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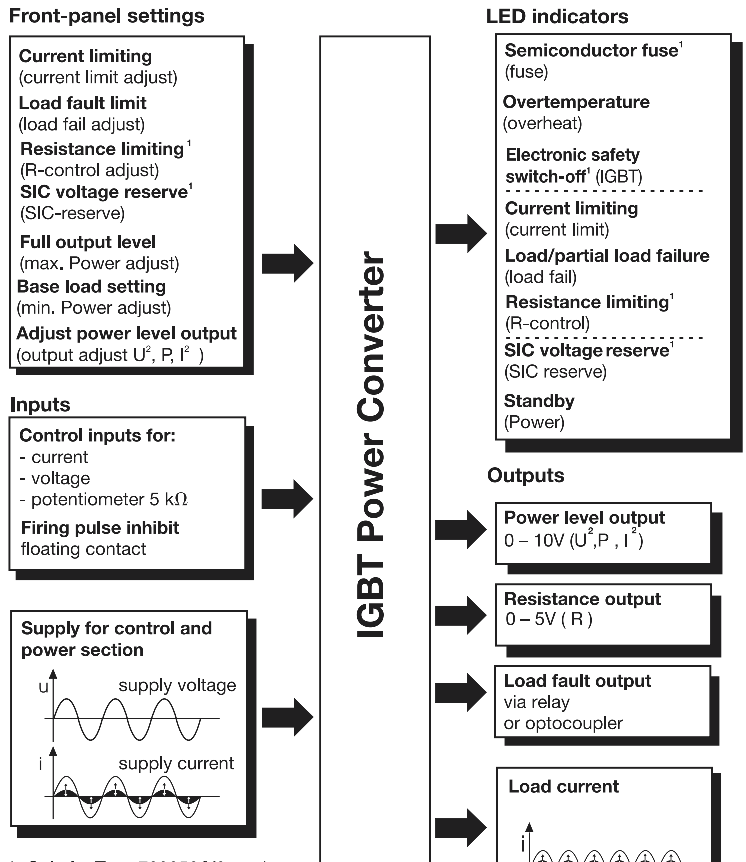
JUMO IPC
IGBT Power Converter
with amplitude control

Brief description

The JUMO IPC is a power converter for controlling heater loads that previously required a transformer (either a variable transformer or a combination of transformer and thyristor power converter).
Its function is that of an electronic transformer with a pulsed DC output.
It combines the advantages of a conventional variable transformer, such as amplitude control which is the sinusoidal current loading, with the advantages of a thyristor power switch, such as current limiting, load monitoring, subordinate control action, etc.
There is no electrical isolation between the supply voltage and the load voltage.
This power converter is employed wherever substantial resistive loads need to be switched.
To operate the IPC, a choke and a line filter are indispensable in addition to the IPC power converter itself. Only the chokes or line filters specified by JUMO may be used for this purpose. Thanks to the amplitude control (the current drawn from the supply is always sinusoidal), synchronous clock controls (as for burst-firing operation) and power-factor compensation networks (for the reactive power resulting from phase-control) are no longer required.

Type 709050/X3 ...

Block diagram



1. Only for Type 709050/X2..and 709050/X3...

Special features

- Protective operation when power supply operated under high resistive loads (flicker)
- Operation of low voltage heaters directly at the power supply without impedance-matching transformer
- Minimum harmonics in the instrument power supply and low weight (power transformer n/a)
- Short-circuit control when switching on
- Line current in proportion to the required power (amplitude control)
- Control independent of the heaters' resistive characteristics
- Minimum reactive power
- Compact dimensions
- The subordinate control action U^2, P, I^2 can be freely chosen
- Ageing process compensation for SIC heating elements
- Indicator showing when ageing can no longer be compensated by the voltage reserve[1]
- Resistance limitation, protection of Molybdenum Disilicide heating elements against overheating in the upper temperature range[1]
- Integrated semiconductor fuses to protect the IPC in the event of an earth short[1]

1. Only for types 709050/X2 and ... /X3

Technical data

Control

Control signal	0(4) … 20mA 0(2) … 10V 0(1) … 5V	R_i = 50 Ω R_i = 25kΩ R_i = 12 kΩ Manual control through an external 5 kΩ potentiometer
Input signal attenuation	Adjustment range 100 … 20%	
Base load setting	0 ... 100%	

Voltage supply

	Type 709050/X1...	Type 709050/X2...	Type 709050/X3...
Voltage supply Control section	115V AC +15%/ -20%, 48 ... 63Hz, (only with 115V AC in the power section) 230V AC+15%/ -20%, 48 … 63Hz		
Voltage supply Power section	115V AC +15%/ -20%,48 ... 63Hz, 230V AC +15%/ -20%, 48 … 63Hz 400V AC +15%/ -20%,48 … 63Hz		
Load voltage $U_{L\ rms}$	20V DC, 60V, 90V, 120V ≂	20V DC, 60V, 90V, 120V, 150V, 210V, 270V, 380V ≂	20V DC, 60V, 90V, 120V, 150V, 210V ≂
	Further voltages upon request		
Load current $U_{L\ rms}$	DC 70A ≂	DC 70A / 100A ≂	DC 200A ≂
Load type	Resistive loads		

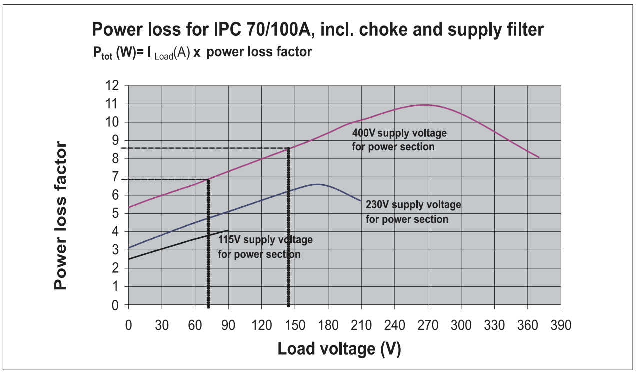
General characteristics

Circuit variants	Single-phase operation		
Operating modes	Amplitude control		
Subordinate control loop	As standard: free choice between U^2-, P-, I^2 control via internal switches		
Current limiting	In operation, the load current can be set in the range of 10 … 100% I_N by a trimmer on the front panel. This limits the rms-value of the load current.		
Partial load failure	20 ... 100% of nominal current		
R-control	-	Adjustment range from R_{Nom} to 10x R_{Nom} R_{Nom} = nominal voltage / nominal current	
SIC reserve	-	Message indicated when the voltage reserve for SIC heating rods is exhausted	
Actual value output	As standard: free choice between U^2-, P-, or I^2 signal via internal switches, adjustable 0 … 5V to 0 … 10V , I_{max} ∪ 2mA, offset deviation ≤ ± 5%		
Control accuracy	The regulation will eliminate supply voltage variations within the tolerance range (+15%/ -20%) with an accuracy of ± 0.5%		
Electrical connection	Control leads via plug-in screw terminals for conductor cross sections 0.5 … 2.5mm^2		
	in the power section via cable lugs as per DIN 46212	in the power section via 10mm^2... 50mm^2 screw terminals	Power section via 10mm^2... 95mm^2 screw terminals
Semiconductor fuse	The I^2t value of an external fuse must be smaller than 2000 A^2s!	The I^2t value of the integrated semiconductor fuse must be smaller than 20000 A^2s!	
Degree of protection	IP 00 as per EN 60 529	IP 10 as per EN 60 529	
Protection class	Protection class I, with isolated control circuitry for connection to SELV circuits		
Permissible ambient temperature range	5 … 40°C (3K3 as per EN 60 721-3-3)		
Permissible storage temperature range	-10 … +70°C (1K3 as per EN 60 721-3-1)		
Cooling	forced convection, maximum inlet air temperature 35°C		
Climatic conditions	Rel. humidity ≤ 5 ... 85 % annual average, no condensation 3K3 as per EN 60 721		
mounting position	vertical		
Operating conditions	The converter is designed as a built-in device as per EN 50 178, pollution degree 2, overvoltage category Ü III		
Electromagnetic compatibility	as per DIN 61326 emitted interference: Class A - Only for industrial use - interference immunity: to industrial requirements		
Test voltage	as per EN 50178		
Creepage distances	Control section to load circuit ÷ 5.5 mm, control section to housing ÷ 5.5 mm, device can be connected to SELV circuits. SELV = Separate Extra Low Voltage (safe low voltage)		
Ground leakage current	The Ground leakage current of the IPC power converter used with an EMC filter in the supply cable is less than 3 mA (excluding any leakage current in the load).		
Housing	Metal housing		
Power consumption of the control section	approx. 50VA	max. 100 VA	
Standard accessories	1 operating manual B 70.9050.0...		

Power loss (W)

Note:
Power loss occurs in the form of thermal discharge at the cooling body of the power converter, at the EMC filter and choke. It has to be be discharged from the point of installation (e.g. in the switch cabinet) according to the climatic conditions!

Type 709050/X1...and type 709050/X2...



Type 709050/82-12-400-150-100/252
Nominal data of the device: Load voltage = 150V; load current = 100A; Voltage supply to the power section = 400V

Resistive loads and Molybdenum Disilicide heating elements:
Heating element data: Load voltage = 140V; load current = 90A

Determine the max. load voltage actually taken (e.g. 140 V) and find the point intersecting with the curve for the voltage supply in the power section. The Y axis shows the attendant power dissipation factor of, e.g., 8.5.

The power dissipation (W) is obtained by multiplying this power dissipation factor by the load current (e.g. 90A)
that flows at max. load voltage (e.g. 140V) through the load resistor

Power loss = 90(A) x power dissipation factor

Power loss = 90(A) x 8.5 = **765W**

Type 709050/92-12-400-150-100/252
Nominal data of the device: Load voltage = 150V; load current = 100A; Voltage supply to the power section = 400V; P control, P = 6300W

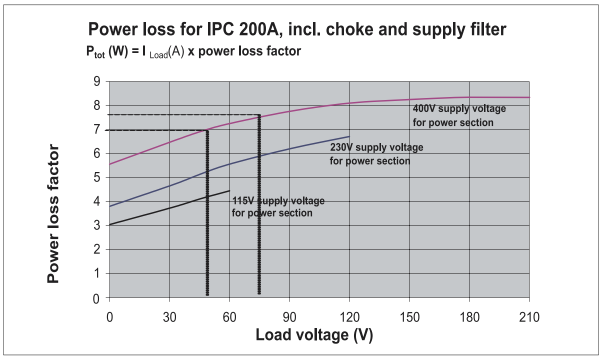
SIC heating elements
SIC heating element data: new: 70V/90A, old 140V/45A; P = 6300W

Determine the maximum load voltage actually taken (e.g. 70V) of the **new** SIC heating element and find the point intersecting with the curve for the voltage supply in the power section. The Y axis shows the attendant power dissipation factor of, e.g., 6.8.

The power dissipation (W) is obtained by multiplying this power dissipation factor by the load current (e.g. 90A)
that flows at max. load voltage (e.g. 70V) through the **new** SIC heating element

Power loss = 90(A) x power dissipation factor

Power loss = 90(A) x 6.8 = **612W**



Type 709050/83-12-400-90-200/252
Nominal data of the device: Load voltage = 90V; load current = 200A; Voltage supply to the power section = 400V

Resistive loads and Molybdenum Disilicide heating elements:
Heating element data: Load voltage = 75V; load current = 130A

Determine the max. load voltage actually taken (e.g. 75V) and find the point intersecting with the curve for the voltage supply in the power section. The Y axis shows the attendant power dissipation factor of, e.g., 7.5.

The power dissipation (W) is obtained by multiplying this power dissipation factor by the load current (e.g. 130A) that flows through the load resistor at max. load voltage (e.g. 75V)

Power loss = 130 (A) x power loss factor

Power loss = 130 (A) x 7.5 = **975W**

Type 709050/93-12-400-90-200/252
Nominal data of the device: Load voltage = 90V; load current = 200A; voltage supply to the power section = 400V; P control, P=9000W

SIC heating elements
SIC heating element data: new: 45V/200A, old 90V/100A; P = 9000W

Determine the maximum load voltage actually taken (e.g. 45V) of the **new** SIC heating element and find the point intersecting with the curve for the voltage supply in the power section. The Y axis shows the attendant power dissipation factor of, e.g., 6.8.

The power dissipation (W) is obtained by multiplying this power dissipation factor by the load current (e.g. 200A) that flows at max. load voltage (e.g. 45V) through the **new** SIC heating element

Power loss = 200(A) x power loss factor

Power loss = 200(A) x 6.8 = **1360W**

General characteristics

Fault signal output	Type 709050/X1...	Type 709050/X2...	Type 709050/X3...
Relay (changeover contact) without contact suppression	150000 switching actions at switched power level of 3A/230V 50Hz resistive load		
Optocoupler output	I_{Cmax} = 2mA, U_{CEOmax} = 32V		
Dimensions of the power converter			
(length x width x height)	(272 x 260 x 175) mm	(348.6 x 300 x 217) mm	(403.5 x 300 x 257.5) mm
Weight	approx. 9 kgs	approx. 17 kgs	approx. 22.5 kgs

Chokes

Type	Dimensions	Abutting cross section	Connection, tightening torque	Weight	Sales number
L = 0.6 mH / I_N = 75A protection IP 10 as per EN 60529	Choke diameter: 155 mm Height: 135 mm Diameter of fixing hole: 10.4 mm	4...25 mm^2	Via screw terminals, max. 4...4.5 Nm	approx. 7.5 kgs	70/00392474
L = 0.6 mH / I_N = 100A protection IP 10 as per EN 60529	Height: 208 mm Width: 200 x 200 mm	10...50 mm^2	Via screw terminals, max. 6...8 Nm	approx. 20 kgs	70/00415759
L = 0.6 mH / I_N = 200A protection IP 10 as per EN 60529	Height: 190 mm Width: 200 x 385 mm	35...95mm^2	Via screw terminals, max. 15...20 Nm	approx. 37 kgs	70/00436848

EMC filter

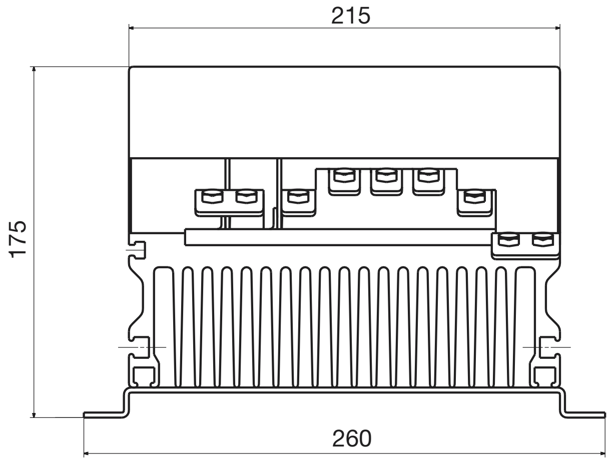
For voltage supply to power section						
Nominal voltage, Nominal current	Dimensions (length x width x height)	Abutting cross section	tightening torque	Weight	Permissible ambient temperature	Sales No.
115V/250V/440V AC, I_{Nom} = 16A	(255 x 60 x 125) mm	0.25...4 mm^2	0,6 ... 0.8 Nm	approx. 4 kgs	40°C	70/00399527
115V/250V/440V AC, I_{Nom} = 20A	(289 x 70 x 140) mm	0.5...10 mm^2	1,5 ... 1.8 Nm	approx. 5.5 kgs	40°C	70/00438775
115V/250V/440V AC, I_{Nom} = 32A	(324 x 90 x 160) mm	0.5...10 mm^2	1,5 ... 1.8 Nm	approx. 9.5 kgs	40°C	70/00409831
115V/250V/440V AC, I_{Nom} = 63A	(380 x 117 x 190) mm	0.5...16 mm^2	2 ... 2.3 Nm	approx. 17 kgs	40°C	70/00409990
115V/250V/440V AC, I_{Nom} = 100A	(445 x 150 x 220) mm	10...50 mm^2	6 ... 8 Nm	approx. 26 kgs	40°C	70/00431997
For voltage supply to the control section						
115V/250V AC, I_{Nom} = 1A	(80 x 45 x 30) mm	via spade connec-tor 6,3 x 0,8mm	-	approx. 120 kgs	40°C	70/00413620

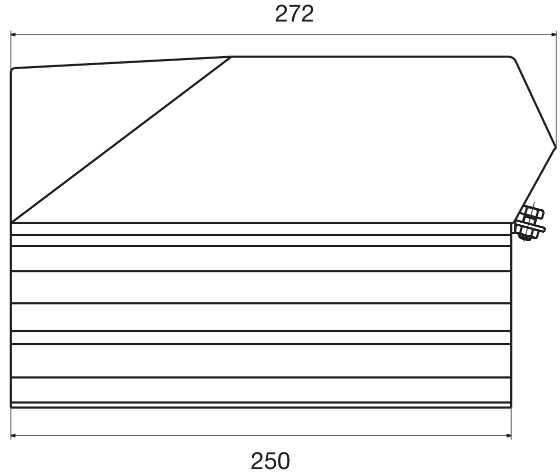
Dimensions

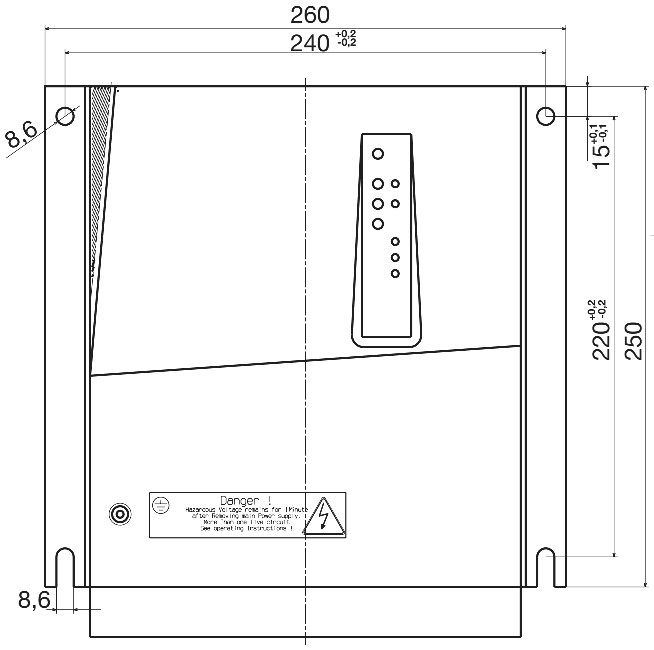
Type 709050/X1...

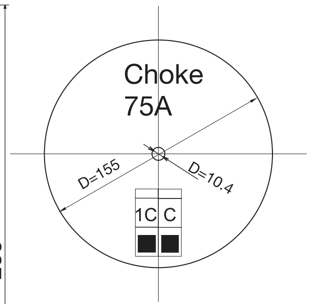
Note:

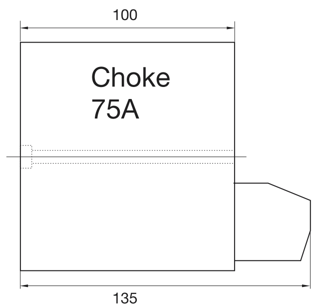
Screw tightening torque in the power section (width across flats 10 mm) max. 15 Nm
Tightening torque of the 75 A choke screw terminals: 4...4.5 Nm
Tightening torque of the green screw terminals in the control section: 0,5 ... 0.6 Nm





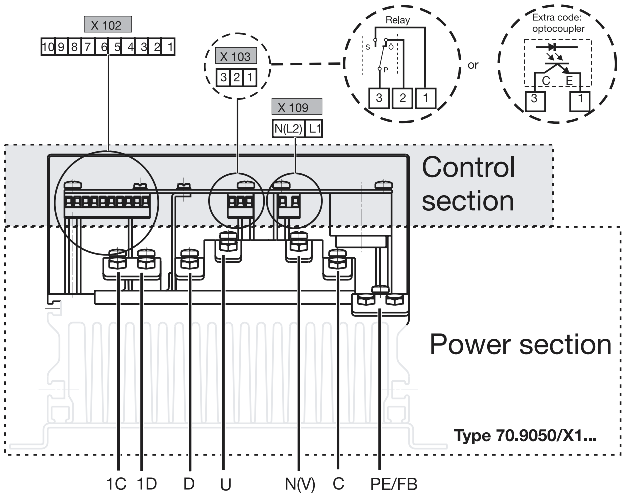






Connection diagram

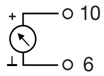
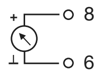
Type 709050/X1...

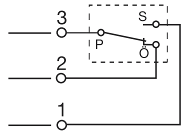
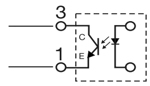


	Connection for	terminal screw X109	Detail
	Voltage supply to the control section	L1 N (L2)	L1—o L1 N (L2)—o N (L2)

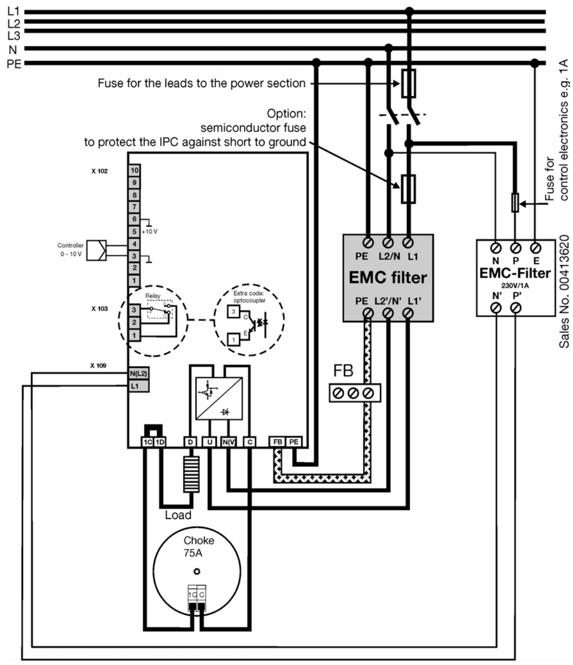
	Connection for	screw connections in the power section	Detail
	Protective earth	PE	PE—o PE
	Functional equipotential bonding also see Operating Manual, Chapter 3.1 „Installation notes“	FB	FB—o FB
	Voltage supply to power section	U N(V)	L1—o U N (L2)—o N (V)
	Choke connection	1C C	o 1C o C
	Load connection	1D + D -	o 1D o D

	Connection for	terminal screw X102	Detail
	Current input (differential input)	1- 2+	- o 1 + o 2
	Voltage input (referred to ground)	3 ground 4+	⊥ o 3 + o 4
	External manual adjustment Potentiometer 5 kΩ	3 Start (ground) 4 slider 5 end (+10V)	A o 3 5kΩ o 4 E o 5
	Firing pulse inhibit (inhibit input) I_K approx. 1mA (break or make contact)	6 ground 7+	o 6 o 7 or o 6 o 7

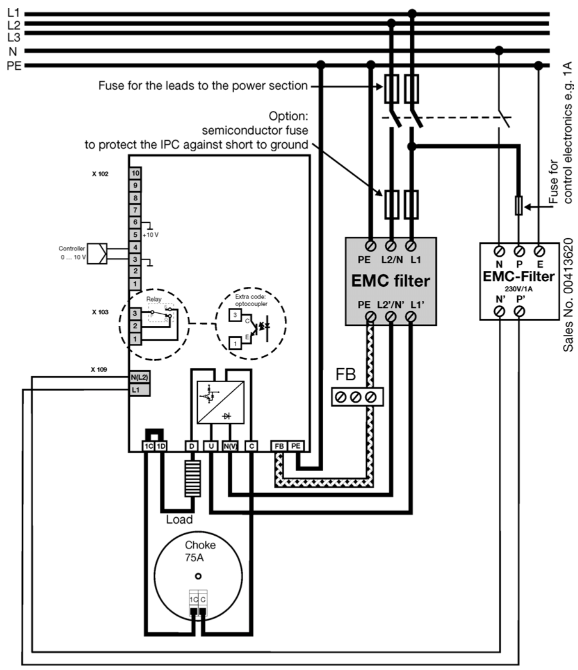
	Actual value output 0 ... 10V (U^2, P, I^2) I_{max} approx. 2mA	10 + 6 ground	
	Resistance output 0 ... 5V (R) I_{max} approx. 2mA	8 + 6 ground	

	Connection for	Screw terminal X103	Detail
	Load fault output with relay contact rating 230V AC/3A resistive load relay drops out at fault	1 make contact 2 break contact 3 common	
	Load fault output with optocoupler Ic $_{max}$ = 2mA $U_{CEO\ max}$ = 32 V	3 collector 1 emitter	

Wiring for single-phase mode phase / N with type 709050/X1...



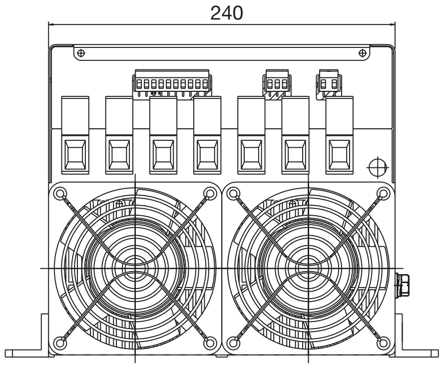
Wiring for single-phase mode phase / phase with type 709050/X1...

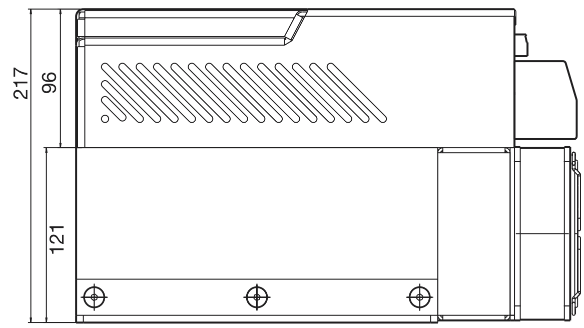


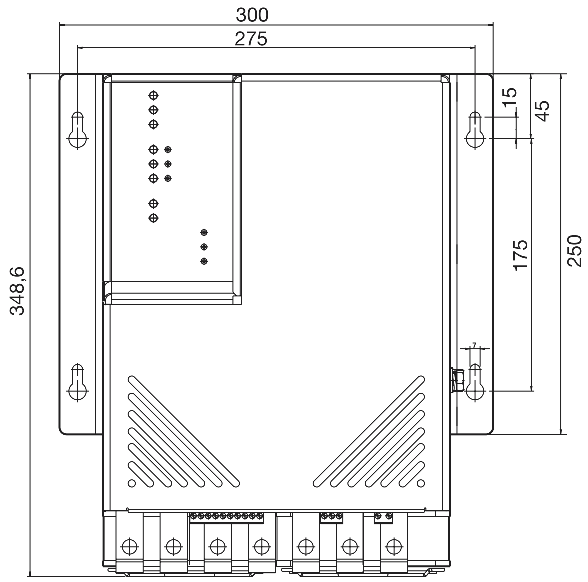
Dimensions

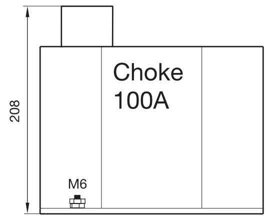
Type 709050/X2...

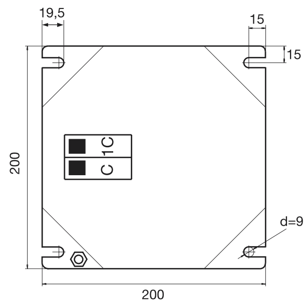
Note:
Tightening torque of the screws in the power section (Allen key width across flats 5 mm) 6...8 Nm.
Tightening torque of the 100A choke screw terminals: 6...8 Nm

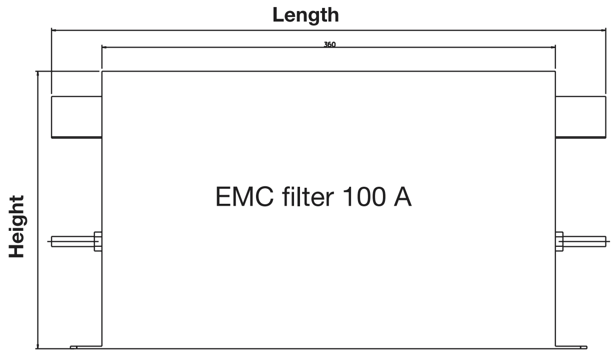


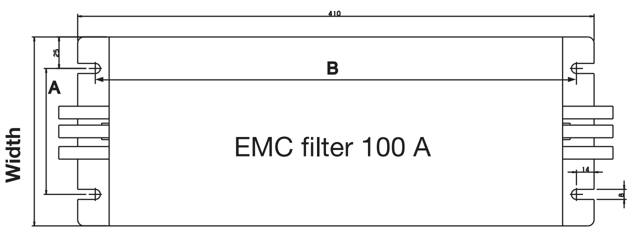










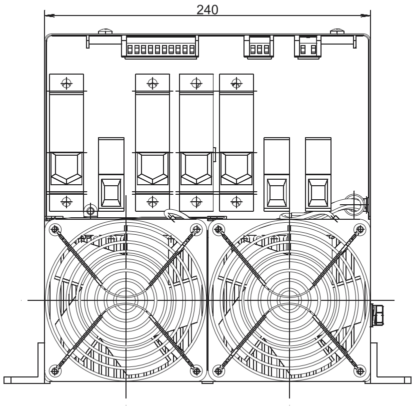


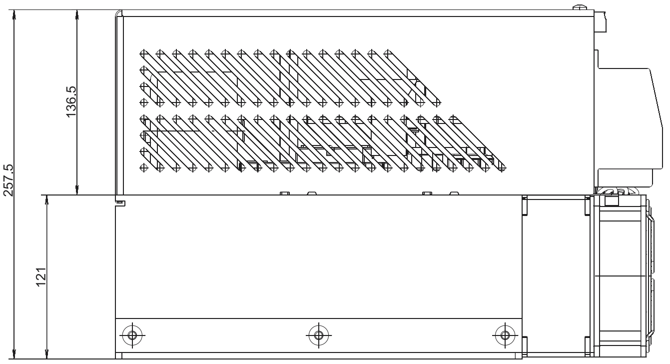
EMC filter current	Length in mm	Width in mm	Height in mm	Fastening holes Spacings in mm		Tightening torque	Connection cross-section in mm^2
for the power section				A	B		
16A	255	60	125	25	240	0.6 ... 0.8 Nm	0.25...4
20A	289	70	140	50	295	1.5 ... 1.8 Nm	0.5...10
32A	324	90	160	50	295	1.5 ... 1.8 Nm	0.5...10
63A	380	117	190	65	330	2 ... 2.3 Nm	0.5...16
100A	445	150	220	100	385	6 ... 8 Nm	10...50
for the control section							
1A	80	46	30	-	61		via tab connector 6.3 x 0.8mm

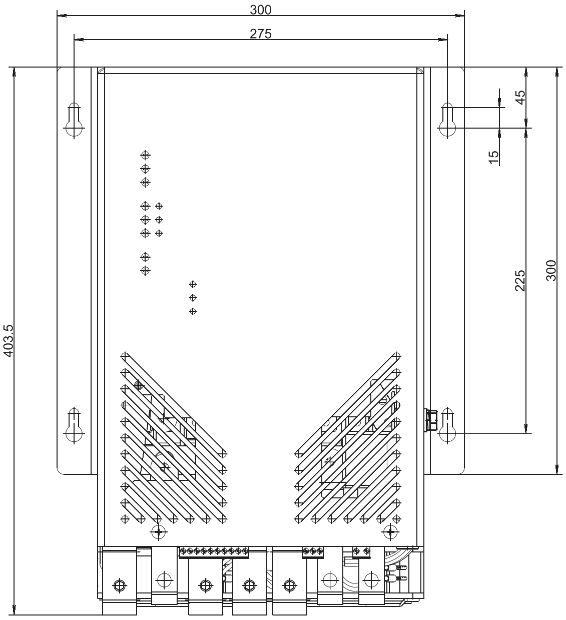
Type 709050/X3...

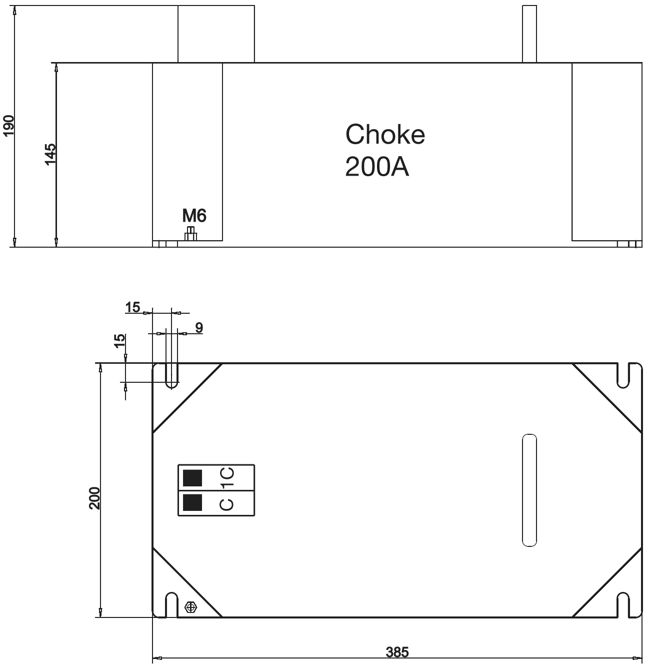
Note:

Tightening torque of the screws in the power section (Allen width across flats 5 mm) 6...8 Nm.
Tightening torque of the screws in the power section (Allen width across flats 6 mm) 15...20 Nm
Tightening torque of the 200A choke screw terminals: 15...20 Nm
Tightening torque of the green screw terminals in the control section: 0.5 ... 0.6 Nm

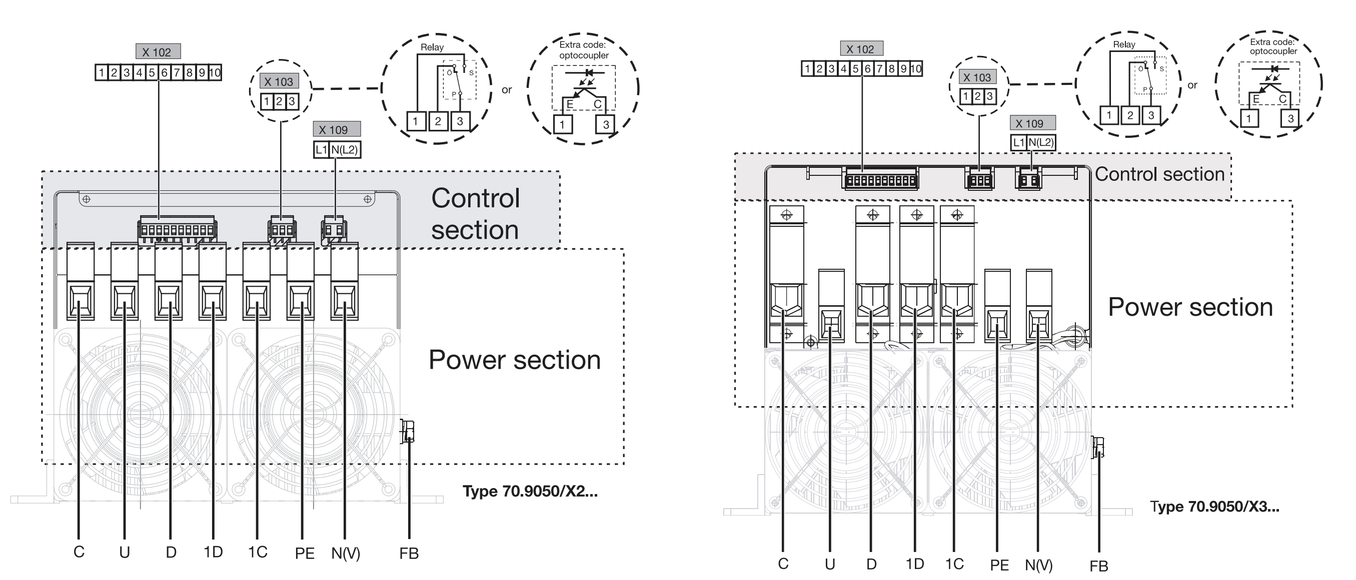








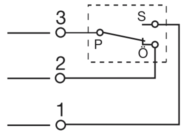
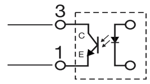
Connection diagram for type 709050/X2... and 709050/X3...



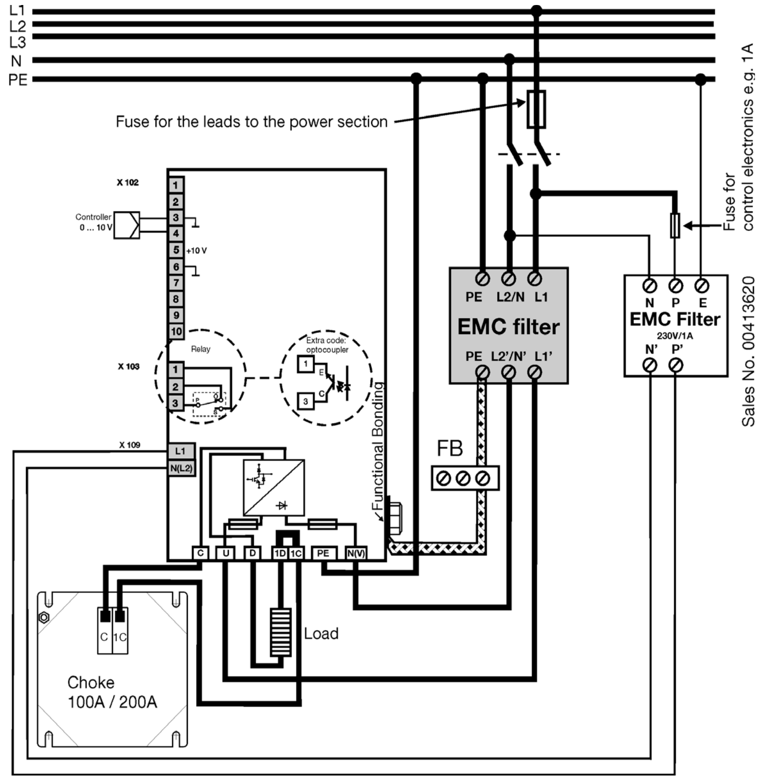
	Connection for	terminal screw X109	Detail
	Voltage supply to the control section	L1 N (L2)	L1—o L1 N (L2)—o N (L2)

	Connection for	screw connections in the power section	Detail
	Protective earth	PE	PE—o PE
	Functional equipotential bonding also see Operating Manual, Chapter 3.1 „Installation notes“	FB	FB—o FB
	Voltage supply to power section	U N(V)	L1—o U N (L2)—o N (V)
	Choke connection	1C C	o 1C o C
	Load connection	1D - D +	o 1D o D

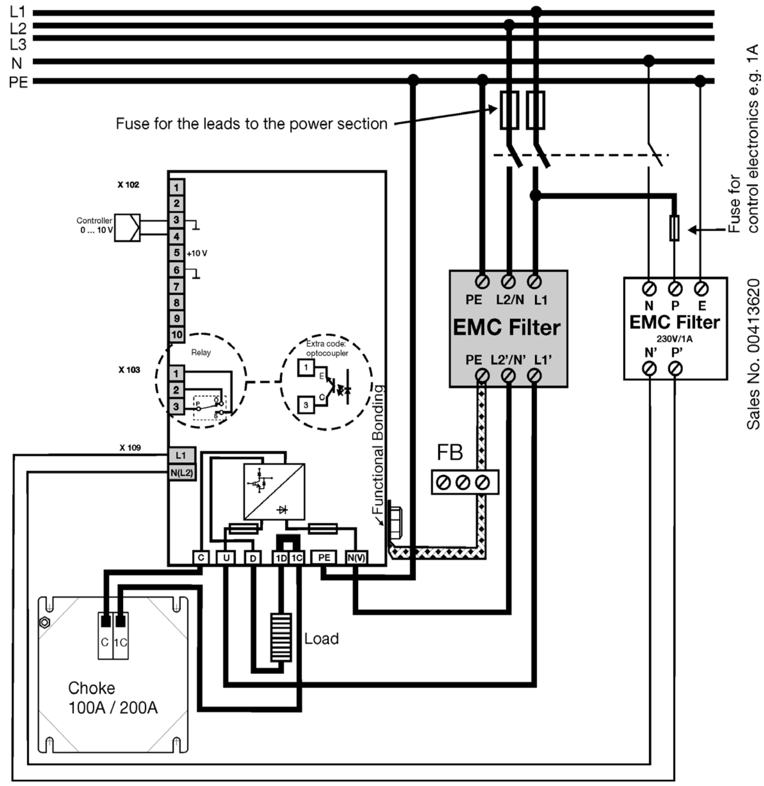
	Connection for	terminal screw X102	Detail
	Current input (differential input)	1- 2+	- o 1 + o 2
	Voltage input (referred to ground)	3 ground 4+	⊥ o 3 + o 4
	External manual adjustment Potentiometer 5 kΩ	3 Start (ground) 4 slider 5 end (+10V)	A o 3 5kΩ o 4 E o 5
	Firing pulse inhibit (inhibit input) I_K approx. 1mA (break or make contact)	6 ground 7+	o 6 o 7 or o 6 o 7
	Actual value output 0 ... 10V (U^2, P, I^2) I_{max} approx. 2mA	10 + 6 ground	+ o 10 ⊥ o 6
	Resistance output 0 ... 5V (R) I_{max} approx. 2mA	8 + 6 ground	+ o 8 ⊥ o 6

	Connection for	Screw terminal X103	Detail
	Load fault output with relay contact rating 230V AC/3A resistive load relay drops out at fault	1 make contact 2 break contact 3 common	
	Load fault output with optocoupler $I_{C\,max}$ = 2mA $U_{CEO\,max}$ = 32 V	3 collector 1 emitter	

Wiring for single-phase mode Phase / N with type 709050/X2... and 709050/X3...



Wiring for single-phase mode Phase / Phase with type 709050/X2 and 709050/X3...



Order details:

										(1) Basic version
									709050/81	IGBT power converter 70A (max. load voltage 120V) standard version
									709050/91	Customer-specific version
									709050/82	IGBT power converter 70A or 100A (max. load voltage 380V) standard version
									709050/92	Customer-specific version
									709050/83	IGBT power converter 200A (max. load voltage 210V) standard version
									709050/93	Customer-specific version
										(2) Voltage supply to the control section
x			x			x			11	115V AC +15/-20%, 48 ... 63Hz (only for 115V AC in the power section)
	x	x		x	x		x	x	12	230V AC +15/-20%, 48 ... 63Hz
										(3) Voltage supply to power section
x			x			x			115	115V AC +15/-20%, 48 ... 63Hz
	x			x			x		230	230V AC +15/-20%, 48 ... 63Hz
		x			x			x	400	400V AC +15/-20%, 48 ... 63Hz
										(4) Load voltage
x	x	x	x	x	x	x	x	x	020	20V DC
x	x	x	x	x	x	x	x	x	060	60V DC
x	x	x	x	x	x		x	x	090	90V DC
	x	x		x	x		x	x	120	120V DC
				x	x			x	150	150V DC
				x	x			x	210	210V DC
					x				270	270V DC
					x				380	380V DC
										(5) Load current
x	x	x	x	x	x				070	70A DC
			x	x	x				100	100A DC
						x	x	x	200	200A DC
										(6) Extra code for fault signal output
x	x	x	x	x	x	x	x	x	252	Relay SPDT (changeover contact) 3A
x	x	x	x	x	x	x	x	x	257	Optocoupler

	(1)		(2)		(3)		(4)		(5)		(6)
Order code		-		-		-		-		-	
Order example	**709050/81**	**-**	**12**	**-**	**230**	**-**	**060**	**-**	**070**	**/**	**252**

Standard accessories

1 Operating Manual

Accessories

Chokes
L = 0.6 mH / I_{Nom} =75A, 100A or 200A

EMC filter (for voltage supply to the power section)
115V/250V/440V AC I_{Nom} =16A, 20A, 32A, 63A or 100A,

EMC filter (for voltage supply to the control section)
115V/250V AC I_{Nom} =1A

Semiconductor fuse (2 fuses required)
extra fast 200A for I_{Nom} = 100A,
The I^2t value of the semiconductor fuse must be smaller than 20000 A^2s!
(only use for type 709050/X2... and 709050/X3... !)