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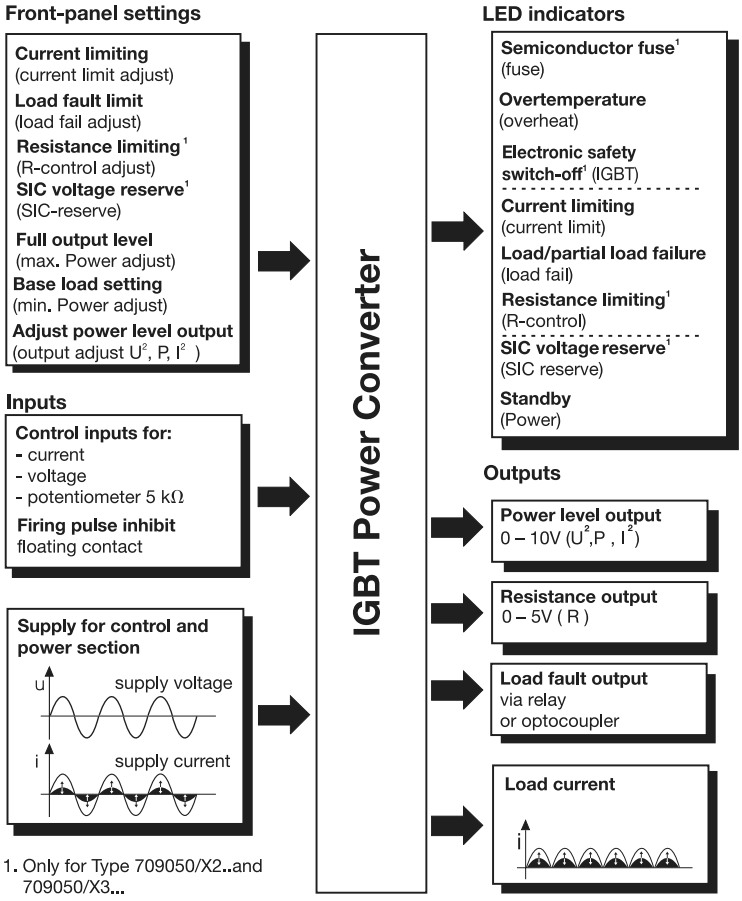
JUMO IPC
IGBT Power Converter
with amplitude control

Type 709050/X3 ...

Brief description

The JUMO IPC is a power converter for controlling heater loads that previously required a transformer (either a variable transformer or the combination of a transformer with a thyristor power converter).
It functions in such a way that it can be considered to be an electronic transformer with a pulsed DC output.
It combines the advantages of conventional variable transformers, such as amplitude control and sinusoidal supply current loading, with the advantages of a thyristor power switch, such as current limiting, load monitoring, subordinate control action and so on.
There is no electrical isolation between the supply voltage and the load voltage
These power converters are employed wherever substantial resistive loads need to be switched.
A choke and a mains/line filter, in addition to the IPC power converter itself, are mandatory for operating the IPC. Only chokes or 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 not needed.

Functional overview



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

Key features

- Low-interference on the supply with high-power resistive loads (flicker)
- Operation of low-voltage heater elements directly from the electrical supply, without a step-down transformer
- Minimum harmonics in the plant supply, and low weight (no power transformer required)
- Short-circuit proof during power-on
- Supply current proportional to the power required (amplitude control)
- Control is independent of the resistance characteristic of the heater elements
- Minimum control reactive power
- Compact size
- Free choice of subordinate control loop U^2, P, I^2
- Compensation of the ageing process in SIC heater elements
- Indication if the voltage reserve is no longer able to compensate for ageing[1]
- Resistance limiting, protection for Molybdenum Disilizid-Super heater elements from overheating in the upper temperature range[1]
- Integrated semiconductor fuses to protect the IPC from a short to ground[1]

1. Only for Type 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%	

Supply voltage

	Type 709050/X1...	Type 709050/X2....	Type 709050/X3...
Supply voltage Control section	115V AC +15%/ -20%, 48 — 63Hz (only with 115V AC in the power section) 230V AC +15%/ -20%, 48 — 63Hz		
Supply voltage 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, 60V, 90V, 120V DC ≂	20V, 60V, 90V, 120V, 150V, 210V, 270V, 380V DC ≂	20V, 60V, 90V, 120V, 150V, 210V DC ≂
Load current $I_{L\ rms}$	70A DC ≂	70A / 100A DC ≂	200A DC ≂
Load type	resistive loads		

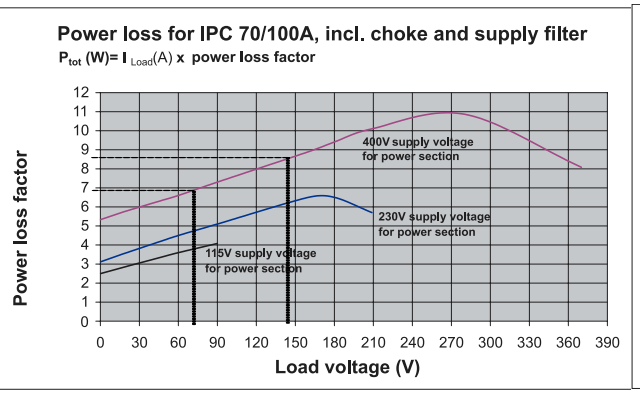
General characteristics

Circuit configuration	Single-phase operation		
Operating modes	Amplitude control		
Subordinate control loop	As standard: free choice between U^2, P, I^2 control, selected by internal switches		
Current limiting	In operation, the load current can be set by a trimmer on the front panel in the range 10 — 100% I_N. 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 10 x R_{Nom} R_{Nom} = nominal voltage / nominal current	
SIC reserve	-	Message is generated as soon as the voltage reserve in SIC heater elements is used up	
Power level output	As standard: free choice between U^2, P or I^2 signal, selected by 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-section 0.5 — 2.5mm²		
	in the power section: via cable lugs to DIN 46212	in the power section: via screw terminals 10mm² — 50mm²	in the power section: via screw terminals 10mm² — 95mm²
Semiconductor fuse	-	integrated into the unit	
Enclosure protection	IP00 as per EN 60 529	IP20 as per EN 60 529	
Protection class	Protection Class I, with isolated control circuitry for connection to SELV circuits.		
Permissible ambient temperature range	5 to 40°C (3K3 as per EN 60 721-3-3)		
Permissible storage temperature range	-10 to +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		
Operating 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		
Test voltage	as per EN 50 178		
Creepage distances	Control section – load circuit: ≥ 5.5 mm, control section – housing: ≥ 5.5 mm, device can be connected to SELV circuits. SELV = Separate Extra Low Voltage (safety low voltage)		
Earth leakage current	The earth leakage current of the IPC power converter with an EMC filter wired into the supply lead (excluding any leakage current in the load) is less than 3 mA.		
Housing	Metal housing		
Power consumption of control section	approx. 50 VA	approx. 75 VA	
Standard accessory	1 Operating Manual B 70.9050.0...		

Power loss (W)

Note: The power losses appear as heat dissipated in the heat sinks of the power converter.
This heat must be removed by the on-site arrangements (e. g. switchgear cabinet) according to the climatic conditions !

Type 709050/X1... and **Type 709050/X2...**



Type 709050/82-12-400-150-100/252
Converter ratings: load voltage = 150V; load current = 100A;
Supply voltage for power section = 400V

Resistive loads and Molybdenum Disilizid Super heater elements
Data for heater element: load voltage = 140V; load current = 90A

Measure the maximum load voltage that is actually produced (e.g. 140V) and find the intercept point of this value with the supply voltage curve for the power section. The value on the Y axis is the corresponding power loss factor (e.g. 8.5).

Multiply the load current (e.g. 90A) that flows through the load resistor by the power loss factor that applies for the maximum load voltage (e.g. 140V) and the result is the power loss (in W).

Power loss = 90(A) x power loss factor

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

Type 709050/92-12-400-150-100/252
Converter ratings: Load voltage = 150V; Load current = 100A;
Supply voltage for power section = 400V; P-control, P = 6300W

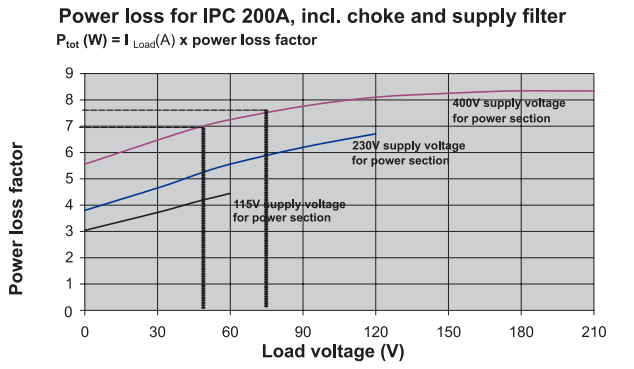
SIC heater element
Data for SIC heater element: new: 70V/90A, old 140V/45A; P = 6300W

Measure the maximum load voltage that is actually produced for the **new** SIC heater element (e.g. 70V) and find the intercept point of this value with the supply voltage curve for the power section. The value on the Y axis is the corresponding power loss factor (e.g. 6.8).

Multiply the load current (e.g. 90A) that flows through the **new** SIC heater element by the power loss factor that applies for the maximum load voltage (e.g. 70V) and the result is the power loss (in W).

Power loss = 90(A) x power loss factor

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



Type 709050/83-12-400-90-200/252
Converter ratings: load voltage = 90V; load current = 200A;
Supply voltage for power section = 400V

Resistive loads and Molybdenum Disilizid Super heater elements
Data for heater element: load voltage = 75V; load current = 130A

Measure the maximum load voltage that is actually produced (e.g. 75V) and find the intercept point of this value with the supply voltage curve for the power section. The value on the Y axis is the corresponding power loss factor (e.g. 7.5).

Multiply the load current (e.g. 130A) that flows through the load resistor by the power loss factor that applies for the maximum load voltage (e.g. 75V) and the result is the power loss (in W).

Power loss = 130 (A) x power loss factor

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

Type 709050/93-12-400-90-200/252
Converter ratings: Load voltage = 90V; Load current = 200A;
Supply voltage for power section = 400V; P-control, P = 9000W

SIC heater element
Data for SIC heater element: new: 45V/200A, old 90V/100A; P = 9000W

Measure the maximum load voltage that is actually produced for the **new** SIC heater element (e.g. 45V) and find the intercept point of this value with the supply voltage curve for the power section. The value on the Y axis is the corresponding power loss factor (e.g. 6.8).

Multiply the load current (e.g. 200A) that flows through the **new** SIC heater element by the power loss factor that applies for the maximum load voltage (e.g. 45V) and the result is the power loss (in W).

Power loss = 200(A) x power loss factor

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

General data

Fault signal output	**Type 709050/X1...**	**Type 709050/X2...**	**Type 709050/X3...**
Relay (SPDT-changeover contact) without contact suppression	150,000 switching actions at switched power level of 3A/230V 50Hz (resistive load)		
Optocoupler output	I_{Cmax} = 2mA, U_{CEOmax} = 32V		
Power converter dimensions			
(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 kg	approx.17 kg	approx. 22.5 kg

Chokes

Type	**Dimensions**	**Connection cross-section**	**Tightening torque**	**Weight**	**Sales No.**
L = 0.6 mH / I_N = 75A IP20 enclosure protection as per EN 60 529	Choke diameter: 155 mm Height: 135 mm Diameter of fixing hole: 10.4 mm	4 — 25 mm^2	screw terminals max. 4 — 4.5 Nm	approx. 7.5kg	70/00392474
L = 0.6 mH / I_N = 100A IP20 enclosure protection as per EN 60 529	Height: 208 mm, Width: 200 x 200 mm	10 — 50 mm^2	screw terminals max. 6 — 8 Nm	approx. 20 kg	70/00415759
L = 0.6 mH / I_N = 200A IP20 enclosure protection as per EN 60 529	Height: 190 mm, Width: 200 x 385 mm	35 — 95mm^2	screw terminals max. 15 — 20 Nm	approx. 37 kg	70/00436848

EMC filter

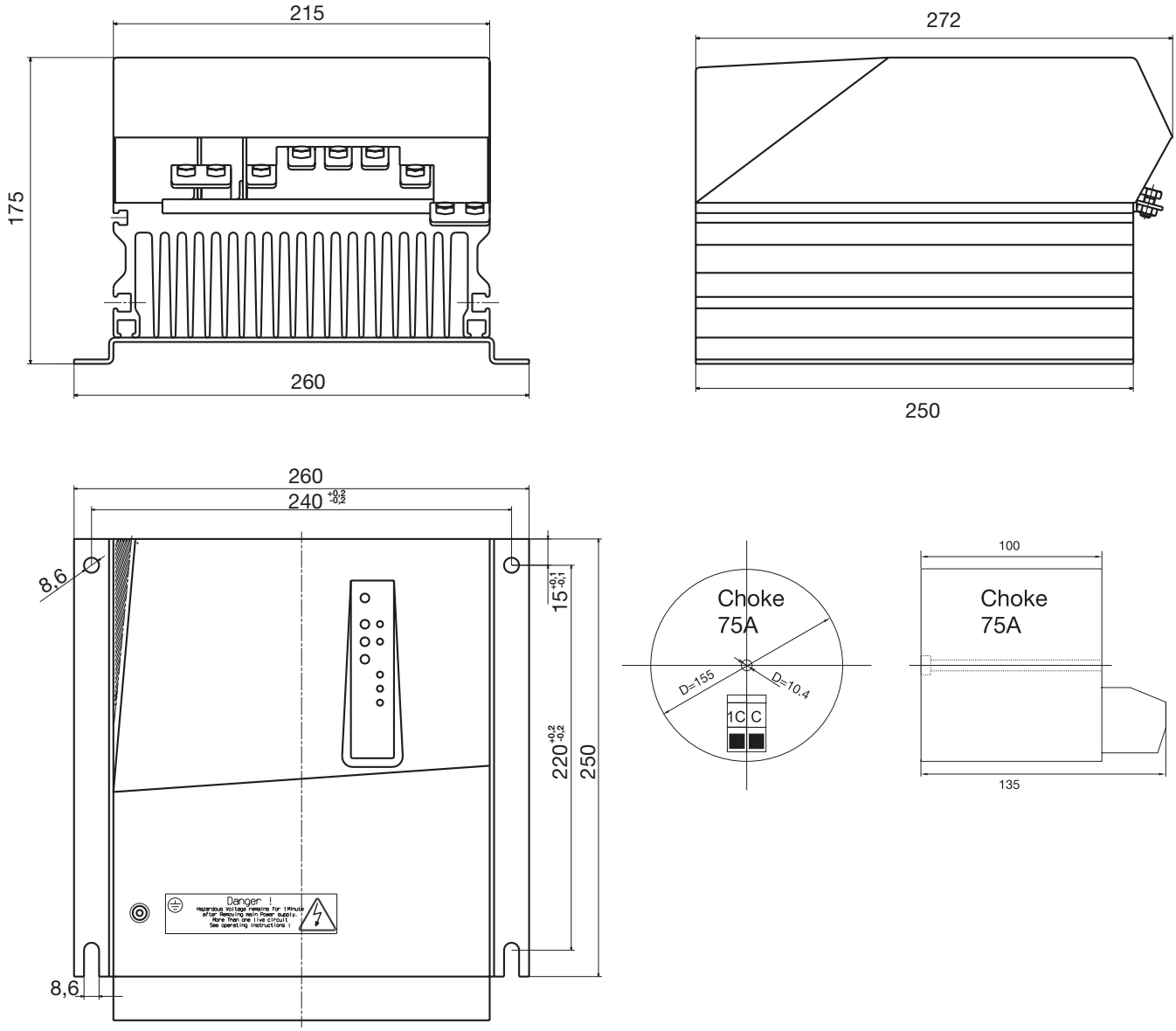
For the supply to the power section						
Nominal voltage, nominal current	Dimensions (length x width x height) in mm	Connection cross-section	Tightening torque	Weight	Permissible ambient temperature	Sales No.
115V/250V/440V AC, I_{Nom} = 16A	(255 x 50 x 126)	0.25 — 4 mm^2	0.6 — 0.8 Nm	approx. 4 kg	40°C	70/00399527
115V/250V/440V AC, I_{Nom} = 20A	(289 x 70 x 140)	0.5 — 10 mm^2	1.5 — 1.8 Nm	approx. 5.5 kg	40°C	70/00438775
115V/250V/440V AC, I_{Nom} = 32A	(324 x 90 x 160)	0.5 — 10 mm^2	1.5 — 1.8 Nm	approx. 9.5 kg	40°C	70/00409831
115V/250V/440V AC, I_{Nom} = 63A	(380 x 117 x 190)	0.5 — 16 mm^2	2 — 2.3 Nm	approx. 17 kg	40°C	70/00409990
115V/250V/440V AC, I_{Nom} = 100A	(445 x 150 x 220)	10 — 50 mm^2	6 — 8 Nm	approx. 26 kg	40°C	70/00431997
For the supply to the control section (only required if the power section is operated from 400 V AC)						
115V/250V AC, I_{Nom} = 1A	(80 x 45 x 30)	through faston connectors 6.3 x 0.8mm	—	approx. 120 g	40°C	70/00413620

Dimensions for Type 709050/X1...

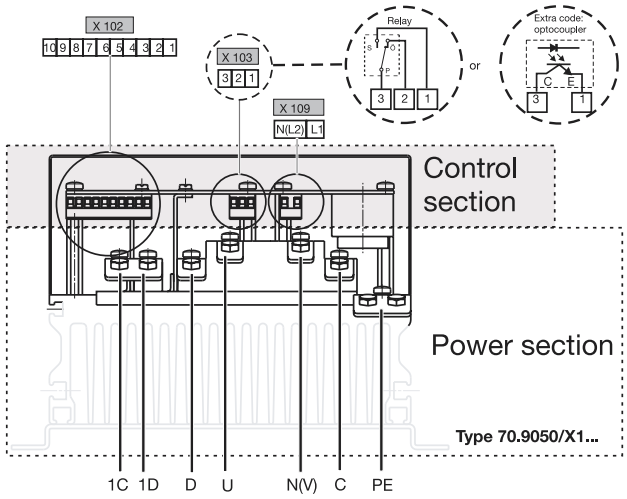
Type 709050/X1...

Note:

Tightening torque for screws in power section (wrench size 10mm a/f): max. 15 Nm.
Tightening torque for screw terminals, for 75A choke: 4 — 4.5 Nm
Tightening torque for green screw terminals in control section: 0.5 — 0.6 Nm



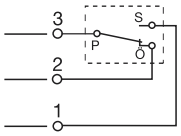
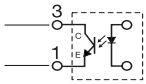
Connection diagram for Type 709050/X1...



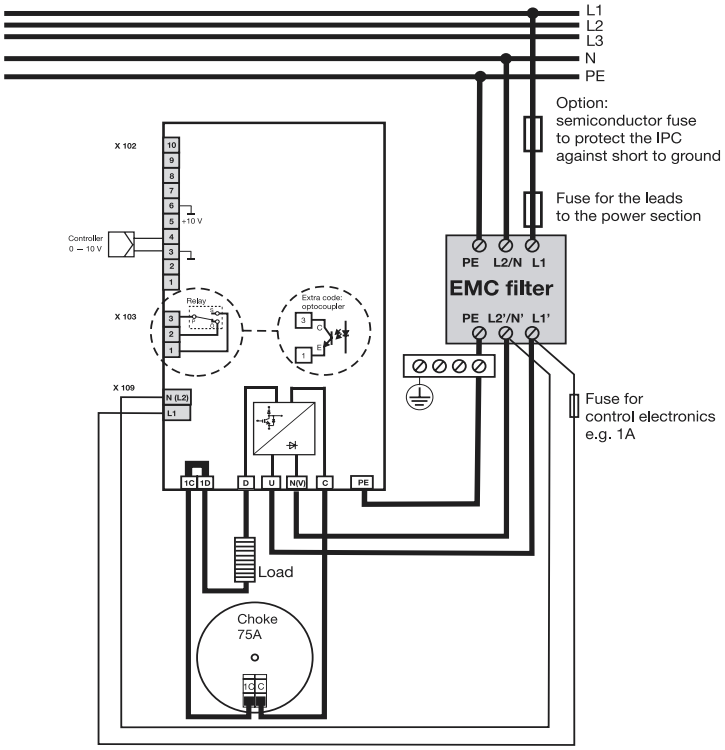
	Connection for	Screw terminal X109	Diagram
→	Supply for control section	L1 N (L2)	L1 — o L1 N (L2) — o N (L2)

	Connection for	Screw connections in power section	Diagram
→	Protective earth conductor	PE	PE — o PE
→	Supply for 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

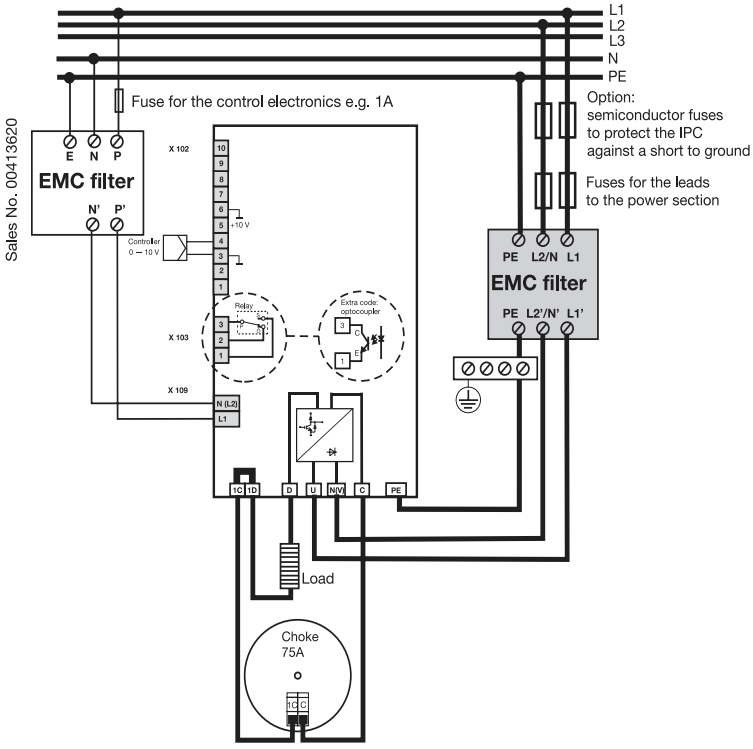
	Connection for	Screw terminal X102	Diagram
→	Current input (differential input)	1- 2+	o 1 o 2
	Voltage input (referred to ground)	3 ground 4+	o 3 o 4
	External manual adjustment Potentiometer 5 kΩ	3 start (ground) 4 slider 5 end (+10V)	A o 3 5kΩ o 4 E o 5
	Firing pulse inhibit (inhibit input) I_K approx. 1mA (SPST-NC) break or (SPST-NO) make contact	6 ground 7+	o 6 o 7 or o 6 o 7
→	Power level 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	Diagram
	Load fault output, with relay Contact rating 230V/3A AC resistive load Relay drops out on fault	1 (SPST-NO) make contact 2 (SPST-NC) 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 operation Phase / N for Type 709050/X1...



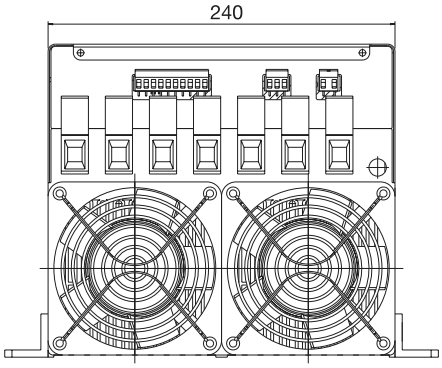
Wiring for single-phase operation Phase / Phase for Type 709050/X1...

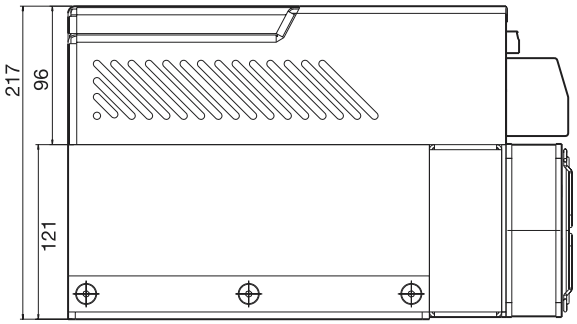


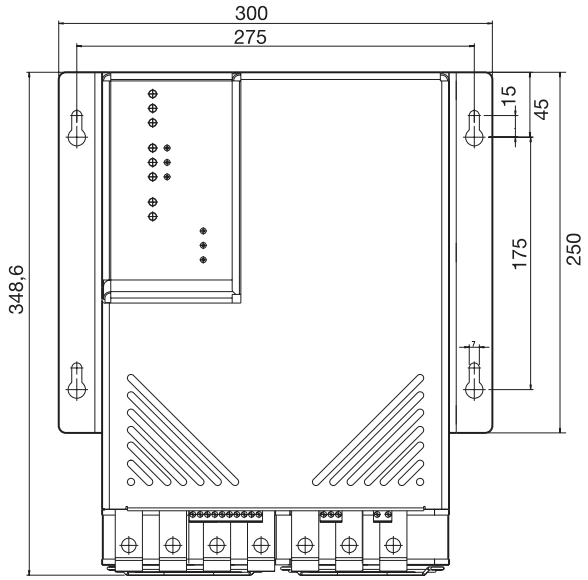
Dimensions

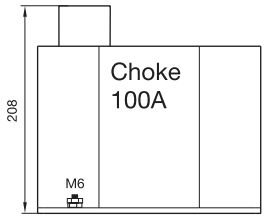
Type 709050/X2...

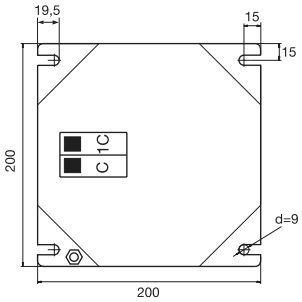
Note:
Tightening torque for the screws in the power section (socket wrench, 5 mm a/f) is 6 — 8 Nm.
Tightening torque for screw terminals, for 100A choke: 6 — 8 Nm
Tightening torque for green screw terminals in control section: 0.5 — 0.6 Nm

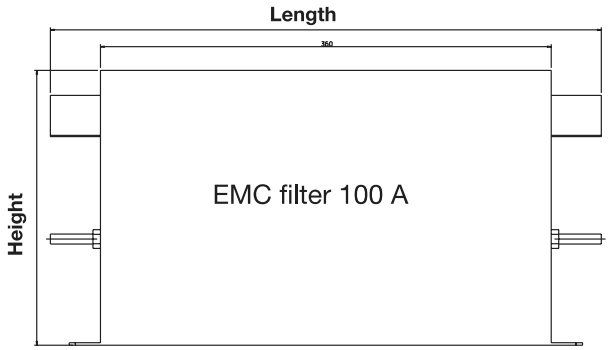


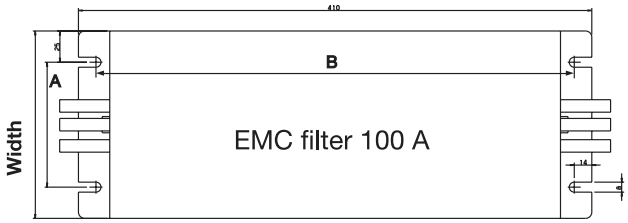










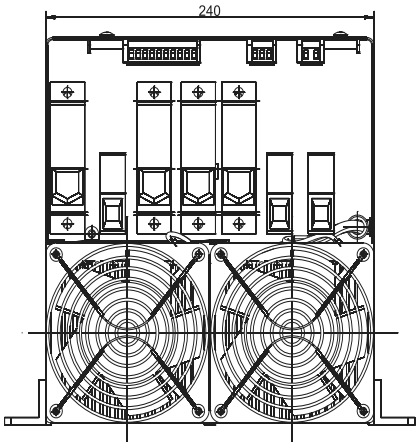


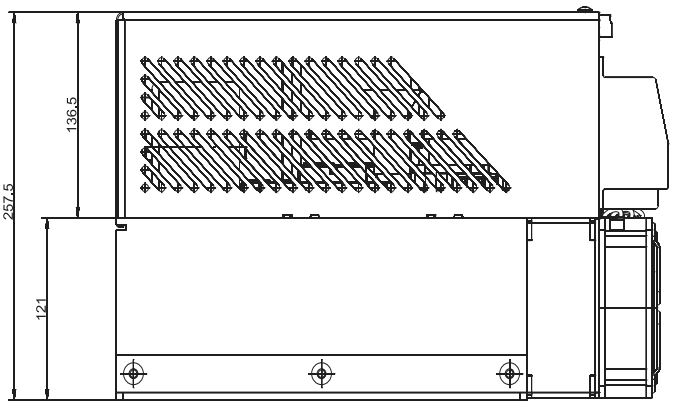
EMC filter current	Length (mm)	Width (mm)	Height (mm)	Fixing hole spacing (mm)		Tightening torque	Connection cross-section (mm^2)
for power section				**A**	**B**		
16A	255	50	126	25	240	0.6 — 0.8 Nm	0.2—4
20A	289	70	140	50	295	1.5 — 1.8 Nm	0.5—10
32A	324	90	160	50	295	1.5 — 1.8 Nm	0.5—10
63A	380	117	190	65	330	2 — 2.3 Nm	0.5—16
100A	445	150	220	100	385	6 — 8 Nm	10—50
for control section							
1A	80	46	30	-	61		via faston connectors 6.3 x 0.8mm

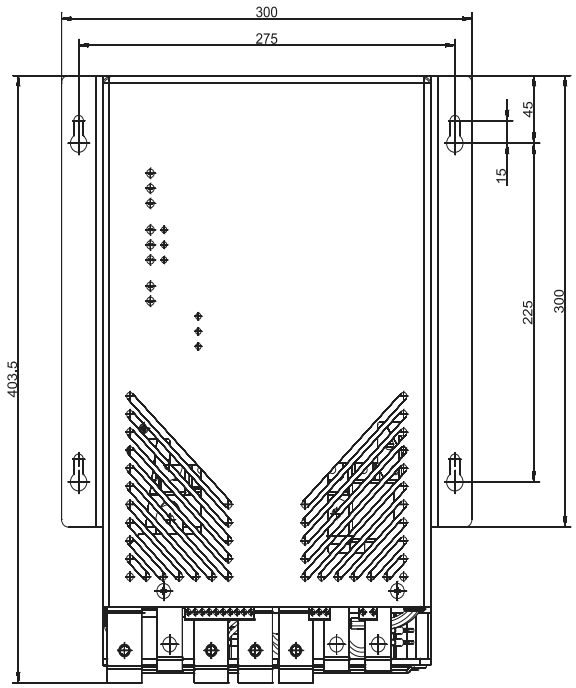
Type 709050/X3...

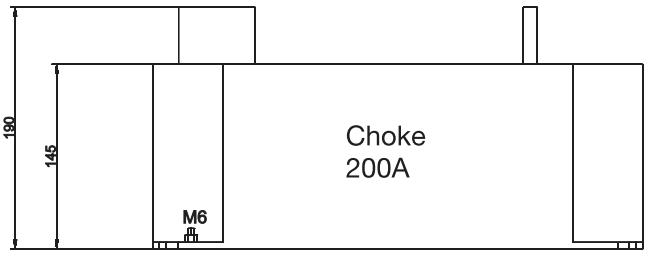
Note:

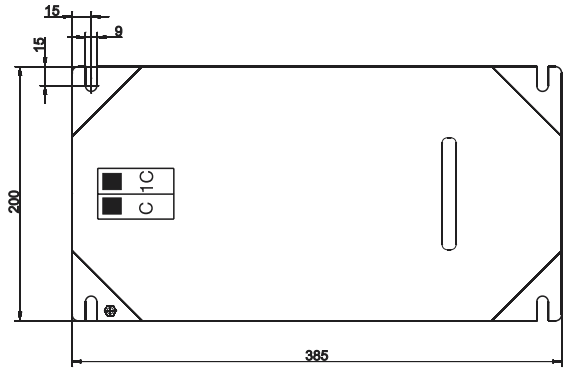
Tightening torque for the screws in the power section (socket wrench, 5 mm a/f) is 6 — 8 Nm
Tightening torque for the screws in the power section (socket wrench, 6 mm a/f) is 15 — 20 Nm
Tightening torque for screw terminals, for 200A choke: 15 — 20 Nm
Tightening torque for green screw terminals in control section: 0.5 — 0.6 Nm



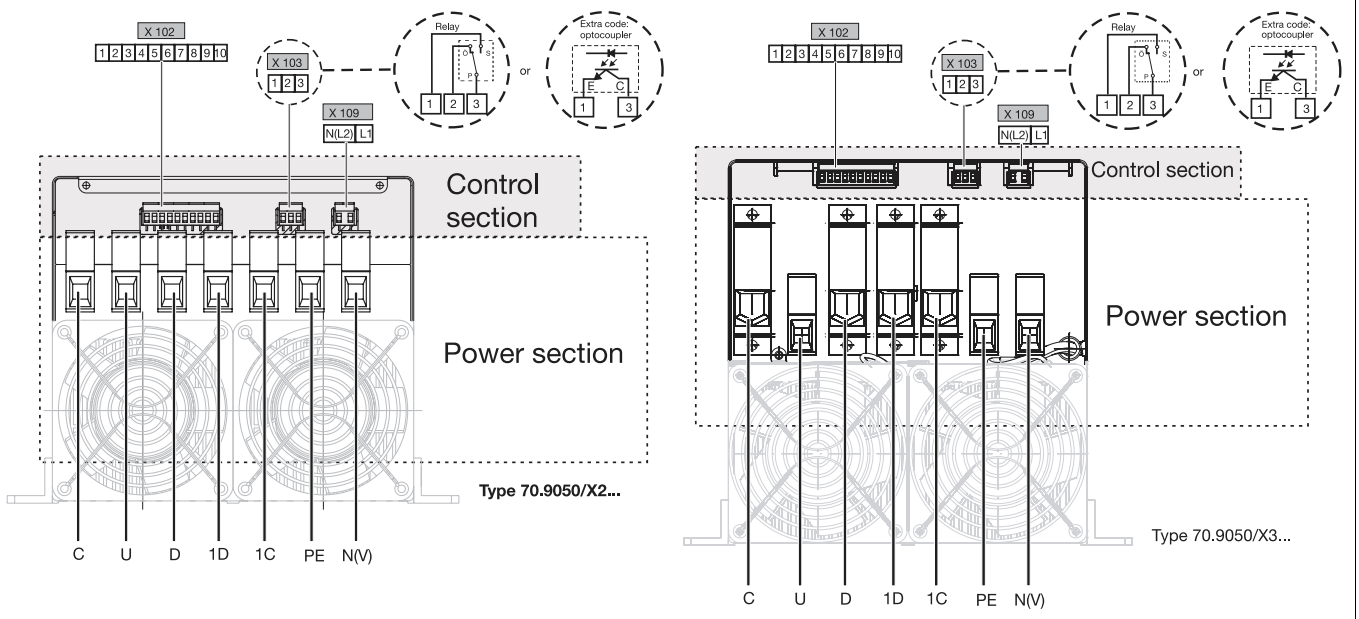








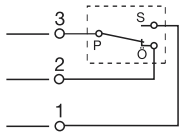
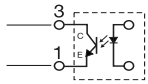
Connection diagram for Type 709050/X2... and 709050/X3...



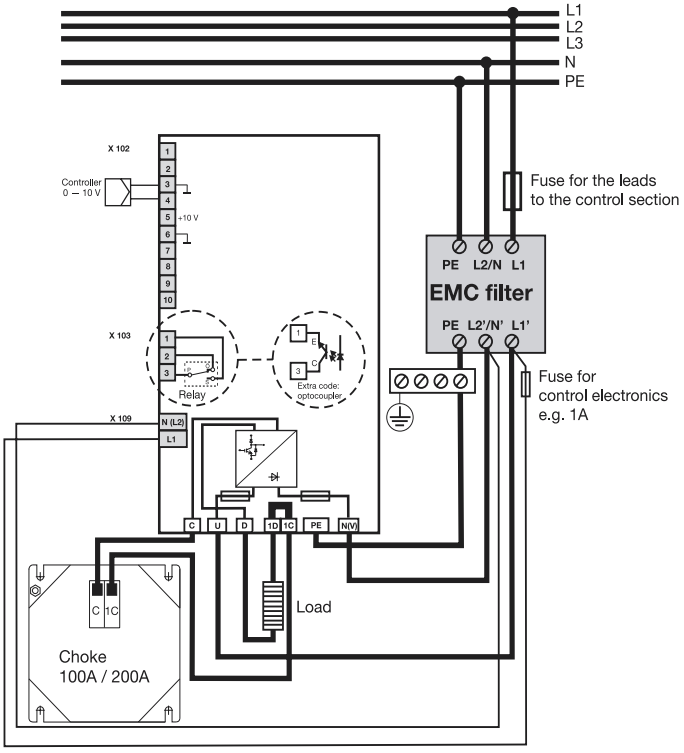
	Connection for	Screw terminal X109	Diagram
→	Supply for control section	L1 N (L2)	L1 — o L1 N (L2) — o N (L2)

	Connection for	Screw connections in power section	Diagram
→	Protective earth conductor	PE	PE — o PE
→	Supply for 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

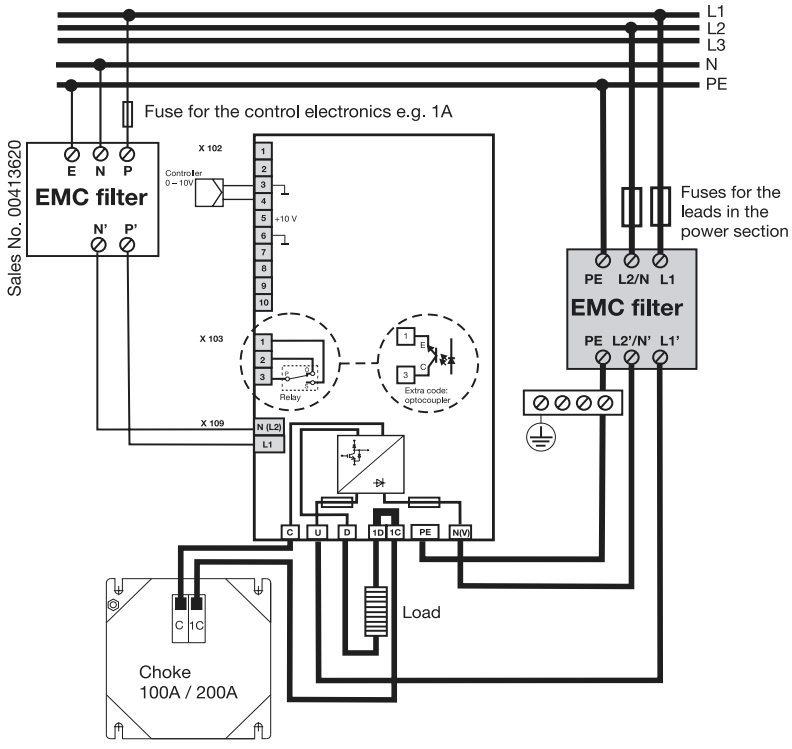
	Connection for	Screw terminal X102	Diagram
→	Current input (differential input)	1- 2+	o 1 o 2
	Voltage input (referred to ground)	3 ground 4+	o 3 o 4
	External manual adjustment Potentiometer 5 kΩ	3 start (ground) 4 slider 5 end (+10V)	A o 3 5kΩ o 4 E o 5
	Firing pulse inhibit (inhibit input) I_K approx. 1mA (SPST-NC) break or (SPST-NO) make contact	6 ground 7+	o 6 o 7 or o 6 o 7
→	Power level 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	Diagram
	Load fault output, with relay Contact rating 230V/3A AC resistive load Relay drops out on fault	1 (SPST-NO) make contact 2 (SPST-NC) 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 operation Phase / N for Type 709050/X2... and 709050/X3...



Wiring for single-phase operation Phase / Phase for 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			customized version
								709050/82			IGBT power converter 70A or 100A (max. load voltage: 380V) standard version
								709050/92			customized version
								709050/83			IGBT power converter 200A (max. load voltage: 210V) standard version
								709050/93			customized version
									(2)	**Supply for control section**	
x			x			x			11		115V AC +15/-20%, 48 — 63Hz (only with 115V AC in the power section)
	x	x		x	x		x	x	12		230V AC +15/-20%, 48 — 63Hz
									(3)	**Supply for 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: 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 accessory

1 Operating Manual

Accessories

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

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

EMC filter (for supply to control section)
(only necessary for 400V AC supply voltage in power section)
115V/250V AC I_{Nom} =1A

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