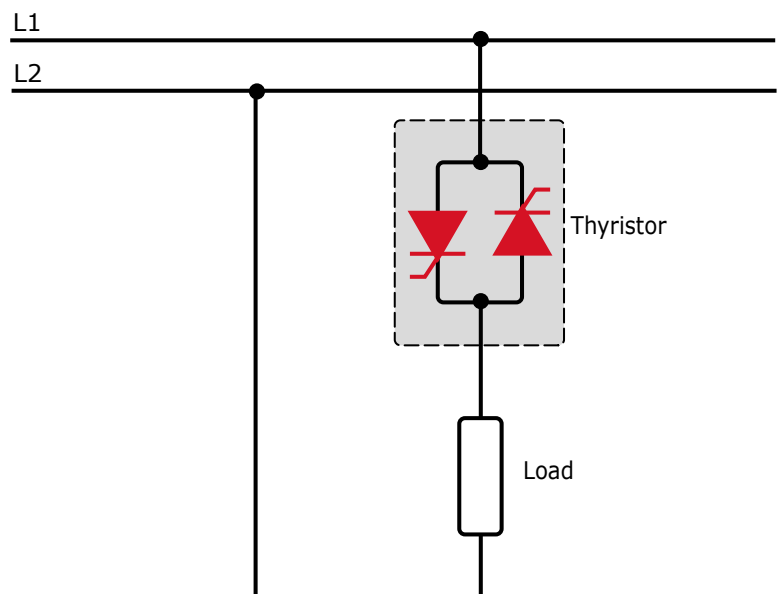
Overview

A thyristor power controller is an electronic device which functions like a switch formed by two anti-parallel thyristors. By applying the control voltage, the thyristor is turned on and the AC supply can flow. After switching off the control signal, the thyristor remains conductive until the next ac voltage zero crossing.

The advantages of thyristor actuators over electro-mechanical contactors are: No moving parts, low maintenance, very high switching frequency.

Key features

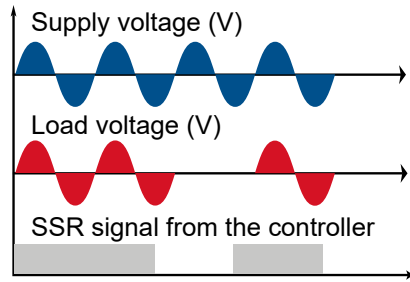
- Load voltage 24 to 690 V
- 30 to 800 A load current per phase
- 1-, 2- or 3-phase version
- Three selectable input signals
- Two selectable operating modes
- Heater current, short circuit monitoring
- Integrated semiconductor fuse
- Protection at excessive temperatures
- Led indicators for operating status and errors



Modes

Zero Crossing ZC (with SSR input only)

ZC firing mode is used with Logic Output from temperature controllers and the Thyristor operates like a contactor. The Cycle time is performed by temperature controller. ZC minimizes interferences because the Thyristor unit switches ON-OFF at zero voltage.

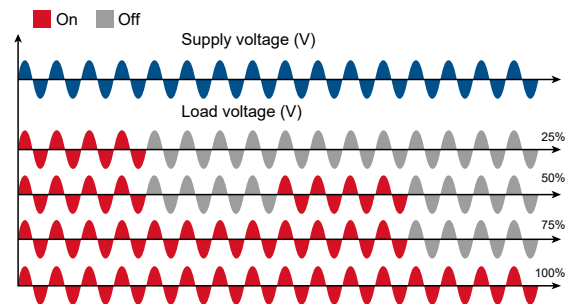


Burst Firing BF (only with analogue input)

In burst fire mode, several single cycles are sequentially switched on. ON cycles are selectable as 4, 8 or 16 with reference to a 50% input signal. This firing is performed digitally within the thyristor unit at zero volts, producing no EMC interferences.

The example shows burst fire mode with "Min Cycle" = 4.

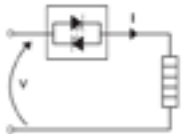
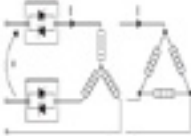
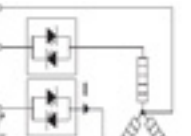
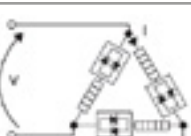
The operating modes are selected during the order, but they can be subsequently changed on the device by the user.



Application overview

	Application	Load type	Comment
Relay S 1PH		Resistance, medium and long wave-length IR emitters	For ohmic loads with low temperature coefficients or no ageing.
Relay S 2PH		Resistance	Relay S 2PH can switch delta or star connected resistors without N.
Relay S 3PH		Resistance	For 3 phases and N, all 3 phases must be controlled.
Relay S 1PH		Three-phase resistance load Open delta	

Relay S Function Overview

	Model	Number of devices	Controlled phases	Recommended operating mode		Dimensions	
				Zero cross Switching	Burst Fire	V	I
	Relay S 1PH	1	1	•	•	V	$\frac{P}{V}$
	Relay S 2PH	1	2		•	V	$\frac{P}{1.73 V}$
	Relay S 3PH	1	3		•	$\frac{V}{1.73}$	$\frac{P}{1.73V}$
	Relay S 1PH	3	3	•	•	V	$\frac{P}{3 V}$

	Description	Relay S		
		1-phase	2-phase	3-phase
	Version:			
Load type	Max. voltage 480 V	•	•	•
	Max. voltage 600 V	•	•	•
	Max. voltage 690 V	• from 60 A	• from 60 A	• from 60 A
	Single phase	•		
	3-phase load, star (no neutral) or delta		•	•
	3-phase load, star with neutral			•
Input signal	3-phase load, open delta			•
	SSR 4 - 30V	•	•	•
	4 - 20 mA	○	○	○
operating mode	0 - 10 V	○	○	○
	Zero-cross switching	•	•	•
	Burst Fire Operation (1)	•	•	•
	Heater current and short circuit monitoring	○	○	○
	Fuse and fuse holder	○ ≤ 40A	○ ≤ 40A	○ ≤ 40A
	Integrated fuse	• > 40 A	• > 40 A	• > 40 A

• = Standard

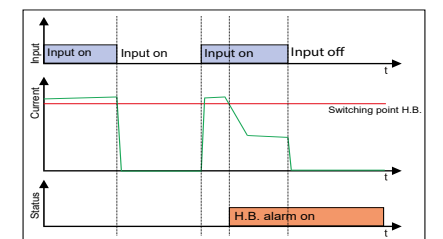
○ = Option

(1) Burst Fire operation only in conjunction with an analogue input signal

Heater current monitoring

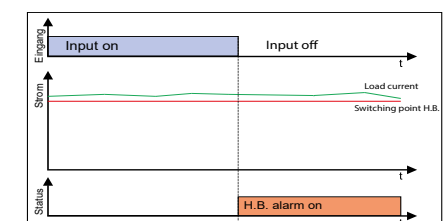
The heater current monitoring is an option to detect partial and total load failure. The device continuously measures the current value. The set point for the typical current consumption is stored by the user via the button on the front of the device or via the digital input. As soon as the present measured current value falls below the assigned set point value by 20%, an alarm is triggered (relay output).

Heater current monitoring - Alarm when load conditions exceeded



So that the set point is saved during a fluctuating current measurement, the unit saves five values and the mean value. Once there are three equal averages in succession, this value is multiplied by 0.8 and stored as the switching point for the heater current monitoring. This compensates for voltage fluctuations and thus avoids false alarms. The electronics also monitors the thyristor element for short circuit (= defective thyristor) and sends an alarm signal to the relay output.

Heater current monitoring - Alarm for thyristor short circuits



Dimensions and weight

Load current	Housing type					
	1-phase		2-phase		3-phase	
	480,600 V	690 V	480,600 V	690 V	480,600 V	690 V
30	SR3 (1), SR6		SR4 (1), SR7		SR5 (1), SR8	
35	SR3 (1), SR6		SR4 (1), SR7		SR5 (1), SR8	
40	SR3 (1), SR6		SR4 (1), SR7		SR5 (1), SR8	
60	SR12	S11	SR15	S11	SR16	S11
90			SR15		SR16	
120	SR15	S11	SR15	S11	SR17	S11
150	SR15	S11	SR16	S13	SR17	S13
180	SR15	S11	SR16	S13	SR17	S13
210	SR15	S11	SR16	S13	SR17	S13
300	SR15	S11	SR16	S13	SR17	S13
400	S12	S12	S14	S14	S14	S14
450					S14	S14
500	S12	S12	S14	S14	S14	S14
600			S14	S14	S14	S14
700	S12	S12	S14	S14	S14	S14
800	S12	S12	S14	S14	S14	S14

CE and UL version Only in CE version Only in UL version (1) Version without a fuse



Technical specifications

Single-phase versions

General

Material of cover and base:	V2 Polymer
Mounting:	DIN rail (maximum thickness 1 mm) - only 30 - 40 A version
Utilisation category	AC-51 AC-55b AC-56 A
Protection	IP 20
Load	1-PH Single-phase
Supply voltage with option HB/analogue input:12-24 VAC/DC for devices up to 210 A, max. 70 mA	
Supply voltage > 210 A: max. 8 VA for the electronics	
Order number:RS1 ___ - _1 - Mains voltage:100/120 V transformer range 90 to 135 V	
Order number:RS1 ___ - _2 - Mains voltage:200/208/220/230/240 V Transformer range 180 to 265 V	
Order number:RS1 ___ - _3 - Mains voltage:277 V transformer range 238 to 330 V	
Order number:RS1 ___ - _5 - Mains voltage:380/400/415/440/480 V Transformer range 342 to 528 V	
Order number:RS1 ___ - _6 - Mains voltage:600 V transformer range 540 to 759 V	
Order number:RS1 ___ - _7 -Mains voltage:690 V Transformer range 540 to 759 V	
Important:The load voltage must be within the above ranges.	
Relay output for the HB alarm (only with the HB option)	125 VAC 0.5 A

Input

Analogue input V:	0 - 10 VDC Impedance 15 kΩ
Analogue input A:	4 - 20 mA Impedance 100 Ω
SSR input	7 - 30 VDC 5 mA max. (ON> 7 VDC OFF < 1 VDC)
Digital input (Calib. input, only with the HB option)	12 - 24 V AC / DC, 30 - 40 A:37 mA, from 60 A:5 mA

Output

Current	Load voltage range (Ue)	Repeatable peak blocking voltage Uimp:	Holding current	Max. peak current (one cycle)	Leakage current	Fuse I ² T recommended value for 500 VAC	Frequency range	Power loss Thyristor + fuse	Isolation voltage (Ui)	
(A)	(V)	(480 V) (600 V)	(MArms)	(10 ms) (A)	(MArms)	tp = 10 ms	(Hz)	I = Inom (W)	(V)	
30	24 - 600	1200	1600	250	360	15	525	47 - 70	38	2500
35	24 - 600	1200	1600	250	540	15	1260	47 - 70	44	2500
40	24 - 600	1200	1600	250	700	15	1260	47 - 70	50	2500
60	24 - 600	1200	1600	600	1900	15	10780	47 - 70	102	3000
90	24 - 600	1200	1600	600	1900	15	10780	47 - 70	145	3000
120	24 - 600	1200	1600	600	1900	15	14280	47 - 70	200	3000
150	24 - 600	1200	1600	300	5000	15	17500	47 - 70	205	3000
180	24 - 600	1200	1600	300	5000	15	30800	47 - 70	235	3000
210	24 - 600	1200	1600	300	5000	15	53900	47 - 70	304	3000
300	24 - 600	1200	1600	200	7800	15	73500	47 - 70	443	3000
400	24 - 600	1200	1600	200	7800	15	150500	47 - 70	547	3000
500	24 - 600	1200	1600	1000	17800	15	294000	47 - 70	591	2500
600	24 - 600	1200	1600	1000	17800	15	246400	47 - 70	832	2500
700	24 - 600	1200	1600	1000	17800	15	246400	47 - 70	945	2500
800	24 - 600	1200	1600	1000	15000	15	246400	47 - 70	1144	2500

Fan specification

480 - 600 V version:

60 - 210 A:

Supply voltage 230 VAC (default)

Supply voltage 115 VAC (option)


Supply voltage 24 VDC (option)

Power 16 W (one fan)

Power 14 W (one fan)

Power 7 W (one fan)

300 - 800 A:

Device type and power supply fan:	Number of fans for 	Number of fans for 
230 V:		
300, 400 A, 500 A, 600 A	16 W fan	Two fans 32 W (2 x 16 W)
700 A	Two fans 32 W (2 x 16 W)	Two fans 32 W (2 x 16 W)
800 A	Two fans 32 W (2 x 16 W)	Two fans 32 W (2 x 16 W)
115 V:		
300, 400 A, 500 A, 600 A	14 W fan	Two fans 28 W (2 x 14 W)
700 A	Two fans 28 W (2 x 14 W)	Two fans 28 W (2 x 14 W)
800 A	Two fans 28 W (2 x 14 W)	Two fans 28 W (2 x 14 W)
24 V DC		
300, 400 A, 500 A, 600 A	7 W fan	Two fans 14W (2 x 7 W)
700 A	Two fans 14W (2 x 7 W)	Two fans 14W (2 x 7 W)
800 A	Two fans 14W (2 x 7 W)	Two fans 14W (2 x 7 W)

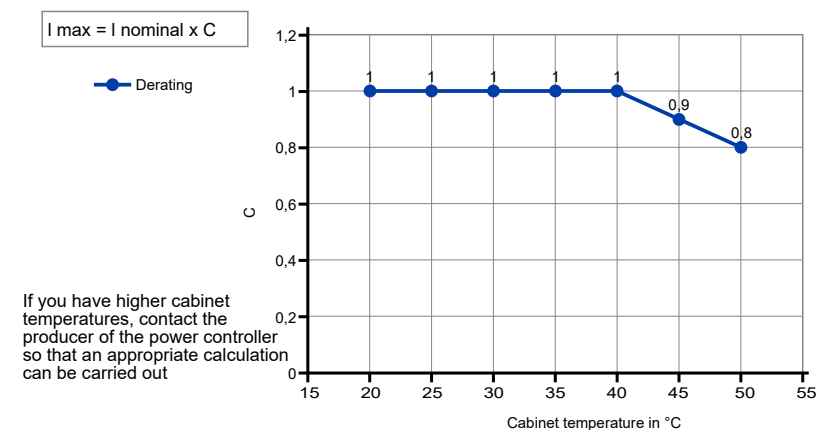
690 V version:

Load current	230 V AC	115 V AC	24 V DC
60, 90, 120, 150, 180, 210 A	16 W fan	14 W fan	7 W fan
300, 400, 500, 600 A	16 W fan	14 W fan	7 W fan
700 A	Two fans 32 W (2 x 16 W)	Two fans 28 W (2 x 14 W)	Two fans 14W (2 x 7 W)
800 A	Two fans 32 W (2 x 16 W)	Two fans 28 W (2 x 14 W)	Two fans 14W (2 x 7 W)

Environmental conditions

Ambient temperature	0-40 °C (32-104 °F) up to rated current. Observe the derating curve above 40 °C (104 °F).
Storage temperature	-25 °C to 70 °C (-13 °F to 158 °F)
Installation location	Do not install in places where direct sunlight, conductive dust, corrosive gas, vibrations or water are present, or where the environment is saline.
Sea level	All specifications are valid up to 1000 m above sea level. For higher altitudes, the maximum load current is reduced by 2% for each 100 m over 1000 m.
Humidity	5 - 95% relative humidity with no condensation or icing
Pollution degree	Up to pollution degree 2 (IEC 60947-1 6.1.3.2)

Derating curve



Installation conditions:

All thyristor units have power losses whilst they are in operation. This leads to heat generated within the control cabinet. For this reason, the internal temperature of the control cabinet is higher than the ambient temperature.

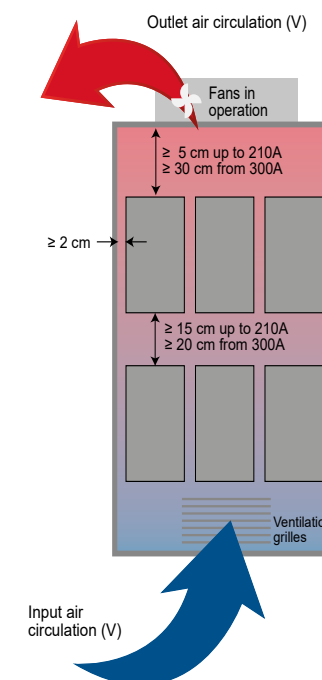
Observe the minimum distances in the vertical and horizontal as shown, this area must be free of obstacles (wire, copper rail, plastic channel).

If several devices are mounted in the cabinet, ensure that the air circulation is uninhibited as shown in the illustration.

It may be necessary to use an additional fan cooling system.

The volume of air flow must at least comply with the calculated values.

$V = f \cdot \frac{Q_v}{t_c - t_a}$	Q_v = Total power loss (w) (Loss at the thyristor and the fuse)	Height → (Height coefficient) 0 - 100 metres f = 3.1 m ³ K/Wh 100 - 250 metres f = 3.2 m ³ K/Wh 250 - 500 metres f = 3.3 m ³ K/Wh 500 - 750 metres f = 3.4 m ³ K/Wh
	t_a = Ambient temperature (°C)	
	t_c = Cabinet temperature (°C)	
	V = Fan air mass flow (m ³ /h)	
	f = Height coefficient (see right column)	



Wiring instructions

The thyristor controller in some circumstances could be disrupted by interference from other devices or via the mains supply. For this reason, the following precautions should be taken:

- Coils of contactors, relays and other inductive loads must be equipped with a suitable RC filter.
- Use shielded bipolar cables for all input and output signals.
- Signal cables must not be routed near or parallel to the power cables.
- Local regulations for electrical installation must always be followed.

Only use copper cables or copper busbars rated for at least 75 °C (90 °C for 30 - 40 A), which are listed for field wiring, line ratings (AWG), line terminal type (ZMVV), and torques as shown in the performance table - load cable and load rail dimensions charts .

Power connections (recommended)					
Type	Terminal type	Torque	Cable cross section	Max. terminal current	Wire ends UL-listed (ZMVV)
030 035 040	M5 screw	3.0 Nm	1.5 - 10 mm ² (AWG 16 - 8)	45 A	Solid/Flexible Fork cable lug

Cable sizes of the control cables: 0.5 mm² (AWG 18)
Temperature class 90°C or higher

Cable sizes for ground connection (recommended): 6 mm² (AWG 18)
Temperature class 75 °C or higher

Power connections (recommended)					
Type	Terminal type	Torque	Cable cross section	Max. terminal current	Wire ends UL-listed (ZMVV)
060 090 120	M6 screw	8.0 Nm	16 mm ² (AWG 5) 25 mm ² (AWG 3) 35 mm ² (AWG 2)	150 A	Fork cable lug Copper pipe Crimp connections
150 180 210	M8 screw	16.0 Nm	50 mm ² (AWG 0) 70 mm ² (AWG 00) 90 mm ² (AWG 000)	250 A	

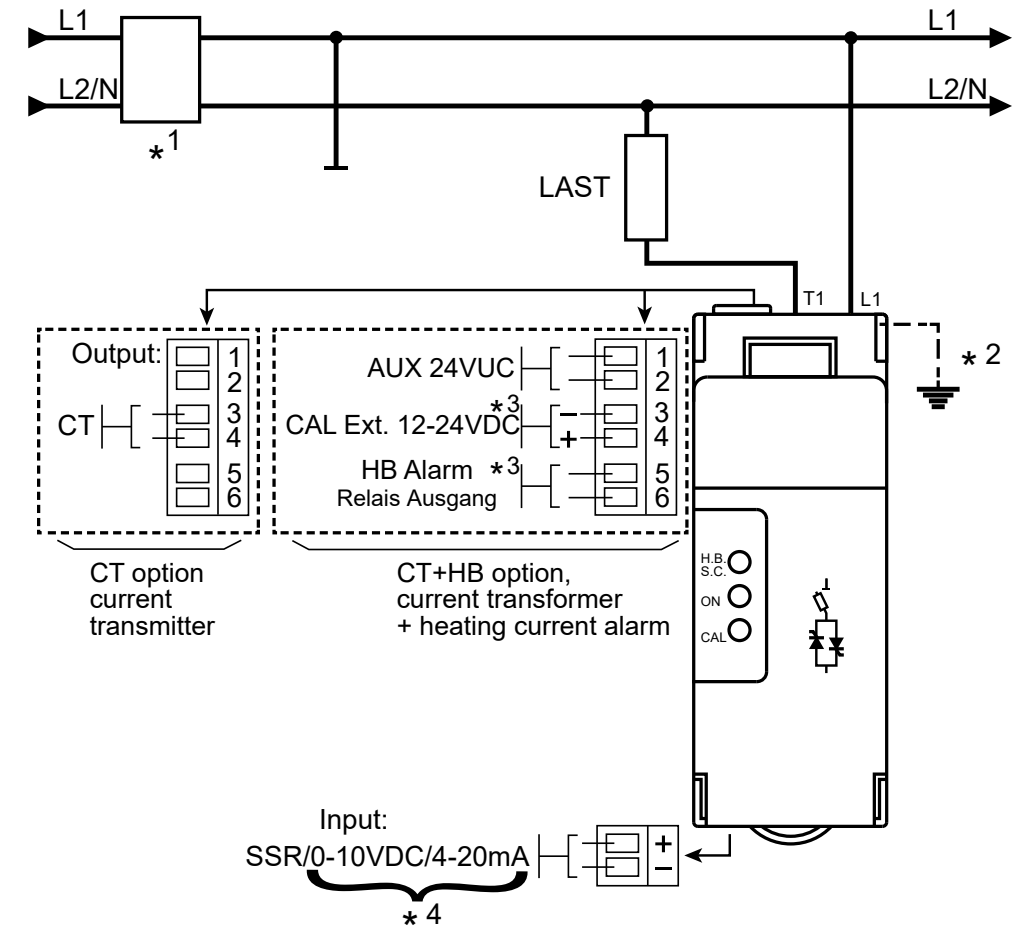
Cable sizes of the control cables: 0.5 mm² (AWG 4)
Temperature class 90°C or higher

Cable sizes for ground connection (recommended): 6 mm² (AWG 4)
Temperature class 75 °C or higher

Current	Connection type	Torque (Nm)	Cables			Cable connection	Busbar (mm)
			AWG	mm ²	kcmil		
300 A (S14)	Wiring of the power Busbar with an M10 screw	30.0 Nm	2 x 1/0	2 x 70	350	UL-listed (ZMVV) Fork cable lug copper tube crimp connections	30 x 5mm
400 A (S14)			2 x 3/0	2 x 95	600		66 x 4 mm
500 A (S14)			-	2 x 150	2 x 250 900		66 x 6 mm
600 A (S14)			-	2 x 185	2 x 350 1500		66 x 6 mm
700 A (S14)			-	2 x 300	2 x 500		66 x 6 mm
800 A (S16)			-	2 x 300	2 x 500		66 x 6 mm

Connection diagram

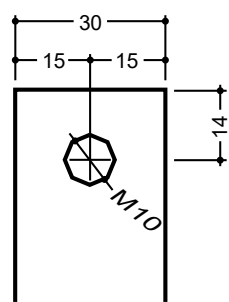
30 to 40 A



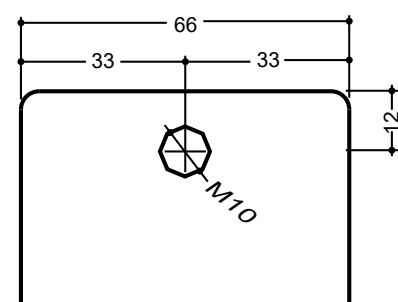
Note:

- * 1 A suitable device (a load contactor or a fused switch disconnector) must ensure that the system can be galvanically isolated from the power supply. This enables the qualified persons to work safely.
- * 2 The heat sink must be connected to the ground.
- * 3 Only for the HB option
- * 4 The analogue input is isolated from Aux Supply, except with the analogue entry option. A series connection between the analogue inputs of the devices is not possible. With AC-Aux supply, it is not possible to connect the zero point of the analogue input to the ground. With the DC Aux supply, it is not possible to connect the zero point of the power supply to the zero point of the analogue input.

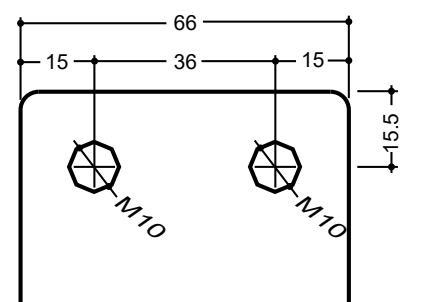
1PH 300A



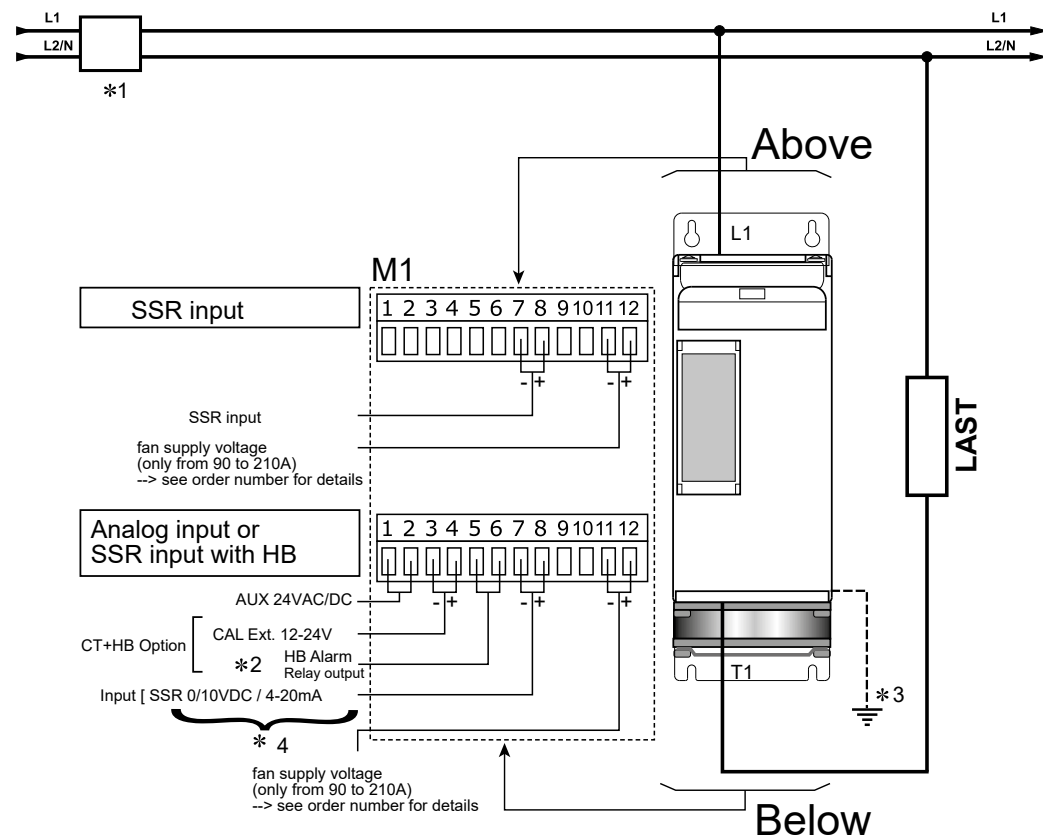
1PH 400A



1PH 500-800A



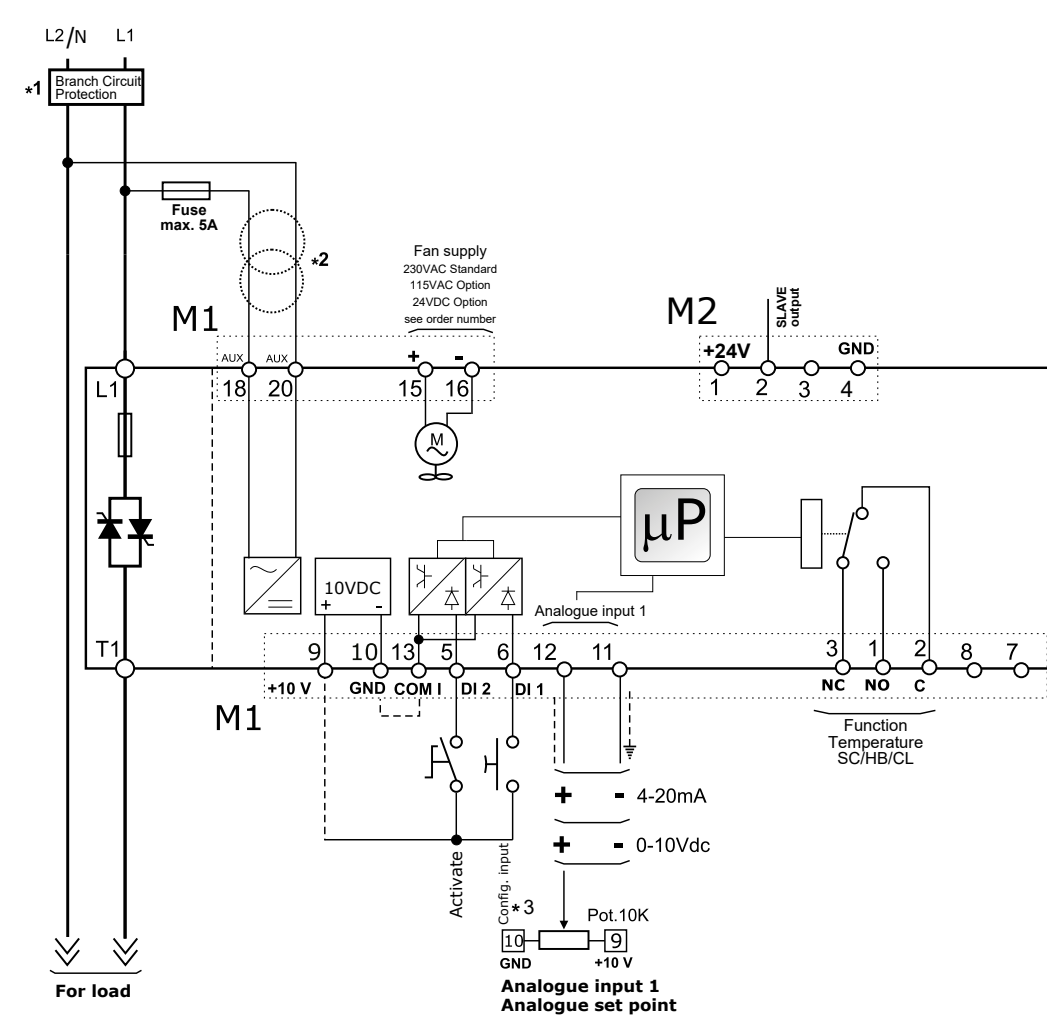
60 to 210 A - 480/600 V



Note:

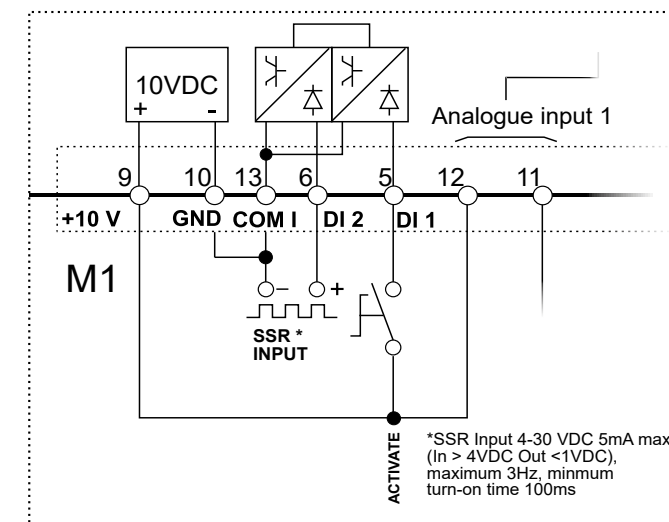
- * 1 A suitable device (a load contactor or a fused switch disconnecter) must ensure that the system can be galvanically isolated from the power supply. This enables the qualified persons to work safely.
- * 2 The heat sink must be connected to the ground.
- * 3 Only for the HB option
- * 4 The analogue input is isolated from Aux Supply, except with the analogue entry option. A series connection between the analogue inputs of the devices is not possible. With AC-Aux supply, it is not possible to connect the zero point of the analogue input to the ground. With the DC Aux supply, it is not possible to connect the zero point of the power supply to the zero point of the analogue input

300 to 800 A - 480/600 V



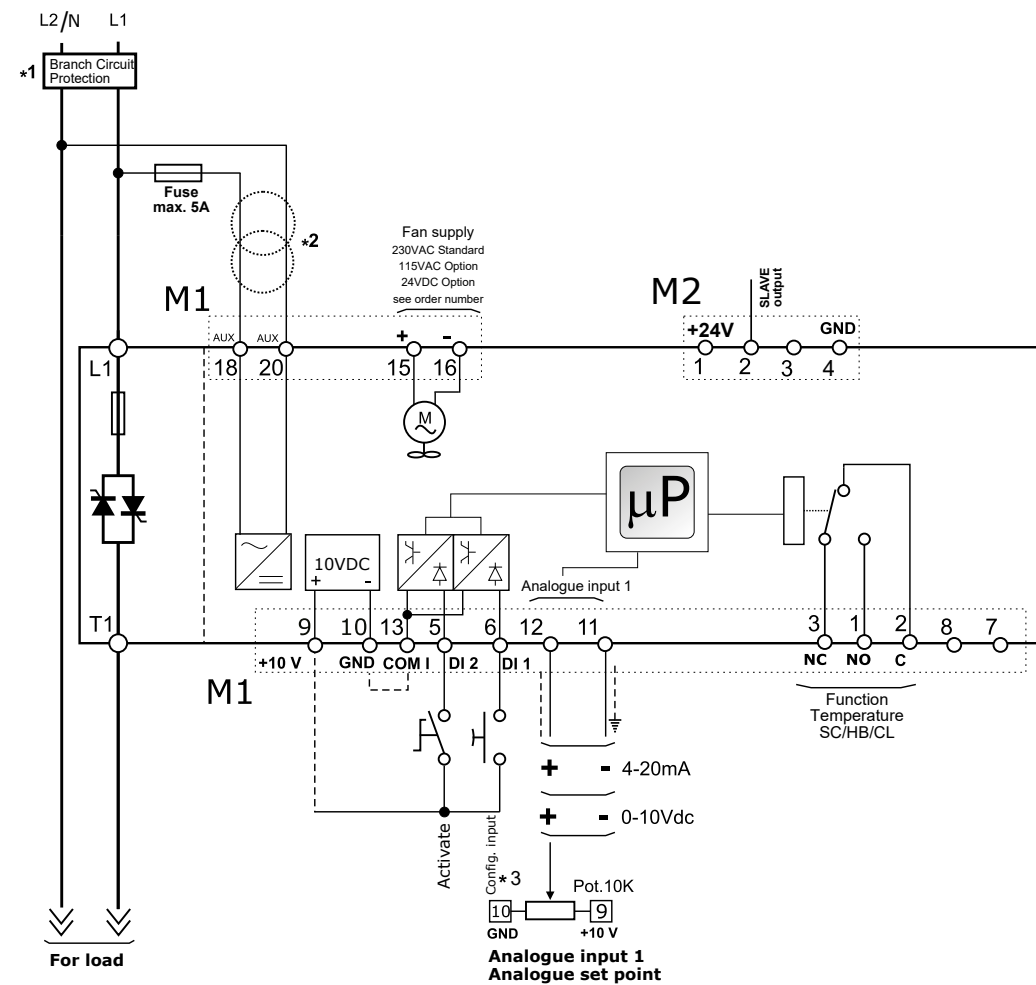
Note:

- * 1 The installation must be protected by a circuit breaker or a fused switch disconnecter.
- The fuse must be in accordance with "branch circuit protection". For UL, all external fuses are suitable according to the "National Electrical Code" for ohmic loads with 125% load current nominal value to protect the external lines.
- * 2 The power supply for relay S electronics must be synchronised with the load voltage. The required power supply for the electronics can be gauged from the order number. If this differs from the load voltage, use an external transformer as indicated.
- * 3 For an SSR input, please use this wiring:



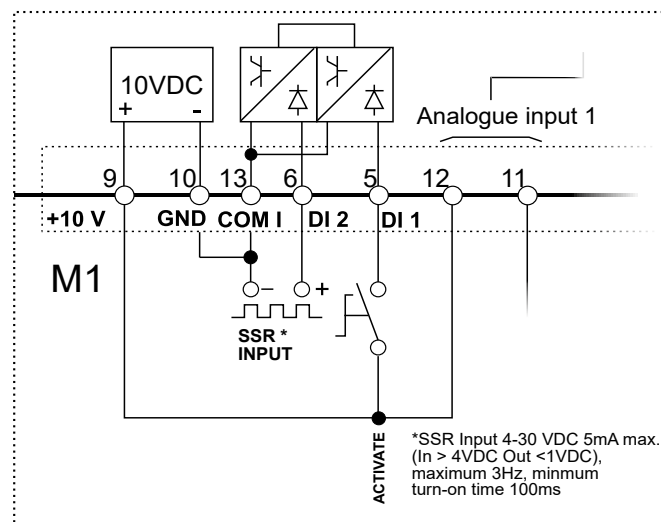
*SSR Input 4-30 VDC 5mA max (In > 4VDC Out <1VDC), maximum 3Hz, minimum turn-on time 100ms

60 to 800 A - 690 V



Note:

- * 1 The installation must be protected by a circuit breaker or fuse disconnecter. The fuse must be in accordance with "branch circuit protection".
- * 2 The power supply for relay S electronics must be synchronised with the load voltage. The required power supply for the electronics can be gauged from the order number. If this differs from the load voltage, use an external transformer as indicated.
- * 3 For an SSR input, please use this wiring:



*SSR Input 4-30 VDC 5mA max.
(In > 4VDC Out <1VDC),
maximum 3Hz, minimum
turn-on time 100ms

Two-phase versions

General

30 - 40 A

Material of cover and base:	V2 Polymer
Mounting:	DIN rail (thickness 1 mm max)
Utilisation category	AC-51 AC-55b
Protection	IP 20
Load	Load in delta connection, load in star connection
Only for version with integrated backup:	
Relay output for the HB alarm (only with the HB option)	125 VAC 0.5 A

From 60 A:

Material of cover and base:	V2 Polymer
Utilisation category	AC-51 AC-55b
Protection	IP 20
Load	Load in delta connection, load in star connection
Supply voltage with option HB/analogue input: 12-24 VAC/DC for devices up to 210 A, max. 70 mA Supply voltage for the control electronics, 8 VA max.	
Order number: RS2 ___ - 1 - Mains voltage: 100/120 V transformer range 90 to 135 V	
Order number: RS2 ___ - 2 - Mains voltage: 200/208/220/230/240 V Transformer range 180 to 265 V	
Order number: RS2 ___ - 3 - Mains voltage: 277 V Transformer range 180 to 265 V	
Order number: RS2 ___ - 5 - Mains voltage: 380/400/415/440/480 V Transformer range 342 to 528 V	
Order number: RS2 ___ - 6 - Mains voltage: 600 V Transformer range 238 to 330 V	
Order number: RS2 ___ - 7 - Mains voltage: 690 V Transformer range 540 to 759 V	
Important: The load voltage must be within the above ranges.	
Relay output for the HB alarm (only with the HB option)	125 VAC 0.5 A

Input

Analogue input V:	0 - 10 VDC Impedance 15 kΩ
Analogue input A:	4 - 20 mA Impedance 100 Ω
Potentiometer	10 kΩ min.
Digital input	4 - 30 VDC 5 mA max. (ON > 4 VDC OFF < 1 VDC)

Output

Current	Load voltage range (Ue)	Repeatable peak blocking voltage Uimp:	Holding current	Max. peak current (one cycle)	Leakage current	Fuse I ² T recommended value for 500 VAC	Frequency range	Power loss Thyristor + fuse	Isolation voltage (Ui)	
(A)	(V)	(480 V) (600 V)	(MArms)	(10 ms) (A)	(MArms)	tp = 10 ms	(Hz)	I = Inom (W)	(V)	
30	24 - 600	1200	1600	250	360	15	525	47 - 70	76	2500
35	24 - 600	1200	1600	250	540	15	1260	47 - 70	88	2500
40	24 - 600	1200	1600	250	700	15	1260	47 - 70	100	2500
60	24 - 600	1200	1600	600	1900	15	10780	47 - 70	205	3000
90	24 - 600	1200	1600	600	1900	15	10780	47 - 70	290	3000
120	24 - 600	1200	1600	600	1900	15	14280	47 - 70	398	3000
150	24 - 600	1200	1600	300	5000	15	17500	47 - 70	409	3000
180	24 - 600	1200	1600	300	5000	15	30800	47 - 70	486	3000
210	24 - 600	1200	1600	300	5000	15	53900	47 - 70	598	3000
300	24 - 600	1200	1600	200	7800	15	73500	47 - 70	903	3000
400	24 - 600	1200	1600	200	7800	15	149000	47 - 70	1092	3000
450	24 - 600	1200	1600	200	7800	15	215600	47 - 70	1259	3000
500	24 - 600	1200	1600	200	8000	15	215600	47 - 70	1407	3000
600	24 - 600	1200	1600	1000	17800	15	294000	47 - 70	1528	3000
700	24 - 600	1200	1600	1000	17800	15	294000	47 - 70	1753	3000
800	24 - 600	1200	1600	1000	15000	15	246400	47 - 70	2281	2500

Fan specification

For 480 - 600 V:

60 - 90 A:

Supply voltage 230 VAC (default)
Supply voltage 115 VAC (option)
Supply voltage 24 VDC (option)



Power 32 W (one fan 16 W)
Power 32 W (one fan 14 W)
Power 14 W (one fan 7 W)

120 - 210 A:

230 VAC (standard) supply voltage
115 VAC supply voltage (option)
24 VDC supply voltage (option)

Power 32 W (16 W for each of the two fans)
Power 32 W (14 W for both fans)
Power 14 W (7 W for both fans)

300 - 800 A:

Device type	Number of fans for 	Number of fans for 
230 V:		
300, 400 A, 500 A, 600 A	Two fans 32 W (2 x 16 W)	Four fans 64 W (4 x 16 W)
700 A	Four fans 64 W (4 x 16 W)	Four fans 64 W (4 x 16 W)
800 A	Four fans 64 W (4 x 16 W)	Four fans 64 W (4 x 16 W)
115 V:		
300, 400 A, 500 A, 600 A	Two fans 28 W (2 x 14 W)	Four fans 56 W (4 x 14 W)
700 A	Four fans 56 W (4 x 14 W)	Four fans 56 W (4 x 14 W)
800 A	Four fans 56 W (4 x 14 W)	Four fans 56 W (4 x 14 W)
24 V DC		
300, 400 A, 500 A, 600 A	Two fans 14W (2 x 7 W)	Four fans 28 W (4 x 7 W)
700 A	Four fans 28 W (4 x 7 W)	Four fans 28 W (4 x 7 W)
800 A	Four fans 28 W (4 x 7 W)	Four fans 28 W (4 x 7 W)

690 V version:

Load current	230 V AC	115 V AC	24 V DC
60 - 90 A	16 W fan	14 W fan	7 W fan
120, 150, 180, 210 A	Two fans 32 W (2 x 16 W)	Two fans 28 W (2 x 14 W)	Two fans 14W (2 x 7 W)
300, 400, 500 A	Four fans 64 W (4 x 16 W)	Four fans 64 W (4 x 14 W)	Four fans 28 W (4 x 7 W)
600, 700, 800 A	Six fans 84 W (6 x 16 W)	Six fans 84 W (6 x 14 W)	Six fans 42 W (6 x 7 W)

Environmental and installation conditions, derating curve

See single-phase versions (page 9)

Wiring instructions

The thyristor controller in some circumstances could be disrupted by interference from other devices or via the mains supply. For this reason, the following precautions should be taken:

- Coils of contactors, relays and other inductive loads must be equipped with a suitable RC filter.
- Use shielded bipolar cables for all input and output signals.
- Signal cables must not be routed near or parallel to the power cables.
- Local regulations for electrical installation must always be followed.

Only use copper cables or copper busbars rated for at least 75 °C (90 °C for 30 - 40 A), which are listed for field wiring, line ratings (AWG), line terminal type (ZMVV), and torques as shown in the performance table - load cable and load rail dimensions charts .

Power connections (recommended)					
Type	Terminal type	Torque	Cable cross section	Max. terminal current	Wire ends UL-listed (ZMVV)
030 035 040	M5 screw	3.0 Nm	1.5 - 10 mm ² (AWG 16 - 8)	40 A	Solid/Flexible Fork cable lug

Cable sizes of the control cables:0.5 mm² (AWG 18)
Temperature class 90°C or higher

Cable sizes for ground connection (recommended):6 mm² (AWG 18)
Temperature class 75 °C or higher

Power connections (recommended)					
Type	Terminal type	Torque	Cable cross section	Max. terminal current	Wire ends UL-listed (ZMVV)
060 090 120	M6 screw	8.0 Nm	16 mm ² (AWG 5) 25 mm ² (AWG 3) 35 mm ² (AWG 2)	150 A	Fork cable lug Copper tube Crimp connections
150 180 210	M8 screw	16.0 Nm	50 mm ² (AWG 0) 70 mm ² (AWG 00) 90 mm ² (AWG 000)	250 A	

Cable sizes of the control cables:0.5 mm² (AWG 18)
Temperature class 90°C or higher

Cable sizes for ground connection (recommended):16 mm² (AWG 18)
Temperature class 75 °C or higher

Current	Connection type	Torque (Nm)	Cables			Cable connection	Busbar (mm)
			AWG	mm ²	kcmil		
300 A (S14)	Power wiring Busbar with an M10 screw	30.0 Nm	2 x 1/0	2 x 70	350	UL-listed (ZMVV) Fork cable lug Copper pipe Crimp connections	30 x 6 mm
400 A (S14)			2 x 3/0	2 x 95	600		30 x 6 mm
450 A (S14)			2 x 4/0	2 x 95	700		30 x 6 mm
500 A (S14)			-	2 x 150	2 x 250 900		60 x 4 mm
600 A (S14)			-	2 x 185	2 x 350 1500		60 x 5 mm
700 A (S14)			-	2 x 300	2 x 500		60 x 6 mm
800 A (S16)			-	2 x 300	2 x 500		60 x 6 mm

Recommended cable sizes of the control cables and the ground connection for the 400 - 600 V version

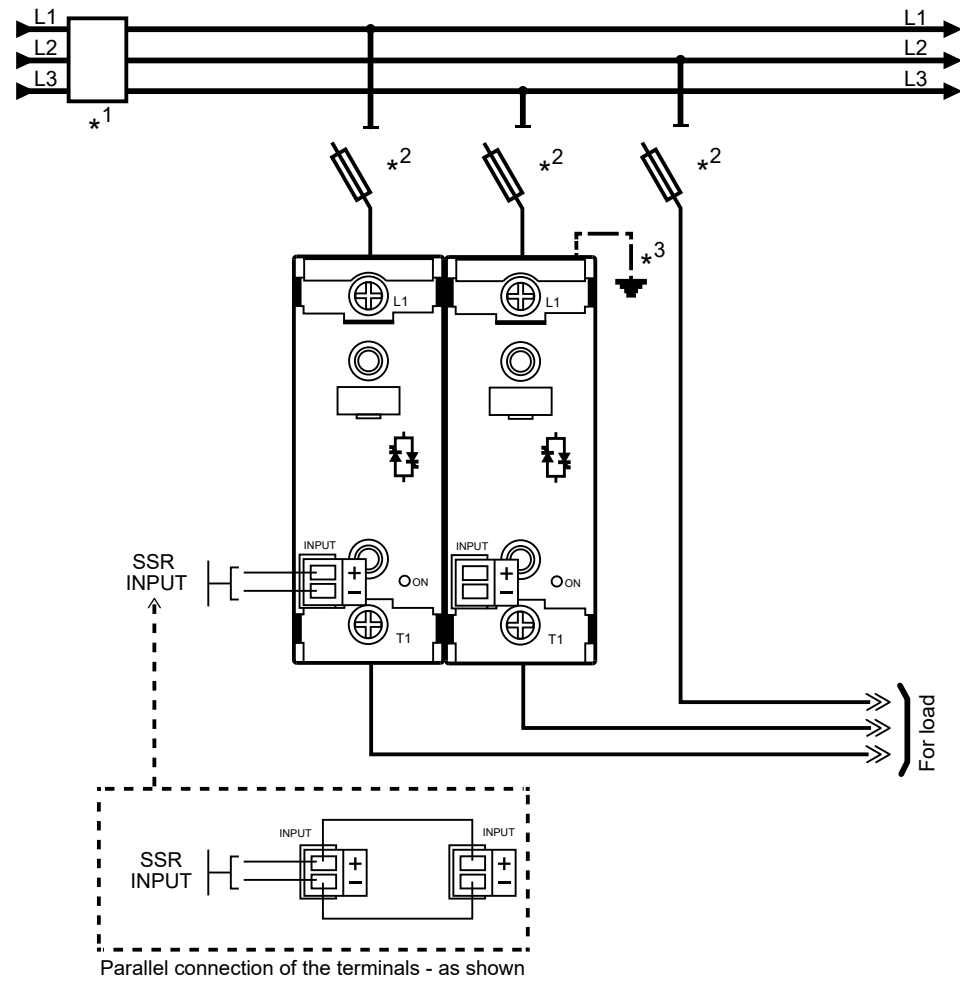
Current	Ground			Control lines	
	Cables		Screw	Cables	
	mm ²	AWG		mm ²	AWG
300 A (S14)	50	1	M8	0.50	18
400 A (S14)	50	1	M8	0.50	18
450 A (S14)	70	1/0	M8	0.50	18
500 A (S14)	70	1/0	M8	0.50	18
600 A (S14)	70	1/0	M8	0.50	18
700 A (S14)	70	1/0	M8	0.50	18
800 A (S16)	70	1/0	M8	0.50	18

Recommended cable sizes of the control cables and the ground connection for the 690 V- version

Current	Ground			Control lines	
	Cables		Screw	Cables	
	mm ²	AWG		mm ²	AWG
60, 90, 120 A	16	6	M8	0.50	18
150, 180, 210 A	25	4	M8	0.50	18
300, 400 A	50	1	M8	0.50	18
450 - 800 A	70	1/0	M8	0.50	18

Connection diagram

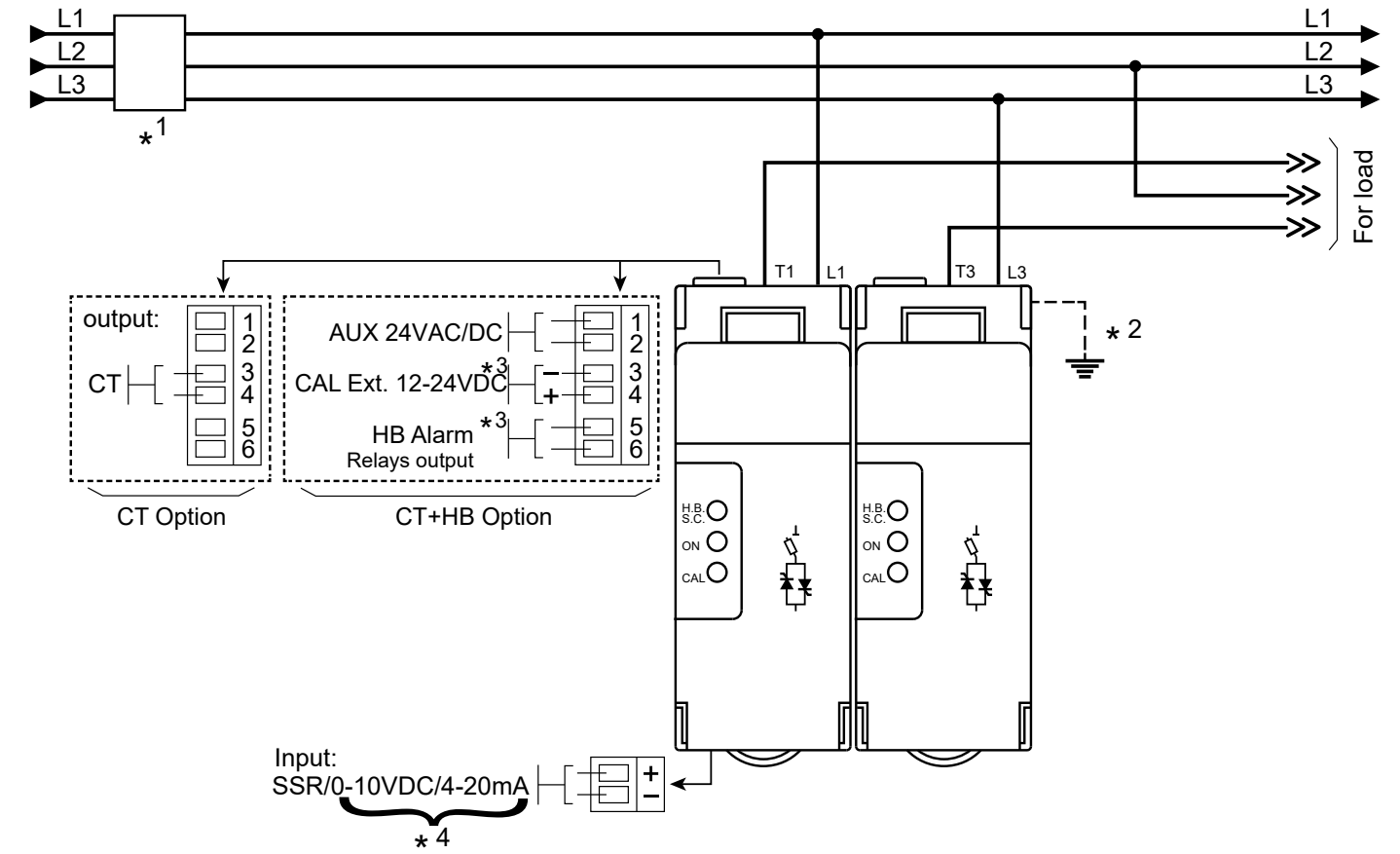
30 to 40 A (without an internal fuse)



Note:

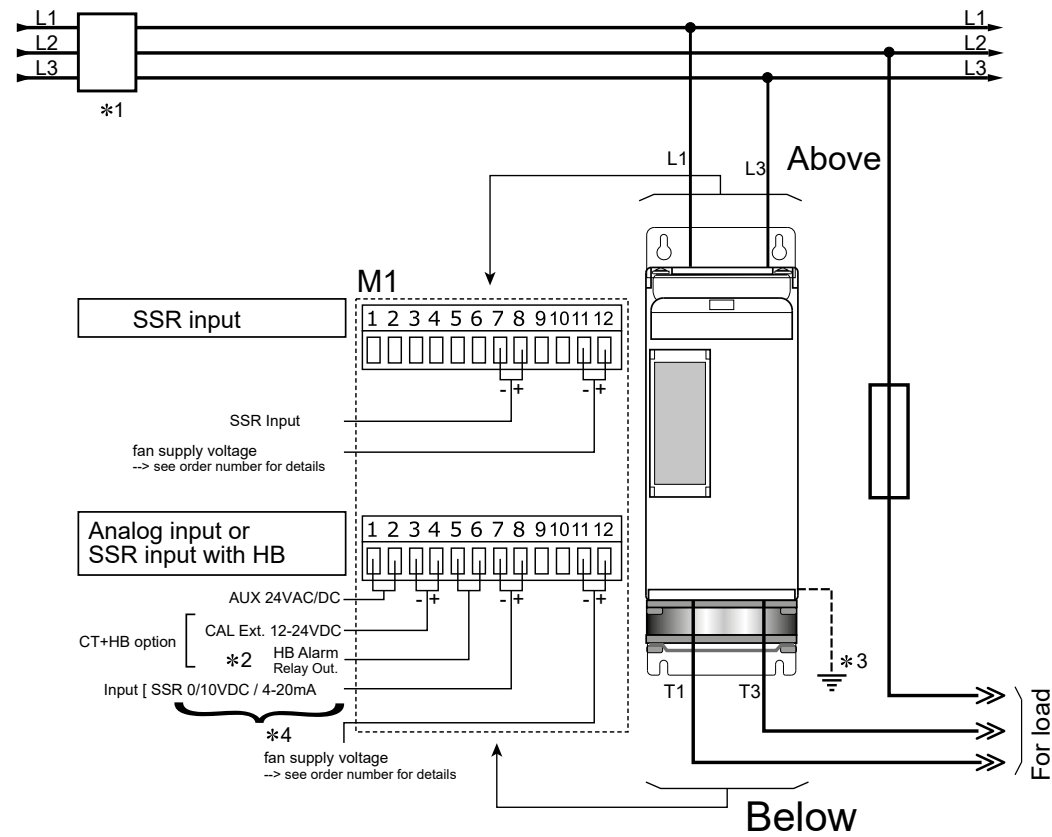
- * 1 The installation must be protected by a circuit breaker or fuse disconnecter. The fuse must be in accordance with "branch circuit protection".
- * 2 The thyristor must be protected by external fast fuses. The fuses must be 20% lower in value than the I^2t of the thyristor. If the appropriate fuse is not used, the warranty claim shall become invalid.
- * 3 The heat sink must be grounded.

30 to 40 A (with an internal fuse)



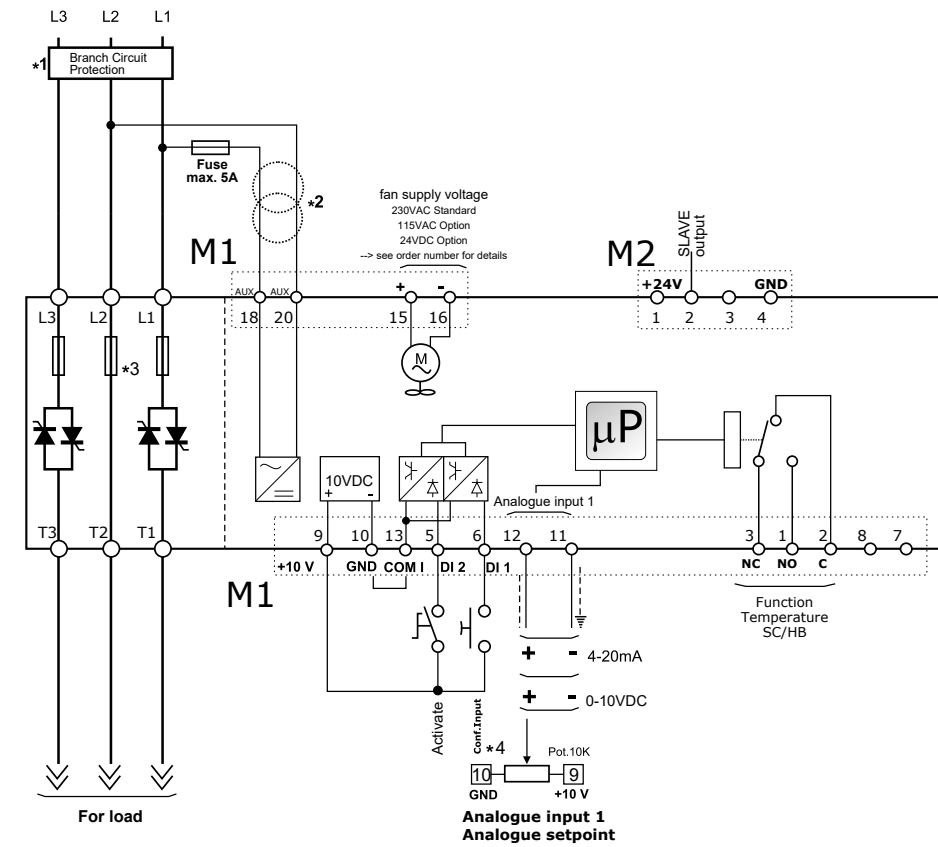
Note:

- * 1 A suitable device (a load contactor or a fused switch disconnecter) must ensure that the system can be galvanically isolated from the power supply. This enables the qualified persons to work safely.
- * 2 The heat sink must be connected to the ground.
- * 3 Only for the HB option
- * 4 The analogue input is isolated from Aux Supply, except with the analogue entry option. A series connection between the analogue inputs of the devices is not possible.
With AC-Aux supply, it is not possible to connect the zero point of the analogue input to the ground.
With the DC Aux supply, it is not possible to connect the zero point of the power supply to the zero point of the analogue input



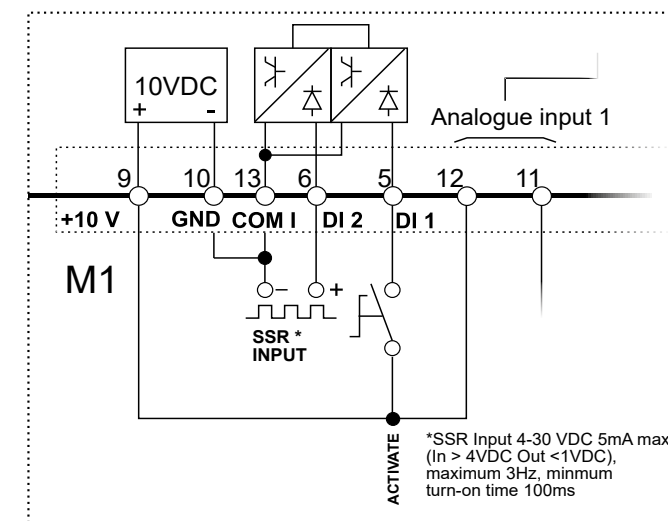
Note:

- * 1 A suitable device (a load contactor or a fused switch disconnector) must ensure that the system can be galvanically isolated from the power supply. This enables the qualified persons to work safely.
- * 2 Only for the HB option
- * 3 The heat sink must be connected to ground.
- * 4 The analogue input is isolated from Aux Supply, except with the analogue entry option. A series connection between the analogue inputs of the devices is not possible.
With AC-Aux supply, it is not possible to connect the zero point of the analogue input to the ground.
With the DC Aux supply, it is not possible to connect the zero point of the power supply to the zero point of the analogue input



Note:

- * 1 The installation must be protected by a circuit breaker or fuse disconnector. The fuse must be in accordance with "branch circuit protection". For UL, all external fuses are suitable according to the "National Electrical Code" for ohmic loads with 125% load current nominal value to protect the external lines.
- * 2 The power supply for relay C electronics must be synchronised with the load voltage. The required power supply for the electronics can be gauged from the order number. If this differs from the load voltage, use an external transformer as indicated.
- The fuse for phase L2 is not available for the frame size 600-700 A.
- * 3 For an SSR input, please use the following connection diagram:



*SSR Input 4-30 VDC 5mA max. (In > 4VDC Out <1VDC), maximum 3Hz, minimum turn-on time 100ms

Three-phase versions

General

30 - 40 A

Material of cover and base:	V2 Polymer
Mounting:	DIN rail (thickness 1 mm max)
Utilisation category	AC-51 AC-55b
Protection	IP 20
Load	Load in delta connection, load in star connection
Only for version with integrated backup:	
Power supply for electronics (only with the HB option)	24 V AC/DC, max. 70 mA
Relay output for the HB alarm (only with the HB option)	125 VAC 0.5 A

From 60 A:

Material of cover and base:	V2 Polymer
Utilisation category	AC-51 AC-55b
Protection	IP 20
Load	Load in delta connection, load in star connection
Supply voltage with option HB/analogue input:12-24 VAC/DC for devices up to 210 A, max. 70 mA Supply voltage > 210 A: max. 8 VA for the electronics Order number:RC3 ___ - 1 - Mains voltage:100/120 V Transformer range 90 to 135 V Order number:RC3 ___ - 2 - Mains voltage:200/208/220/230/240 V Transformer range 180 to 265 V Order number:RC3 ___ - 3 - Mains voltage:277 V Transformer range 180 to 265 V Order number:RC3 ___ - 5 - Mains voltage:380/400/415/440/480 V Transformer range 342 to 528 V Order number:RC3 ___ - 6 - Mains voltage:600 V Transformer range 238 to 330 V Order number:RC3 ___ - 7 -Mains voltage:690 V Transformer range 540 to 759 V Important:The load voltage must be within the above ranges.	
Relay output for the HB alarm (only with the HB option)	125 VAC 0.5 A

Input

Analogue input V:	0 - 10 VDC Impedance 15 kΩ
Analogue input A:	0/4 - 20 mA Impedance 100 Ω
SSR input	7 - 30 VDC 5 mA max. (ON> 7 VDC OFF < 1 VDC)
Digital input (Calib. input, only with the HB option)	12 - 24 V AC / DC, 30 - 40 A:37 mA, from 60 A:5 mA

Output

Current	Load voltage range (Ue)	Repeatable peak blocking voltage Uimp:		Holding current	Max. peak current (one cycle)	Leakage current	Fuse I ² T recommended value for 500 VAC	Frequency range	Power loss Thyristor + fuse	Isolation voltage (Ui)
(A)	(V)	(480 V)	(600 V)	(MArms)	(10 ms) (A)	(MArms)	tp = 10 ms	(Hz)	I = Inom (W)	(V)
30	24 - 600	1200	1600	250	360	15	525	47 - 70	114	2500
35	24 - 600	1200	1600	250	540	15	1260	47 - 70	135	2500
40	24 - 600	1200	1600	250	700	15	1260	47 - 70	150	2500
60	24 - 600	1200	1600	600	1900	15	10780	47 - 70	290	3000
90	24 - 600	1200	1600	600	1900	15	10780	47 - 70	580	3000
120	24 - 600	1200	1600	600	1900	15	14280	47 - 70	598	3000
150	24 - 600	1200	1600	300	5000	15	17500	47 - 70	594	3000
180	24 - 600	1200	1600	300	5000	15	30800	47 - 70	740	3000
210	24 - 600	1200	1600	300	5000	15	53900	47 - 70	898	3000
300	24 - 600	1200	1600	200	7800	15	73500	47 - 70	903	3000
400	24 - 600	1200	1600	200	7800	15	149000	47 - 70	1092	3000
450	24 - 600	1200	1600	200	7800	15	215600	47 - 70	1259	3000
500	24 - 600	1200	1600	200	8000	15	215600	47 - 70	1407	3000
600	24 - 600	1200	1600	1000	17800	15	294000	47 - 70	1528	3000
700	24 - 600	1200	1600	1000	17800	15	294000	47 - 70	1753	3000
800	24 - 600	1200	1600	1000	15000	15	246400	47 - 70	2281	2500

Fan specification

For 480 - 600 V:

60 - 90 A:

Supply voltage 230 VAC (default)
Supply voltage 115 VAC (option)
Supply voltage 24 VDC (option)



Power 32 W 16 W (two fans)
Power 28 W 14 W (two fans)
Power 14 W 7 W (two fans)

120 - 210 A:

230 VAC (standard) supply voltage
115 VAC supply voltage (option)
24 VDC supply voltage (option)

Power 48 W (16 W for each of the two fans)
Power 42 W (14 W for both fans)
Power 21 W (7 W for both fans)

300 - 800 A:

Device type and power supply fan:	Number of fans for 	Number of fans for 
230 V:		
300, 400 A, 500 A, 600 A	Four fans 64 W (4 x 16 W)	Four fans 64 W (4 x 16 W)
700 A	Six fans 94 W (6 x 16 W)	Six fans 96 W (6 x 16 W)
800 A	Six fans 96 W (6 x 16 W)	Six fans 96 W (6 x 16 W)
115 V:		
300, 400 A, 500 A, 600 A	Four fans 64 W (4 x 14 W)	Four fans 56 W (4 x 14 W)
700 A	Six fans 84 W (6 x 14 W)	Six fans 84 W (6 x 14 W)
800 A	Six fans 84 W (6 x 14 W)	Six fans 84 W (6 x 14 W)
24 V DC		
300, 400 A, 500 A, 600 A	Four fans 28 W (4 x 7 W)	Four fans 28 W (4 x 7 W)
700 A	Six fans 42 W (6 x 7 W)	Six fans 42 W (6 x 7 W)
800 A	Six fans 42 W (6 x 7 W)	Six fans 42 W (6 x 7 W)

690 V version:

Load current	230 V AC	115 V AC	24 V DC
60 - 90 A	16 W fan	14 W fan	7 W fan
120, 150, 180, 210 A	Two fans 32 W (2 x 16 W)	Two fans 28 W (2 x 14 W)	Two fans 14W (2 x 7 W)
300, 400, 500 A	Four fans 64 W (4 x 16 W)	Four fans 64 W (4 x 14 W)	Four fans 28 W (4 x 7 W)
600, 700, 800 A	Six fans 84 W (6 x 16 W)	Six fans 84 W (6 x 14 W)	Six fans 42 W (6 x 7 W)

Environmental and installation conditions, derating curve

See single-phase versions (page 9)

Wiring instructions

The thyristor controller in some circumstances could be disrupted by interference from other devices or via the mains supply. For this

reason, the following precautions should be taken:

- Coils of contactors, relays and other inductive loads must be equipped with a suitable RC filter.
- Use shielded bipolar cables for all input and output signals.
- The signal cables must not be routed near or parallel to the power cables.
- Local regulations for electrical installation must always be observed.

Only use copper cables or copper busbars specified for at least 75 °C (90 °C for 30 - 40 A), which are listed for field wiring, line ratings (AWG), line terminal type (ZMVV), and torques as shown in the performance table - load cable and load rail dimensions charts

Power connections (recommended)					
Type	Terminal type	Torque	Cable cross section	Max. terminal current	Wire ends UL-listed (ZMVV)
030 035 040	M5 screw	3.0 Nm	1.5 - 10 mm ² (AWG 16 - 8)	40 A	Solid/Flexible Fork cable lug

Cable sizes of the control cables: 0.5 mm ² (AWG 18) Temperature class 90°C or higher
Cable sizes for ground connection (recommended): 6 mm ² (AWG 18) Temperature class 75 °C or higher

Power connections (recommended)					
Type	Terminal type	Torque	Cable cross section	Max. terminal current	Wire ends UL-listed (ZMVV)
060 090* 120	M6 screw	8.0 Nm	16 mm ² (AWG 5) 25 mm ² (AWG 3) 35 mm ² (AWG 2)	150 A	Fork cable lug Copper tube Crimp connections
150 180 210	M8 screw	16.0 Nm	50 mm ² (AWG 0) 70 mm ² (AWG 00) 90 mm ² (AWG 000)	250 A	

* 75 A for UL

Cable sizes of the control cables: 0.5 mm ² (AWG 4) Temperature class 90°C or higher
Cable sizes for ground connection (recommended) : 16 mm ² (AWG 4) 25 mm ² (AWG 4) up to 210 A Temperature class 75 °C or higher

Current	Connection type	Torque (Nm)	Cables			Cable connection	Busbar (mm)
			AWG	mm ²	kcmil		
300 A (S14)	Power wiring Busbar with an M10 screw	30.0 Nm	2 x 1/0	2 x 70	350	UL-listed (ZMVV) Fork cable lug Copper pipe Crimp connections	30 x 6 mm
400 A (S14)			2 x 3/0	2 x 95	600		30 x 6 mm
450 A (S14)			2 x 4/0	2 x 95	700		30 x 6 mm
500 A (S14)			-	2 x 150	2 x 250 900		60 x 4 mm
600 A (S14)			-	2 x 185	2 x 350 1500		60 x 5 mm
700 A (S14)			-	2 x 300	2 x 500		60 x 6 mm
800 A (S16)			-	2 x 300	2 x 500		60 x 6 mm

Recommended cable sizes of the control cables and the ground connection for the 400 - 600 V version

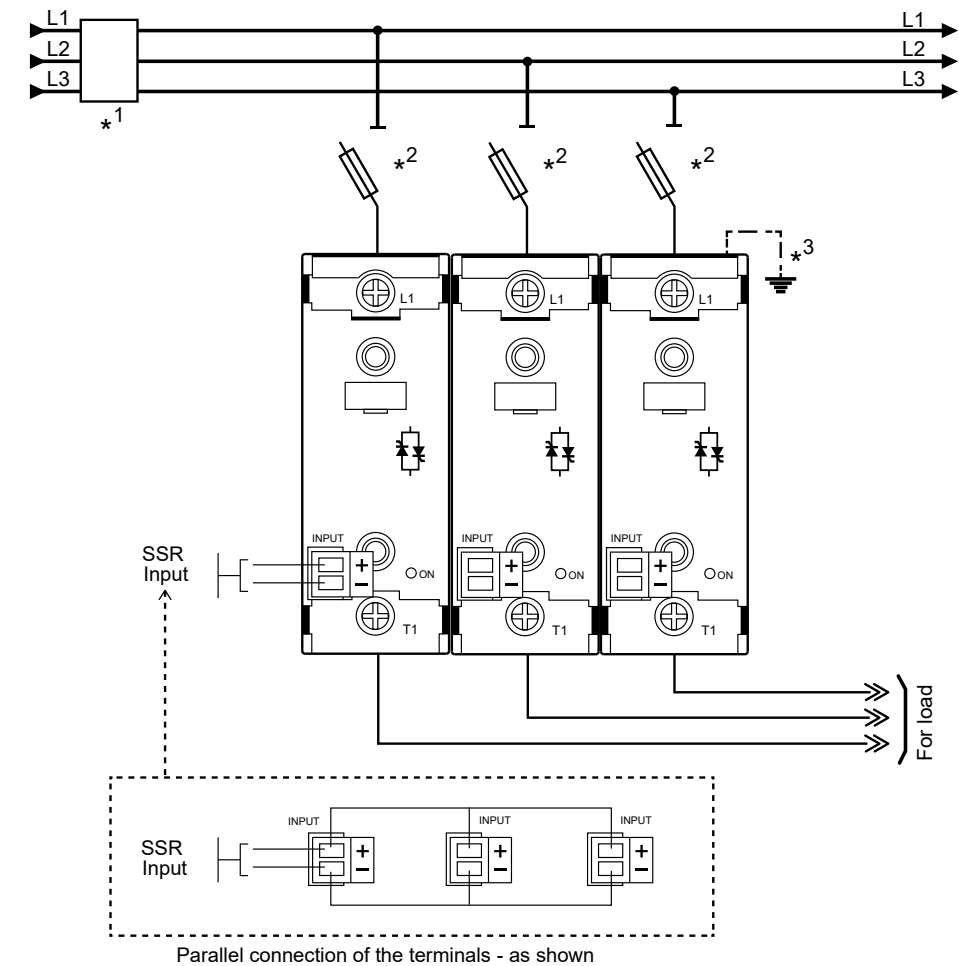
Current	Ground			Control lines	
	Cables		Screw	Cables	
	mm ²	AWG		mm ²	AWG
300 A (S14)	50	1	M8	0.50	18
400 A (S14)	50	1	M8	0.50	18
450 A (S14)	70	1/0	M8	0.50	18
500 A (S14)	70	1/0	M8	0.50	18
600 A (S14)	70	1/0	M8	0.50	18
700 A (S14)	70	1/0	M8	0.50	18
800 A (S16)	70	1/0	M8	0.50	18

Recommended cable sizes of the control cables and the ground connection for the 690 V- version

Current	Ground			Control lines	
	Cables		Screw	Cables	
	mm ²	AWG		mm ²	AWG
60, 90, 120 A	16	6	M8	0.50	18
150, 180, 210 A	25	4	M8	0.50	18
300, 400 A	50	1	M8	0.50	18
450 - 800 A	70	1/0	M8	0.50	18

Connection diagram

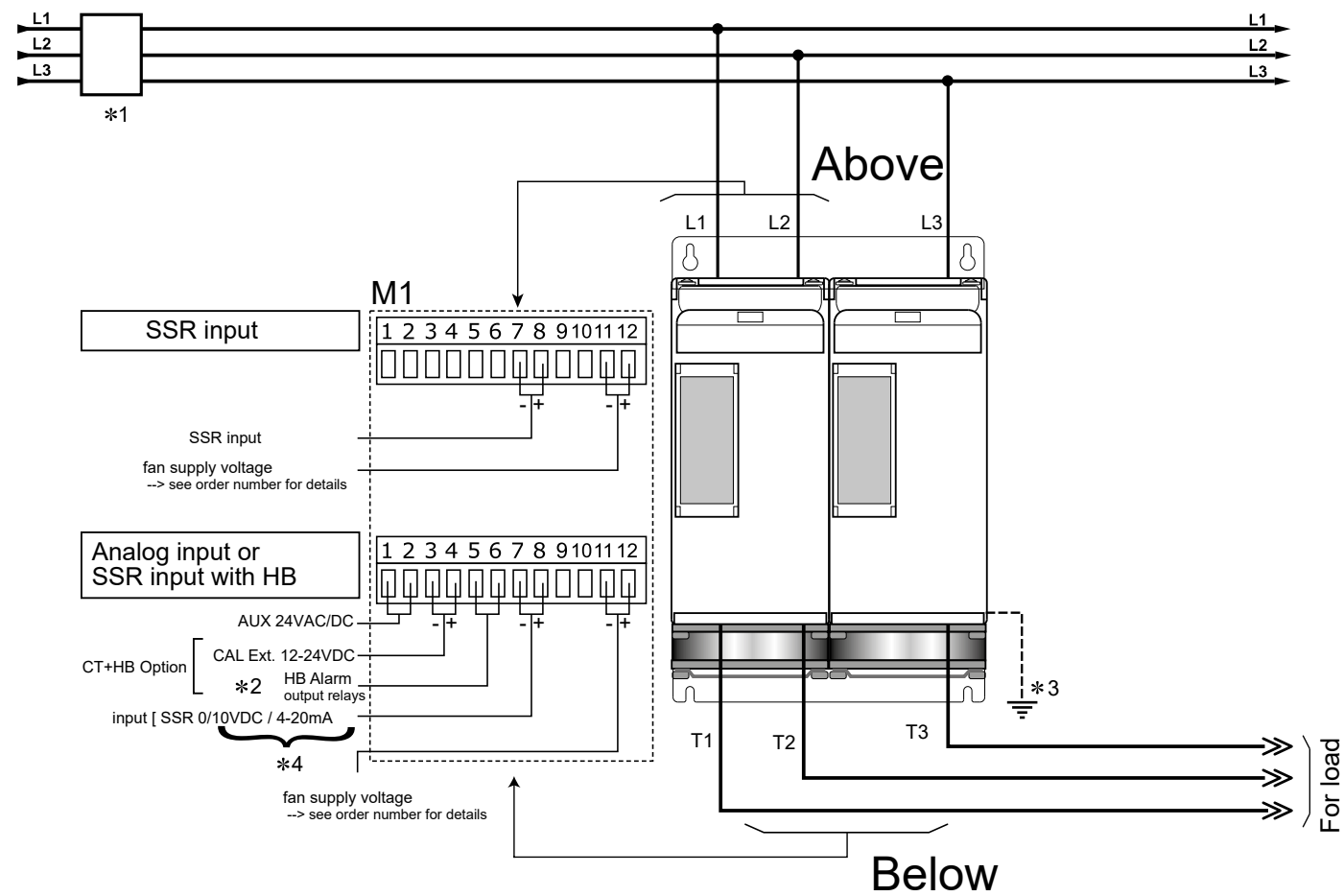
30 to 40 A (without an internal fuse)



Note:

- * 1 The installation must be protected by a circuit breaker or fuse disconnecter. The fuse must be in accordance with "branch circuit protection".
- * 2 The thyristor must be protected by external fast fuses. The fuses must be 20% lower in value than the I²t of the thyristor. If the appropriate fuse is not used, the warranty claim shall become invalid.
- * 3 The heat sink must be grounded.

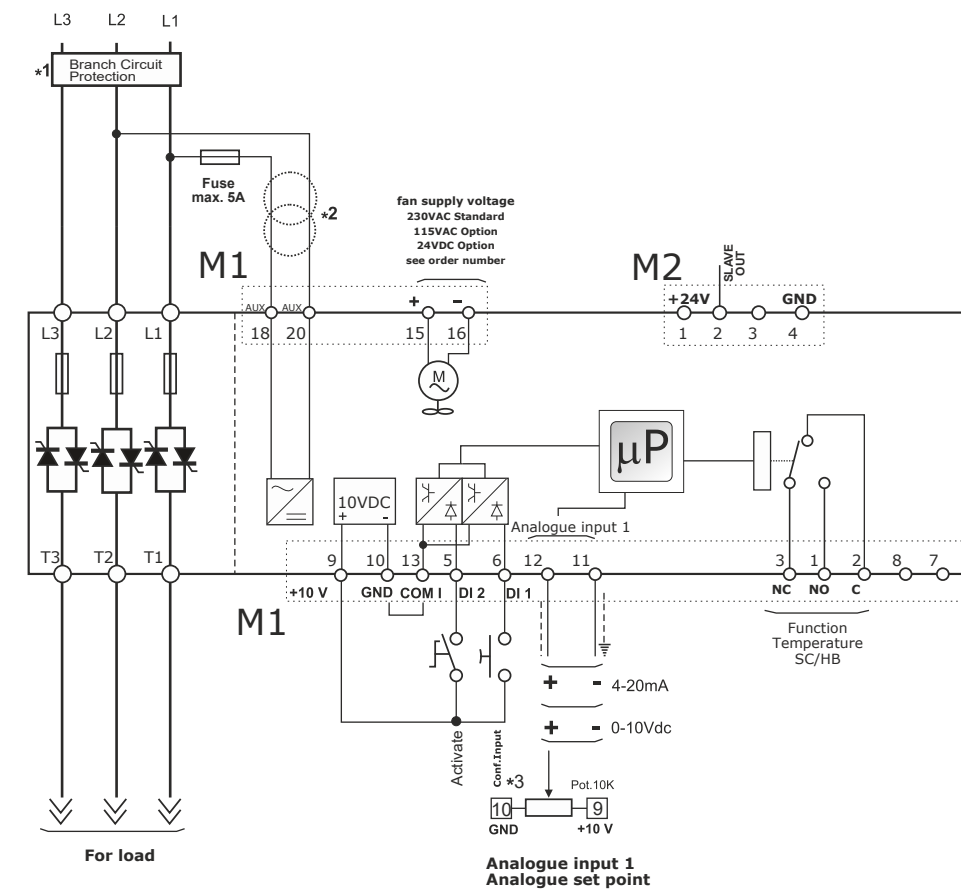
60 to 210 A



Note:

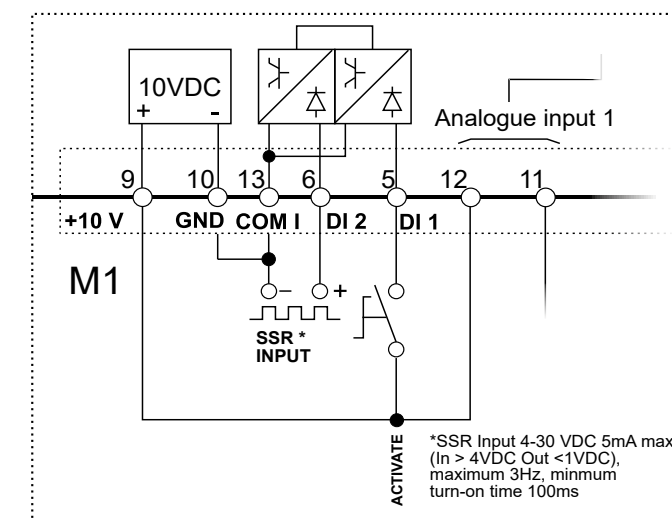
- * 1 A suitable device (a load contactor or a fused switch disconnector) must ensure that the system can be galvanically isolated from the power supply. This enables the qualified persons to work safely.
- * 2 The heat sink must be connected to the ground.
- * 3 Only for the HB option
- * 4 The analogue input is isolated from Aux Supply, except with the analogue entry option. A series connection between the analogue inputs of the devices is not possible.
With AC-Aux supply, it is not possible to connect the zero point of the analogue input to the ground.
<With the DC Aux supply, it is not possible to connect the zero point of the power supply to the zero point of the analogue input

300 to 800 A

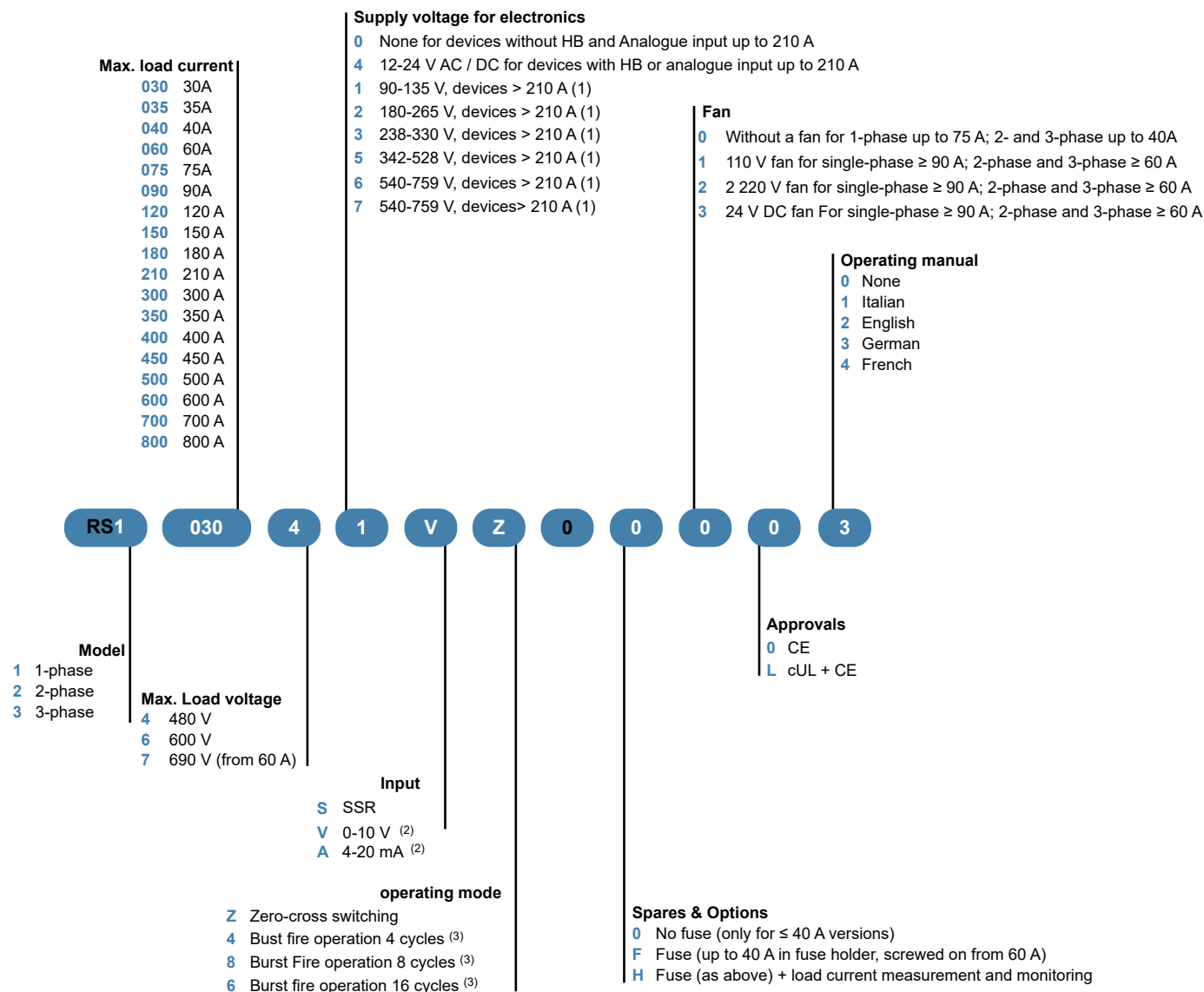


Note:

- * 1 The installation must be protected by a circuit breaker or fuse disconnector. The fuse must be in accordance with "branch circuit protection". For UL, all external fuses are suitable according to the "National Electrical Code" for ohmic loads with 125% load current nominal value to protect the external lines.
- * 2 The power supply for relay C electronics must be synchronised with the load voltage. The required power supply for the electronics can be gauged from the order number. If this differs from the load voltage, use an external transformer as indicated.
- The fuse for phase L2 is not available for the frame size 600-700 A.
- * 3 For an SSR input, please use the following connection diagram:



Order information



(1) For devices > 210 A, the load voltage must be within the specified range
 (2) Controllers with analogue input require a fuse
 (3) Cycle indication at 50% control value, only in conjunction with analogue input

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