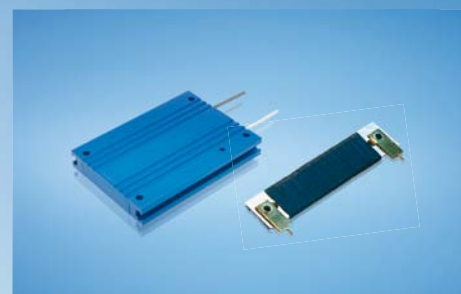
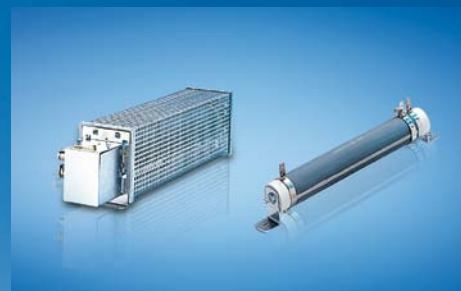


**DYNAMIK DURCH
WIDERSTAND**

***DYNAMICS
THROUGH RESISTANCE***



FRIZLEN
LEISTUNGSWIDERSTÄNDE
POWER RESISTORS

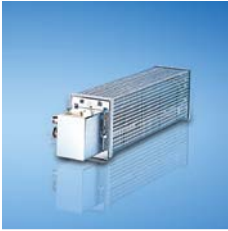


DYNAMIK DURCH WIDERSTAND

Wir über uns

DYNAMICS THROUGH RESISTANCE

About us



DIE KLASSIKER

Drahtgewickelte Rohrfestwiderstände
10 bis 6000 Watt

THE ORIGINAL ONES

Wirewound tubular fixed resistors
10 up to 6000 Watt

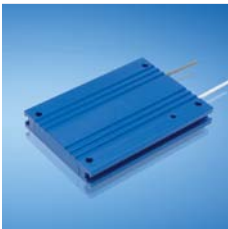


DIE FLEXIBLEN

**Zementierte
Drahtdrehwiderstände**
16 bis 1500 Watt

THE FLEXIBLE ONES

**Cement coated wirewound
variable resistors**
16 up to 1500 Watt



DIE INNOVATIVEN

**Drahtgewickelte Flachwiderstände,
auch gekapselt und in wassergekühlter
Ausführung**
5 bis 40000 Watt

THE INNOVATIVE ONES

**Wirewound flat resistors,
also enclosed and
watercooled**
5 up to 40000 Watt



DIE BELASTBAREN

Last- und Prüfwiderstände
0,01 bis 250 Kilowatt

THE LOADABLE ONES

Load- and test resistors
0.01 up to 250 Kilowatt



DIE MODULAREN

**Drahtgewickelte
Lamellenfestwiderstände**
0,15 bis 30 Kilowatt

THE MODULAR ONES

**Wirewound lamina type
fixed resistors**
0,15 up to 30 Kilowatt



DIE ROBUSTEN

Stahlgitterfestwiderstände
0,5 bis 250 Kilowatt

THE ROBUST ONES

Steel-grid fixed resistors
0,5 up to 250 Kilowatt



FRIZLEN SONDERGERÄTE

DC-POWERSWITCH
Kundenspezifische Widerstandsgeräte

FRIZLEN SPECIAL DEVICES

DC-POWERSWITCH
Customised resistor units

Das richtige Produkt für Ihre Anwendung

Suitable products for your application

Anwendungen	Application	Typleistung [kW]		Produktgruppe					
		min.	max.	T 100	T 200	T 300	T 400	T 500	T 600
Bremswiderstände für Frequenzumrichter- und Gleichstromantriebe	Braking resistors for frequency converters and DC drives	0,01	40,0			X		X	
		0,01	6,0	X				X	X
		6,0	30,0					X	X
		30,0	250						X
Belastungswiderstände für Spannungsquellen, Batterien, USV-Geräte, Generatoren und Netzgeräte	Load resistors for supply units, power packs, batteries, UPS units and generators	0,01	250				X		
Stufenlose Drehzahlverstellung von kleinen Gleich- und Wechselstrommotoren	Stepless variable speed adjustment for small AC and DC motors	0,01	1,5		X		X		
Feldsteller für Generatoren, Widerstände zur Strom- und Spannungsbegrenzung	Field rheostats for generators, resistors for current and voltage limitation	0,01	3,8	X	X				
Motorische Potentiometer als fernbetätigte Sollwertgeber	Motorised potentiometers as nominal value setters	0,01	1,5		X				
Widerstandsbaugruppen für Einbau in leistungselektronische Geräte	Resistor modules fitting into electronic power devices	0,01	0,75	X		X		X	
		0,3	2,0					X	
Anlass- und Stellwiderstände für Schleifringläufer- und Gleichstrommotoren	Starting and regulating resistors for slip-ring rotor and DC motors	0,15	30,0					X	
		0,5	250						X
Ständer-Vorschaltwiderstände für Kurzschlussläufermotoren	Stator series resistors for squirrel-cage motors	0,5	250						X
Strombegrenzungswiderstände zur Ladung und Entladung von Kondensatoren	Resistors for current limitation e.g. for charging and discharging of capacitors	0,01	1,0	X		X		X	
Experimentier- und Prüfwiderstände in Laboratorien, Schulen und Universitäten	Resistors for experimenting and testing in laboratories, schools and universities	0,01	50				X		
Widerstände zur Schutzbeschaltung, Filterwiderstände	Protective resistors, filter resistors	0,01	0,75	X		X		X	
		0,75	6,0	X				X	
		1,5	22,0						X



Wir über uns

Mit FRIZLEN Leistungswiderständen haben Sie elektrische Leistung voll im Griff.

Unser umfassendes Know-how zeigt sich im kompletten Spektrum vom Einzelstück bis zur Serie, für Leistungen von 5 Watt bis 250 Kilowatt.

Einsatz- und Anwendungsgebiete stellen die Anforderungen, die Lösungen entwickeln wir.

Ihrem Anforderungsprofil entsprechend berechnen und fertigen wir Widerstände und Widerstandskombinationen unter Berücksichtigung Ihrer Vorgaben. Natürlich beraten wir Sie gern und ermitteln auf Wunsch die Widerstandsdimensionierung mit Hilfe EDV-gestützter Berechnung und Simulation.

Hochwertige Standard- sowie Sonderlösungen von FRIZLEN sorgen für Dynamik im Verbund mit leistungselektronischen Geräten in Maschinen und Anlagen. Bewegung zu stoppen, konstant zu halten und exakte Abläufe zu ermöglichen – dabei unterstützen wir die elektrische Antriebstechnik und verbessern so die Dynamik Ihrer Antriebe.

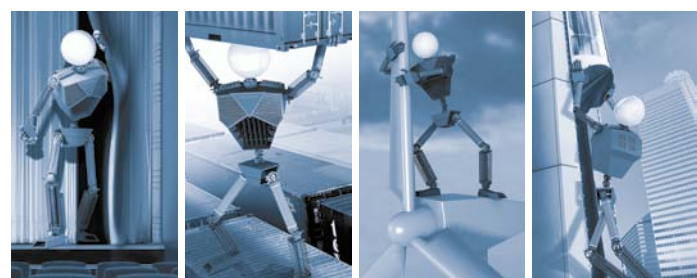
About us

Keep your electric power under control with FRIZLEN power resistors.

Our extensive know-how is demonstrated in a complete spectrum from single item up to series production, for power values from 5 watts up to 250 kilowatts. Different ranges of use and application set the requirements, we provide the solutions.

We design and produce resistors and resistor combinations exactly to meet your requirements. We are, of course, happy to advise you according to your specification. Upon request, we can determine resistor dimensioning using our computer-supported calculation and simulation system.

High-quality standard and special solutions from FRIZLEN ensure dynamics when you are dealing with high performance electrical equipment in machines and processes. We support electrically driven power engineering by stopping movement, keeping it constant and ensuring exact sequences, which improves the dynamics of your drive systems.





Last- und Prüfwiderstände

0,01 bis 250 Kilowatt

Stationäre oder mobile Stellwiderstandsgeräte für Labor oder Versuchsfeld. Individuelle Auslegung je nach Leistung und Anforderungen der Last in Stufen oder fein einstellbar.

Einsatzbereiche in Schulen und Universitäten, im Bereich Forschung und Entwicklung. Für den Einsatz in der industriellen Nutzung in unterschiedlichen Schutzarten lieferbar.

- Ein- und dreiphasige Ausführungen
- Stufenlose bzw. stufige Einstellung des Widerstandswertes
- Auch für mobilen Einsatz
- Gehäuse verzinkt, lackiert bzw. aus Aluminium in Laborausführung

Load and test resistors

0,01 up to 250 Kilowatt

Stationary or mobile loads for laboratory or test sites. Individually designed according to the requirements of power and the type of load, which can be fine adjustable or switched in steps.

For example at schools or universities, in research and development or as well as in different degrees of protection for industrial needs.

- One- or threephase design
- Resistance value fine adjustable or switched in steps
- For mobile use
- Enclosure made from hot-galvanised sheet steel, varnished, respectively out of aluminium in laboratory design

Contents

This list describes load and test resistors for laboratory environment, test rooms and industrial environment with different protection degrees. These resistor types are series resistor usable for different applications like voltage divider or as load resistor. The load and test resistors consist of different resistor elements out of our type series T100 to T600.

<i>maximum power</i>	<i>characteristics</i>	<i>type series</i>	<i>page</i>
	survey		T402E
	technical details		T403E
Laboratory resistors, fixed and adjustable			
3,0 kW	fixed resistors	FZ.L..	T410E
1,4 kW	slide resistors	SZ.L..	T411E
3,8 kW	slide resistors, with spindle drive	SZ.PL..	T412E
0,25 kW	potentiometers	RGL..	T413E
1,0 kW	slide resistors, with stop, stepped winding	SU..L/SZ..L..	T414E
Laboratory resistors, switchable and adjustable			
5,6 kW	Adjustable, 14/28 V, laboratory version	BW 18 – BW 81	T420E
50 kW	Adjustable, 230/400 V, laboratory version	BW 20 – BWV 83	T421E
Resistors in low weight design, switchable with steps			
100 kW	switchable with steps, mobile version	BWMV37..	T422E
1,3 kW	load- and discharging resistor, IP 54	FDLZ..	T423E
6,0 kW	19-inch rack, mounting in switch cabinet	BWZV..	T424E
Resistors in industrial version, fixed and switchable with steps			
60 kW	steelgrid resistors with natural cooling	FA 3.. / FS 3..	T430E
500 kW	steelgrid resistors with fan	FAV 3.. / FSV 3..	T431E
250 kW	steelgrid resistors with switch cabinet	FAVR3../FSVR3..	T432E
Further series			T433E

Properties

- **low temperature coefficient for laboratory version and test area**
⇒ constant ohmic value over a large temperature range
- **high powers adjustable**
⇒ in steps by means of switches or contactors, or without steps by means of slider and spindle
- **one- and three-phase versions**
⇒ Application for different power supplies, also for different voltages
- **enclosure made of hot galvanised steel sheet; type BWMV aluminium chassis**
⇒ Laboratory version with additional varnishing
- **very robust construction**
⇒ different protection degrees and installation possibilities, also mobile
- **control of the load steps**
⇒ by electric contactors or switches placed in an attached switch cabinet for the type FAVR/FSVR or by internal switches for type BW and BWMV

Applications

- regulating resistors in laboratory or test field, stationary or mobile
- load resistors for batteries, battery chargers, UPS-units, generators, emergency power units
- load resistors up to protection degree IP 23, usable for outdoor location
- resistors for experimenting and testing in laboratories, schools and universities

T 400 - survey

type series		FZL	SZL	SZPL	RGL	SUL - SZL	BW18 - BW 81	BW18 - BWV 83	BWMV 37..	FDLZ	BWZV	FA./ FS. 3...	F.V 3..	F.VR 3..
	page symbol	T410 E	T411 E	T412 E	T413 E	T414 E	T420 E	T421 E	T422 E	T423 E	T424 E	T430 E	T431 E	T432 E
typical power from [kW]		0,07	0,1	1,2	0,008	0,1	1,2	1,2	12,5	0,24	2,0	5	70	70
typical power up to [kW]		3	1,4	3,8	0,25	1,0	5,6	50	100	1,28	6,0	60	500	250
max. terminal connections		2	3	3	3	2	3	6	6	2	6	40	40	40
protection degree IP 20		X	X	X	X	X	X	X	X		X	X	X	X
protection degree IP 23												X	X	X
protection degree IP 54										X				
horizontal mounting											X	X	X	X
temperature switch (optional)									X			X	X	X
forced ventilation								X	X		X		X	X
transportable									X	X		X		
switchable in steps							X	X	X	X	X			X
fine adjustment device			X	X	X	X	X	X						
laboratory version		X	X	X	X	X	X	X	X	X	X			

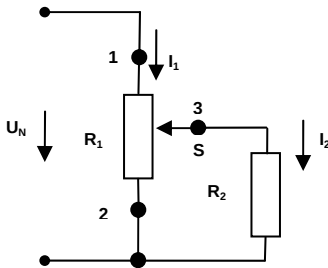
Rights for improvements and modifications of our products reserved.
Modifications, errors and misprints justify no claim for damages.
We refer to our terms of sales and delivery.

Technical details

<i>Construction</i>	This list includes resistors, which are derived from the type series T100 wirewound tubular fixed resistors, T200 cemented wirewound variable resistors, T500 lamina type fixed resistors and T600 steel-grid fixed resistors. More technical details are described in the lists of these resistor types.
<i>Resistance values/ Production tolerance/ Temperature dependency</i>	The resistance values in the column "production range" refer to our standard production program. The normal tolerance is $\pm 10\%$. The resistance value of the wirewound laboratory resistors is changing only slightly. The resistance will change between cold and warm condition: wiring made of CuNi 44 approx. $\pm 1\%$ and made of CrAl 25 5 approx. $+1\%$. The resistance value for the resistors in industry version with steel-grid resistor elements, increases approx. $+15\%$ between cold and operating temperature. This is considered in the calculation for our load resistors, so that the rated power will be achieved at operating temperature.
<i>Air- and creepage distances</i>	Air and creepage distances are rated according to IEC 664 (DIN EN 0110 part 1) for the overvoltage category III and degree of pollution 3 for grounded three-phase mains supplies up to $3 \times 500 \text{ V}$. Testing voltage 2.5 kV AC. These data are valid for all devices that are connected to mains voltage and derived voltages, as for example the intermediate circuit voltage of frequency converters. Do not conclude from the calculated relation between the rated power and the maximum producible ohmic value to the rated voltage!
<i>Protective measures</i>	All our power resistors with degree of protection IP 20 and IP 23, correspond to safety class I, i.e. connections for protective earth conductor according to EN 61140 are provided.
CE	These devices also comply with the CE low voltage directive. Power resistors being passive electronical or electrical units are not affected by the specific EMC standards. They do not produce any interfering radiations nor are they affected.
<i>Terminal details</i>	The choice of the terminals and the wire cross-section is chosen according to the rated current. The electrical connections are made of with flexible, heat resistant, silicone-insulated wire. We use safety sockets or binding posts with flat clamp for the connections of our BW.. series load resistors.
<i>Permissible voltage</i>	The maximum rated voltage is 500 V AC or DC for wirewound variable and slide resistors. Please be aware not to exceed the rated current of slide resistors. The maximum voltage is given on the name plate for load resistors. A higher voltage is not allowed, because the resistor will be overloaded and destroyed. You can check this with $P=U^2/R$.
<i>Starting up</i>	Resistors in industry version. On first operation during commissioning, the steelgrid resistors will produce some smoke. This is due to the lubricant used in the manufacturing process of the resistor element.

Basic wirings and applications of adjustable resistors

voltage divider



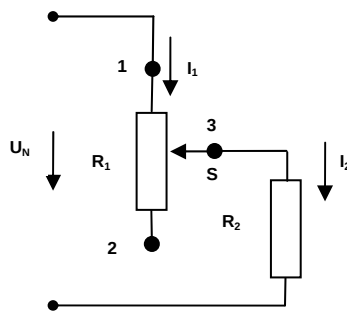
Voltage divider wiring to adjust the voltage of an electrical load.

Principally it is possible to realize a voltage divider wiring with an adjustable resistor, when the resistor begin 1 and resistor end 2 of the voltage divider resistor R_1 are connected to the power supply U_N . The consumer or test object R_2 lies via connection 3 at the variable slider S . By adjusting the slider you can adjust the voltage of the electrical load between 0 and 100% U_N .

Is the electrical consumer or test object R_2 self variable with changing current consumption, for example a DC - motor with different load, so it reduces principally the applied voltage at the slider S with increasing load current I_2 , the speed of the motor falls. Should this voltage decrease be held very low, the flowing current I_1 through voltage divider resistor should be a multiple of the current I_2 ($I_1/I_2 = 5$ up to 10), the same is valid for the power of the voltage divider resistor. By economic purpose you should take this application only for small electrical consumers up to 100W with $U_N=24V$ or up to 300W with $U_N=230V$ and should be limited for special cases.

For this wiring you can take cemented wirewound variable resistors with enclosure of the type series RGL (page T413E) or cemented wirewound tubular fixed resistors of the type series SZL (page T411E) or SZ.PL (page T412E).

series resistor



Series resistor to adjust the current of an electrical load.

Should the current of an electrical load or test object be adjusted with a constant voltage, you have to use the series resistor wiring. You need only the connection 1 (resistor begin) and connection 3 (slider). Resistor and electrical load are wired in series. The current of the series resistor and the electrical load is the same, the current is the highest in position 1, the lowest in position 2, if the series resistor is fully efficient.

The series resistor wiring is used for example to adjust the field current of DC - motors and DC-current- or synchronous generators, the exciting current of magnetic- or eddy current brakes, the premagnetisation current of ripple filter chokes to adjust the ripple of current of an arc welder.

To dimension a series resistor, the following data are needed, shown for example for a field rheostat of a small synchronous generator: Rated voltage U_N (here 110V DC); rated resistor R_2 of the electrical load (here cold resistor value of the exciter field 40 ohm)

Maximum current of the load:

$$I_{\max.} = \frac{U_N}{R_{\max.}} = \frac{110V}{40\Omega} = 2,75A$$

Desired minimal current $I_{\min}$ (here $I_{\min}=2A$).

This gives a current rate $I_{\max}/I_{\min}$ (here: $2,75A/2A=1,375$).

Now you can calculate the necessary resistance value of the series resistor R_1 corresponding to the wiring in series of the two resistors R_1 and R_2 .

Here:

$$R_1 = \frac{U_N}{I_{\min.}} - R_2 = \frac{110V}{2A} - 40\Omega = 55\Omega - 40\Omega = 15\Omega$$

The minimum power of the series resistor will be calculated according to:

$$P = I_{\max.}^2 * R_1 = (2,75A)^2 * 15\Omega = 113W$$

The series resistor can be realized, when it must be operationally adjusted, as a cement coated wirewound variable resistor with enclosure corresponding to our type RGL (page T413E) or as a cement coated wirewound slide resistor corresponding to our type SZL (page T411E) or SZ.PL (page T412E). You will have the following two solutions in this example: A cement coated wirewound variable resistor type RGL 250-15 with a typical power of 150 W or a cemented wirewound slide resistor as our type SZL 200x45 -15 with a typical power of 135 W.

If the adjusting range of current between $I_{\max}$ and $I_{\min}$ should be higher than the factor 1,5, it can be favourable to use a stepped winding, which is adapted to the flow of the current. You will receive a reduced resistor size then.

This can be realized either for wire wound variable resistors with a stepped winding made of a blank wire (then type RGL...A) or for slide resistors with a stepped winding made of an isolated-oxidized resistance wire (then type series SU.L...x..G or. SU.PL...x...G).

We need for the calculation of the resistor size the above mentioned data.

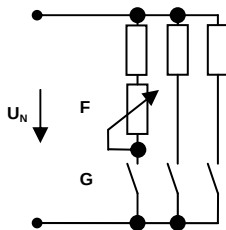
Remark: If it is not necessary for the application to adjust the current operationally and permanently, but only one time for the start-up procedure or occasionally for changes in the facility, it could be more economical to use a tubular fixed resistor of our list T100, which is adjustable with an adjustable clip instead of the operationally adjustable resistor, which are described here.

load resistor

Load resistor wiring to adjust the continuous dissipation.

Adjustable resistors are mostly used as load resistors for one- or three phase supply units. In development, laboratories are tested power supply and charging units, rectifiers, inverters or Ups – units, in hospitals emergency power batteries or emergency power units must be checked continuously according to their function. So there are various requirements, for which you need different solutions. To make the selection easier for our customer, we offer in our lists resistors with our long-time experience, with which we can achieve most of the customer applications. You find typically load resistors up to 1 kW on page T414E. These are our slide-resistors built with 2 terminals and a linear or stepped winding. These resistors have 2 winding parts, the so-called fixed resistor part R_F , which is responsible for the maximum power and which can not be reduced and the effective slide resistor part R_S . For protection of the fixed resistor part we can deliver a mechanical stop.

wiring example
BW18 – BWV83



*F – fine adjustment,
potentiometer or slide resistor
G – rough adjustment, cam
switch*

Concerning the load resistors of our type series BW 18 – BWV 83 on page T420E and T421E from 1,2 kW up to 50 kW there are connected multiple resistor steps in parallel to receive a higher continuous dissipation.

If there is no solution for a special application with our listed resistors, we need (for the dimensioning of your special load resistor) the following detail:

- rated voltage U_N , one- or three phase, DC or AC
- maximum power $P_{\max}$ respectively maximum current $I_{\max}$
- minimum power $P_{\min}$ respectively minimum current $I_{\min}$

Remark to the voltage and power rating :

Operators often need loads for different rated voltages and currents, e.g. from 14 V DC up to 230 V AC or 3 x 400 V AC for currents from 1 A up to 10 A and they want normally to use one single load resistor. But this is not possible mostly because of technical and economical reasons.

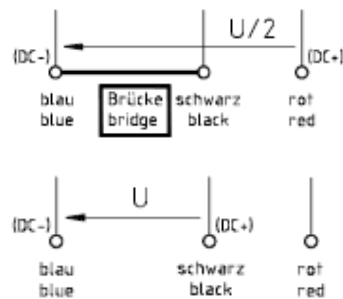
The dimensioning of a load resistor is normally made for a rated voltage U_N , which corresponds to the maximum voltage. Hereby the maximum continuous dissipation $P_{\max}$ is calculated.

Of course this load resistor can be used with smaller voltages U_x , but then you will receive a smaller continuous dissipation P_x .

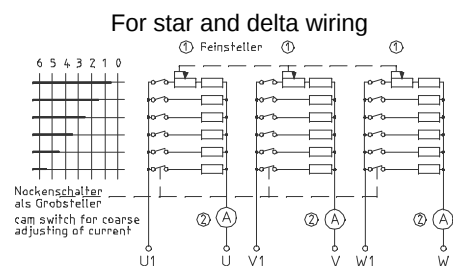
$$P_x = \left(\frac{U_x}{U_N}\right)^2 \cdot P_{\max} = \left(\frac{24V}{28V}\right)^2 \cdot 1,2kW$$

E.g. for a load resistor with a rated voltage of 28 V DC, which is used with 24 V DC, then the continuous dissipation is reduced P_x to 73%.

To increase the economic efficiency and the customer's benefit we have engineered two wiring solutions, which are permitted for 2 voltages while retaining the full continuous dissipation. On the one hand these are load resistors for 2 voltages, which are in relation 1:2. You will find different types on page T420E, for examples.



On the other hand we can build our threephase load resistors according to our page T421E with 6 terminals. Thereby you can use it with the complete continuous dissipation either for 3 x 400 V AC in star wiring or for 3 x 230 V AC in delta wiring or additional for 230 V AC in parallel wiring.



Remark to the usage of a rheostat in slide- or cement coated wirewound variable version as load resistor, which does not protect the series resistor with a mechanical stop: Basically you can use each rheostat as load resistor. The operator must be careful, that the rated current, which is given also on the name plate, will not be exceeded and especially the resistor will not be short-circuited, because the load resistor will be destroyed then.



Type series FZL / FZZL / FZDL

fixed resistors in laboratory design 65 – 3000 W

IP
20

Cemented wirewound tubular fixed resistor in one-, two- or three-tube design, in laboratory version, enclosure with aluminium coloured varnish and rubber feet. Degree of protection IP 20.

Technologies

- 2 safety sockets 4 mm
- 1 earthing safety socket 4mm
- completely closed enclosure
- rubber feet for location on tables

The safety sockets form a secure 4 mm plug system together with the adjusted safety plugs, which are protected by rigid insulation coverings. So you cannot touch any blank energised parts. The use of conventional 4 mm plugs is possible; we do not provide a lug connection.

Application

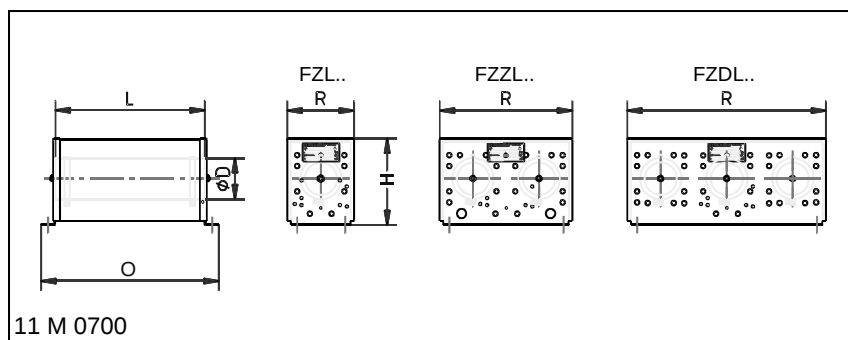
These resistors are suitable for educational modelling and experimenting applications, for load testing in laboratories, schools and universities as well as for manufacturing. Engineering consultants and development divisions use these handy devices.

Special design

- individual varnish on request
- with micro-fuse

Electrical and mechanical data

Type series	typical power in W at 40°C, 100% DCF	production range Ω -value		dimension in mm			approx. weight in kg
		from	to	H	O	R	
FZL 100x35	65	0,22	22k	82	137	66	0,5
FZL 200x35	150	0,56	47k	82	237	66	0,7
FZL 160x45	150	0,47	33k	92	206	75	0,7
FZL 200x45	180	0,68	39k	92	246	75	0,8
FZL 300x45	300	1,2	56k	92	346	75	1,1
FZL 300x65	430	6,8	47k	125	346	92	1,8
FZL 400x65	600	10	68k	125	446	92	2,3
FZZL 300x65	860	3,9	82k	125	346	185	3,6
FZZL 400x65	1200	5,6	120k	125	446	185	4,4
FZZL 500x65	1600	6,8	150k	125	546	185	5,4
FZZL 600x65	2000	8,2	180k	125	646	185	6,4
FZDL 500x65	2400	3,9	150k	125	546	275	7,8
FZDL 600x65	3000	5,6	180k	125	646	275	9,2





Type series SZL / SUL
Type series SZZL / SUZL

adjustable slide resistors 105 – 1400 W,
up to max. 15 A

IP
20



SZL 400x65

Technologies

- 3 safety sockets 4 mm
- 1 earthing safety socket 4mm
- completely closed enclosure
- rubber feet for location on tables
- load capacity up to 15 A

The safety sockets form a secure 4 mm plug system together with the adjusted safety plugs, which are protected by rigid insulation coverings. So you cannot touch any blank energised parts. The use of conventional 4 mm plugs is possible; we do not provide a lug connection.

The resistance value can be adjusted between zero and the requested maximum resistance value by a slider.

Attention: There is danger of burning, because the slider is possibly in the heat sector.

We also equip with a spindle drive, which is charged additionally. (only D=65 + 85). The adjustment is accomplished sensitively by turning a handwheel.

The adjustable slide resistor can be used as voltage divider with three sockets as well as series resistor with two sockets. When optionally equipped with micro-fuse only wiring as series resistor is possible (2 sockets).

If you use an adjustable slide resistor as load resistor we suggest a stepped winding adapted to the flow of the current.

Even more so if the adjusting range of current is higher than 1:1,5. The resistance wire will be oxidized and is therefore insulating. You will get a reduced resistor size.

⇒ type SU.L .. x .. G

(Compare technical indications for dimensioning on page T414E)

Special design

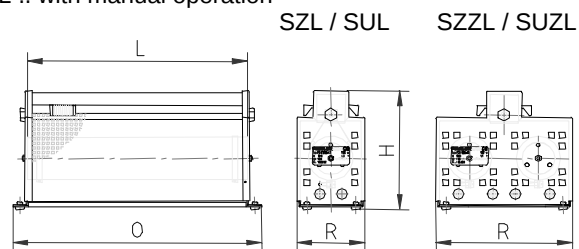
- individual varnish on request
- with micro-fuse

Elektrische und mechanische Daten

Type series	typical power in W at a surface temperature of		production range Ω-value		dimensions in mm					approx. weight in kg
	L x D	250°C	300°C	von	bis	H	P nur S..PL	L	O	
SZL 160x45	105	150	0,47	1,2 k	123	153	160	206	75	1,2
SZL 200x45	135	180	0,56	1,8 k	123	153	200	246	75	1,5
SZL 300x45	210	285	1,0	2,7 k	123	153	300	346	75	1,8
SZ.L 300x65	320	430	1,5	3,9 k	156	186	300	346	92	2,5
SZ.L 400x65	440	600	1,8	5,6 k	156	186	400	446	92	3,2
SZ.L 400x85	610	850	2,7	6,8 k	181	211	400	450	120	4,2
SZZ.L 300x65	620	860	2,7	1,8 k	156	186	300	346	185	4,5
SZZ.L 400x65	870	1200	3,9	2,7 k	156	186	400	446	185	5,5
SZZ.L 500x65	1120	1600	5,6	3,3 k	156	186	500	546	185	6,5
SZZ.L 600x65	1400	2000	6,8	4,7 k	156	186	600	646	185	7,5

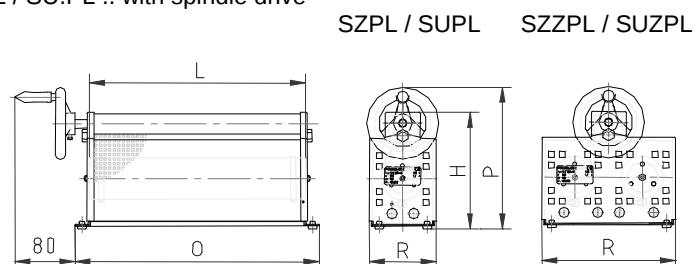
At continuous dissipation we advise to select from the table surface temperature 250°C.

SZ.L / SU.L .. with manual operation



11 M 0200

SZ.PL / SU.PL .. with spindle drive



11 M 0201



Type series SZZPL / SUZPL
Type series SZDPL / SUDPL

adjustable slide resistors 1180 – 3800 W,
up to max. 30 A

IP
20



SZDPL 400x85

SZ.PL .. Cemented two-tube (SZZPL..)- or three-tube (SZDPL..) adjustable slide resistors with spindle drive (standard version)

SU.PL .. Uncemented two-tube (SUZPL..)- or three-tube (SUDPL..) adjustable slide resistors with spindle drive (special version)

in laboratory version, enclosure with aluminium coloured varnish and rubber feet, degree of protection IP 20.

Technologies

- with spindle drive
- 3 safety sockets 4 mm
- 1 earthing safety socket 4mm
- completely closed enclosure
- rubber feet for location on tables
- load capacity up to 30 A (one-phase version)

The safety sockets form a secure 4 mm plug system together with the adjusted safety plugs, which are protected by rigid insulation coverings. So you cannot touch any blank energised parts. The use of conventional 4 mm plugs is possible; we do not provide a lug connection.

The resistance value can be adjusted between zero and the requested maximum resistance value. The adjustment is accomplished sensitively by turning a handwheel. The advantage of the spindle drive is, that there is no danger of burning, because the operating is outside the heat sector.

The adjustable slide resistor can be used as voltage divider with three sockets as well as series resistor with two sockets. When optionally equipped with micro-fuse only wirings of series resistor is possible (2 sockets).

If you use an adjustable slide resistor as load resistor we suggest a stepped wiring adapted to the flow of the current. Even more so if the adjusting range of current is higher than 1:1.5. The resistance wire will be oxidized and is therefore insulating. You will get a reduced resistor size

⇒ Type SU.PL .. x .. G, see page 414E

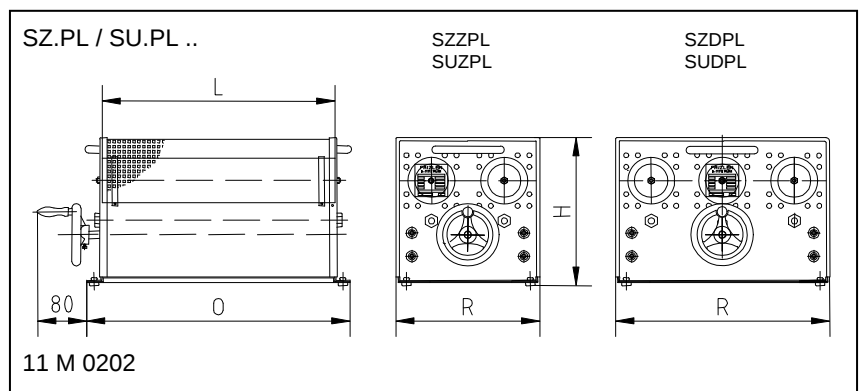
Special design

- individual varnish on request
- with micro-fuse
- three-phase version (only type series S.DPL)

Electrical and mechanical data

Type series L x D	typical power in W at a surface temperature of		production range Ω-value		dimensions in mm				weight in kg
	250°C	300°C	von	bis	H	L	O	R	
SZZPL 400x85	1180	1700	1,2	3,3k	235	400	444	230	8,5
SZZPL 600x85	1880	2700	1,8	4,7k	235	600	644	230	11,5
SZZPL 800x85	2520	3700	2,7	6,8k	235	800	844	230	14,5
SZDPL 600x85	2800	4000	2,7	3,3k	235	600	644	340	15,0
SZDPL 800x85	3800	5500	3,9	4,7k	235	800	844	340	23,0

At continuous dissipation we advise to select from the table surface temperature 250°C.



Type SU..L / SU.PL:

For the exact dimensioning of a load resistor we need the following details: (calculation examples pls. look on page T414E)

- maximum voltage value of the supply unit which is to be loaded.
- maximum current at this voltage
- minimum current to be adjusted at this voltage
- supply unit with one- or three-phase output

It is important to know, if the partial resistance, which results from maximum voltage and maximum current should be a separate fixed resistor, which is connected in series, or a part of the adjustable slide resistor. If so, we suggest to provide a mechanical stop to avoid overload or short circuit.

Example of dimensioning and selection of a specific unit:

adjustable slide resistors with spindle drive, 2800 W, resistance value 100 Ω;

SZDPL 600 x 85 - 100
 ohmic value ± 10%
 size
 type



Type series RGL



cement coated wirewound resistor with enclosure,
8 W – 250 W



Cement coated wirewound resistor in laboratory design, with aluminium coloured varnish, degree of protection IP 20. With safety sockets and rubber feet for usage in standing and lying position.

Technologies

- continuous dissipation up to 250 W
- in laboratory version with knob and scale
- safety sockets 4 mm

The safety sockets form a secure 4 mm plug system together with the adjusted safety plugs, which are protected by rigid insulation coverings. So you cannot touch any blank energised parts. The use of conventional 4 mm plugs is possible; we do not provide a lug connection.

With the usage in lying position there is danger of burning, because the knob is in the heat sector.

The resistance value can be adjusted proportionally between zero and the wanted maximum resistance value by rotation.

The cement coated resistor can be used as voltage divider with three sockets as well as series resistor with two sockets. You have to pay attention to the maximum current of the resistor, depending on type, max. 9 A.

More details and technical description you will find in the chapter "Technical details" beginning with page T403E.

Application

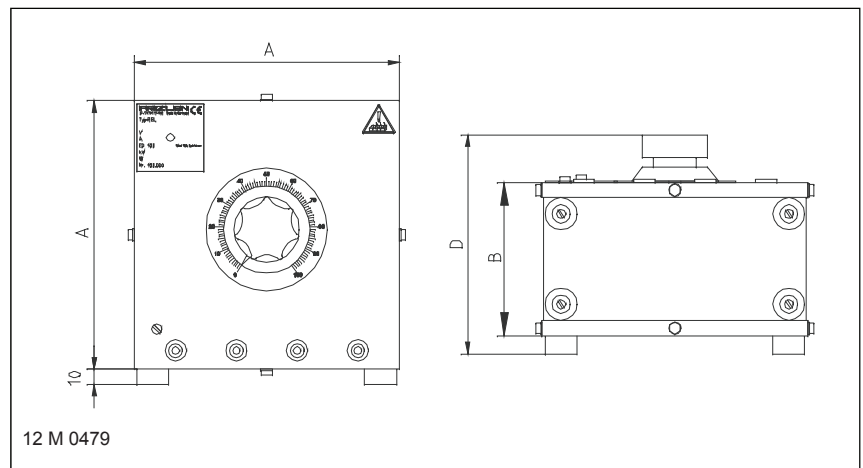
- adjustable load resistors to use as voltage divider or series resistor
- resistors for experimenting and testing in laboratories, schools and universities

Special design

- stepped winding according to the flow of the current
- centre tap and zero position
- three phase version is possible
- enclosure in special varnish

Electrical and mechanical data

Type series	Typical power in W	production range Ω -value	test voltage in kV	dimensions in mm			weight in kg
				A	B	D	
RGL10	8	1,5 – 10k	2	124	100	128	0,59
RGL20	15	2,2 – 15k	2	124	100	128	0,62
RGL40	25	3,9 - 27k	2,5	124	100	132	0,69
RGL80	40	1,0 – 33k	2,5	124	100	132	0,8
RGL100	60	1,2 - 39k	2,5	124	100	136	1,2
RGL150	90	1,5 – 47k	2,5	124	100	136	1,3
RGL250	150	1,8 – 47k	2,5	175	100	144	2,6
RGL500	250	3,3 – 10k	2,5	240	110	167	4,8





Type series SU..L/SZ..L



SUDL400x65G

load resistors up to 1 kW, adjustable,
(selection for 230/400 V)

IP
20



Slide resistors in laboratory version, with aluminium coloured varnish, in protection degree IP 20. The winding is made of isolated - oxidized resistance wire or of blank wire and in cemented version. With mechanical stop, safety sockets and rubber feet.

Technologies

- different current rates possible
- continuous dissipation up to 1 kW
- in laboratory version as slide-resistor, in one- or three phase version
- adjustable without steps
- safety sockets 4 mm

Adjustable load resistor for smaller continuous dissipation up to 1000 Watt. Built for a rated voltage and a winding, which is adapted to the flow of current. The winding is made of blank wire and in cemented version for smaller current rates up to about 1:2,5. Or wound with isolated - oxidized wire in different steps for higher current rates up to 1:10.

The winding is divided into an adjustable part R_S to reduce the current and power from the maximum to the minimum value and in a not adjustable part, the fixed resistor R_F , which is protected by a mechanical stop.

The current and the power can be adjusted between the maximum and the minimum value through a slider.

Attention: There is danger of burning, because the slider is possibly in the heat sector.

Alternative we can build it for an extra charge as a slide resistor with spindle drive.

Application

- adjustable load resistors
- resistors for experimenting and testing in laboratories, schools and universities

Special design

- designed for other rated voltages
- enclosure in special varnish
- with micro-fuse

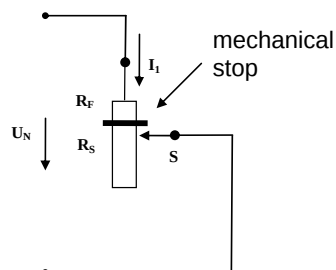
Electrical and mechanical data

Type series - resistor value	max. continuous dissipation in W	min. power in W	Current rates	current - rate from ...A up to ...A	rated voltage in V, AC	Mechanical stop in ohm for partial- resistor
SZZL400x65-212	500	250	1 : 2	1,09 – 2,17	230	106
SZZL500x65-265	500	215	1 : 2,5	0,9 – 2,17	230	106
SUZL400x65G-320	500	165	1 : 3	0,72 – 2,17	230	106
SUZL400x65G-530	500	100	1 : 5	0,43 – 2,17	230	106
SUZL500x65G-1060	500	50	1 : 10	0,22 – 2,17	230	106
SUZL500x65G-460	700	115	1 : 6	0,5 – 3,0	230	77
SUZL600x65G-460	1000	115	1 : 9	0,5 – 4,5	230	51
SUDL200x65G-3x4.0k	350	35	1 : 10	0,05 – 0,5	3x400	3x460
SUDL400x65G-3x2.5k	620	65	1 : 10	0,09 – 0,9	3x400	3x250
SUDL600x65G-3x3.0k	1000	55	1 : 19	0,075 – 1,4	3x400	3x160

Type series	dimensions in mm				weight in kg
	H	L	O	R	
S.ZL400x65	156	400	446	185	5,5
S.ZL500x65	156	500	546	185	6,5
S.ZL600x65	156	600	646	185	7,5
S.DL200x65	156	200	246	275	5,0
S.DL400x65	156	400	446	275	7,8
S.DL600x65	156	600	646	275	11,0

see on page T411E, or on request

wiring:



R_F – fixed resistor
 R_S – adjustable resistor
S - slider

Example of dimensioning:

Requested data: - rated voltage, e.g. 230 V AC,

- maximum continuous dissipation, e.g. 500 W, therefore you get a maximum current of 2,17 A,

- rate of minimum current or power to maximum current or power, with e.g. 1:3; you get a minimum current of 0,72 A, minimum power of 165 W

Selection from above chart results in our type SUZL 400x65G – 320 with a resistance value of 320 ohm (mechanical stop at 106 ohm)



Type series BW 18 up to BW 81

load resistor unit up to 5,6 kW, adjustable,
for 14V and 28V DC voltage



IP
20



Wirewound lamina type fixed resistor, degree of protection IP 20 in varnished steel sheet enclosure, in laboratory version with laboratory terminals, cam switch, fine adjustment device and rubber feet.

Technologies

- compact construction form
- continuous dissipation up to 5,6 kW
- for 14 V and 28 V, interchangeable
- BW 18 up to BW 20 for location on table with rubber feet
- BW 80 up to BW 81 for location on floor with 4 rollers
- gapless adjustment range of current and dissipation

The total power is divided into 6 or 10 equal steps, which are connected in parallel by a cam switch. The current may be adjusted gaplessly (but not steplessly) by a power potentiometer or a slide resistor as a fine adjustment device in step 1. This version with 3 terminals is suited for 14V and/or 28V DC voltage.

The adjustment to the supply voltage is done by fitting an enclosed connection bridge between adequate terminals.

Supply voltages of e.g. 12 or 24 VDC can also be connected. Power or current are then reduced according to Ohm's law. Please look at page T406E.

Application

- use in laboratory or experimental setup
- as load resistor for a monophasic supply unit
- for testing or continuous loading of power packs or charging units
- for discharging of accumulators

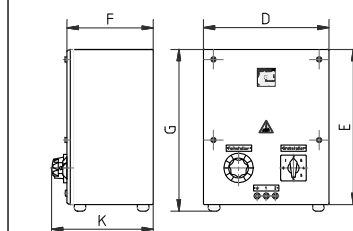
Special design

- further power and voltage values on request

Electrical and mechanical data

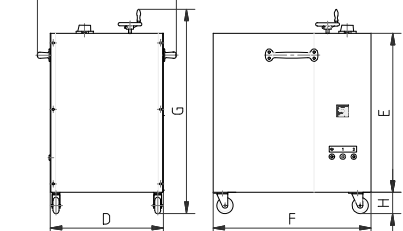
Type	typical power in kW at 40°C and 100% DCF	no. of steps	adjustment range of current in ampere at voltage of		dimension in mm						weight in kg
			14 VDC (U/2)	28 VDC (U)	D	E	F	G	H	K	
BW 18	1,2	6	1,5-86	0,75-43	230	295	182	310	-	216	8
BW 19	2,0	6	3,0-142	1,5-71	290	410	200	440	-	234	14
BW 20	2,8	10	4,0-200	2,0-100	290	410	335	440	-	370	20
BW 80	4,2	10	5,0-300	2,5-150	430	500	450	700	101	430	35
BW 81	5,6	10	6,0-400	3,0-200	430	600	600	800	101	524	50

BW 18 up to BW 20



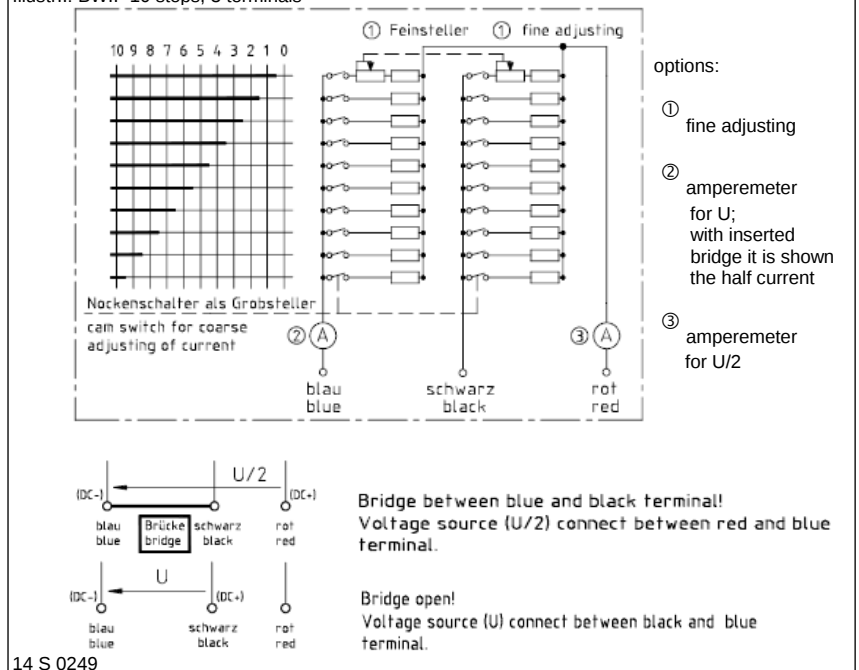
14 M 0257

BW 80 up to BW 81



14 M 0250

Illustr.: BW.. -10 steps, 3 terminals



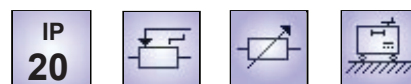
14 S 0249



Type series BW 18 up to BWV 83

load resistor unit up to 50 kW, adjustable,
for AC- or three-phase voltage (230/400V)

BW 81



Wirewound lamina type fixed resistor, degree of protection IP 20 in varnished steel sheet enclosure, in laboratory version with laboratory terminals, cam switch, fine adjustment device, mobile by 4 rollers (BW 80 up to BWV 83) for 230 V AC current as well as for 3 x 230/400 V three-phase current.

Technologies

- compact construction form
- continuous dissipation up to 50 kW
- BW 18 up to BW 20 for location on table with rubber feet
- BW 80 up to BWV 83 for location on floor with 4 rollers
- gapless adjustment range of current and dissipation
- BWV 83 with forced ventilation, 230 V; 50 Hz., with IEC power plug

The total power is divided into 6, 10 or 20 equal steps, which are connected in parallel by a cam switch.

The current may be adjusted gaplessly (but not steplessly) by a power potentiometer or a slide resistor as a fine adjustment device in step 1.

The monophase version with 2 terminals is standard for 230V AC current. The three-phase version for three-phase current is wired in star and has 3 terminals. The star point is in the resistor. As an option with 6 terminals (star point at terminals, please look at page T406E).

Application

- use in laboratory or experimental setup
- as load resistor for mono- or three-phase supply unit.
- for developing, testing or for continuous loading of power packs, uninterruptible power supply, alternators, generators and batteries.

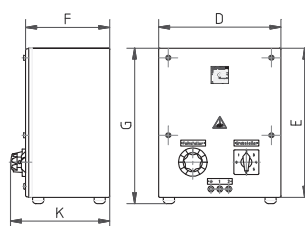
Special design

- other AC/DC voltages
- integrated amperemeter possible for BW 80 – 83
- micro fuse for protection

Electrical and mechanical data

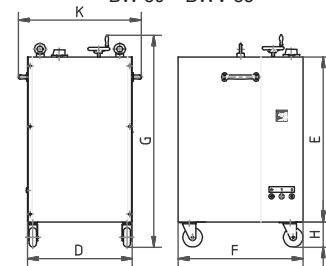
Type	typical power in kW at 40°C and 100% DCF	# of steps	adjustment range of current in ampere at voltage of		dimension in mm						weight in kg
			230V, 50 Hz.	3 x 230/400V, 50 Hz.	D	E	F	G	H	K	
BW 18	1,2	6	0,2 – 5,2	-	230	295	182	310	-	216	8
BW 19	2,0	6	0,2 – 8,7	-	290	410	200	440	-	234	14
BW 20	3,0	6	0,3 – 13	0,2 – 4,3	290	410	335	440	-	370	20
BW 80	3,0	6	0,3 – 13	0,2 – 4,3	430	500	450	700	101	430	32
BW 80	5,0	6	0,6 – 22	0,3 – 7,3	430	500	450	700	101	430	35
BW 81	7,5	6	0,7 – 33	0,4 – 11	430	600	600	800	101	524	52
BW 81	10	6	0,7 – 44	0,5 – 15	430	600	600	800	101	524	55
BW 82	15	10	-	0,5 – 22	505	800	600	1000	122	600	85
BW 82	20	10	-	0,6 – 29	505	800	600	1000	122	600	90
BW 83	25	10	-	0,7 – 36	685	940	680	1140	122	780	125
BW 83	30	10	-	0,9 – 43	685	940	680	1140	122	780	130
BWV83	50	20	-	0,6 – 72	685	940	680	1140	122	780	130

BW 18 - 20



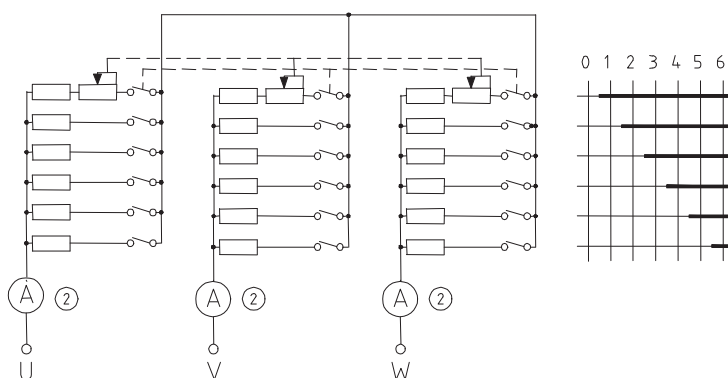
14 M 0257

BW 80 – BWV 83



beginning with type BW 82 with eyebolts for lifting 14 M 0250

Illustr: 3phase, 6-steps, 3 terminals



14 S 0136; B3-6-3

② amperemeter as option

Type series BMWV.37..



load resistors in light weight construction up to 96 kW,
for DC-, AC- or three phase voltages (230/400V)



Easily transportable load resistors, with steel-grid elements in protection degree IP 20, housing made of aluminium, with temperature monitoring and forced ventilation by a built-in fan.

Technologies

- compact and very light design for higher continuous dissipation
- continuous dissipation switchable in steps
- forced ventilation by built-in fan 230 V; 50 Hz., with IEC power plug
- for easy mobile use, also transportable in a car

The complete power is divided in 2 up to 8 different steps, which are switched in parallel by electric contactors. The resistance value increases approx. +15% between cold and operating temperature. The given power values will be achieved at operating temperature. Under load it is possible to receive a soft glow of the steelgrid-elements. The load resistor has for safety a temperature switch and an additional follow-up control of the fan. The bolt-type terminals are mounted submerged (safe for transportation). Additionally, the load resistor has acid-proof rolls, gliding rails, and a trolley handle for better transportation. The combination types with 4 main terminals are usable for DC- and AC-rated voltage. The three phase version fits for a rated voltage of 3x230/400 VAC, which is switched in star. The star point is in the resistor. Optionally with star point wired on terminal.

Application

- as load resistor for batteries in automotive- or telecommunication use
- as load resistor for one- and three phase power supply for e.g. emergency standby systems, uninterruptible power supplies
- use in laboratory or test area

Special design

- different power and rated voltage values on request
- special voltage for fan and electric contactors is possible

Electrical and mechanical data

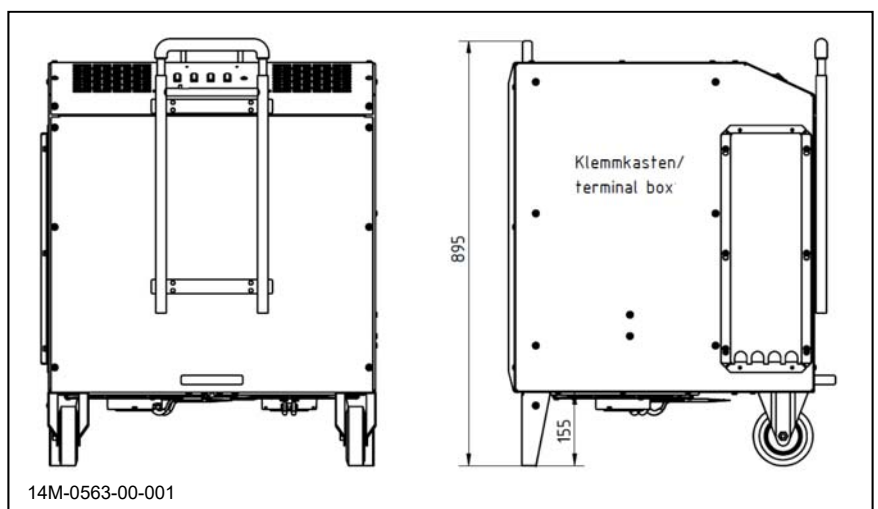
Load resistor types for three-phase voltage 3 x 400V

Type	max. cont. dissip. in kW	max. steps	max. current	number of built-in load steps in kW			dim. D in mm	weight in kg
				12	24	48		
BWMVD3700205	24	2	3x35	2	0	0	400	38
BWMVD3710305	48	4	3x69	2	1	0	400	45
BWMVD3720405	72	6	3x104	2	2	0	700	55
BWMVD3730405	96	8	3x139	2	1	1	700	62

Combinated load resistor devices, through setting a bridge they are suitable for AC- 230 (2x115)V and DC voltages 220 (2x110)V

Type	max. cont. dissip. in kW	max. steps	number of built-in load steps in kW			dim. D in mm	weight in kg
			230V AC 220V DC 2x110V DC	4,8 4,5 2x2,2	12 11,2 2x5,6		
BWMVC370020	24	2	0	2	0	400	38
BWMVC371030	48	4	0	2	1	400	45
BWMVC372040	72	6	0	2	2	700	55
BWMVC373060	96	8	0	4	2	700	62

The chart shows a choice of combinations for each dimension.



Example of dimensioning:

Please contact us, we would like to give you a detailed offer!

Type series FDLZ..

Portable load- or discharge resistor 240 – 1280 W,
IP54, with switch and safety sockets



1000V
DC

IP
54



Short-circuit proof wirewound load- and discharge resistor to use as load for the batteries and discharging the capacitors. Version in protection degree IP 54, with load switch and safety sockets for measuring.

Technologies

- compact construction form
- short-circuit proof
- self-extinguishing
- protection degree IP 54
- incl. load switch and safety sockets
- portable solution
- for voltage up to 1000 VDC

All connections are mounted on terminals in the attached terminal box. A M25 cable gland can be used for cable inlet and strain relief. With additional sockets for measuring the voltage.

Electrical and mechanical data

type	continuous dissipation in W at 40°C, 100% DCF and surface excess temperature of 200 K	production range Ω -Wert		dimension in mm A	weight in kg
		from	up to		
FDLZ52202..	240	2,7	2,7 k	340	4,0
FDLZ52203..	360	1,8	1,8 k	340	4,2
FDLZ52204..	480	1,2	1,5 k	340	4,4
FDLZ52304..	640	1,8	2,2 k	395	5,0
FDLZ52404..	960	2,7	3,9 k	500	6,2
FDLZ52504..	1280	3,3	4,7 k	600	7,4

Application

Load resistor for batteries and discharging resistor for capacitors.

Relevant for the calculation is

- voltage
- storage capacity
- maximum discharging time
- maximum possible surface temperature

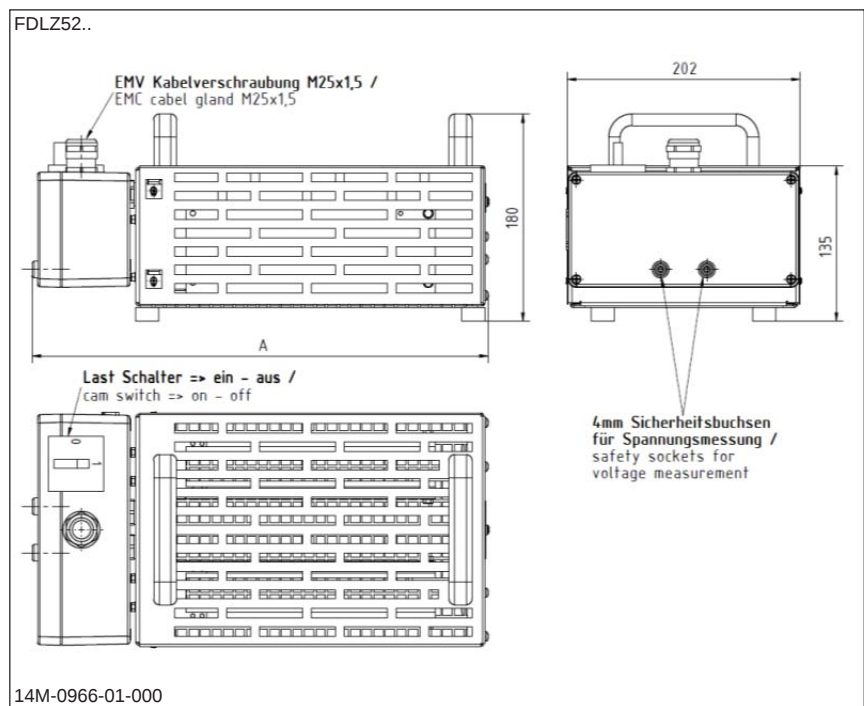
Due to the various applications and the voltage-/energy combinations exists no valid assignment.

Typical application with a various range:

from up to
voltage: 50 VDC and 1000 VDC,
capacity: 1 Farad and 100 Farad
energy: 50 and 500 kW
discharging time: 1 min. and 1 h

Special design

- with connection cable, shielded or unshielded cable, also with plug





Type series BWZV..

load resistor for integration into 19-inch rack, IP20
3,0 – 6,75 kW, 230 VAC, 20 kW with 3x400 VAC

IP
20



BWZV 6441206

Wirewound lamina type fixed resistor in 19-inch rack for laboratory and datacentre applications. Designed in aluminium chassis, degree of protection IP 20, with forced ventilation by three built-in fans.

Technologies

- for thermal and electrical simulation
- slide-in module with different depths
- continuous power configurable
- protection degree IP 20
- low induction version possible
- forced ventilation by 3 built-in fans 230 V; 50 Hz., connection with C14-IEC connector

The type series can be used as testing and load resistor for power supplies in laboratories or used for thermal and electrical simulation of servers in datacentres. The hot air is blown out at the backside, small temperature rise at side plates of the chassis.

The 19-inch load resistor is equipped with wirewound lamina type resistors in different lengths and can be build in different rack units. With different combinations of the needed load, or different steps and switches, it is possible to build the version for your application.

Application

- load resistor for thermal and electrical simulation in datacenters
- load resistor for one- and three phase power supply, e.g. power supplies or frequency converters
- to be used in datacenters, laboratory and control engineering
- higher continuous dissipation with combination of several modules possible

Special design

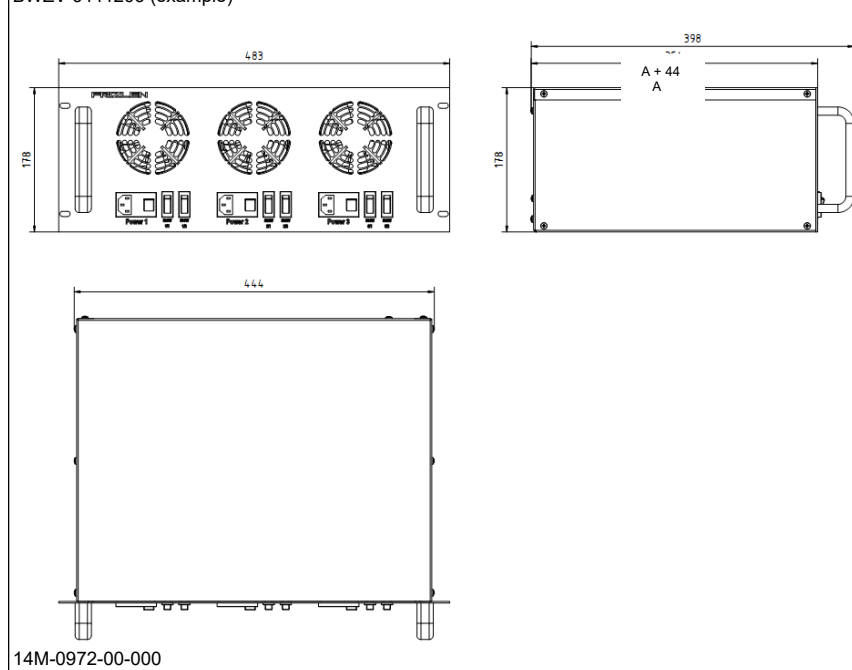
- other voltages on request
- optionally with customized connections
- with different fan voltage, e.g. 230VAC; 50 Hz or 24 VDC

Electrical and mechanical data

type with 4 HE - rack units	typical power in W, at 40°C and 100% DCF	ohmic value for 230 VAC in ohm	chassis- depth without grips dim. A	weight in kg
BWZV 6441206	6 x 500	6 x 106	440	14
BWZV 6451206	3 x 1500	3 x 35,3	580	19
BWZV 6461206	3 x 2000	3 x 26,5	580	20
BWZV 6461206	3 x 2250	3 x 23,5	580	20,5
Type 15 HE	in kW	for 3x400 VAC		
BWZV61564804	2 x 10	2 x 3 x 16	499	78

Outlet air temperature and volume flow vary depending on the chosen model and technical setup. Setup can be adjusted to individual demands.

BWZV 6441206 (example)



For the integration we recommend to use sliding or telescopic sliding rails.

Example of dimensioning:

Please contact us, for a detailed offer!



Type series FA.3../ FS.3..



FSMS 3342303, in special design

load resistors in steel-grid design,
self-ventilated, 5 – 60 kW, for 3 x 230/400VIP
20IP
23FA...Steel-grid resistor unit, degree of protection IP 20, without weather-proof roof
FS...Steel-grid resistor unit, degree of protection IP 23, with weather-proof roof

In completely closed zinc sheet enclosure with stationary safety guard at the top and bottom. Ceramic insulated flat or bolt terminals of 35 A up to 87 A in variable combinations for star and delta wiring are possible.

Technologies

- continuous dissipation from 5 up to 60 kW
- switchable in parallel for higher continuous dissipation
- for floor-level mounting or for mobile applications optional with handgrip and steering rolls
- for outdoor location (FS..)

The necessary terminals are mounted on a terminal strip in the lower part of the device and are accessible after demounting a cover.

The resistance value increases approx. +15% between cold and operating temperature. The given power values will be achieved at operating temperature. The load resistor can be chosen with star or delta wiring. On request we can build it for different voltages up to 3 x 690 V AC as well.

Application

An important application is the use as economic load resistor. Protection degree IP 20 is sufficient for installing in factory rooms, IP 23 is necessary for outdoor location.

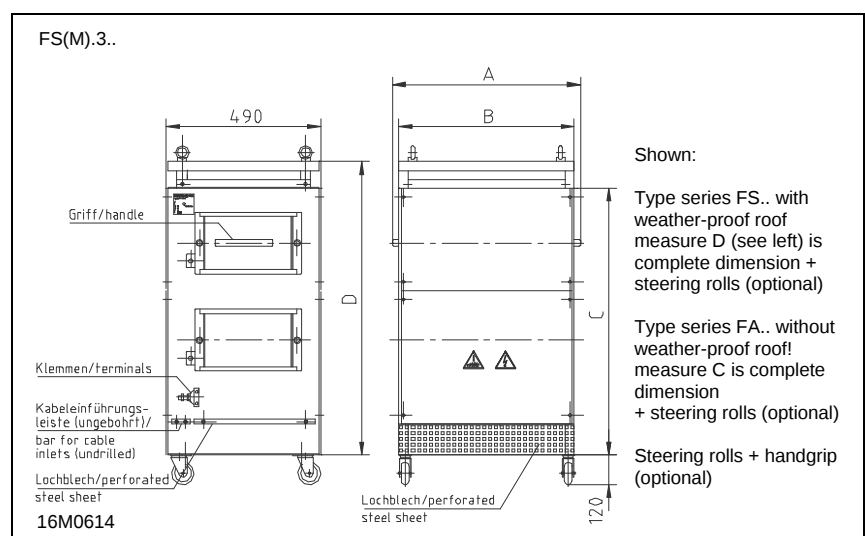
Special design

- different power steps or combinations with higher power possible
- connection parts and enclosure out of stainless steel 1.4301
- mobile, for test area
- consoles for wall installation
- CEE-plug with cable and holder

Electrical and mechanical data of load resistors

Type FA.3.. / FS.3..	max. typical power in kW at 40°C and 100%ED	resistor value in Ohm	current in A	dimension in mm				weight in kg
				A	B	C	D only IP23	
F.. 31218..	5,0	3 x 31,8	3 x 7,2	570	595	460	520	33
F.. 31215..	7,5	3 x 21,4	3 x 10,9	570	595	460	520	32
F.. 31221..	10,0	3 x 16,0	3 x 14,5	570	595	460	520	35
F.. 31224..	12,5	3 x 12,8	3 x 18	570	595	460	520	36
F.. 31330..	15,0	3 x 10,6	3 x 22	770	795	460	520	49
F.. 31442..	20,0	3 x 8,0	3 x 28,9	970	995	460	520	60
F.. 32351..	25,0	3 x 6,4	3 x 36	770	795	710	770	78
F.. 32360..	30,0	3 x 5,3	3 x 43,3	770	795	710	770	82
F.. 32472..	35,0	3 x 4,6	3 x 51	970	995	710	770	93
F.. 32475..	37,5	3 x 4,3	3 x 54	970	995	710	770	95
F.. 32481..	40,0	3 x 4,0	3 x 58	970	995	710	770	98
F.. 33399..	45,0	3 x 3,5	3 x 65	770	795	960	1100	111
F.. 33414..	50,0	3 x 3,2	3 x 72	970	995	960	1100	124
F.. 33423..	55,0	3 x 2,9	3 x 80	970	995	960	1100	134
F.. 33432..	60,0	3 x 2,7	3 x 87	970	995	960	1100	138

This chart shows a choice of preferred power types. Other continuous dissipation, voltage and ohmic values are possible.



Example of dimensioning and selection of a specific unit:
Type in star wiring FA 3121803 – 3 x 31.8, for 5 kW, 3 x 7,2 A



Type series FAV 3../ FSV 3..

load resistors in steel-grid design,
forced ventilation, 70 – 500 kW, for 3 x 230/400 V



- FAV... Steel-grid fixed resistor unit, degree of protection IP 20,
without weatherproof roof, air outlet on top,
FSV... Steel-grid fixed resistor unit, degree of protection IP 23
with weatherproof roof, for outdoor location, air outlet at the side via air
deflectors in the upper area.

In completely closed zinc sheet enclosure with barrier grid at the bottom and
powered ventilation by an integrated ventilator. With air flow monitoring by wind
indicator relay. Ceramic insulated flat or bolt terminals of 35A up to 400A in
variable combinations available.

Technologies

- model for high power ratings with best price-performance ratio
- power ventilated by integrated 230/400 V; 50 Hz axial flow fan
- for floor-level location
- continuous dissipation up to 500 kW
- paralleling of 2 or more units for even higher dissipation
- for outdoor location (FSV)

The necessary terminals are mounted on a terminal strip in the lower part of the device and are accessible after demounting a cover.

By the use of steel-grid elements with a typical power of 1100 W up to 1700 W per steel-grid with forced ventilation we cover a power range of up to 500 kW per unit. The resistance value increases approx. +15% between cold and operating temperature. The given power values will be achieved at operating temperature. You can achieve higher dissipations by installing several units in parallel.

Application

An important application is the use as load resistor for the testing of emergency standby power system. Protection degree IP 20 is sufficient for installing in factory rooms, IP 23 is necessary for outdoor location.

Special design

- with 2 temperature switches wired on terminals
- special voltages of fan
- please ask for devices with higher power ratings or other construction forms
- mobile, for test area by rollers

Electrical and mechanical data

Type FAV .. FSV ..	max. typical power in kW at 40°C and 100% DCF	max. number of steel-grids corresp. to given size of device	dimension in mm						max. weight in kg
			A	B	C	D	E	F	
F.V 38568..	75	68	1200	1240	800	700	795	770	142
F.V 38602..	110	102	1500	1540	800	700	795	770	185
F.V 38776..	185	176	1400	1450	955	850	995	970	265
F.V 38864..	250	264	1700	1750	955	850	995	970	370
F.V 38976..	300	176	1820	1875	1190	1000	1004	980	350
F.V 39052..	500	352	2230	2285	1190	1000	1004	980	480

This chart shows the size and the maximum power which can be built-in. You have much possibilities of combinations, depending on your needed power rating and your needed number of steps (examples see below).

Standard load resistors for 3 x 230/400 V; 50 Hz

Type series FAV..	power - steps in kW	FAV..
FAV 3856612	37,5/37,5	Technical drawing of the FAV resistor unit. It shows a side view and a front view. The side view shows the unit's profile with dimensions A (height), B (width), C (depth), and D (width of the base). The front view shows the unit's face with dimensions E (width), F (depth), and G (height). Labels include 'Abluft' (exhaust air) at the top, 'Klemmen' (terminals) on the left, 'Windfahnenrelais' (wind vane relay), 'Kabeleinführungsteile (ungebohrt)' (cable entry parts (unthreaded)), 'Zuluft' (supply air) at the bottom, and 'φ13' (hole diameter) for the base. The unit is shown with three horizontal resistor elements and a central control unit.
FAV 3856609	75	
FAV 3869612	50/50	
FAV 3869009	100	
FAV 3876818	25/50/50/50	
FAV 3875609	175	
FAV 3884021	5 x 50	
FAV 3882209	250	
FAV 3896812	2 x 150	
FAV 3908809	400	
FAV 3903612	2 x 250	
16 M 0182 type 385-388; 16M-0786-00-001 type 389-390		

Type series FSV..	power - steps in kW	FSV..
FSV 3856609	75	Abluft Klemmen Windfahnenrelais Kabeleinführungs- leiste (ungebohrt) Zuluft Φ13 D C A B F E
FSV 3869618	10/20/20/50	
FSV 3869009	100	
FSV 3875612	75/100	
FSV 3875609	175	
FSV 3882212	100/150	
FSV 3882209	250	
FSV 3896809	300	
FSV 3906409	350	
FSV 3908812	2 x 200	
FSV 3903609	500	
16 M 0088 type 385-388; 16M-0786-00-002 type 389-390		



Type series FAVR.3../FSVR.3..

load resistors in steel-grid design,
forced ventilation, 70 – 250 kW, with attached switch cabinet

FSVR mit Schaltschrank



FAVR... Steel-grid fixed resistor unit, degree of protection IP 20, without weatherproof roof, air outlet on top,

FSV... Steel-grid fixed resistor unit, degree of protection IP 23 with weatherproof roof, for outdoor location, air outlet at the side via air deflectors in the upper area.

In completely closed zinc sheet enclosure with barrier grid at the bottom and powered ventilation by an integrated ventilator. With air flow monitoring by wind indicator relay. With attached switched cabinet for controlling the AC and DC loads. Control voltage 230 V AC or 24 V DC is possible.

Technologies

- model for high power ratings with best price-performance ratio
- power ventilated by integrated 230/400 V; 50 Hz axial flow fan
- for floor-level location
- paralleling of 2 or more units for even higher dissipation
- with integrated power contactors in the attached switch cabinet to control the load steps

There are 2 possibilities to control the contactors of the individual load steps. Either by internal cam switches or by wiring the coils of contactors to terminals. The power connections in the switch cabinet are on terminals or on copper bars.

By the use of steel-grid elements with a typical power of 1100 W per steel-grid with forced ventilation we cover a power range of up to 250 kW per unit. The resistance value increases approx. +15% between cold and operating temperature. The given power values will be achieved at operating temperature. Higher power ratings can be achieved by in parallel connection of several units.

Application

An important application is the use as load for the testing of emergency standby power systems or for use in test areas.

Special design

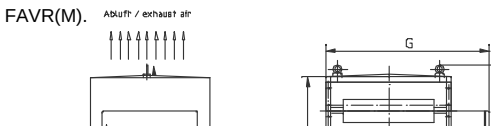
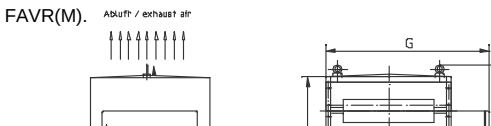
- with wirewound lamina type fixed resistors and the resistance value will change from cold to warm condition +/-1%
- special voltages of fan
- enclosure and parts out of stainless steel, switch cabinet varnished
- mobile, for test area by rollers

Electrical and mechanical data

Type FAVR .. FSV ..	max. typical power in kW at 40°C and 100% DCF	max. number of steel-grids corresp. to given size of device	dimension in mm					max. weight in kg
			A	B	C	E	G	
F.VR38568	75	68	1200	1240	800	795	1100	170
F.VR38602	110	102	1500	1540	800	795	1100	220
F.VR38776	185	176	1400	1450	955	995	1350	310
F.VR38864	250	264	1700	1750	955	995	1350	410

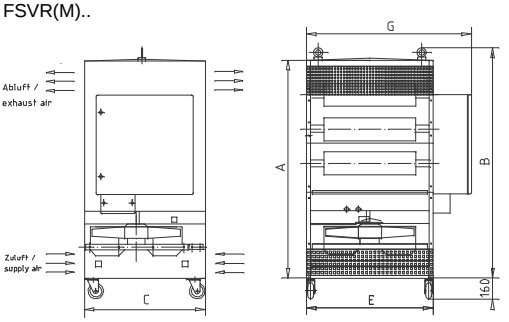
This chart shows the size and the maximum power which can built-in. You have very much possibilities for combinations, depending from your needed power and your needed steps (e.g. below).

Example for load resistors, e.g. AC/DC load

Type FAVR..	power - steps in kW for 3x400 V	FAVR(M). 
FAVR385660	75	
FAVR385661	37,5/37,5	
FAVR386900	100	
FAVR386961	50/50	
FAVR386961	10/20/20/50	
FAVR387560	175	
FAVR387561	75/100	
FAVR387681	50/50/50/25	
FAVR388220	250	
FAVR388221	150/100	
FAVR388402	5 x 50	

16 M 0429, shown with option mobile

16 M 0429, shown with option mobile

Type FSVR..	power - steps in kW for ...DC	FSVR(M).. 
FSVR3867511	5/25/50 500 V	
FSVR3872019	12 x 10 400 V	
FSVRM3870712 Fahrbar	10/20/20/50 540 V	
FSVR3886411	50/100/100 500 V	

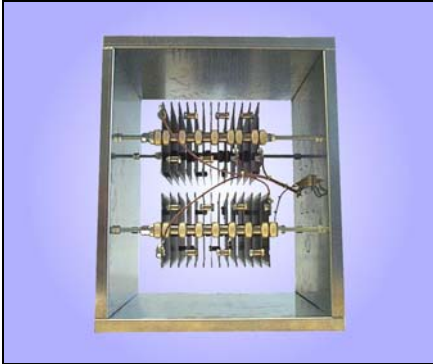
16 M 0260, shown with option mobile

16 M 0260, shown with option mobile

We like to send you for your individual application an offer. Please send us the rated voltage and the preferred steps of the load..

Further series:

1. FKK.. 3..



Special characteristics:

- integrated in a duct section made by us, dimensions according to your specifications, Type FKKE
- for middle and higher dissipations up to 250 kW
- an economic version when a local fan is available, e.g. by the fan of a combustion engine
- with steel-grid elements, the resistance value increases between cold and operating temperature approx. +15%
- with one or more resistor steps
- built-in in a duct of the customer, Type FKKEF...
- optionally available with terminal box
see series T600E

2. FAV 6../FSV6..



- for continuous dissipation up to 250 kW
- versions in protection degree IP 20 and IP23 possible
- with wirewound resistor elements, constant ohmic value over a big temperature range, resistance change +/-1%, also under load
- with one or more resistor steps
- controlling of the load steps in the attached switch cabinet, type F.VR6..
- special voltages of fan
- connections with flat or bolt terminals inside the housing
- versions with low induction and with low noise possible
- mobile version with handgrip and steering rollers,
see series T500E

3. FALL 19..



- various continuous dissipation up to 4,5 kW built in one housing
- in laboratory design
- with wirewound resistor elements, constant ohmic value over a big temperature range, resistance change +/-1%, also under load
- with one or more resistor steps
- also usable for higher currents, connections on flat clamp terminals or safety sockets
- also available as three phase version
see series T500E

4. FAL7../FSL7..



- versions in protection degree IP 20 or IP23
- for continuous dissipation up to 30 kW
- with wirewound resistor elements, constant ohmic value over a big temperature range, resistance change +/-1%, also under load
- with one or more resistor steps
- connection with flat or bolt terminals inside the housing
- versions with low induction and with low noise possible
- mobile version with handgrip and steering rollers,
see series T500E