



# Managing DC Link Energy



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## Energy storage solutions and safe brake resistors in wire-wound and PTC technology

Safety, dependability and efficiency are the basis of our company and product policies. Today and in the future we will be following this path consistently.

When the Michael Koch GmbH was founded, the main focus was on the development of new designs and technologies for brake resistors up to protection class IP65 and to ensure that these devices are safe and conform to the applicable standards. Our Bxx and PTC product lines safely dispose of excess energy from the DC link of drives, while our product line Dynamic Energy Storage DES accumulates and returns this energy if required. And when power interruptions occur, our Dynamic Energy Supply DEV product line guarantees that the drive has sufficient energy to complete its task.

Our headquarters are located in Ubstadt-Weiher, between the Rhine plain and Kraichgau. From this convenient location we supply our products to our customers globally.





$T_{\text{cycle}}$  [S]

Emergency stopp

Quality, environment, workplace safety and fairness – these criteria are important to us. We are certified in accordance with DIN EN ISO 9001:2008, the European Eco-Management and Audit Scheme EMAS III regulation and we are a corporate member of Transparency International, the coalition against corruption. These areas are audited by independent parties on a regular basis.

In addition to tested products and certified processes, we offer a high degree of flexibility and responsiveness. Our aims are short delivery times and absolute reliability. We count on long term relationships and are a reliable partner who trusts in direct customer relationships.



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# Dynamic Energy Storage DES

A new option to process braking energy: the Dynamic Energy Storage DES. A solution that is independent of the mains. One device that can be used on almost all converters and servo controllers with a maximum DC link voltage of 800 VDC. The DES is an opportunity to increase the energy efficiency of various applications, to save resources, protect the power grid and even the users nerves.

## Active buffer module for DC links

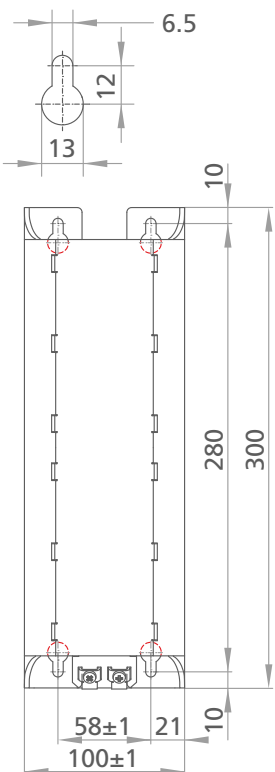
- > for single axis and multi axes systems
- > independent adjustment (Black Box)
- > no displays or any kind of control elements
- > shorter cycle times result in increased efficiency



[www.brakeenergy.com/des](http://www.brakeenergy.com/des)



## Installation dimensions and mounting-holes (mm)



## The operation – savings without circuit feedback

Unlike the direct DC link capacity expansion of converters, the active DES does not have any contact with the input side of the mains. The DES is only energised and charged in the event of braking. This feature leads to one of the most important characteristics: the DES does not cause any circuit feedbacks.

The DES independently sets the range of its working voltage level. This range is defined by two values from the voltage level of the DC link: the maximum voltage level of the DC link and the minimum voltage level of the DC link. From now on the DES starts absorbing energy from the DC link once the voltage level reaches the defined maximum value (e.g. in case of braking). As soon as the voltage level in the DC link reaches the defined minimum value (e.g. in case of accelerating) the DES returns its stored energy to the DC link. This is the moment when energy is being saved, because instead of using power from the grid the converter is driven by electrical energy from the DES!

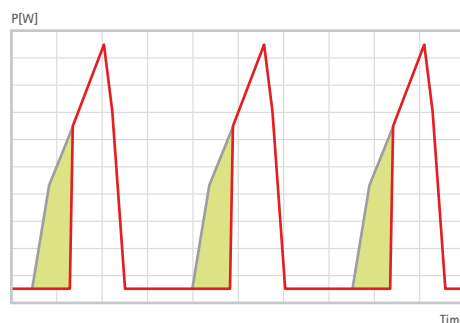
The DES stops supplying energy once the voltage level in its capacitor reaches the dynamically established charging level / minimum voltage level and waits for the next braking event which recharges the capacitor. Charging, discharging, charging, etc. can take place in fractions of a second without causing any power circuit feedbacks.

## Technical specifications of the DES

Parameter	Value
Useful energy approx.	1,600 Ws
Continuous voltage of the DC link	800 VDC max.
Output	18 kW max.
Built-in PTC discharge resistor	+
Dimensions H x W x D	300 x 100 x 201 mm
Weight approx.	6.9 kg
Protection class	IP 20

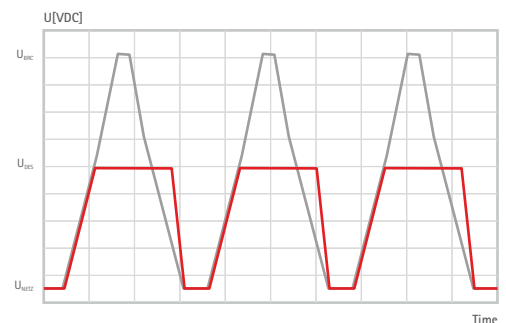
## Energy savings with the DES

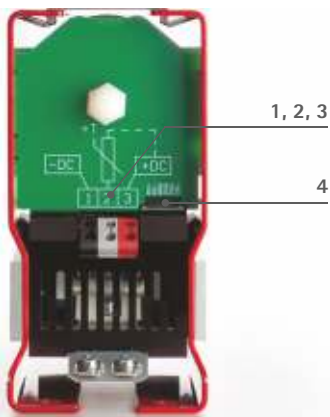
- with the DES
- without the DES
- Energy savings



## Voltage characteristics of the DC link

- without the DES
- with the DES





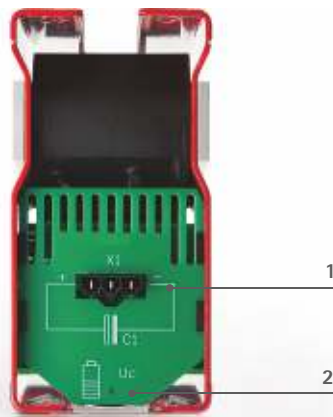
1, 2, 3

4

### Simple connections I (bottom side)

With only three cables, the DES is extremely easy to connect.

1. Negative terminal of the DC link
2. Braking transistor (braking chopper)
3. Positive terminal of the DC link
4. Connection of the RS422 interface



1

2

### Simple connections II (top side)

1. Reverse polarity protected interface to connect extension modules
2. Safety-relevant LED: flashes as long as the unit is charged



The small built-in PTC braking resistor safely absorbs expected and unexpected energy peaks

### Just give it a try

Based on its concept the DES can easily be tested in an existing system as a retrofit solution. To be installed the DES has to be connected in parallel to the existing braking resistor of the converter of the drive system. After a few cycles the collected data in the processor can be read out and evaluated. Based on the analysis of these data the suitable DES solution can be chosen – Can it get any easier than this?

### Control cabinet solutions

If (e.g. in case of retrofitting) the control cabinet of the machine does not provide enough space for our DES, we can also supply equipped, standardised control cabinets ready for mounting and connection. Individual solutions are possible.



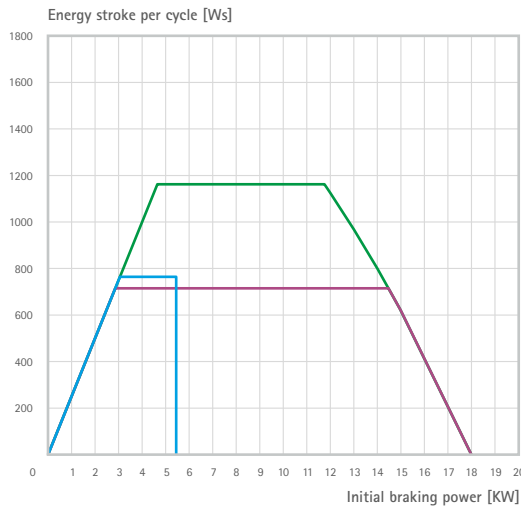
# DES Maximum Energy Stroke/ Initial Braking Power

The diagrams show the capability of the most common DES types DES 2.0B, DES 2.0F and DES 3.0F for braking ramps and braking blocks in relation with cycle times of 1, 2 and 4 seconds. The term cycle time defines the process time that is required to

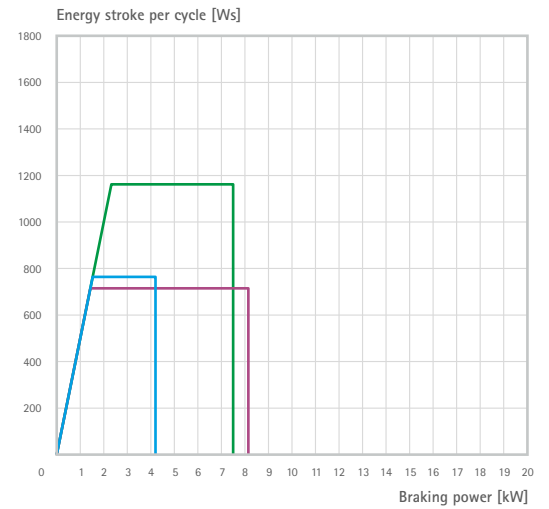
DES  
 $U_{BRCmax} = 800$  VDC  
1s-cycle

- DES 2.0 B
- DES 2.0 F
- DES 3.0 F

Braking ramp

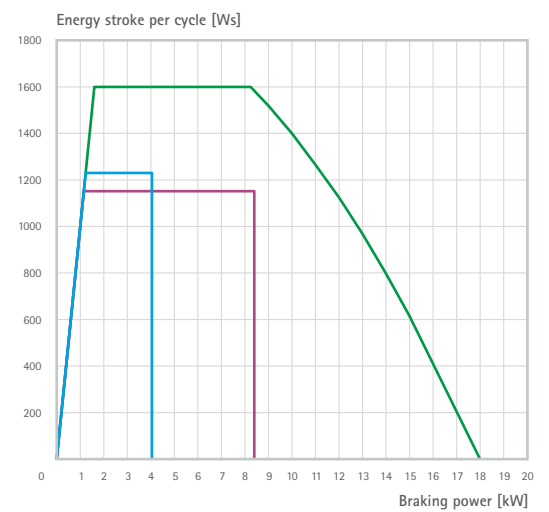
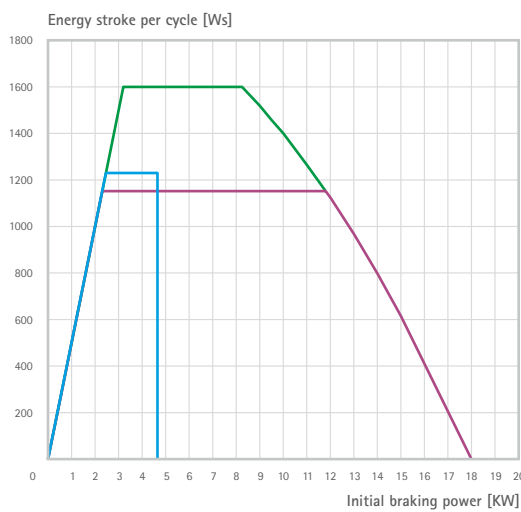


Braking block



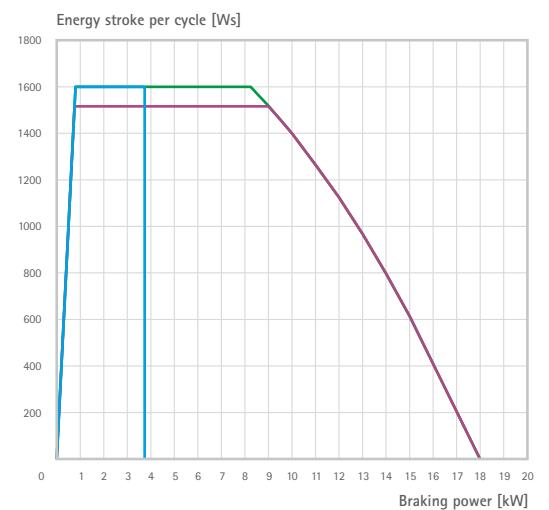
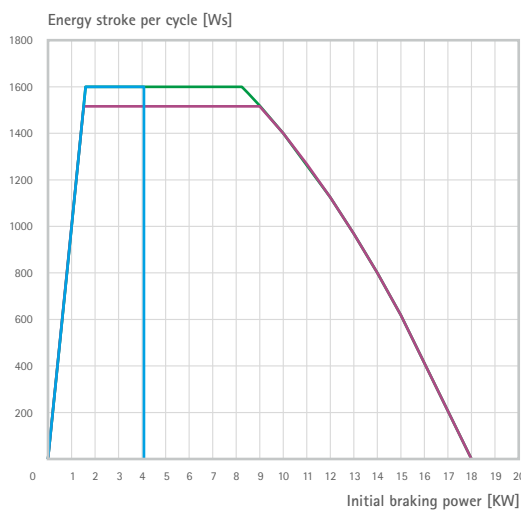
DES  
 $U_{BRCmax} = 800$  VDC  
2s-cycle

- DES 2.0 B
- DES 2.0 F
- DES 3.0 F



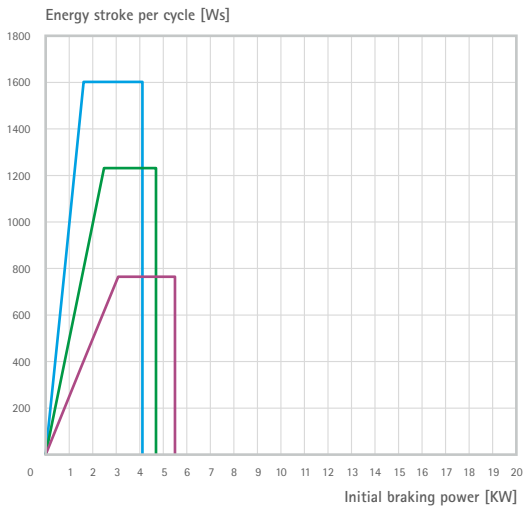
DES  
 $U_{BRCmax} = 800$  VDC  
4s-cycle

- DES 2.0 B
- DES 2.0 F
- DES 3.0 F

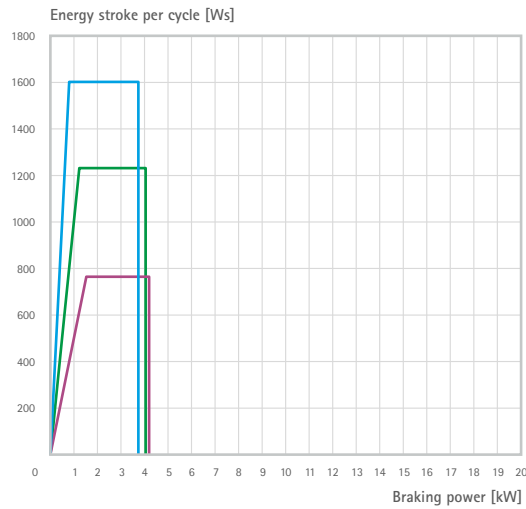


absorb and release the stated energy by the device (energy stroke). We can design a system that suits your requirements based on accurate application data (initial braking power, form and duration of braking, cycle time and voltage level in the DC link). Kindly contact our sales team for this purpose.

### Braking ramp

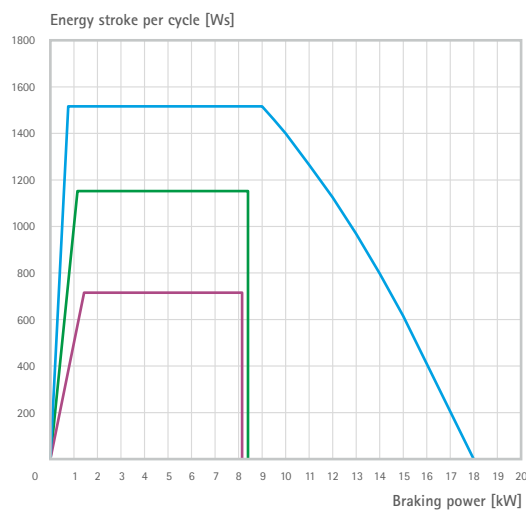
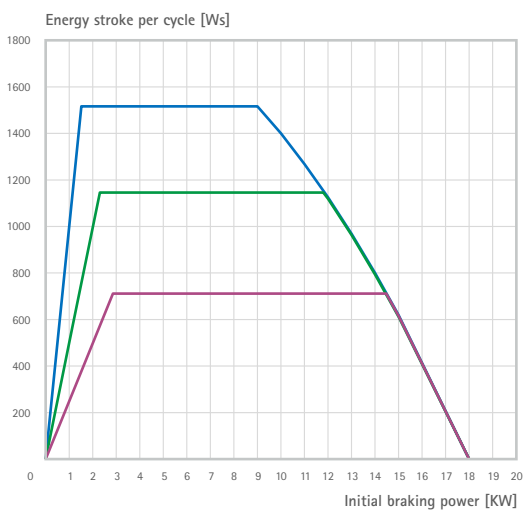


### Braking block



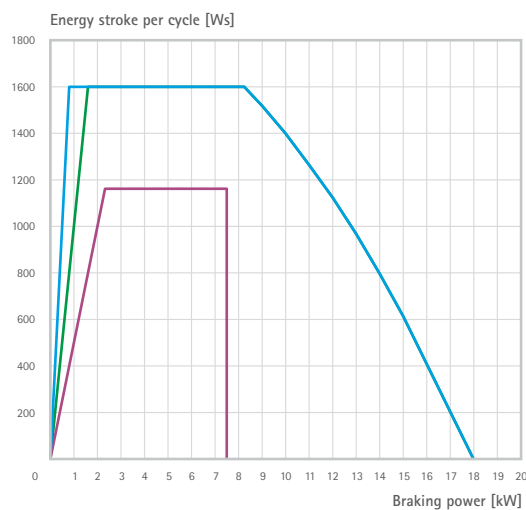
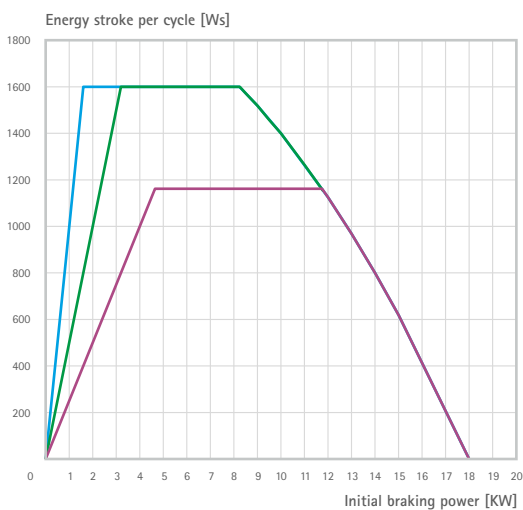
DES 2.0 B  
 $U_{BRCmax} = 800 \text{ VDC}$

- 1s-cycle
- 2s-cycle
- 4s-cycle



DES 2.0 F  
 $U_{BRCmax} = 800 \text{ VDC}$

- 1s-cycle
- 2s-cycle
- 4s-cycle



DES 3.0 F  
 $U_{BRCmax} = 800 \text{ VDC}$

- 1s-cycle
- 2s-cycle
- 4s-cycle

# DES Maximum Energy Stroke/ Initial Braking Power with parallel connection

Dynamic Energy Storage can easily be connected in parallel since they synchronise independently due to their self-learning feature. When connecting devices in parallel, higher initial braking powers or currents can be processed. The number of devices connected in parallel is not limited. The following diagrams show the characteristics of a single DES as well as two and three devices connected in parallel for ramp and block braking.

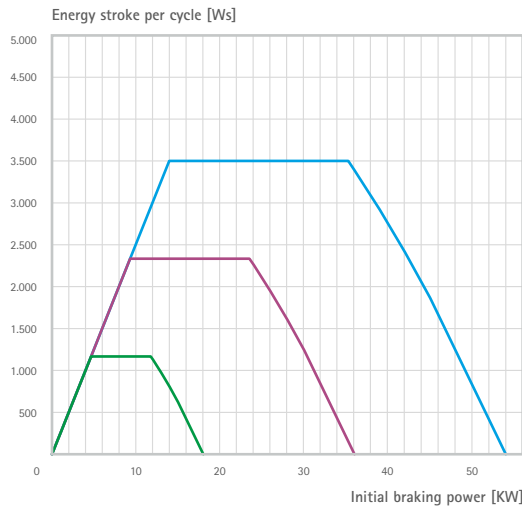
## DES 3.0F

$U_{BRCmax} = 800\text{ V}$

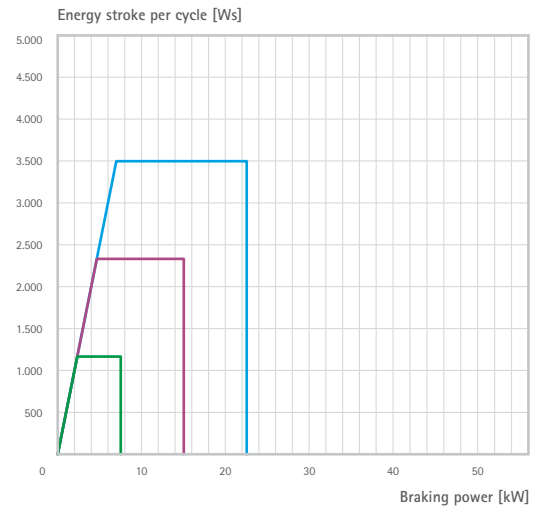
1s-cycle

- 3 DES 3.0F devices in parallel
- 2 DES 3.0F devices in parallel
- DES 3.0F

Braking ramp



Braking block



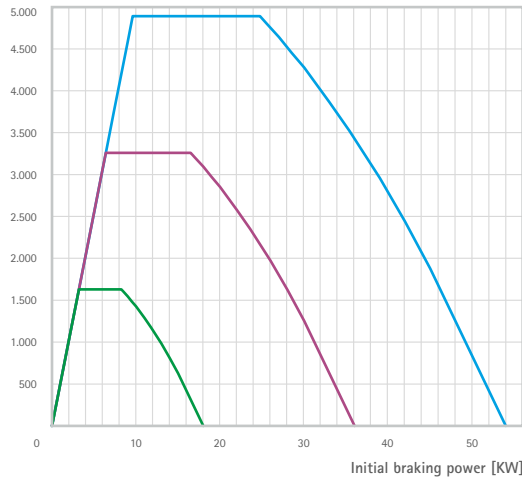
## DES 3.0F

$U_{BRCmax} = 800\text{ V}$

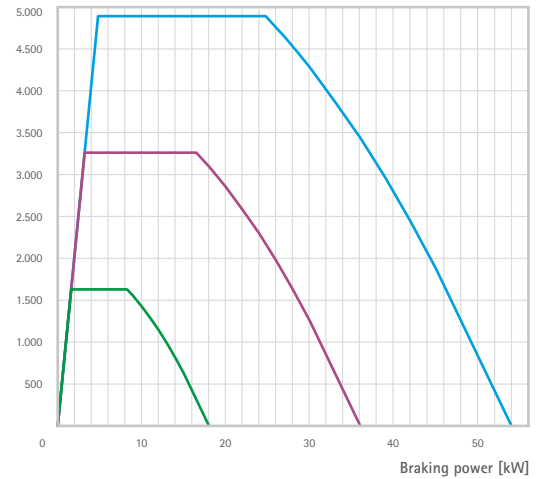
2s-cycle

- 3 DES 3.0F devices in parallel
- 2 DES 3.0F devices in parallel
- DES 3.0F

Energy stroke per cycle [Ws]



Energy stroke per cycle [Ws]



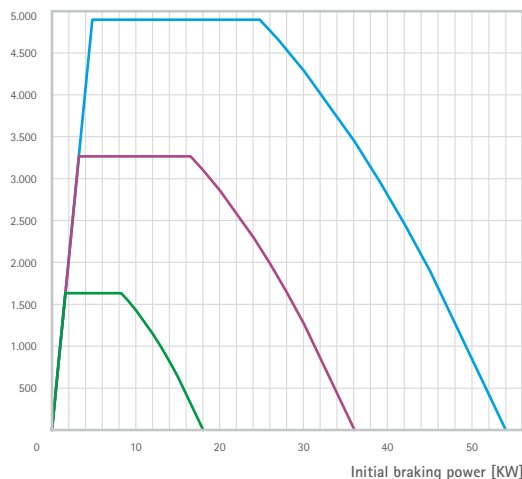
## DES 3.0F

$U_{BRCmax} = 800\text{ V}$

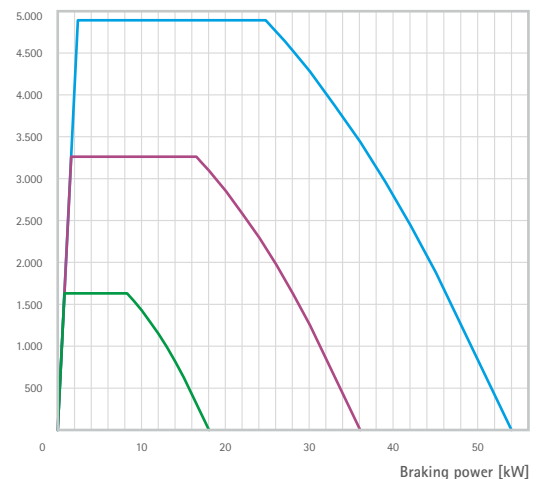
4s-cycle

- 3 DES 3.0F devices in parallel
- 2 DES 3.0F devices in parallel
- DES 3.0F

Energy stroke per cycle [Ws]



Energy stroke per cycle [Ws]





## Extension module DES + EM

If the storage of the DES is not sufficient it can easily be increased with Extension modules. Those modules only need to be connected with the DES via the accompanying cable with polarity protected plugs. Done!

Before connecting with the DES the capacitors of the EM are safely discharged via the internal discharge resistor in the extension modules. The number of connected extension modules and thus the level of the storable energy is adapted to the requirements of the application.



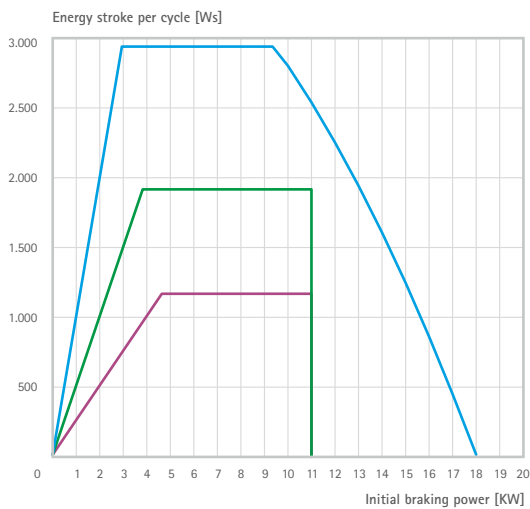
### Storage extension for the DES

- > Multiplying the stored energy
- > easiest connection via plugs
- > neither configuration nor commissioning effort required
- > Integrated discharge resistor

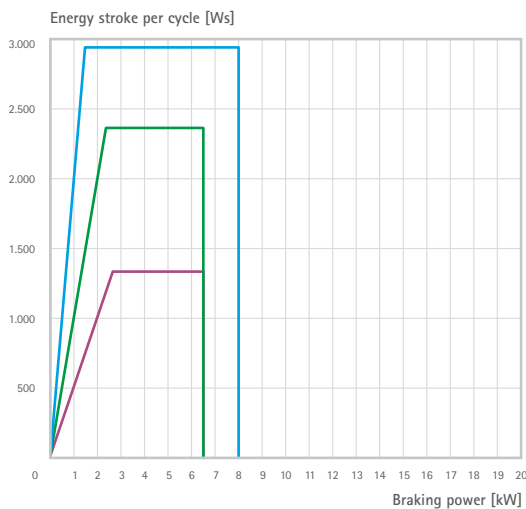
### Technical specifications

Parameter	EM 2.0A20	EM 2.0A2020
Usable storage capacity approx.	1,600 Ws	3,200 Ws
Built-in PTC discharge resistor	+	+
Dimensions H x W x D	300 x 100 x 201 mm	300 x 100 x 201 mm
Weight approx.	4.1 kg	6.2 kg
Protection Class	IP 20	IP 20

#### Braking ramp

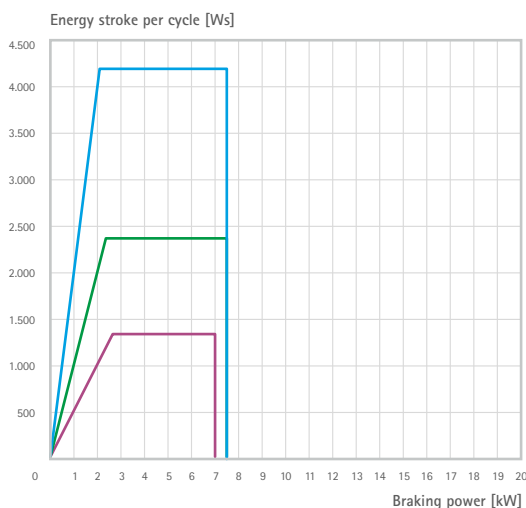
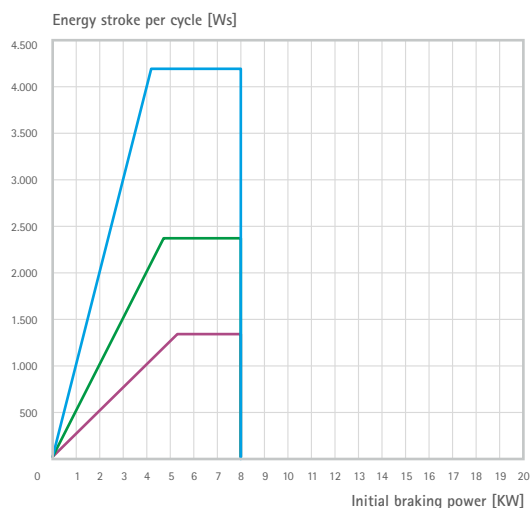


#### Braking block



DES 3.0F  
with EM2.0A20  
 $U_{BRCmax} = 800 V$

- 1s-cycle
- 2s-cycle
- 4s-cycle



DES 3.0F  
with EM2.0A2020  
 $U_{BRCmax} = 800 V$

- 1s-cycle
- 2s-cycle
- 4s-cycle

# Dynamic Energy Supply DEV

With regard to electric energy, companies place particular importance on two factors: guaranteed supply and low prices. Both are called into question with the implementation of the withdrawal of atomic energy. Broken down on electrical drives, power failures present a special challenge even today in developed nations. With the Dynamic Energy Supply for converters and drive controllers short-term power failures can be bridged and their consequences minimised.

## Active supply module for DC links

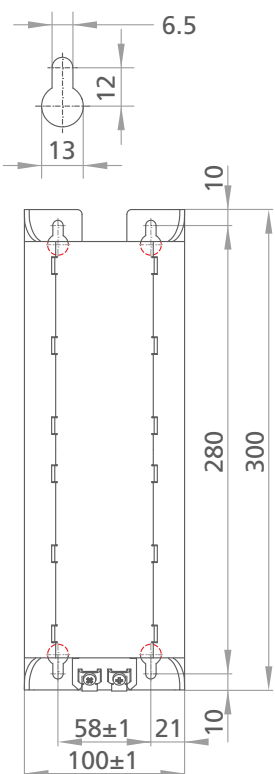
- > for single and multiple axes systems
- > no buttons, displays, other controls
- > provides support during power failures or interruptions
- > with a digital interface



[www.brakeenergy.com/dev](http://www.brakeenergy.com/dev)



## Installation dimensions and mounting-holes (mm)



## Short-term UPS for drives

The Dynamic Energy Supply DEV acts as a short-term uninterruptable power supply for drives and servo controllers. The active capacity extension of the DC link of the inverter stores an amount of energy that is defined to the technical design. It serves to keep the voltage level of the DC link at a level which bridges over the downtime without trouble and/or brings the machine to a defined stop state in case of power failure. In each case, the objective is that the drive and all systems supplied by it either do not perceive the power failure at all or are brought into a defined state from which a restart is possible without any effort.

## Gentle on the power grid and drives

The energy storage is charged after switching on the inverter for each charging routine, which acts very carefully not to overload the charging circuit and not to generate any negative circuit feedback either.

The DEV is fully ready for use after only eight seconds. It then supports the DC link every time that its voltage falls below 470 VDC.

## With digital interface

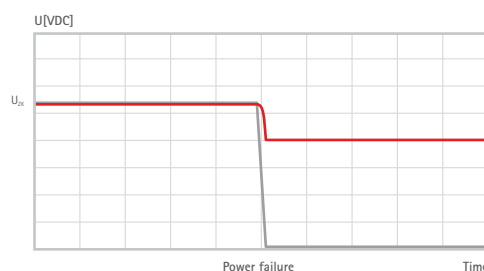
The Dynamic Energy Supply DEV is equipped with a digital interface with 24 Volt input. The evaluation of the signal takes over the control of the machine just like the initiation of the established measures.

## Technical specifications DEV

Parameter	Value
Useful energy approx.	2,000 Ws
Continuous voltage of the DC link	800 VDC max.
Cycle time of use	30 minutes
Working voltage	470 VDC (other possible)
Output	18 kW max.
Digital interface	24 VDC (for function monitoring)
Built-in PTC discharge resistor	+
Dimensions H x W x D	300 x 100 x 201 mm
Weight approx.	6.9 kg
Protection class	IP 20

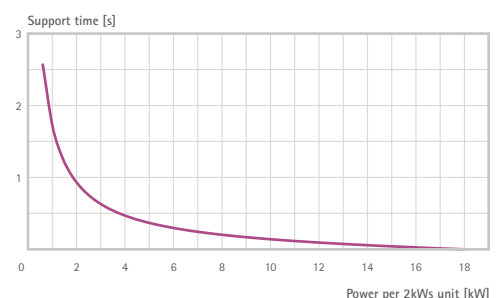
## Voltage curve of the DC link with DEV

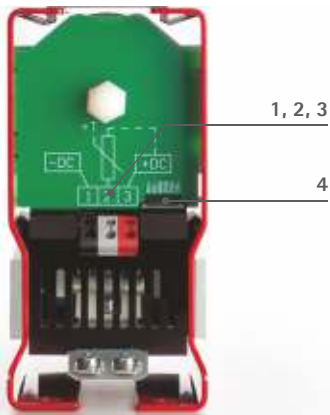
— without DEV      — with DEV



## Support time according to power

The time which a unit can support a given power with two Kilowatt seconds of energy can be read from the diagram. For x units, the support time is extended by x times.





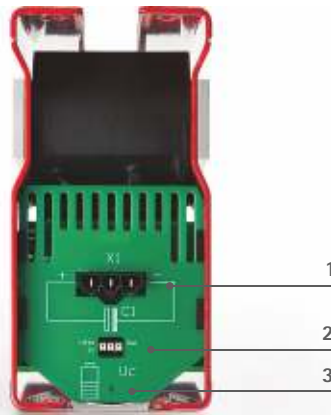
1, 2, 3

4

### Simple connection I (Bottom side)

The DEV is extremely easy to connect with only two cables.

1. Negative terminal of the DC link
2. Discharge resistor
3. Positive terminal of the DC link
4. Connection of the RS422 interface



1

2

3

### Simple connection II (Top side)

1. Interface secured against polarity reversal for connecting extension modules and NEV
2. Digital interface for function monitoring
3. Safety-relevant LED: Flashes, as long as the storage unit is charged



The small built-in PTC braking resistor in the DEV serves as discharge resistor

### The ideal addition to the DEV: NEV

The 24 Volt emergency power supply ensures stable supply of a 24 V DC network to be secured as an option in combination with the DEV.

With at most 6 Amperes (150 VA), the self-learning device is strong enough to support control units and other peripheral devices of the drive. Simply plugged into a basic device and connected via plugs, the NEV keeps the 24 Volt appliance active even with voltage fluctuations or power outages. For further information see page 26.



### Control cabinet solutions

The Dynamic Energy Supplies required for the application are also offered as equipped ready-to-assemble and prewired, standardised control cabinets with the type designation KTS, which can take on up to ten devices.

For further information see page 28.



## Extension module DEV + EM

When the capacity storage of the Dynamic Energy Supply DEV is insufficient extension modules can then be used. They can easily be connected via the accompanying cables with reverse-polarity protected plugs with the DEV. Done!

The storage is safely discharged via the discharge resistor built into the extension modules before the connection. The number of connected extension modules and thus the level of the stored energy is adapted to the requirements of the application.



### Storage extension for the DEV

- > Multiplying the stored energy
- > simple connection using plugs
- > neither configuration nor commissioning effort
- > Discharge resistor on board

### Technical specifications

Parameter	EM 2.0A20	EM 2.0A2020
Usable storage capacity approx.	2,000 Ws	4,000 Ws
Built-in PTC discharge resistor	+	+
Dimensions H x W x D	300 x 100 x 201	300 x 100 x 201
Weight approx.	4.1 kg	6.2 kg
Protection Class	IP 20	IP 20

### Accompanying energies can very easily be implemented by the combinatorics with the extension modules

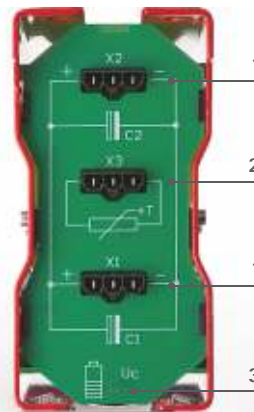
If the power of a DEV of max. 18 kW is not sufficient by itself, Dynamic Energy Storages can also be connected in parallel. The power is multiplied according to the number of devices connected in parallel.

### DEV + extension module

Required energy [kWs]	Module			Space requirement/ total width [mm]	Required energy [kWs]	Module			Space requirement/ total width [mm]
	DEV 2.0B	EM2.0 A20	EM2.0 A2020			DEV 2.0F	EM2.0 A20	EM2.0 A2020	
2	1	0	0	100	20	1	1	4	600
4	1	1	0	200	22	1	0	5	600
6	1	0	1	200	24	1	1	5	700
8	1	1	1	300	26	1	0	6	700
10	1	0	2	300	28	1	1	6	800
12	1	1	2	400	30	1	0	7	800
14	1	0	3	400	32	1	1	7	900
16	1	1	3	500	34	1	0	8	900
18	1	0	4	500	36	1	1	8	1000
					38	1	0	9	1000

### Simple connection I (Bottom side)

Ground terminals



### Simple connection II (Top side)

1. Reverse polarity protected interface to connect to the DEV or from additional extension modules and NEV
2. Central reverse polarity protected interface. Discharge resistor
3. Safety-relevant LED: Blinks, as long as the storage is still charged

## Dynamic Energy Supply DEV 3.0

The DEV 3.0 is the first choice whenever the grid is too weak and the energetic support to the drive is being required very often or rather cyclic e.g. in very short intervals. Based on the technical details of your individual application and combined with our know-how, we will find the perfect solution for your requirements.

### Active supply module for DC links

- > for single and multiple axes systems
- > no buttons, displays, other controls
- > provides support during power failures or interruptions

### Technical specifications DEV 3.0

Parameter	Value
Useful energy approx.	2,000 Ws
Continuous voltage of the DC link	800 VDC max.
Working voltage	470 VDC (other possible)
Output	18 kW max.
Built-in PTC discharge resistor	+
Dimensions H x W x D	300 x 100 x 201 mm
Weight approx.	6.9 kg
Protection class	IP 20



[www.brakeenergy.com/dev3-0](http://www.brakeenergy.com/dev3-0)



### The ideal addition to the DEV: NEV

The 24 Volt emergency power supply ensures stable supply of a 24 V DC network to be secured as an option in combination with the DEV.

With at most 6 Amperes (150 VA), the self-learning device is strong enough to support control units and other peripheral devices of the drive. Simply plugged into a basic device and connected via plugs, the NEV keeps the 24 Volt appliance active even with voltage fluctuations or power outages. For further information see page 26.



### Control cabinet solutions

The Dynamic Energy Supplies required for the application are also offered as equipped ready-to-assemble and prewired, standardised control cabinets with the type designation KTS, which can take on up to ten devices.

For further information see page 28.



# Dynamic Energy Storage Combination DEK

The dynamic energy storage combination DEK is optimal, when the energy supply for the drives has to be ensured and at the same time the braking energy for the system can be regenerated. DEK is the optimal combination of the Dynamic Energy Storage Unit DES and the Dynamic Power Supply Unit DEV. A part of the installed energy storage - to be defined individually, but at least 50% - is reserved for the UPS case, the remaining part is used for intermediate storage of braking energy. This part helps make the investment in the UPS functionality cheaper due to the possible energy savings.

## Active supply module for DC links

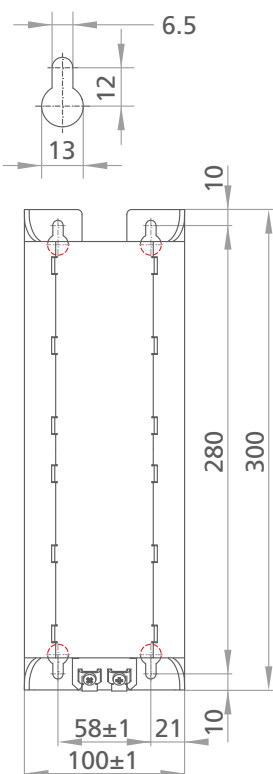
- > for single axis and multi axes systems
- > buffers braking energy for use in the system
- > no buttons, display indicators, other controls
- > provides support during power failures or interruptions
- > with a digital interface



[www.brakeenergy.com/dek](http://www.brakeenergy.com/dek)



## Dimensions and mounting holes (mm)



## Combined optimally: Buffer with UPS-function

DEK can both store braking energy as well as compensate for voltage fluctuations and power failures. This is enabled by the division of the storage into one area for braking energy and one for the short-term UPS energy, where the UPS area is allocated at least half of the energy storage. The exact division of the amount of energy available is thus the result of application engineering.

Starting with an example where it applies that 500 Joules of energy are stored temporarily, the remaining 1,500 Joules are stored for the UPS case.

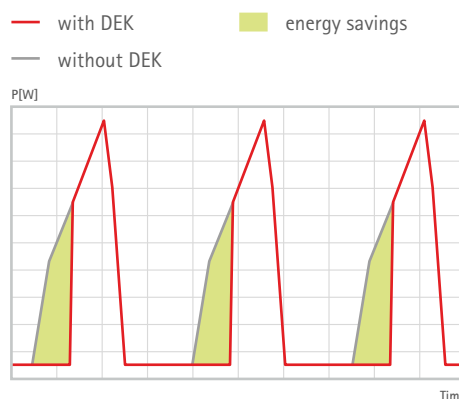
Connecting the DEK to the machine is very easily done by three strands via "Plug&Play". The device then works without any further actions. Based on its concept the DEK can easily be tested in an existing system as a retrofit solution. At the same time a braking resistor can be installed in the converter of the drive system. After a few cycles the collected data in the processor can be read out and evaluated. Based on the analysis of these data the suitable DEK solution can be chosen - Can it get any easier than this?

DEK is available in several power classes. Besides the basic variant 2.0, which is offered in two power classes, variant 3.0 offers another energy boost, it can thus be loaded higher in case of factor power multiplied by time. The higher load capacities for the isometric devices are achieved by changed electronics and active cooling. For the Dynamic Energy Storage Unit, this means the same amount of energy with short cycles, for the Dynamic Power Supply Unit, very large amounts of energy with unplanned, or in the other case the same amount of energy with commonly planned, power failure.

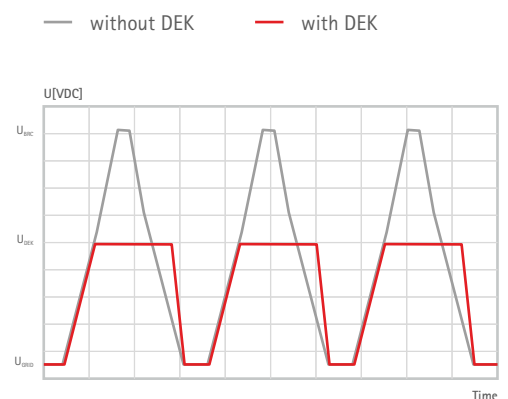
## Technical Specifications DEK

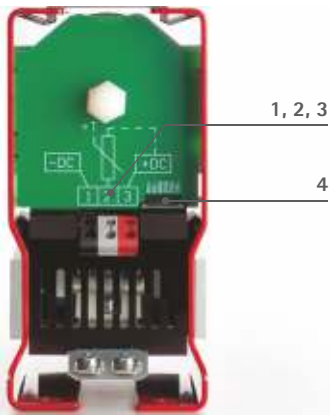
Parameter	Value
Available storage capacity, up to	2,000 Ws
Continuous voltage DC link Output power	max. 800 VDC
Output	max. 18 kW
Digital interface	24 VDC (for function monitoring)
Built-in PTC braking resistor	+
Dimensions H x W x D	300 x 100 x 201 mm
Weight approx.	6.9 kg
Protection Class	IP 20

## Energy savings with the DEK



## Voltage curve of the DC link

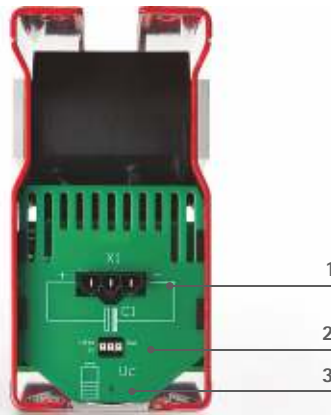




### Simple connections I (bottom side)

With only three cables, the DEK is extremely easy to connect.

1. Negative terminal of the DC link
2. Braking transistor (braking chopper)
3. Positive terminal of the DC link
4. Connection of the RS422 interface



### Simple connection II (Top side)

1. Interface secured against polarity reversal for connecting extension modules and NEV
2. Digital interface for function monitoring
3. Safety-relevant LED: Flashes, as long as the storage unit is charged



A PTC braking resistor is built into the DEK to determine the braking chopper voltage.

### Ideal addition to the DEK: the NEV

The NEV in combination with the DEK is used to supply the 24 V DC circuit with mains independent electrical voltage.

With at most 6 Amperes (150 VA), the self-learning device is strong enough to support control units and other peripheral devices of the drive. Simply plugged into a basic device and connected via plugs, the NEV keeps the 24 Volt appliance active in case of voltage fluctuations or power failure. For further information see page 26.



### Control cabinet solutions

If (e.g. in case of retrofitting) the control cabinet of the machine does not provide enough space, we can also supply equipped, standardised control cabinets ready for mounting and connection. Individual solutions are possible. For further information see page 28.



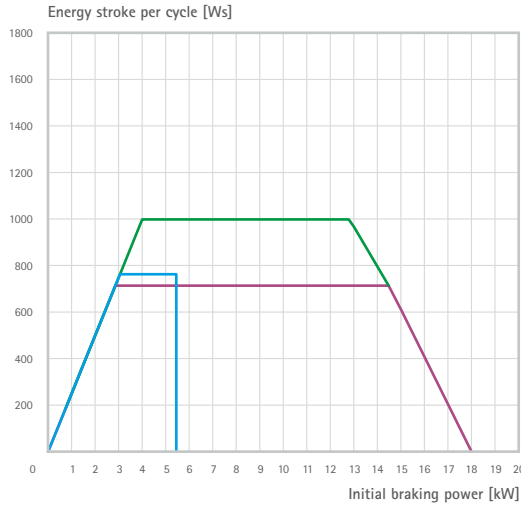
# DEK Maximum Energy Stroke/ Initial Braking Power

The diagrams show the capability of the most common DEK types DEK 2.0B, DEK 2.0F and DEK 3.0F for braking ramps and braking blocks in relation with cycle times of 1, 2 and 4 seconds. The term cycle time defines the process time that is required

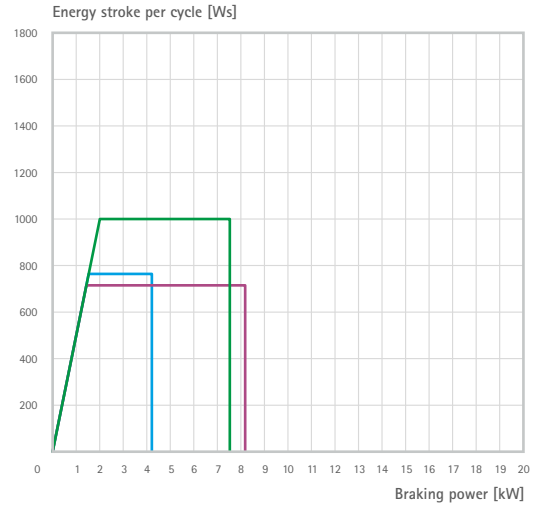
DEK  
 $U_{BRCmax} = 800 \text{ VDC}$   
1s-cycle

- DEK 2.0B
- DEK 2.0F
- DEK 3.0F

Braking ramp

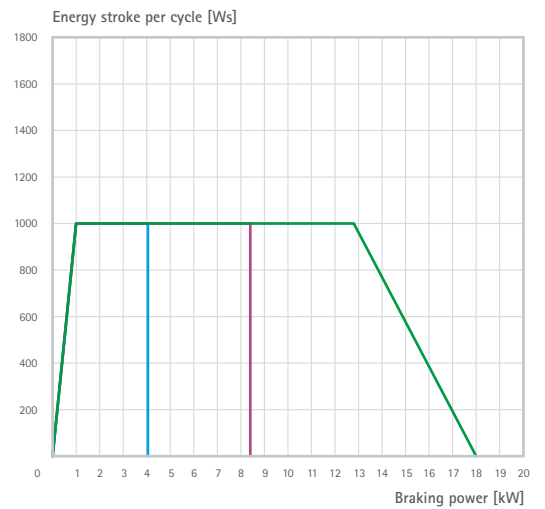
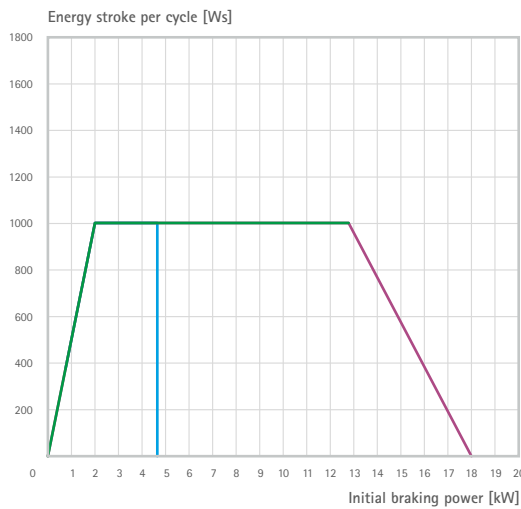


Braking block



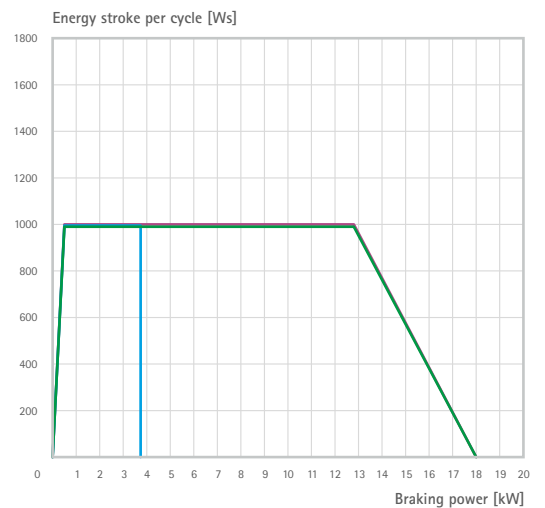
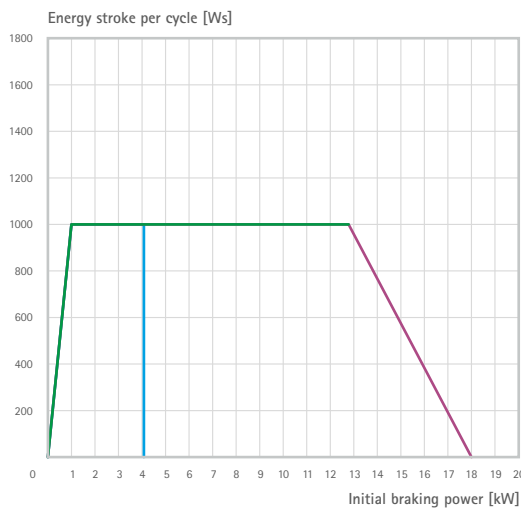
DEK  
 $U_{BRCmax} = 800 \text{ VDC}$   
2s-cycle

- DEK 2.0B
- DEK 2.0F
- DEK 3.0F



DEK  
 $U_{BRCmax} = 800 \text{ VDC}$   
4s-cycle

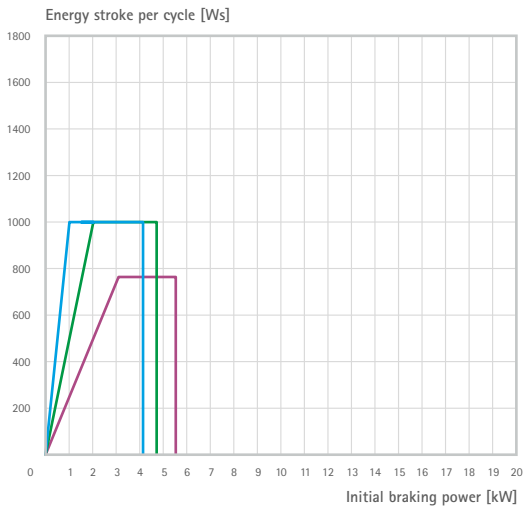
- DEK 2.0B
- DEK 2.0F
- DEK 3.0F



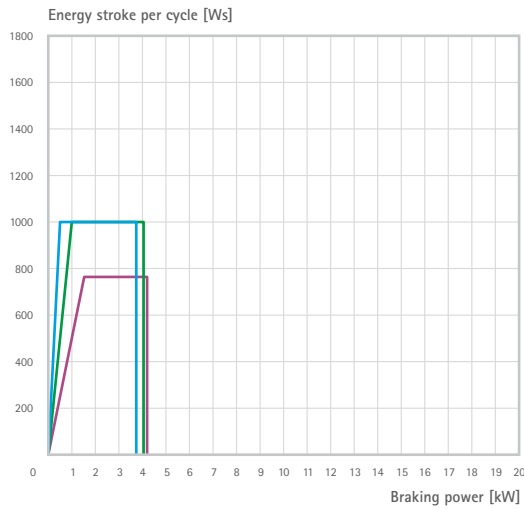


to absorb and release the stated energy by the device (energy stroke). We can design a system that suits your requirements based on accurate application data (initial braking power, form and duration of braking, cycle time and voltage level in the DC link). Please contact our sales team for this purpose.

### Braking ramp

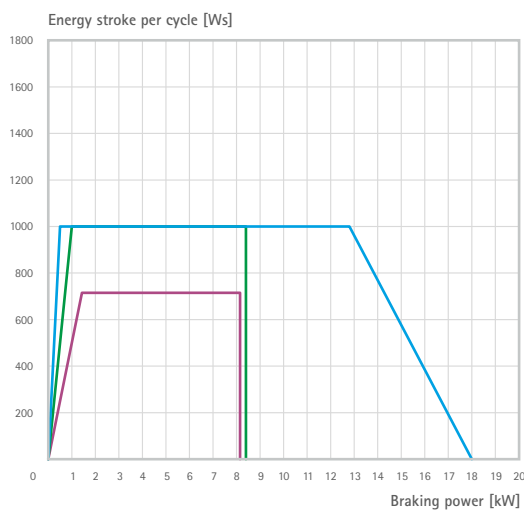
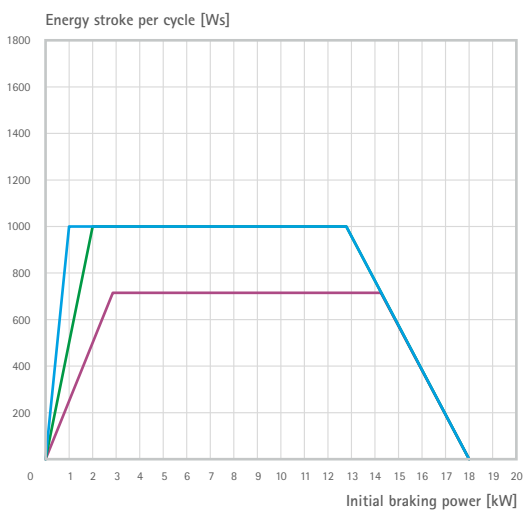


### Braking block



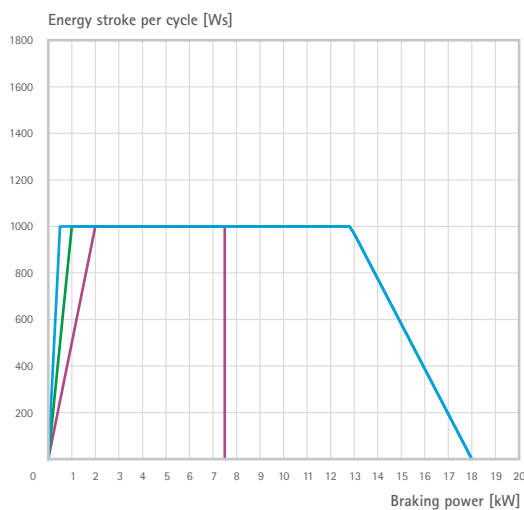
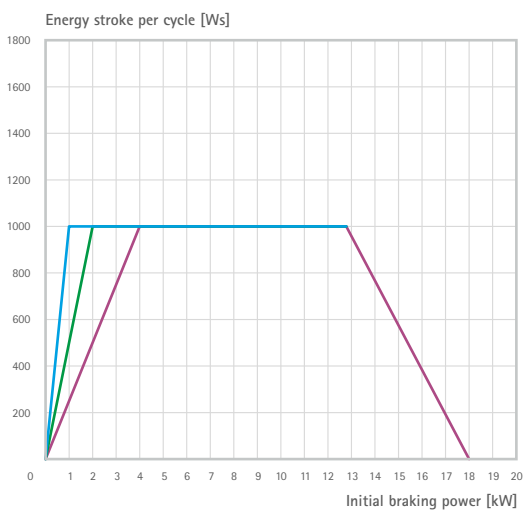
**DEK 2.0B**  
 $U_{BRCmax} = 800 \text{ VDC}$

- 1s-cycle
- 2s-cycle
- 4s-cycle



**DEK 2.0F**  
 $U_{BRCmax} = 800 \text{ VDC}$

- 1s-cycle
- 2s-cycle
- 4s-cycle



**DEK 3.0F**  
 $U_{BRCmax} = 800 \text{ VDC}$

- 1s-cycle
- 2s-cycle
- 4s-cycle

# DEK Maximum Energy Stroke/ Initial Braking Power with parallel connection

Dynamic Energy Storage Combinations can easily be connected in parallel since they synchronise independently due to their self-learning feature. When connecting devices in parallel, higher initial braking powers or currents can be processed. The number of devices connected in parallel is not limited. The following diagrams show the characteristics of a single DES as well as two and three devices connected in parallel for ramp and block braking.

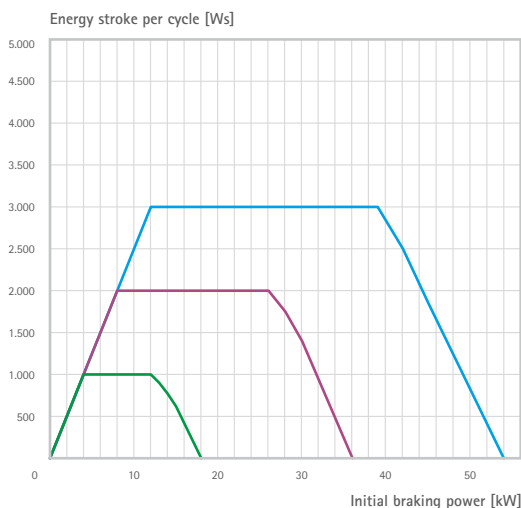
## DEK 3.0F

$U_{BRCmax} = 800\text{ V}$

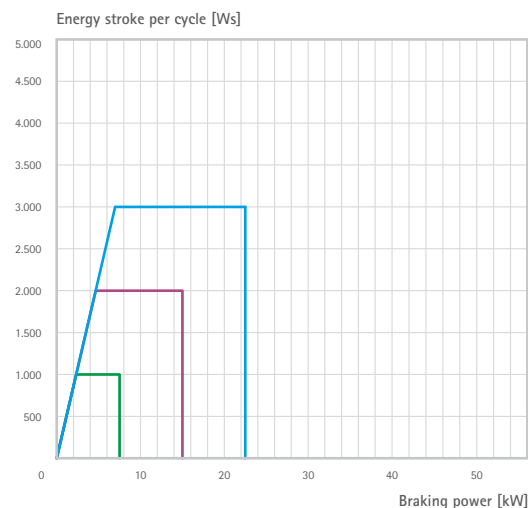
1s-cycle

- 3 DEK 3.0F devices in parallel
- 2 DEK 3.0F devices in parallel
- DEK 3.0F

Braking ramp



Braking block



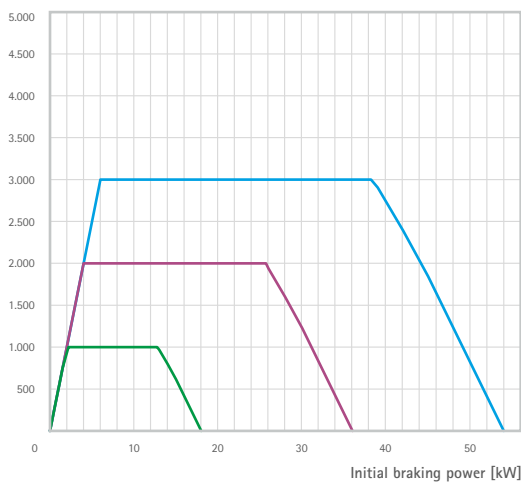
## DEK 3.0F

$U_{BRCmax} = 800\text{ V}$

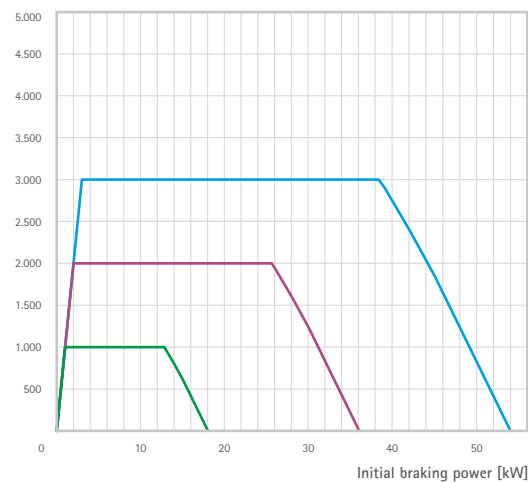
2s-cycle

- 3 DEK 3.0F devices in parallel
- 2 DEK 3.0F devices in parallel
- DEK 3.0F

Energy stroke per cycle [Ws]



Energy stroke per cycle [Ws]



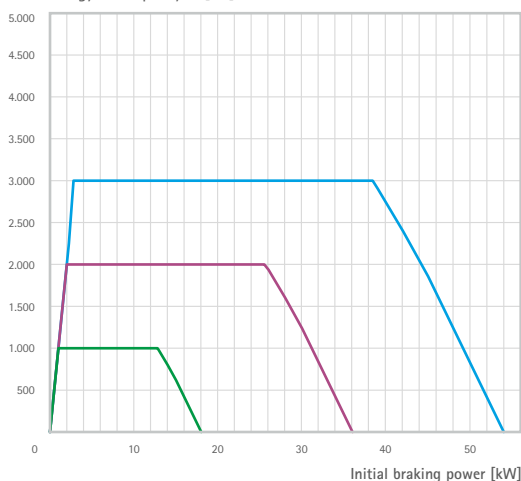
## DEK 3.0F

$U_{BRCmax} = 800\text{ V}$

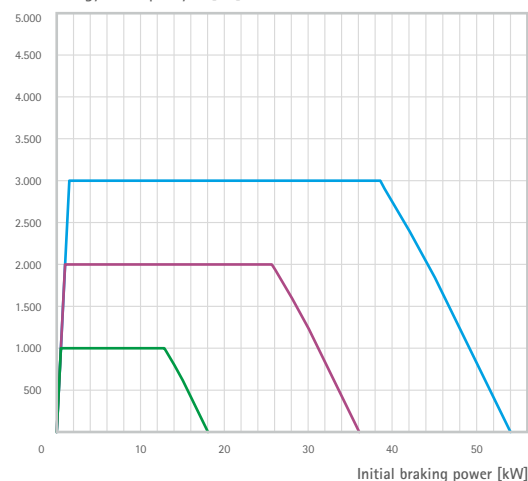
4s-cycle

- 3 DEK 3.0F devices in parallel
- 2 DEK 3.0F devices in parallel
- DEK 3.0F

Energy stroke per cycle [Ws]



Energy stroke per cycle [Ws]



## Extension module DEK + EM

If the storage of the DEK is not sufficient it can easily be increased with Extension Modules. Those modules only need to be connected with the DEK via the accompanying cable with polarity protected plugs.

Before connecting with the DEK the capacitors of the EM are safely discharged via the internal discharge resistor in the extension modules. The number of connected extension modules and thus the level of the storable energy is adapted to the requirements of the application.



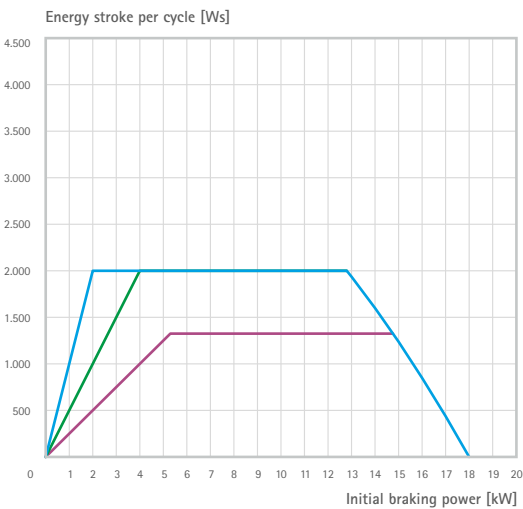
### Storage extension for the DEK

- > Multiplying the stored energy
- > easiest connection via plugs
- > neither configuration nor commissioning effort required
- > Integrated discharge resistor

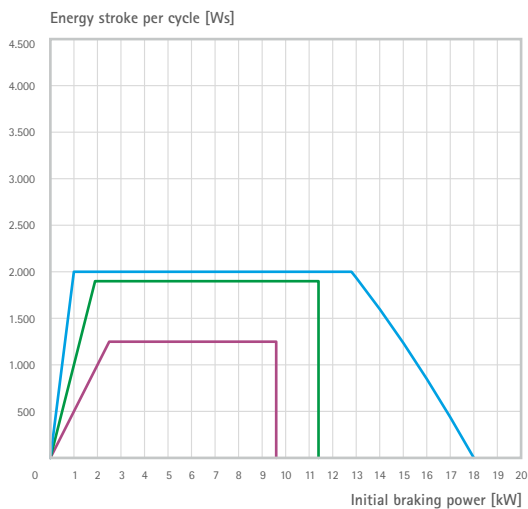
### Technical specifications

Parameter	EM 2.0A20	EM 2.0A2020
Usable storage capacity up to	2,000 Ws	4,000 Ws
Built-in PTC discharge resistor	+	+
Dimensions H x W x D mm	300 x 100 x 201	300 x 100 x 201
Weight approx.	4.1 kg	6.2 kg
Protection Class	IP 20	IP 20

#### Braking ramp

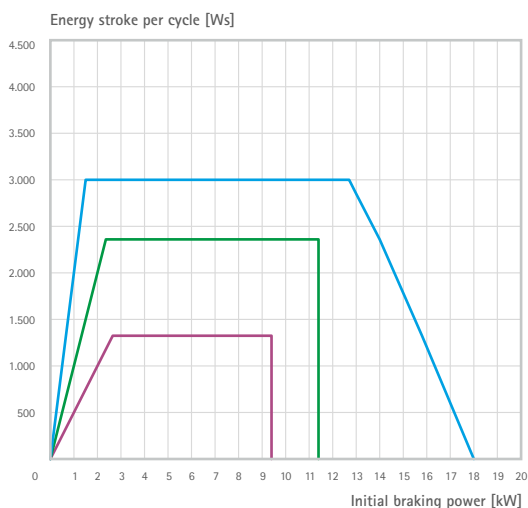
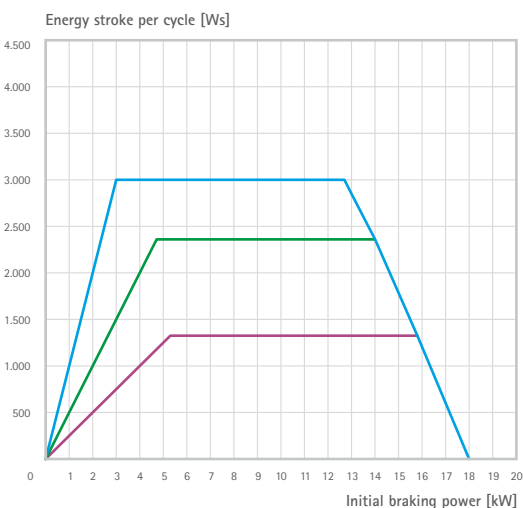


#### Braking block



**DEK 3.0F  
with EM2.0A20**  
 $U_{BRCmax} = 800 V$

- 1s-cycle
- 2s-cycle
- 4s-cycle



**DEK 3.0F  
with EM2.0A2020**  
 $U_{BRCmax} = 800 V$

- 1s-cycle
- 2s-cycle
- 4s-cycle

# Dynamic Energy Storage KES

for drive controllers up to 230V

A new option to process braking energy: the Dynamic Energy Storage KES. A solution that is independent of the mains. One device that can be used on almost all converters and servo controllers with a maximum DC link voltage of 540 VDC. The KES is an opportunity to increase the energy efficiency of various applications, to save resources, protect the power grid and even the users nerves.

## Active buffer module for DC links

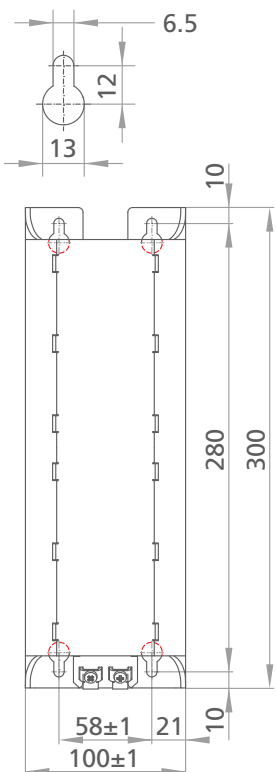
- > for single axis and multi axes systems
- > independent adjustment (Black Box)
- > no displays or any kind of control elements
- > shorter cycle times result in increased efficiency



[www.brakeenergy.com/kes](http://www.brakeenergy.com/kes)



## Installation dimensions and mounting-holes (mm)



## The operation – savings without circuit feedback

Unlike the direct DC link capacity expansion of converters, the active KES does not have any contact with the input side of the mains. The KES is only energised and charged in the event of braking. This feature leads to one of the most important characteristics: the KES does not cause any circuit feedbacks.

The KES independently sets the range of its working voltage level. This range is defined by two values from the voltage level of the DC link: the maximum voltage level of the DC link and the minimum voltage level of the DC link. From now on the KES starts absorbing energy from the DC link once the voltage level reaches the defined maximum value (e.g. in case of braking). As soon as the voltage level in the DC link reaches the defined minimum value (e.g. in case of accelerating) the KES returns its stored energy to the DC link. This is the moment when energy is being saved, because instead of using power from the grid the converter is driven by electrical energy from the KES!

The KES stops supplying energy once the voltage level in its capacitor reaches the dynamically established charging level / minimum voltage level and waits for the next braking event which recharges the capacitor. Charging, discharging, charging, etc. can take place in fractions of a second without causing any power circuit feedbacks.

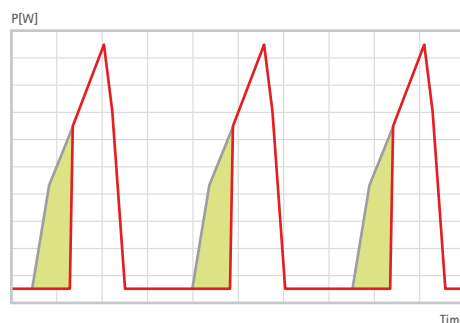
## Technical specifications KES

Parameter	Value
Useful energy approx.	1,300 Ws
Continuous voltage of the DC link	540 VDC max.
Output	10.4 kW max.
Built-in PTC discharge resistor	+
Dimensions H x W x D	300 x 100 x 201 mm
Weight approx.	6.9 kg
Protection class	IP 20

## Energy savings with the KES

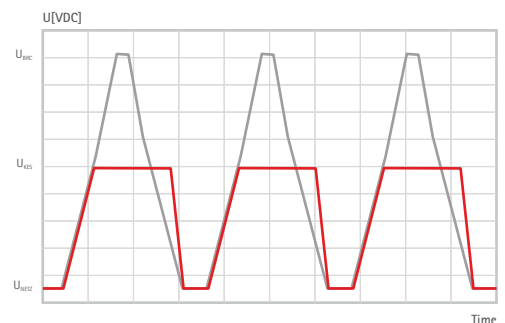
— with the KES      ■ Energy savings

— without the KES



## Voltage characteristics in the DC link

— without the KES      — with the KES

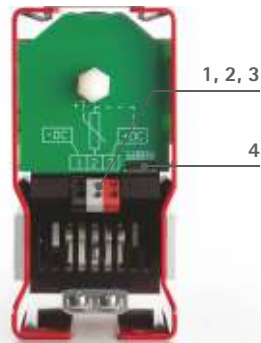


### Simple connections I

(bottom side)

With only three cables, the KES is extremely easy to connect.

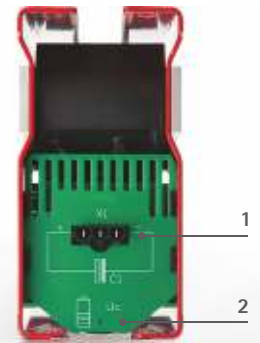
1. Negative terminal of the DC link
2. Braking transistor (braking chopper)
3. Positive terminal of the DC link
4. Connection of the RS422 interface (optional)



### Simple connections II

(top side)

1. Reverse polarity protected interface to connect extension modules
2. Safety-relevant LED: flashes as long as the unit is charged

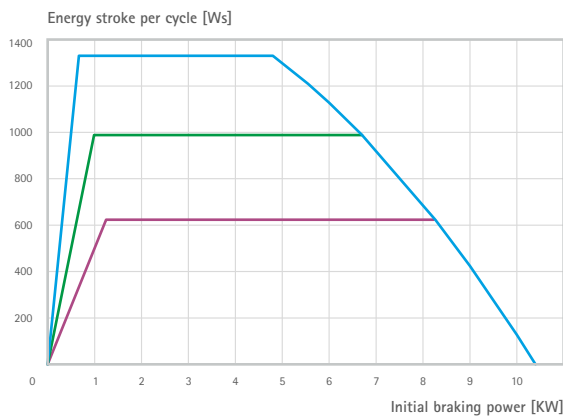


### KES Maximum Energy Stroke/Initial Braking Power

KES 2.0F,  $U_{BRmax} = 540$  VDC

#### Braking block

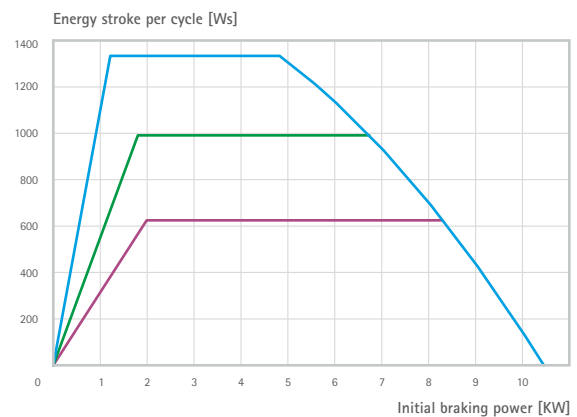
— 1s-cycle — 2s-cycle — 4s-cycle



KES 2.0F,  $U_{BRmax} = 540$  VDC

#### Braking ramp

— 1s-cycle — 2s-cycle — 4s-cycle



### Just give it a try

Based on its concept the KES can easily be tested in an existing system as a retrofit solution. To be installed the KES has to be connected in parallel to the existing braking resistor of the converter of the drive system. After a few cycles the collected data in the processor can be read out and evaluated. Based on the analysis of these data the suitable KES solution can be chosen – Can it get any easier than this? For further information see page 26.

### Control cabinet solutions

If (e.g. in case of retrofitting) the control cabinet of the machine does not provide enough space for our KES, we can also supply equipped, standardised control cabinets ready for mounting and connection. Individual solutions are possible. For further information see page 28.



# Dynamic Energy Supply KEV

for drive controllers up to 230V

Companies place special value on two factors when it comes to electrical energy: guarantee of supply and low prices. Both are called into question with the implementation of the withdrawal of atomic energy. Broken down on electrical drives power failures present a special challenge even today in developed nations. With the Dynamic Energy Supply KEV for converters and drive controllers short-term power failures can be bridged and their consequences minimised.

## Active support module for DC links

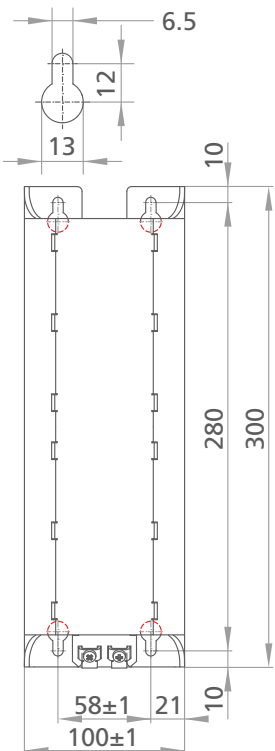
- > for single and multiple systems
- > no keys, displays, other control elements
- > supports in case of power failure or interruptions



[www.brakeenergy.com/kev](http://www.brakeenergy.com/kev)



## Installation dimensions and mounting-holes (mm)



### Simple connection I (Bottom side)

The KEV is extremely easy to connect with two cables. And it works.

1. Negative terminal of the DC link
2. Discharge resistor
3. Positive terminal of the DC link
4. Connection of the RS422 interface (optional)

## Short-term UPS for drives

The Dynamic Energy Supply KEV acts as a short-term uninterruptable power supply for drives and servo controllers. The active capacity extension for the DC link of the inverter stores an amount of energy that is defined according to the technical design. It serves to keep the voltage level of the DC link at a level which bridges over the downtime without trouble and/or brings the machine to the defined stop state in case of power failure. In each case, the objective is that the drive and all systems supplied by it either do not perceive the power failure at all or are brought into a defined state from which a restart is possible without any effort.

## Gentle on the power grid and drives

The energy supply is charged after switching on the inverter for each charging routine, which acts very carefully not to overload the charging circuit and not to generate any negative circuit feedback either.

The KEV is fully ready for use after only eight seconds. It then supports the DC link every time its voltage falls below 270 VDC.

## With digital interface

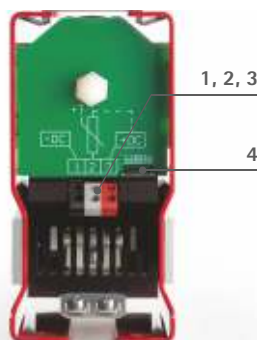
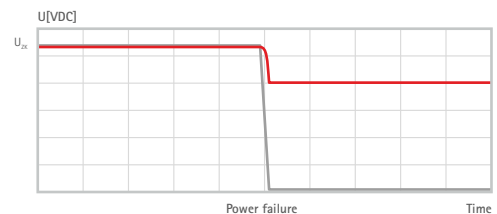
The Dynamic Energy Supply KEV is equipped with a digital interface with 24 Volt input to monitor its function. The control of the machine takes over the evaluation of the signal as well as the initiation of the established measures.

## Technical specifications KEV

Parameter	Value
Useful energy approx.	1,600 Ws
Continuous voltage of the DC link	540 VDC max.
Cycle time of use	30 minutes
Working voltage	270 VDC (other possible)
Output	10.4 kW max.
Digital interface	24 VDC (for function monitoring)
Built-in PTC discharge resistor	+
Dimensions H x W x D	300 x 100 x 201 mm
Weight approx.	6.9 kg
Protection class	IP 20

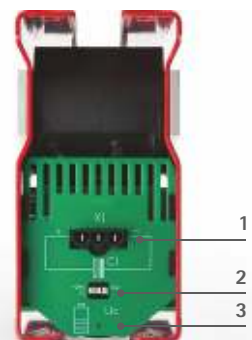
## Voltage curve of the DC link with KEV

— without KEV      — with KEV



### Simple connection II (Top side)

1. Interface secured against polarity reversal for connecting extension modules and NEV
2. Digital interface for function monitoring
3. Safety-relevant LED: Flashes, as long as the storage unit is charged



## Extension module KEV + KEM

When the storage capacity of the Dynamic Energy Supply KEV is insufficient extension modules can then be used. They can easily be connected via the accompanying cables with reverse-polarity protected plugs with the KEV. Done!

The storage is safely discharged via the discharge resistor built into the extension modules before the connection. The number of connected extension modules and thus the level of the stored energy is adapted to the requirements of the application.



### Storage extension for the KEV

- > Multiplying the stored energy
- > simple connection using plugs
- > neither configuration nor commissioning effort
- > Discharge resistor on board

### Technical specifications

Parameter	KEM 2.0B16	KEM 2.0B1616
Usable storage capacity approx.	1,600 Ws	3,200 Ws
Built-in PTC discharge resistor	+	+
Dimensions H x W x D	300 x 100 x 201	300 x 100 x 201
Weight approx.	4.1 kg	6.2 kg
Protection Class	IP 20	IP 20

### Accompanying energies can very easily be implemented by the combinatorics with the extension modules

If the power of a KEV of max. 10.4 kW is not sufficient by itself, Dynamic Energy Storages can also be connected in parallel. The power is multiplied according to the number of devices connected in parallel.

### KEV + extension module

Required energy [kWs]	Module			Space requirement/ total width [mm]	Required energy [kWs]	Module			Space requirement/ total width [mm]
	KEV 2.0	KEM2.0 B16	KEM2.0 B1616			KEV 2.0	KEM2.0 B16	KEM2.0 B1616	
1.6	1	0	0	100	9.6	1	1	2	400
3.2	1	1	0	200	11.2	1	0	3	400
4.8	1	0	1	200	12.8	1	1	3	500
6.4	1	1	1	300	14.4	1	0	4	500
8	1	0	2	300					

### The ideal addition to the KEV: NEV

The 24 Volt emergency power supply (NEV) ensures stable supply of a 24 V DC network to be secured as an option in combination with the KEV.

With at most 6 Amperes (150 VA), the self-learning device is strong enough to support control units and other peripheral devices of the drive. Simply plugged into a basic device and connected via plugs, the NEV keeps the 24 Volt appliance active even with voltage fluctuations or power failure. For further information see page 26.



### Control cabinet solutions

The Dynamic Energy Supplies required for the application are also offered as equipped ready-to-assemble and prewired, standardised control cabinets with the type designation KTS, which can take on up to ten devices.

For further information see page 28.



## Dynamic Energy Storage Combination

### KEK

for drive controllers up to 230V

The KEK is optimal, when the energy supply for the drives has to be ensured and at the same time the braking energy for the system can be regenerated. DEK is the optimal combination of the Dynamic Energy Storage Unit DES and the Dynamic Power Supply Unit DEV. A part of the installed energy storage - to be defined individually, but at least 50% - is reserved for the UPS case, the remaining part is used for intermediate storage of braking energy. This part helps make the investment in the UPS functionality cheaper due to the possible energy savings.

#### Active supply module for DC links

- > for single axis and multi axes systems
- > buffers braking energy for use in the system
- > no buttons, display indicators, other controls
- > provides support during power failures or interruptions
- > with a digital interface



[www.brakeenergy.com/kek](http://www.brakeenergy.com/kek)



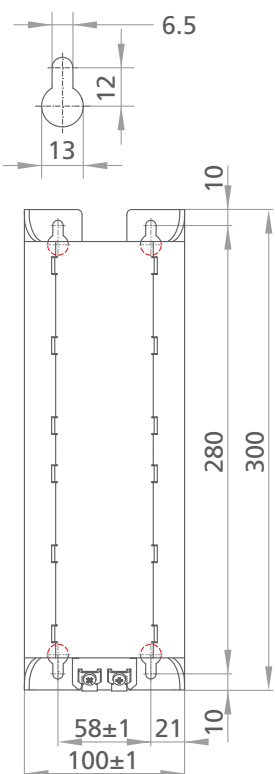
#### Combined optimally: Buffer with UPS-function

KEK can both store braking energy as well as compensate for voltage fluctuations and power failures. This is enabled by the division of the storage into one area for braking energy and one for the short-term UPS energy, where the UPS area is allocated at least half of the energy storage. The exact division of the amount of energy available is thus the result of application engineering.

Starting with an example where it applies that 500 Joules of energy are stored temporarily, the remaining 1,100 Joules are stored for the UPS case.

Connecting the KEK to the machine is very easily done by three strands via "Plug&Play". The device then works without any further actions. Based on its concept the KEK can easily be tested in an existing system as a retrofit solution. To be installed the KEK has to be connected in parallel to the existing braking resistor of the converter of the drive system. After a few cycles the collected data in the processor can be read out and evaluated. Based on the analysis of these data the suitable KEK solution can be chosen - Can it get any easier than this?

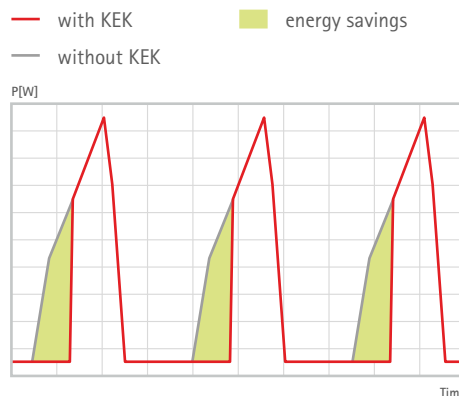
#### Dimensions and mounting holes (mm)



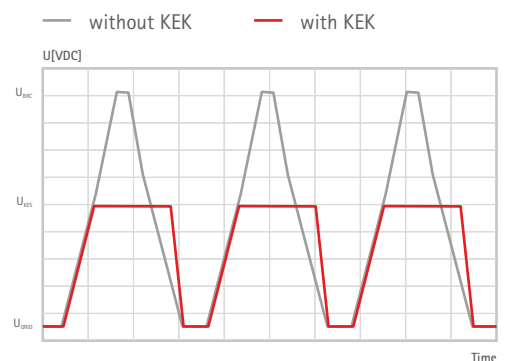
#### Technical Specifications KEK

Parameter	Value
Available storage capacity, up to	1,600 Ws
Continuous voltage DC link	540 VDC
Output power	10.4 kW
Digital interface	24 VDC (for function monitoring)
Built-in PTC braking resistor	+
Dimensions H x W x D	300 x 100 x 201 mm
Weight approx.	6.9 kg
Protection Class	IP 20

#### Energy savings with the KEK



#### Voltage characteristics of the DC link



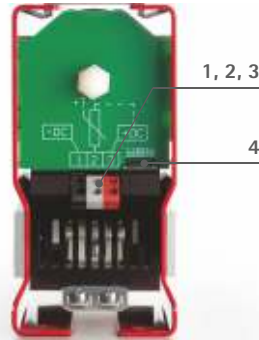


### Simple connections I

(bottom side)

With only three cables, the DEK is extremely easy to connect.

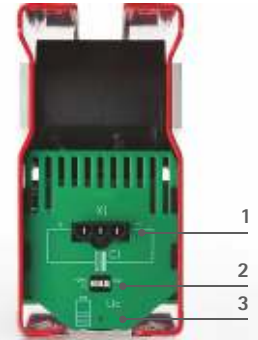
1. Negative terminal of the DC link
2. Braking transistor (braking chopper)
3. Positive terminal of the DC link
4. Connection of the RS422 interface (optional)



### Simple connection II

(Top side)

1. Interface secured against polarity reversal for connecting extension modules and NEV
2. Digital interface for function monitoring
3. Safety-relevant LED: Flashes, as long as the storage unit is charged

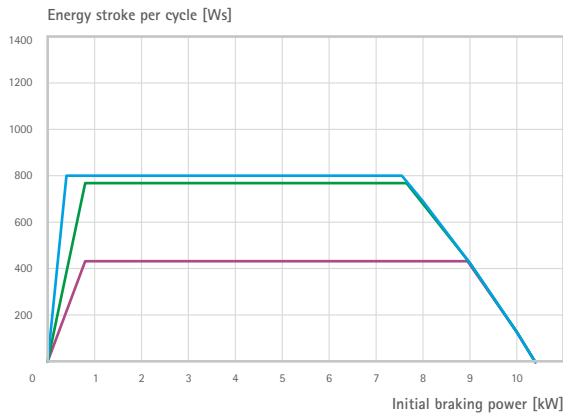


### KEK Maximum Energy Stroke/Initial Braking Power

KEK 2.0F,  $U_{BRmax} = 540$  VDC

#### Braking block

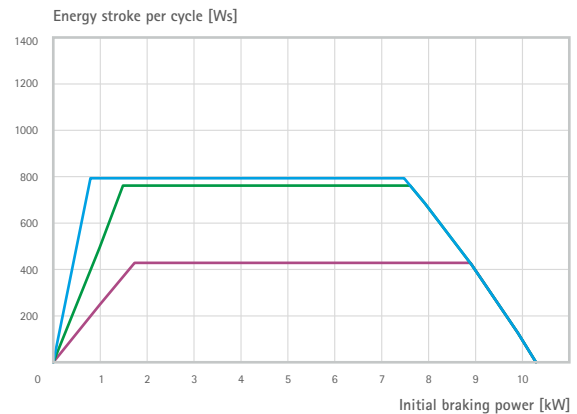
— 1s-cycle — 2s-cycle — 4s-cycle



KEK 2.0F,  $U_{BRmax} = 540$  VDC

#### Braking ramp

— 1s-cycle — 2s-cycle — 4s-cycle



### Ideal addition to the KEK: the NEV

The NEV in combination with the KEK is used to supply the 24 V DC circuit with mains independent electrical voltage.

With at most 6 Amperes (150 VA), the self-learning device is strong enough to support control units and other peripheral devices of the drive.

Simply plugged into a basic device and connected via plugs, the NEV keeps the 24 Volt appliance active in case of voltage fluctuations or power failure. For further information see page 26.



### Control cabinet solutions

If (e.g. in case of retrofitting) the control cabinet of the machine does not provide enough space, we can also supply equipped, standardised control cabinets ready for mounting and connection.

Individual solutions are possible.

For further information see page 28.



## 24 Volt Emergency Power Supply NEV

The NEV is used to supply the 24 V DC circuit with mains independent electrical voltage. For this purpose, the NEV makes use of the energy of a supply unit, namely the dynamic energy supply DEV or the dynamic energy storage combination DEK.

Under severe voltage fluctuations or when power fails, the NEV provides energy to its secured 24 volt circuit. The time depends primarily on the load and the available energy from the supply unit. The settings of the supply unit also have an impact on the duration of the supply of electrical energy. However, the NEV is not designed for continuous operation. The power supply that provides the continuous supply is normally connected as a power source to the NEV. The consumers on the circuit to be secured are connected to the NEV. This is automatically used to teach The NEV about the externally connected voltage and thus to support the voltage level.

### Active 24-Volt support power supply

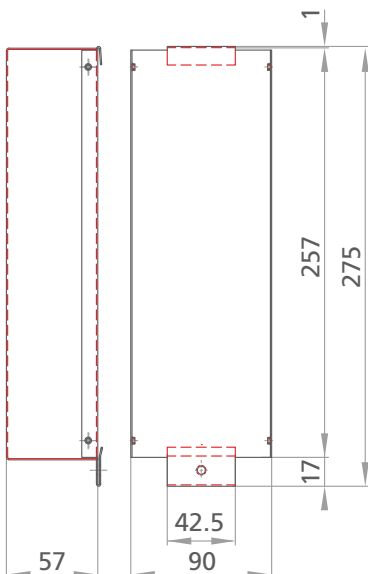
- > space-saving
- > without further manual configuration
- > no keys
- > provides support when power failures or -interruptions occur



[www.brakeenergy.com/nev](http://www.brakeenergy.com/nev)



### Installation dimensions and holes (mm)

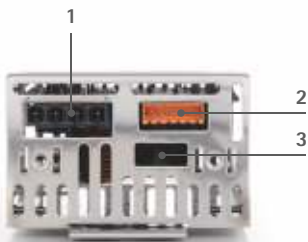


### Technical Specifications NEV

Parameters	Value
Electrical power ratings	
Input voltage (terminal X2)	22 VDC...26 VDC
Rated current	6A (up to 150VA) for failure operation 5A (up to 120VA) for mains operation
Standby power dissipation	< 1 W
Overvoltage category	III (altitude up to 2000 m above sea level) II (altitude about 2000 m above sea level)
Immunity to interference	Industries in accordance with EN 6100-6-2-205 and EN 6100-6-4-2007
Dimensions and weight	
Dimensions H x W x D	275 x 90 x 60 mm
Weight	appr. 1.0 kg
Environmental conditions	
Environmental temperature	-10° C to +85° C (transport, storage) 0° C to +40° C (operation)
Relative humidity	≤ 95% (transport, storage) ≤ 85% (operation)
Cooling type	Air cooled (convection)
Protection level	housing IP20
Degree of pollution installation location	2

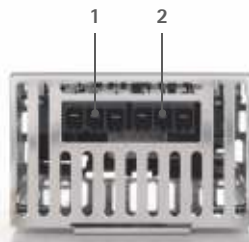
### Simple to install on the supply unit





### Simple connections I (bottom)

1. Connection of external power supply and the 24-volt circuit (X2) that must be secured
2. Signal terminals (X3)
3. Interface RS 422 (optional)



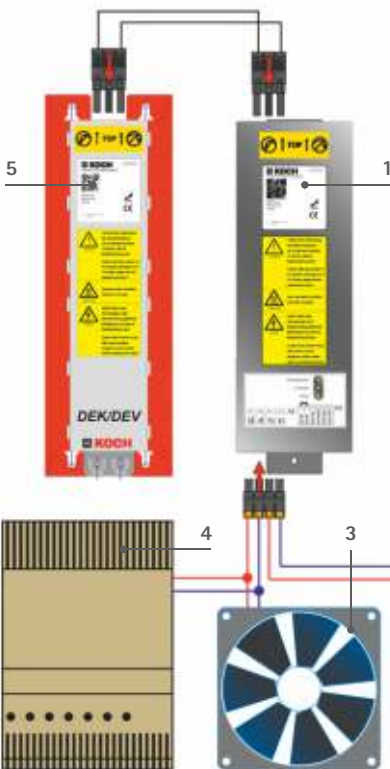
### Simple connections II (top)

1. Reverse polarity secured interface to connect the power supply unit (X1)
2. Reverse polarity secured interface to connect another NEV (X1)



### Labelling (front)

1. Installation position
2. Type label
3. Hazard notice
4. Pin assignment/device status



### Wiring Diagram

1. NEV
2. Consumer, secured  
22...26 VDC, max. 6 A (150 VA)
3. Consumer, unsecured
4. 24 V mains power supply
5. Power supply unit



Connect two or more NEV to a DEV / DEK, an EM or a combination thereof

Several NEV units may also be connected to one unit or the combination by using an extension. For this purpose, each additional NEV is connected by means of connector X1 of the NEV using the connection cable.

No further EM may be connected to plug XI of the NEV.

Important to note! The NEV-outputs must not be connected in parallel! Ensure that no device is loaded with more than 6A/150VA.

# Koch Technology Cabinet for Energy Storage Solutions KTS

The standard control cabinets, which are available for the case that the energy storage systems no longer have any space in the control cabinet of the machine or installation, are designated with KTS. Eventually, many machine operators also want to use the benefits of DES, DEV, DEK as well as KES, KEV, KEK and NEV for existing machines. Upgrade and retrofit are the terms for them. But even "Option" in the case of new machines. We can equip control cabinets for these situations and supply them completely mounted. We offer control cabinets in two sizes - a small and a large variant - depending on the kind and amount of built-in devices.

## Integrating energy storage systems into a control cabinet

- > ready to mount and connect
- > temperature control
- > customized solutions



[www.brakeenergy.com/kts](http://www.brakeenergy.com/kts)



### small variant

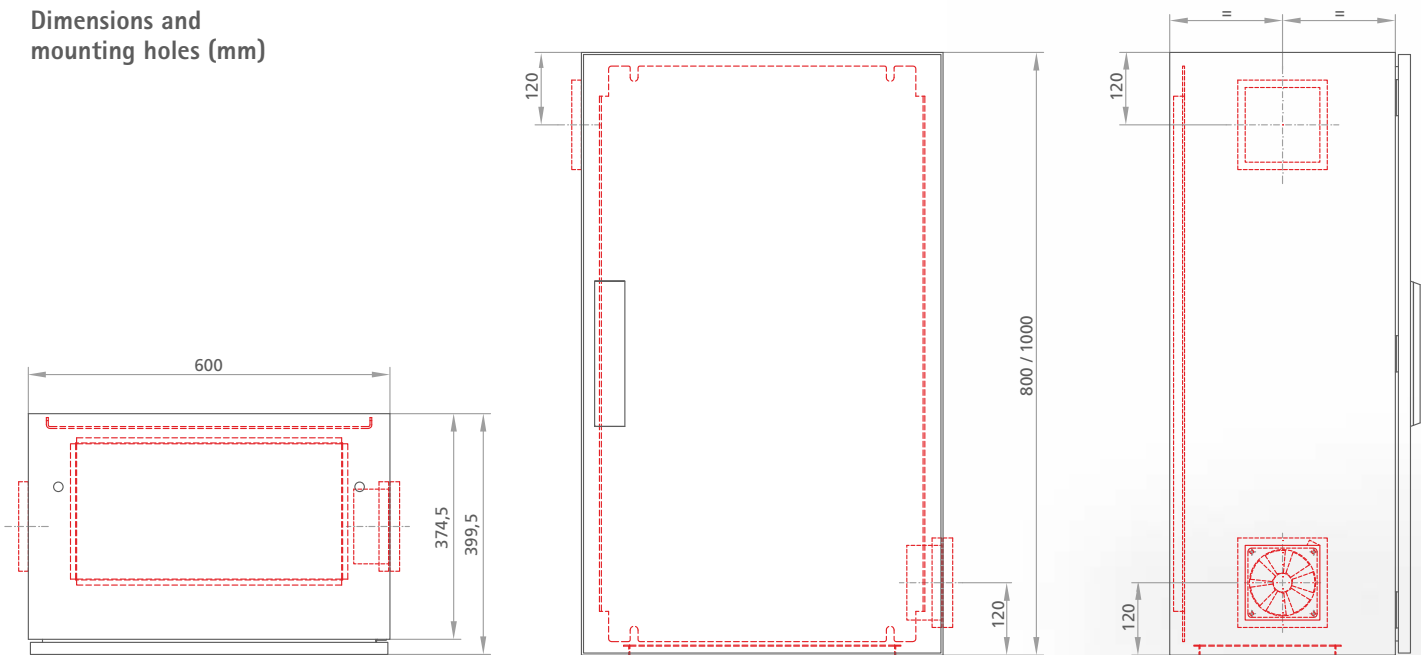
open bottom for individual cable entry  
(optional with a bottom plate)



### Technical specifications small variant

Parameter	Value
Dimension and Weight	
Dimensions H x W x D	800 x 600 x 400 mm
Weight	39 kg (without devices)
Ambient temperature	0 – 40°C (data Energy Storage)
Relative humidity	referring to Energy Storage
Cooling system	convection or ventilator
Protection class	IP 55 / NEMA 12 when choosing corresponding bottom plates and an end plate

### Dimensions and mounting holes (mm)



### large variant

open bottom for individual cable entry (optional with a bottom plate)

### Technical specifications large variant

Parameter	Value
Dimension and Weight	
Dimensions H x W x D	1,000 x 600 x 400 mm
Weight	49 kg (without devices)
Ambient temperature	0 – 40°C (data Energy Storage)
Relative humidity	referring to Energy Storage
Cooling system	convection or ventilator
Protection class	IP 55 / NEMA 12 when choosing corresponding bottom plates and an end plate



### Of course it is also possible individually!

Beyond the already given options for individualisation with the standard solutions, it is also possible to deliver customized solutions that match the customer needs optimally.



## Examples of Applications

### Handling Robot

**Intention:** Raising the dynamics of the robot



**Situation:**

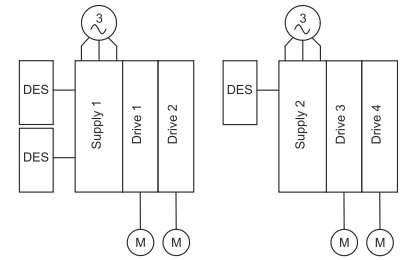
The robot drives 12 cycles/min with a traverse path of 6.5 m and a power consumption of 10.7 kW.

**Problem:**

Short cycles and big masses lead to excessive stress of the electronic drive unit and thus to unplanned outages.

**Solution:**

- > Use of 3 DES3.0 via "Plug & Play":  
Stabilizing the DC link by storing brake energy and providing it again once needed
- 2 DES3.0 parallel for the linear drive axis
- 1 DES3.0 for the robot axis



**Results:**

1. Increasing cycles from 12 to 15/min:  
raise in productivity by 25%
2. Lowering the power consumption to 8 kW:  
energy savings of more than 25%
3. Longer service life of the electronic drive unit

### Portion Cutter

**Intention:** Raising the cutting speed and avoiding unplanned downtimes



**Situation:**

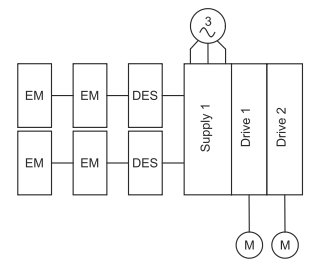
Maximal output quantity of the portion cutter: 80 slices/min.

**Problem:**

Acceleration of the system leads to instability of the DC link. With the given drive solution an increase of the output quantity is not possible. Acceleration also stresses the drive electronics and leads to downtimes caused by wearout failure.

**Solution:**

- > Use of DES3.0 via "Plug & Play": Integrated into the existing system as a retrofit, the energy storage supplies the necessary amount of energy to the DC link.



**Results:**

1. Increasing the output rate from 80 to 120 cuts/min:  
raise in productivity by 50%
2. Longer life-time of electronic drive unit - no outages anymore

### Bottle Filling Line

**Intention:** Securing controlled stops



**Situation:**

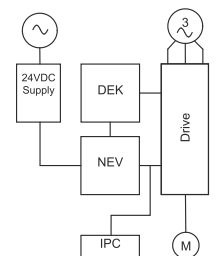
A multi-axis system coordinates the drives of the filling process.

**Problem:**

In case of power failure the machine stops uncontrolled. The restart can take hours and causes high costs.

**Solution:**

- > Use of DEK2.0 via "Plug & Play":  
Supplying the drives with the necessary energy for a controlled stop and saving all the regenerative brake energy that occurs in the ongoing process
- > Use of NEV to supply the 24V power grid for controls and sensorics



**Results:**

1. Controlled stop of the machine in case of power failure
2. Avoidance of only partially filled bottles - no rejects
3. Bringing the system into a defined state
4. System can be restarted productively without extensive setup times

## Textile Machine

**Intention: Controlled stop in case of power failure**



**Situation:**

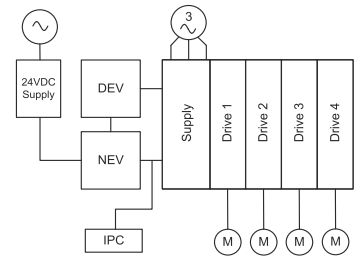
Multiple drives are connected to one DC link.

**Problem:**

In case of power failure and thus reduction in speed to <10% the machines stop uncontrollably, leading to yarn breaking and - clewing. Restarting the machines can take hours, thus high downtime costs occur. Especially in production countries with instable grid power, power failures occur multiple times a day, so there this is an enormous problem.

**Solution:**

- > Use of DEV2.0 via "Plug & Play": Supplying the drives with the energy that is necessary for a controlled stop
- > Use of NEV to supply the 24V power grid for controls and sensorics



**Results:**

1. Controlled stop of the machine in case of power failure
2. Breaking and clewing yarn is avoided – tremendous time savings when restarting
3. Machine protection and material savings

## All-Electric Injection Molding Machine

**Intention: Immediate opening of the mold in case of power failure**



**Situation:**

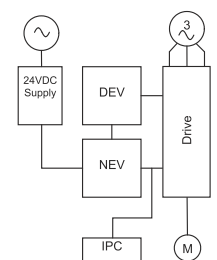
In case of power failure, safety standards require the machine user to be able to stop the filling process and open the mold.

**Problem:**

A power failure during the filling process of the injection mold can lead to an adhesion of the plastic to the machine. Long downtimes, high setup costs and even damages are the result.

**Solution:**

- > Use of DEV2.0 via "Plug & Play": Supplying the drive with the energy that is necessary to open the mold
- > Use of NEV to supply the 24V power grid for controls and sensorics



**Results:**

1. Immediate opening of the tools in case of power failure
2. Destruction of the machine and the workpiece is avoided
3. Cost and time savings

## Automated Guided Vehicle System

**Intention: Removing the AGV out of the critical area when power supply stops**



**Situation:**

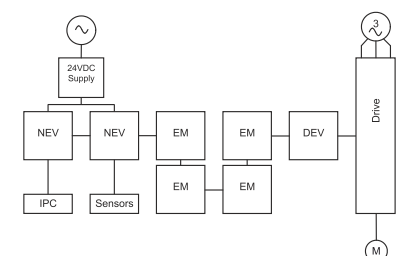
In case of power failure, AGV are not supplied with energy anymore and stop. Safety standards require that the AGV does not stop in fire protection doors.

**Problem:**

In case of power failure, fire protection doors cannot be shut if an AGV blocks the doors.

**Solution:**

- > Use of DEV2.0 with 4 EM via "Plug & Play": Supplying the drive with the energy that is necessary to leave the critical area
- > Use of 2 NEV to supply the 24V power grid for controls and sensorics



**Results:**

1. The AGV is supplied with energy from the DEV to leave the critical area without needing an UPS
2. The fire protection door can close safely

## Project planning/ Application engineering

We will support you with the dimensioning of the break resistors and Energy Storage Solutions. You can trust in the experience and the know-how of our sales representatives who should actually be named "Application-Supporters". We have the suitable tools to analyze even the most difficult applications to find the best possible solution. Should there be any doubt our design engineers are at your service.

You will always receive a clear response to your question based on the technical details of your application.



## Do you have questions about products, technology or applications?

### Direct contact

Call us, send us an e-mail or a fax. We will respond immediately.

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# Safe brake resistors in wire-wound and PTC technology



## Wire-wound resistors

Safe brake resistors for electrical drive technology must meet specific requirements. High pulse loading capacity with controlled surface temperatures and a coherent safety concept under persistent overloads are required.

We have achieved optimum results with our wire-wound resistors to manage this balancing act. In compliance with the relevant standards, sub-components were selected and mounted in rugged, anodized aluminum housings using specific constructive measures.

Results speak for themselves: Low-inductance resistors that are particularly pulse resistant, with a specific safety concept to guarantee long life.



## PTC resistors

PTC denotes Positive Temperature Coefficient with special characteristics. The characteristics of a PTC resistor cause its resistance to exponentially increase from a defined temperature until it reaches high resistance. This property is used to provide advantages in various applications; in our equipment it is used as a brake resistor with the focus on the intrinsic safety of the components. When an integrated PTC is overloaded, the inverter signals an overvoltage on the DC link that can be compensated by an additional external resistor. Regarding the design the temperature and voltage dependencies of the PTC resistor must be taken into account.



## Advantages of all series

- > compact
- > protection class up to IP 65
- > particularly impulse-resistant
- > low inductance
- > "intrinsically safe"<sup>\*\*</sup> under persistent overloads
  - no short-circuit
  - self-extinguishing
  - no fault to frame

<sup>\*\*</sup> "intrinsic safety" is usually provided by wire-wound resistors when the rated power at 35% duty cycle ED is multiplied by four. It is typical for PTC resistors.

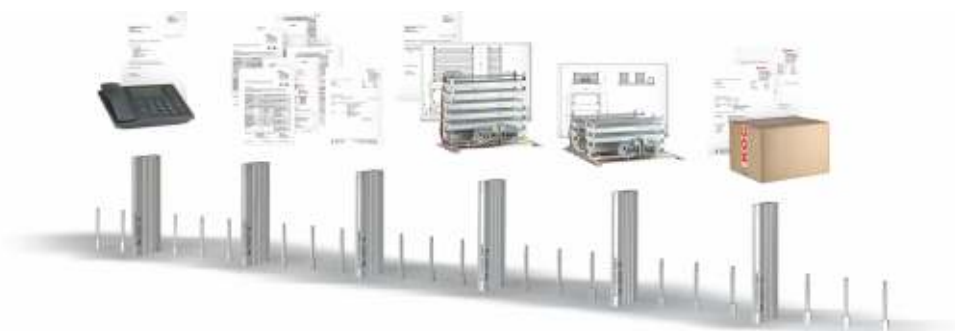
## Special requirements

Different requirements in combination with the special properties of the brake resistor do not present a problem.

A broad spectrum of fully adaptive combinations is available in the range from 100 watts to 7.2 kW. Special geometrical properties to match the hole-pattern of the inverter, an enclosure in a particular color or a special connector do not constitute a problem. All this is available with IP 65 protection class within 24 hours.

## 60,000 types... ex-stock!

Inquiry, design, offer and delivery in one day.



# Brake resistor PTC8006xx

Self-protecting PTC element (aluminum housing) with very high operating voltage limit; protection class IP20.



### Rated power (W)

See tables

### Resistance (Ohm)

See tables

### Dimensions (mm)

Enclosure: See tables

Wiring: up to 450 mm  
Ø AWG 20 or 0.6 mm<sup>2</sup>

With four mechanical and electrical ranges of 35, 70, 105 and 140 watts continuous power on a heat sink, the PTC brake resistors cover the power requirements of small frequency inverters and servo controllers. Similar to the level of wire-based brake resistors, the impulse power ratings are of major importance for the applications and have a factor of 35 with a 1 percent duty cycle. The elements which may be installed in the inverter's enclosure are also known as ballast resistors and have an IP20 protection class. Several mechanical designs are available in the series. Customer requirements are implemented as necessary when the order involves sufficient quantities. The resistance values for each type are dynamic with respect to the temperature at the PTC (see R(T) curve) and the applied voltage.



[www.brakeenergy.com/ptc](http://www.brakeenergy.com/ptc)



### Technical specifications

( $\theta_{\lambda} = 20^{\circ}\text{C}$ , unless otherwise stated)

Parameter	Symbol	Value	Unit	Conditions
Tolerance (resistance)		$\pm 35$	%	Attention: PTC-typical and not to be reduced
Max. perm. operating voltage	$U_b$	$\leq 600$ AC $\leq 850$ DC	V	
Pulse rating	$P_i$	$\leq 20$	kW	Value in approach
Certifications	cCSAus			Standard CSA-C22.2

### Versions



PTC



PTC with connector

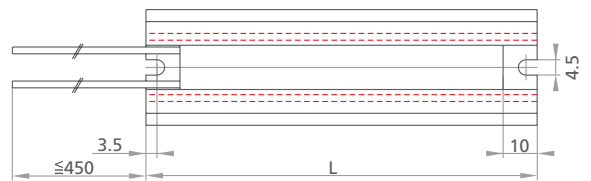
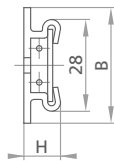


PTC with custom specific connector



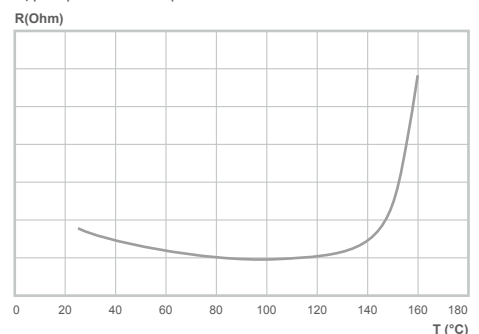
PTC with custom specific connector

### Dimensions and mounting holes (mm)



### Case temperature

**Brake resistor PTC8006xx**  
Resistance-temperature characteristic  
Type specific of request



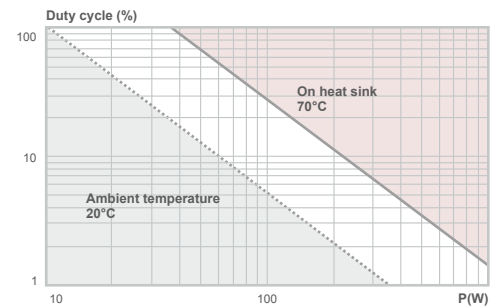


### PTC - 35 W

( $\vartheta_A = 20^\circ\text{C}$ , unless otherwise stated)

Parameter	Symbol	Value	Unit	Conditions
Resistances	R	175, 350, 1750	$\Omega$	*
Rated power	P	10	W	unobstructed convection on heat sink (70 °C)
		35	W	
Dimensions	L	59.5 ± 1	mm	no mounting holes  alternatively
		89.0 ± 0.4	mm	
	W	34.0 ± 0.3	mm	
	H	10.5 ± 0.5	mm	
		11.5 ± 0.5	mm	

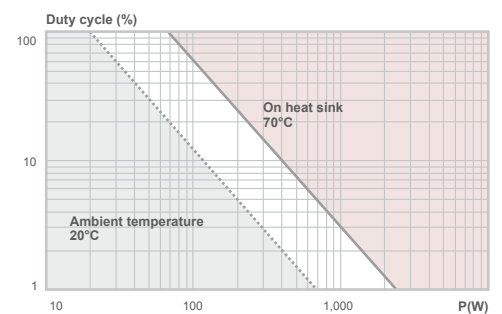
### Impulse loading



### PTC - 70 W

( $\vartheta_A = 20^\circ\text{C}$ , unless otherwise stated)

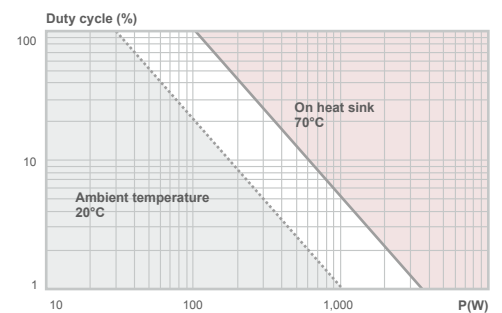
Parameter	Symbol	Value	Unit	Conditions
Resistances	R	90, 175, 875	$\Omega$	*
Rated power	P	20	W	unobstructed convection on heat sink (70 °C)
		70	W	
Dimensions	L	115.0 ± 0.5	mm	
	W	34.0 ± 0.3	mm	
	H	10.5 ± 0.5	mm	



### PTC - 105 W

( $\vartheta_A = 20^\circ\text{C}$ , unless otherwise stated)

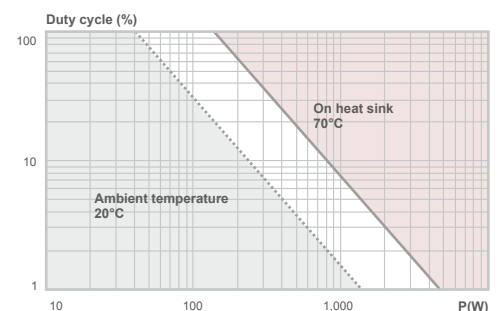
Parameter	Symbol	Value	Unit	Conditions
Resistances	R	60, 120	$\Omega$	*
Rated power	P	30	W	unobstructed convection on heat sink (70 °C)
		105	W	
Dimensions	L	139.0 ± 0.4	mm	
	W	34.0 ± 0.3	mm	
	H	10.5 ± 0.5	mm	



### PTC - 140 W

( $\vartheta_A = 20^\circ\text{C}$ , unless otherwise stated)

Parameter	Symbol	Value	Unit	Conditions
Resistances	R	44, 88	$\Omega$	*
Rated power	P	40	W	unobstructed convection on heat sink (70 °C)
		140	W	
Dimensions	L	167.0 ± 0.4	mm	
	W	34.0 ± 0.3	mm	
	H	10.5 ± 0.5	mm	



\* The resistance values for each type are dynamic with respect to the temperature at the PTC (see R(T) curve) and the applied voltage.

# Brake resistor BWx150

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors) in an aluminum case, IP65 protection class.



### Rated power (W)

60 (150 with duty cycle  
ED = 35%,  $\vartheta_A = 20^\circ\text{C}$ )

### Resistance (Ohm)

75, 300

### Dimensions (mm)

Enclosure: 80 x 52 x 28  
Wiring: length  $510 \pm 40$  mm  
 $\varnothing$  AWG16 or 1.5 mm<sup>2</sup>



[www.brakeenergy.com/  
single-resistors](http://www.brakeenergy.com/single-resistors)



### Technical specifications

( $\vartheta_A = 20^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Value	Unit	Conditions
Tolerance (resistance)		$\pm 5$	%	Room temperature
Temperature coefficient	TK	20 ... 100	$10^{-6}/\text{K}$	
Insulation resistance	$R_{150}$	$\geq 100$	$\text{M}\Omega$	$U_{\text{mess}} = 1,000 \text{ VDC}$
Inductance	L	$\leq 30$	$\mu\text{H}$	$f = 300 \text{ kHz}, U_{\text{mess}} = 50 \text{ mV}$
Capacity against enclosure	C	$\leq 300$	pF	$f = 300 \text{ kHz}, U_{\text{mess}} = 50 \text{ mV}$
Thermal time constant	$\tau$	approx. 250	s	
Weight	m	230	g	
Certifications	cCSAus			Standard CSA-C22.2
Energy absorption	Q	2.2	kJ	with 1.2 s (1% duty cycle)
		4.4	kJ	with 7.2 s (6% duty cycle)
Maximum permissible operating voltage	$U_b$	$\leq 700 \text{ AC}$	V	Taking into consideration the "intrinsic safety" cCSAus certification
		$\leq 1,000 \text{ DC}$	V	
		$\leq 600 \text{ AC}$	V	
		$\leq 850 \text{ DC}$	V	
		$\leq 4,000 \text{ DC}$	V	
Isolation voltage	$U_{150}$	$\geq 4,000 \text{ AC}$	V	$f = 50 \text{ Hz}; t = 1 \text{ min}$
Max. permissible case temp.	$\vartheta_c$	$\leq 250$	$^\circ\text{C}$	unobstructed convection
Storage temperature	$\vartheta_s$	-25 ... +85	$^\circ\text{C}$	

### Versions



BWD150

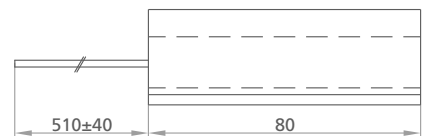
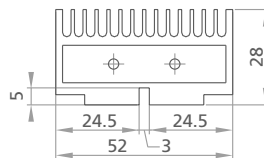


BWS150



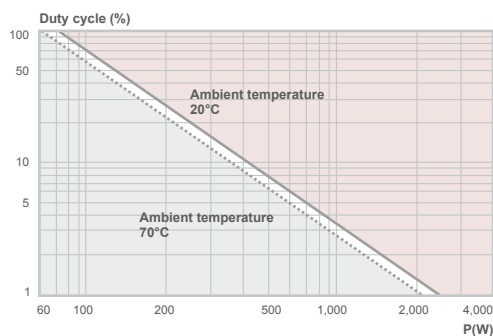
BWS150 with custom specific connector

### Dimensions and mounting holes (mm)



### Pulse loading capacity

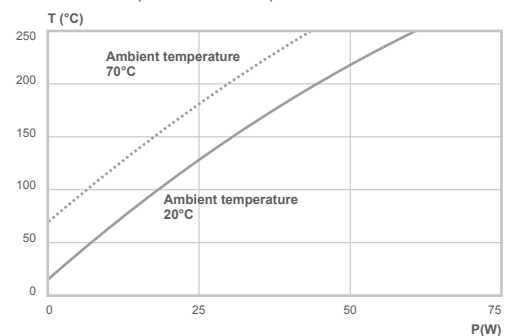
#### Brake resistor BWx150



### Case temperature

#### Brake resistor BWx150

With duty cycle ED = 100%  
Maximum permissible temperature  $T = 250^\circ\text{C}$



# Brake resistor BWx250

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors) in an anodized aluminum case, IP65 protection class.



## Technical specifications

( $\vartheta_A = 20^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Value	Unit	Conditions
Tolerance (resistance)		$\pm 5$	%	Room temperature
Temperature coefficient	TK	20 ... 100		$10^{-6}/\text{K}$
Insulation resistance	$R_{i50}$	$\geq 100$	$\text{M}\Omega$	$U_{\text{mess}} = 1,000 \text{ VDC}$
Inductance	L	$\leq 30$	$\mu\text{H}$	$f = 300 \text{ kHz}, U_{\text{mess}} = 50 \text{ mV}$
Capacity against enclosure	C	$\leq 300$	$\text{pF}$	$f = 300 \text{ kHz}, U_{\text{mess}} = 50 \text{ mV}$
Thermal time constant	$\tau$	approx. 550	s	
Weight	m	280	g	
Certifications	cCSAus cURus			Standard CSA-C22.2 UL 508
Energy absorption	Q	4 8	$\text{kJ}$	with 1.2 s (1% duty cycle) with 7.2 s (6% duty cycle)
Maximum permissible operating voltage	$U_b$	$\leq 700 \text{ AC}$ $\leq 1,000 \text{ DC}$ $\leq 600 \text{ AC}$ $\leq 850 \text{ DC}$	V	Taking into consideration the "intrinsic safety" UL certification UL certification
Isolation voltage	$U_{iso}$	$\geq 4,000 \text{ AC}$	V	AC; $f = 50 \text{ Hz}; t = 1 \text{ min}$
Max. permissible case temp.	$\vartheta_c$	$\leq 250$	$^\circ\text{C}$	unobstructed convection
Storage temperature	$\vartheta_s$	-25 ... +85	$^\circ\text{C}$	

## Rated power (W)

100 (250 with duty cycle  
ED = 35%,  $\vartheta_A = 20^\circ\text{C}$ )

## Resistance (Ohm)

3, 10, 24, 27, 33, 47, 72, 100, 120,  
150, 200, 220, 330, 390, 430,  
530, 620, 830

## Dimensions (mm)

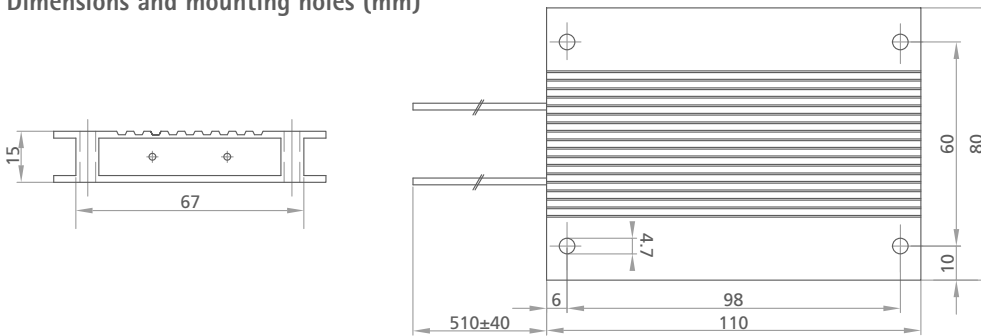
Enclosure: 110 x 80 x 15  
Wiring: length  $510 \pm 40 \text{ mm}$   
 $\varnothing \text{ AWG16 or } 1.5 \text{ mm}^2$



[www.brakeenergy.com/  
single-resistors](http://www.brakeenergy.com/single-resistors)



## Dimensions and mounting holes (mm)



## Versions



BWD250



BWG250



BWS250

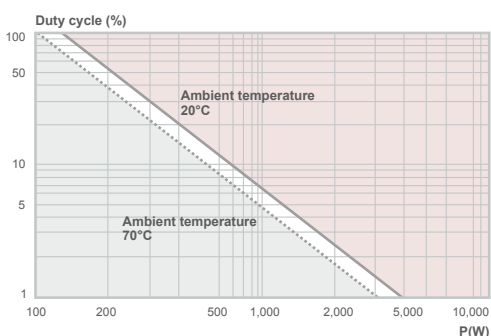


BWT250\*

\*without CSA and UL approval

## Pulse loading capacity

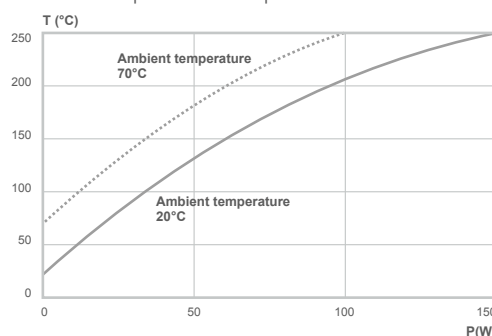
### Brake resistor BWx250



## Case temperature

### Brake resistor BWx250

With duty cycle ED = 100%  
Maximum permissible temperature  $T = 250^\circ\text{C}$



# Brake resistor BWx500

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors) in an anodized aluminum case, IP65 protection class.



### Rated power (W)

200 (500 with duty cycle  
ED = 35%,  $\vartheta_A = 20^\circ\text{C}$ )

### Resistance (Ohm)

10, 12, 15, 22, 27, 35, 40, 43, 47,  
50, 60, 72, 100, 130, 150, 160, 200,  
210, 240, 300, 310, 430, 620

### Dimensions (mm)

Enclosure: 216 x 80 x 15  
Wiring: length 510±40 mm  
Ø AWG16 or 1.5 mm<sup>2</sup>



[www.brakeenergy.com/  
single-resistors](http://www.brakeenergy.com/single-resistors)



### Technical specifications

( $\vartheta_A = 20^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Value	Unit	Conditions
Tolerance (resistance)		± 5	%	Room temperature
Temperature coefficient	TK	20 ... 100		10 <sup>-6</sup> /K
Insulation resistance	R <sub>iso</sub>	≥ 100	MΩ	U <sub>mess</sub> = 1,000 VDC
Inductance	L	≤ 30	μH	f = 300 kHz, U <sub>mess</sub> = 50 mV
Capacity against enclosure	C	≤ 300	pF	f = 300 kHz, U <sub>mess</sub> = 50 mV
Thermal time constant	τ	approx. 550	s	
Weight	m	550	g	
Certifications	cCSAus cURus			Standard CSA-C22.2 UL 508
Energy absorption	Q	7.5 15	kJ	with 1.2 s (1% duty cycle) with 7.2 s (6% duty cycle)
Maximum permissible operating voltage	U <sub>b</sub>	≤ 700 AC ≤ 1,000 DC ≤ 600 AC ≤ 850 DC	V	Taking into consideration the "intrinsic safety"
Isolation voltage	U <sub>iso</sub>	≥ 4,000 AC	V	UL certification
Max. permissible case temp.	ϑ <sub>c</sub>	≤ 250	°C	UL certification
Storage temperature	ϑ <sub>s</sub>	-25 ... +85	°C	AC; f = 50 Hz; t = 1 min unobstructed convection

### Versions



BWD500



BWG500



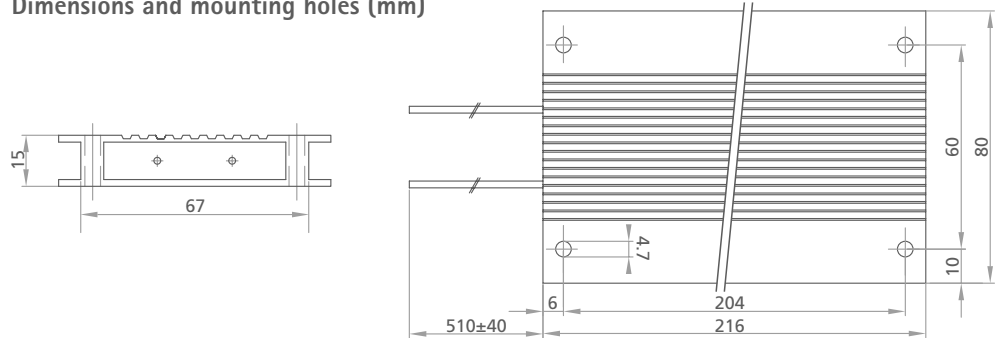
BWS500



BWT500\*

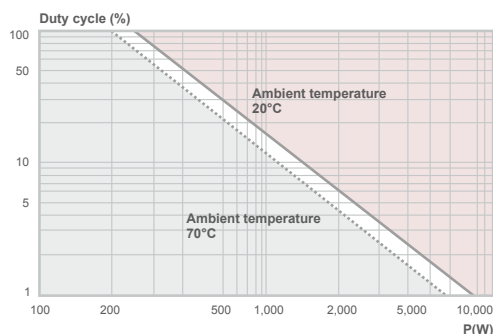
\*without CSA and UL approval

### Dimensions and mounting holes (mm)



### Pulse loading capacity

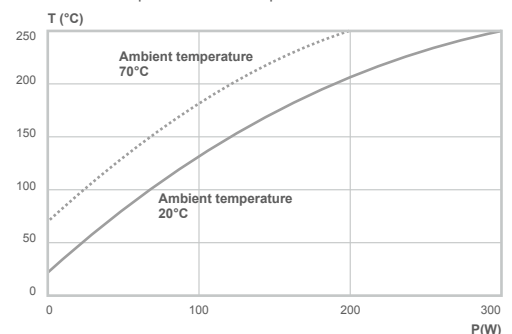
#### Brake resistor BWx500



### Case temperature

#### Brake resistor BWx500

With duty cycle ED = 100%  
Maximum permissible temperature T = 250 °C



# Brake resistor BWx600

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors) in an anodized aluminum case, IP65 protection class.



## Technical specifications

( $\vartheta_A = 20^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Value	Unit	Conditions
Tolerance (resistance)		$\pm 5$	%	Room temperature
Temperature coefficient	TK	20 ... 100		$10^{-6}/\text{K}$
Insulation resistance	$R_{i50}$	$\geq 100$	$\text{M}\Omega$	$U_{\text{mess}} = 1,000 \text{ VDC}$
Inductance	L	$\leq 30$	$\mu\text{H}$	$f = 300 \text{ kHz}, U_{\text{mess}} = 50 \text{ mV}$
Capacity against enclosure	C	$\leq 300$	$\text{pF}$	$f = 300 \text{ kHz}, U_{\text{mess}} = 50 \text{ mV}$
Thermal time constant	$\tau$	approx. 600	s	
Weight	m	1,050	g	
Certifications	cCSAus cURus			Standard CSA-C22.2 UL 508
Energy absorption	Q	13	kJ	with 1.2 s (1% duty cycle)
		26	kJ	with 7.2 s (6% duty cycle)
Maximum permissible operating voltage	$U_b$	$\leq 700 \text{ AC}$	V	Taking into consideration the "intrinsic safety" (4kW)
		$\leq 1,000 \text{ DC}$	V	UL certification
		$\leq 600 \text{ AC}$	V	UL certification
		$\leq 850 \text{ DC}$	V	UL certification
Isolation voltage	$U_{iso}$	$\geq 4,000 \text{ AC}$	V	AC; $f = 50 \text{ Hz}; t = 1 \text{ min}$
Max. permissible case temp.	$\vartheta_c$	$\leq 250$	$^\circ\text{C}$	unobstructed convection
Storage temperature	$\vartheta_s$	-25 ... +85	$^\circ\text{C}$	

## Rated power (W)

240 (600 with duty cycle)  
ED = 35%,  $\vartheta_A = 20^\circ\text{C}$

## Resistance (Ohm)

5, 10, 14, 18, 22, 27, 33, 47, 72, 80, 100, 150, 200, 220, 300

## Dimensions (mm)

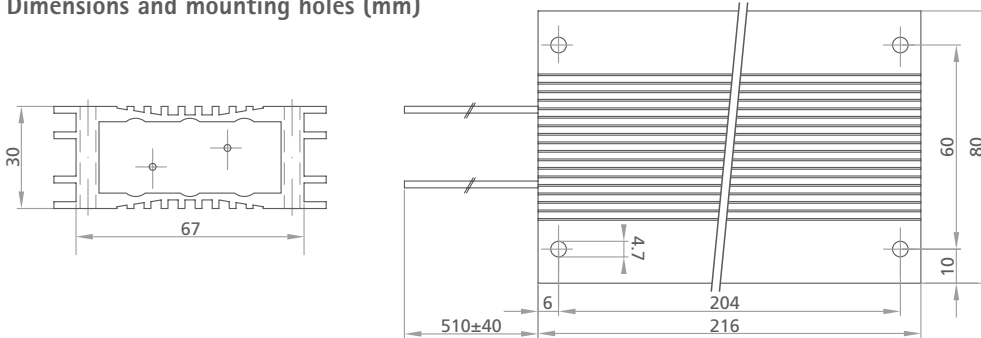
Enclosure: 216 x 80 x 30  
Wiring: length  $510 \pm 40 \text{ mm}$   
 $\varnothing$  AWG14 or 2.5 mm<sup>2</sup>



[www.brakeenergy.com/  
single-resistors](http://www.brakeenergy.com/single-resistors)

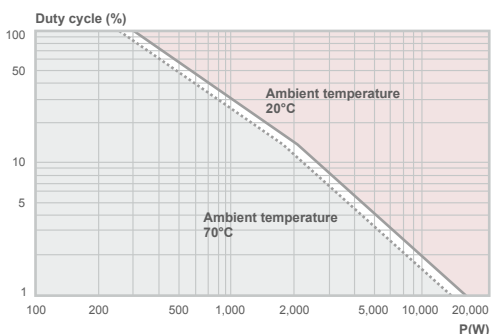


## Dimensions and mounting holes (mm)



## Pulse loading capacity

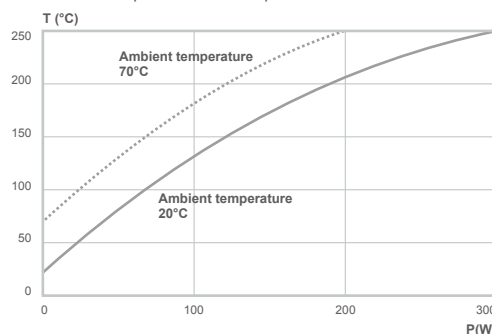
### Brake resistor BWx600



## Case temperature

### Brake resistor BWx600

With duty cycle ED = 100%  
Maximum permissible temperature  $T = 250^\circ\text{C}$



## Versions



BWD600



BWG600



BWS600



BWT600\*

\*without CSA and UL approval

# Brake resistor BWx1000

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors) in an anodized aluminum case, IP65 protection class.



**Rated power (W)**  
400 (1,000 with duty cycle  
ED = 35%,  $\vartheta_A = 20^\circ\text{C}$ )

**Resistance (Ohm)**  
5, 10, 14, 18, 22, 27, 33, 47, 72, 80,  
100, 150, 200, 220, 300

**Dimensions (mm)**  
Enclosure: 216 x 80 x 30  
Wiring: length 510±40 mm  
Ø AWG14 or 2.5 mm<sup>2</sup>



[www.brakeenergy.com/  
single-resistors](http://www.brakeenergy.com/single-resistors)



## Technical specifications ( $\vartheta_A = 20^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Value	Unit	Conditions
Tolerance (resistance)		± 5	%	Room temperature
Temperature coefficient	TK	20 ... 100		10 <sup>-6</sup> /K
Insulation resistance	R <sub>iso</sub>	≥ 100	MΩ	U <sub>mess</sub> = 1,000 VDC
Inductance	L	≤ 30	μH	f = 300 kHz, U <sub>mess</sub> = 50 mV
Capacity against enclosure	C	≤ 300	pF	f = 300 kHz, U <sub>mess</sub> = 50 mV
Thermal time constant	τ	approx. 850	s	
Weight	m	1,050	g	
Energy absorption	Q	13	kJ	with 1.2 s (1% duty cycle)
		26	kJ	with 7.2 s (6% duty cycle)
Maximum permissible operating voltage	U <sub>B</sub>	≤ 700 AC	V	Taking into consideration the "intrinsic safety"
Isolation voltage	U <sub>iso</sub>	≤ 1,000 DC	V	AC; f = 50 Hz; t = 1 min
Max. permissible case temp.	ϑ <sub>c</sub>	≤ 300	°C	unobstructed convection
Storage temperature	ϑ <sub>s</sub>	-25 ... +85	°C	

## Versions



BWD1000



BWG1000

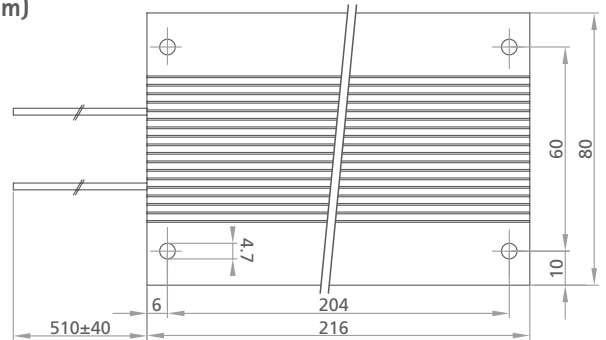
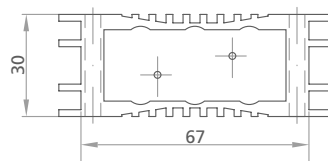


BWS1000

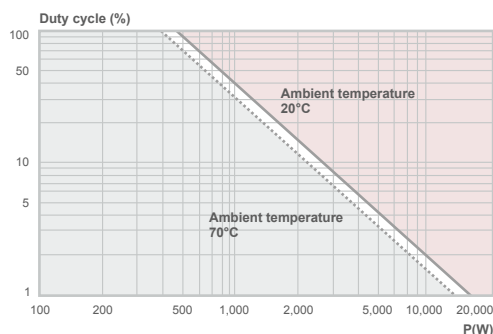


BWT1000

## Dimensions and mounting holes (mm)



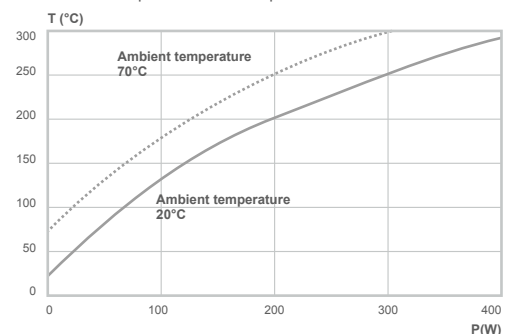
## Pulse loading capacity Brake resistor BWx1000



## Case temperature

### Brake resistor BWx1000

With duty cycle ED = 100%  
Maximum permissible temperature T = 300 °C





## Our modular system for brake resistors



We manufacture resistor combinations by an extensive set of accessories for high performance applications.

The system is based on individual modules of the series BWD 250 to 1,000 with output powers rated from 100 to 400 Watts, whose technical specifications are available on pages 37-40.

In addition to its high performance, this modular system combines a compact design with extreme flexibility. This results in the optimization of the braking resistor in accordance with the specifications of each individual application.

### Optimized application that may be implemented are:

Required power – no "unnecessary over-dimensioning"

Many resistance values – according to the inverters requirements

Mechanical design – depending on the existing installation space

Assembly – horizontal or vertical

Protection class IP 20 or IP 65 – according to installation location and environmental conditions

Individual modules with UL and CSA standard approval

Several braking resistors in a resistor combination, e.g. for moving and hoisting gear



### Technical specifications of individual modules

( $\vartheta_A = 20^\circ\text{C}$ , unless otherwise specified)

Parameter	Symbol	Value	Unit	Conditions
Tolerance (resistance)		$\pm 5$	%	Room temperature
Insulation resistance	$R_{iso}$	$\geq 100$	$M\Omega$	$U_{mess} = 1,000 \text{ VDC}$
Inductance	L	$\leq 30$	$\mu\text{H}$	$f = 300 \text{ kHz}, U_{mess} = 50 \text{ mV}$
Capacity against enclosure	C	$\leq 300$	$\text{pF}$	$f = 300 \text{ kHz}, U_{mess} = 50 \text{ mV}$
Thermal time constant	$\tau$	approx. 550	s	BWD250/500
	$\tau$	approx. 600	s	BWD600
	$\tau$	approx. 850	s	BWD1000
Energy absorption BWD250	Q	4	kJ	with 1.2 s (1% duty cycle)
		8	kJ	with 7.2 s (6% duty cycle)
Energy absorption BWD500	Q	7,5	kJ	with 1.2 s (1% duty cycle)
		15	kJ	with 7.2 s (6% duty cycle)
Energy absorption BWD600/1000	Q	13	kJ	with 1.2 s (1% duty cycle)
		26	kJ	with 7.2 s (6% duty cycle)
Maximum permissible operating voltage	$U_b$	$\leq 700 \text{ AC}$	V	Taking into consideration the "intrinsic safety"
		$\leq 1,000 \text{ DC}$	V	UL certification
		$\leq 600 \text{ AC}$	V	UL certification
		$\leq 850 \text{ DC}$	V	UL certification
Isolation voltage	$U_{iso}$	$\geq 4,000 \text{ AC}$	V	$f = 50 \text{ Hz}; t = 1 \text{ min}$
Max. permissible case temp.	$\vartheta_c$	$\leq 250$	$^\circ\text{C}$	unobstructed convection
	$\vartheta_c$	$\leq 300$	$^\circ\text{C}$	unobstructed conv. (BWD1000)
Storage temperature	$\vartheta_s$	-25 ... +85	$^\circ\text{C}$	



[www.brakeenergy.com/combinations](http://www.brakeenergy.com/combinations)

# Brake resistor combination BWx...K...R...

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors), consisting of single resistor modules installed in a base frame.



**Rated power (kW)**  
Depending on the combination

**Technical specifications**  
For technical data, please refer to page 41 or the pages for the respective individual modules.

**Resistance (Ohm)**  
Depending on the combination

**Dimensions (mm)**  
Individual upon request

**Dimensions and mounting holes (mm)**  
Type-specific sizes available upon request.



[www.brakeenergy.com/substructures](http://www.brakeenergy.com/substructures)

## Individual solutions



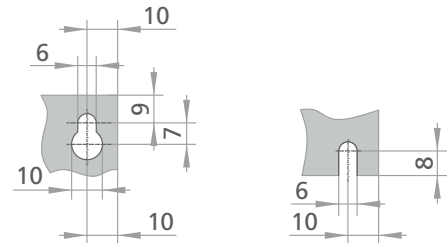
Model with BWD250 and a single frame



Model with BWD250 and a double frame



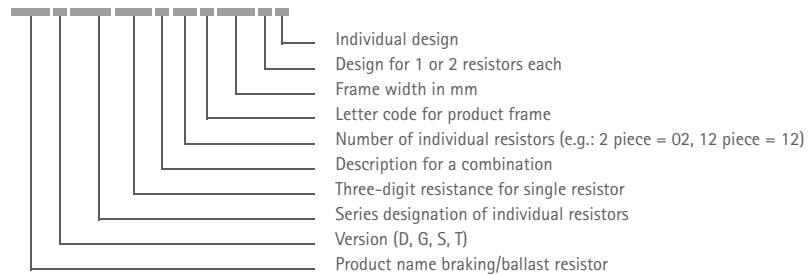
Model with BWD500 and a double frame



## Nomenclature

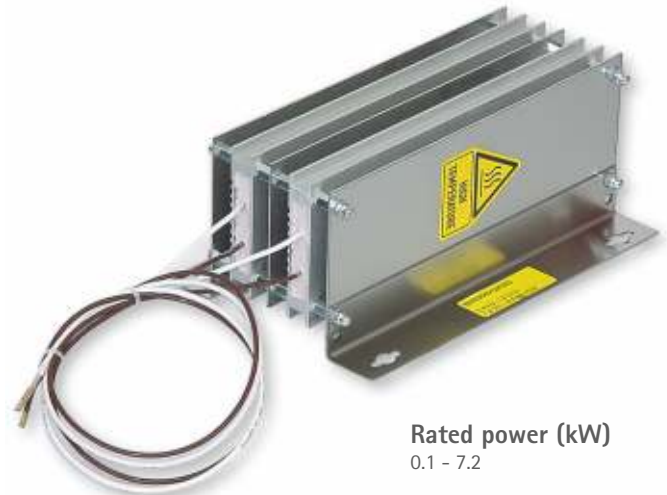
Brake resistor combination BWx...K...R...

**BWD500100K02R1302K**



# Brake resistor combination BWx...K...

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors), consisting of single resistor modules installed in combination.



## Technical specifications

For technical data, please refer to page 41 or the pages for the respective individual modules.

### Rated power (kW)

0.1 - 7.2

### Resistance (Ohm)

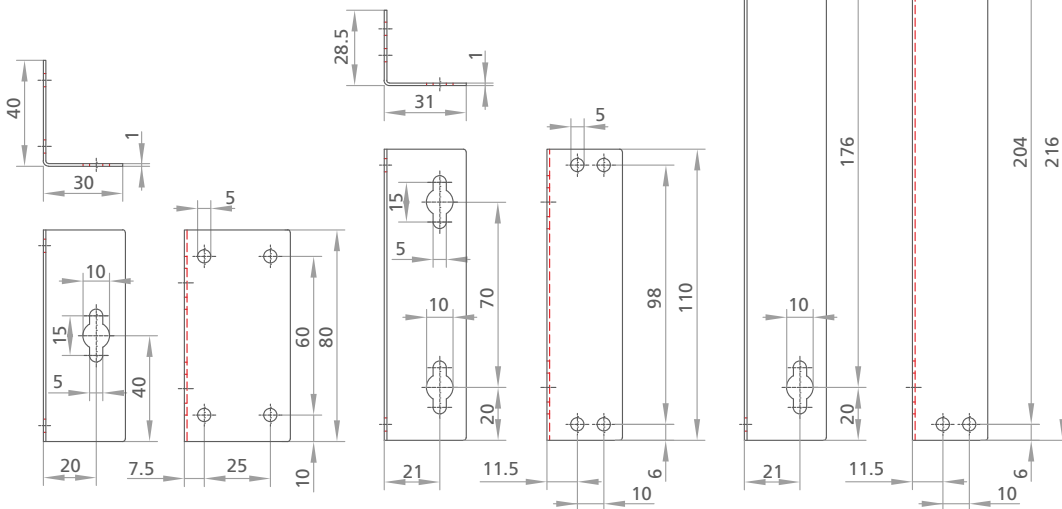
1 - 14,940

### Dimensions (mm)

Upon request

## Dimensions and mounting holes (mm)

Mounting bracket for brake resistor combinations BWX ... K ... Detailed dimensions for specific versions available upon request.



Bracket W080

Bracket W110

Bracket W216



Example based on BWD500:  
[www.brakeenergy.com/combination-bwd-500](http://www.brakeenergy.com/combination-bwd-500)

## Individual solutions



Brake resistor combination with BWD250 and bracket W110 in IP20



Brake resistor combination with BWD600/1000 and bracket W080 and temperature monitor in IP65



Brake resistor combination with BWD500 and bracket W080 and temperature monitor in IP20

## Nomenclature

Brake resistor combination BWx...K...

### BWD1000200K01ALV

Connections	V: in IP20 VIP65: in terminal box Without: no entry
Type of bracket	L: long (flat on the base) K: narrow (module vertically oriented, upside-down) M: narrow (module vertical) Without: no entry
Radiating panels	With: A Without: no entry
Number of individual resistors (e.g.: 2 piece = 02, 12 piece = 12)	
Description for a combination	
Three-digit resistance for single resistor	
Series designation of individual resistors	
Version (D, G, S, T)	
Product name braking/ballast resistor	

# Brake resistor combination BAx...

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors), consisting of single resistor modules installed in combination.



**Rated power (kW)**  
0.2 - 7.2

**Resistance (Ohm)**  
1 - 17,360

**Dimensions (mm)**  
Upon request



Example BAF:  
[www.brakeenergy.com/combinations-baf](http://www.brakeenergy.com/combinations-baf)

### Individual solutions



Brake resistor combination on half a mounting plate in IP65



Brake resistor combination on double mounting plate in IP65



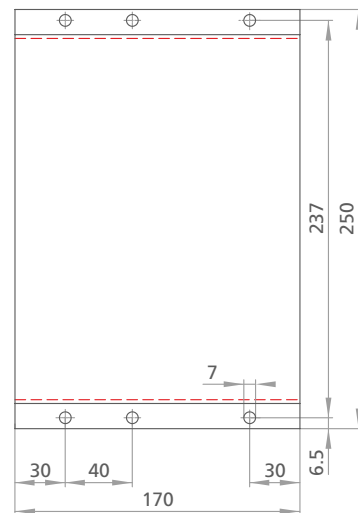
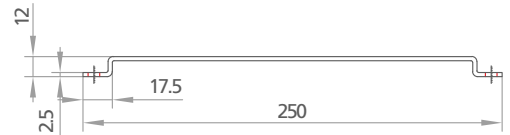
Brake resistor combination on double mounting plate including temperature monitor in IP20

### Technical specifications

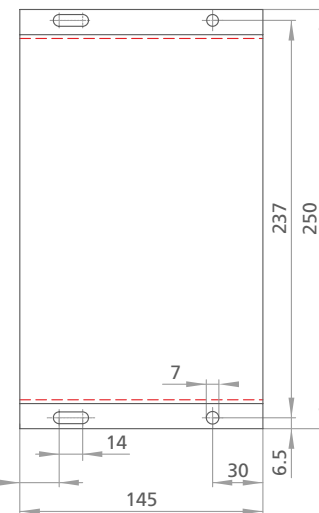
For technical data, please refer to page 41 or the pages for the respective individual modules.

### Dimensions and mounting holes (mm)

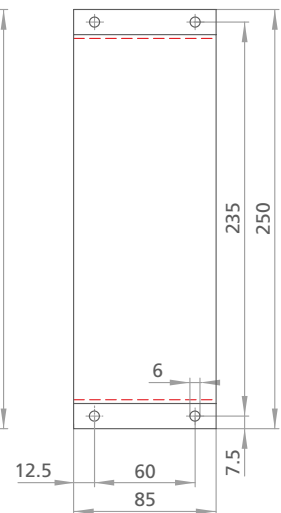
Mounting plates for brake resistor combinations BAx. Detailed dimensions for specific versions available upon request.



Mounting plate P250D



Mounting plate P250

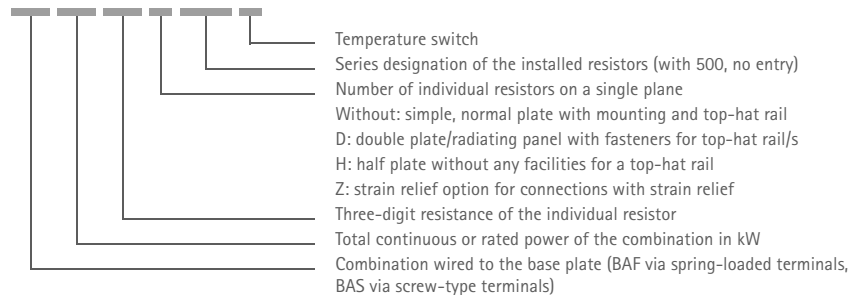


Mounting plate P250H

### Nomenclature

Brake resistor combination BAx...

#### BAF2.4100D-1000TS



# Brake resistor combination BxP...

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors), consisting of single resistor modules installed in combination.



## Technical specifications

For technical data, please refer to page 41 or the pages for the respective individual modules.

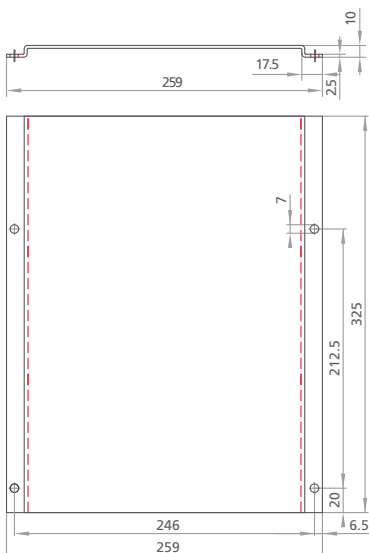
**Rated power (kW)**  
0.4 - 4.8

**Resistance (Ohm)**  
1 - 7,400

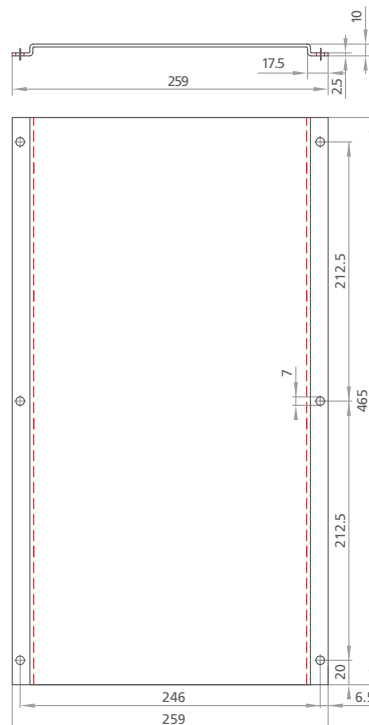
**Dimensions (mm)**  
Upon request

## Dimensions and mounting holes (mm)

Mounting plates for brake resistor combinations BxP. Detailed dimensions for specific versions available upon request.



Mounting plate P259A



Mounting plate P259B



Example B2P:  
[www.brakeenergy.com/combinations-b2p](http://www.brakeenergy.com/combinations-b2p)

## Individual solutions



Brake resistor combination with cover to IP20



Brake resistor combination with cover to IP65

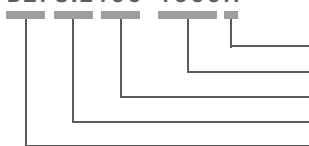


Brake resistor combination, IP20

## Nomenclature

Brake resistor combination BxP...

### B2P3.2100-1000H



- Individual design
- Series designation of the installed resistors (with 500, no entry)
- Three-digit resistance of the individual resistor
- Total continuous or rated power of the combination in kW
- Combination on base plate, wired
- Number of individual resistors on a single plane, 1, 2, 3, ...
- Position of the top-hat rail P: in parallel with the individual resistors  
H: at right angles to the individual resistors

# Brake resistor combination BxH...V...

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors), consisting of single resistor modules installed in combination.



**Rated power (kW)**  
0.4 - 1.2

**Resistance (Ohm)**  
1.67 - 2,480

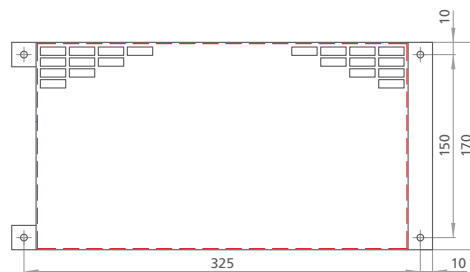
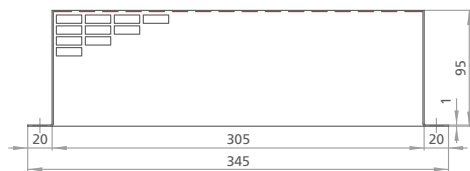
**Dimensions (mm)**  
Upon request

### Technical specifications

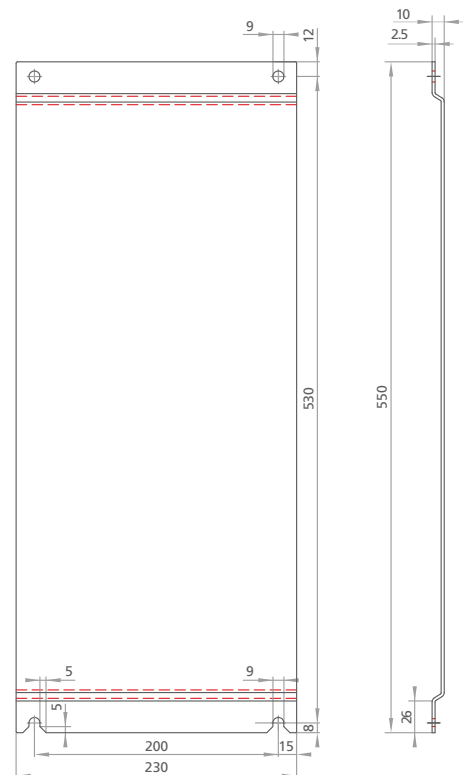
For technical data, please refer to page 41 or the pages for the respective individual modules.

### Dimensions and mounting holes (mm)

Mounting plates for brake resistor combinations BxH...V ... Detailed dimensions for specific versions available upon request.



Cover H305



Mounting plate P550-230

### Detailed views



Detailed view of a terminal box



H305 cover not installed

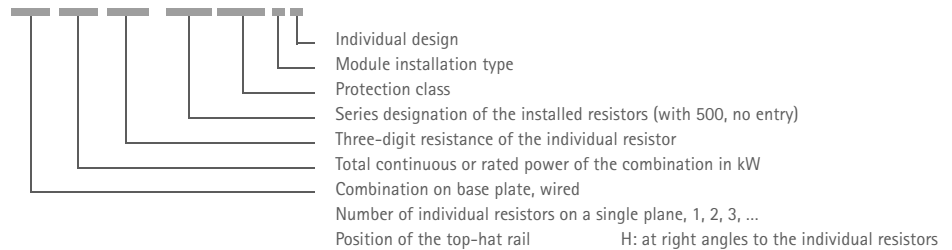


Structure without cover

### Nomenclature

Brake resistor combination BxH...V...

**B3H0.7100-600IP65VS**



# Brake resistor combination BxH...H...

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors), consisting of single resistor modules installed in combination.

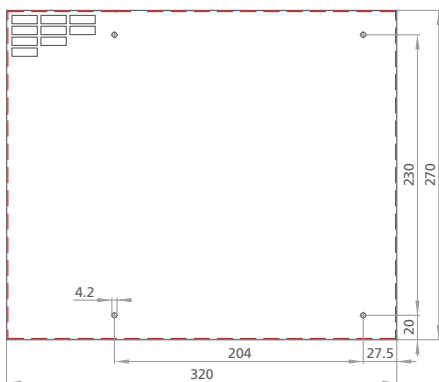


## Technical specifications

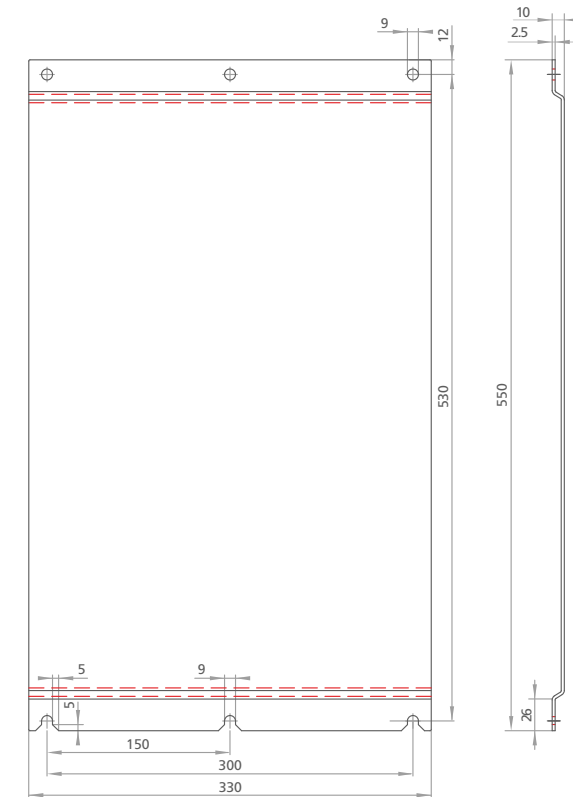
For technical data, please refer to page 41 or the pages for the respective individual modules.

### Dimensions and mounting holes (mm)

Mounting plates for brake resistor combinations BxH...H... Detailed dimensions for specific versions available on request.



Cover H320



Mounting plate P550

**Rated power (kW)**  
0.4 - 3.6

**Resistance (Ohm)**  
1 - 7,400

**Dimensions (mm)**  
Upon request

### Detailed views



Detailed view of a terminal box



H320 cover not installed

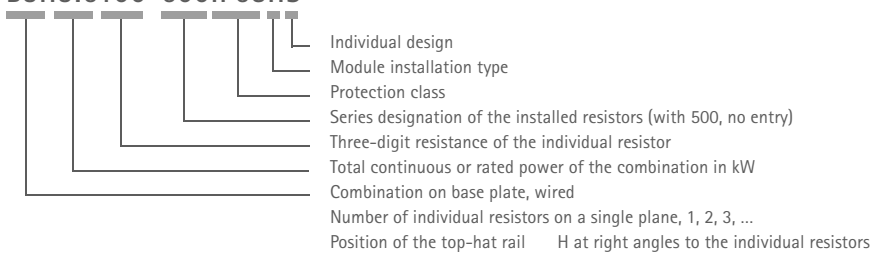


Structure without cover

## Nomenclature

Brake resistor combination BxH...H...

**B3H3.6100-600IP65HS**



# Brake resistor combination BWK...

Short-circuit proof, "intrinsically safe" resistor for use in inverters (brake transistors), consisting of single resistor modules installed in an enclosure.



### Rated power (kW)

0.2 - 2.4

### Resistance (Ohm)

1 - 6,640

### Dimensions (mm)

465 x 310 x 123  
420 x 160 x 107  
530 x 160 x 107



[www.brakeenergy.com/combinations-bwk](http://www.brakeenergy.com/combinations-bwk)

### Individual solutions



Brake resistor combination in an enclosure to IP20

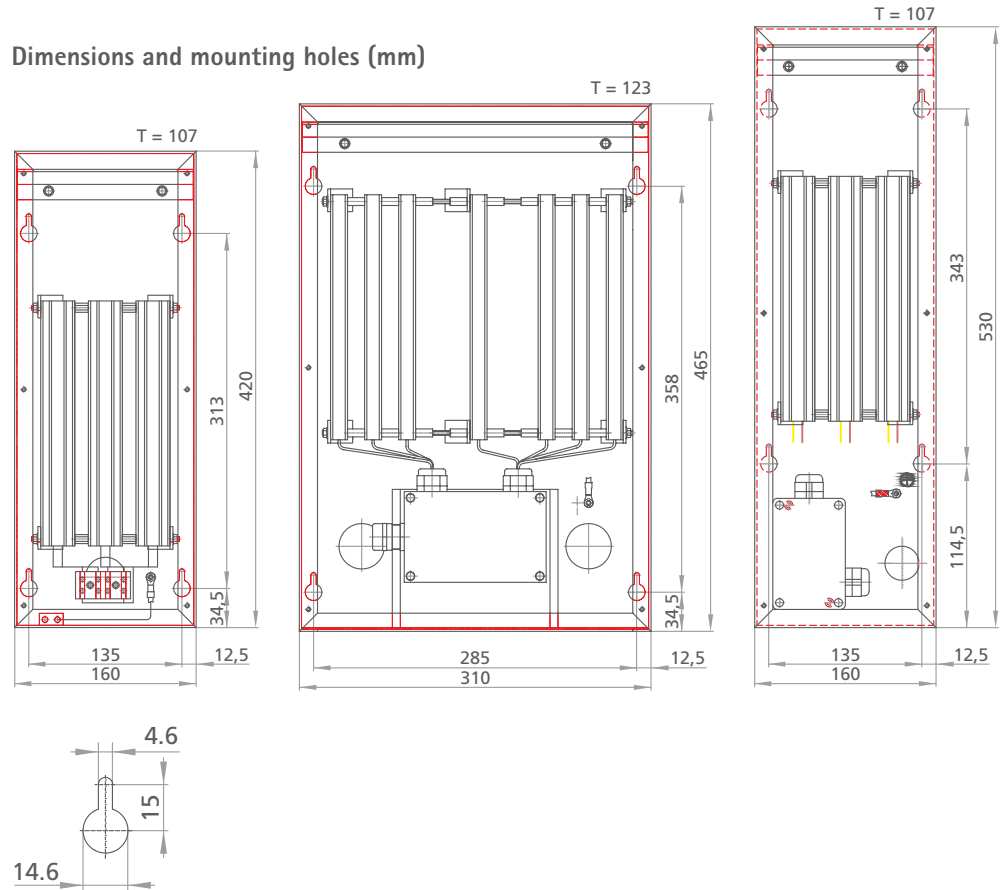


Brake resistor combination in an enclosure to IP65

### Technical specifications

For technical data, please refer to page 41 or the pages for the respective individual modules.

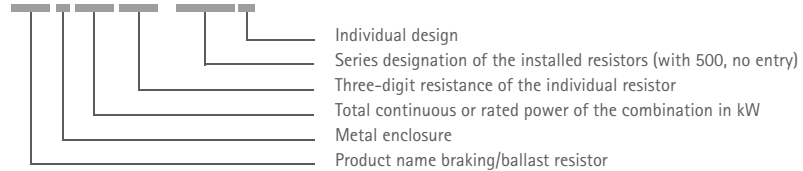
### Dimensions and mounting holes (mm)



### Nomenclature

Brake resistor combination BWK...

**BWK2.0047-1000H**





## Special solutions

Custom designs demonstrate our flexibility:

Starting with the correct interpretation of the requested application, almost no limits apply due to the many available mechanical options...

### Brake resistor combination BWD1.5DV15B

Power rating: 1.5 kW \ 9 x 150 Ohm \ 4 x 100 Ohm \ 2 x 72 Ohm  
 Prot. class: IP20  
 RoHS-conform 2002/95/EG



### Brake resistor combination G900S

Consisting of:  
 frame R900S, hood H904S, cover D904S and 3 for fan DV6224  
 Power rating: to 12 kW with 100 % duty cycle  
 to 360 kW with 1 % duty cycle  
 Prot. class: IP 20  
 RoHS-conform 2002/95/EG  
 Temperature monitoring  
 Fan power: 120 W



### Brake resistor combination BWD600100K18KDV

Power rating: 4.32 kW \ 5.6 Ohm  
 Prot. class: IP20  
 RoHS-conform 2002/95/EG



### Brake resistor combination BAS0.5033-600IP65

Power rating: 0.48 kW \ 16.5 Ohm  
 Prot. class: IP65  
 RoHS-conform 2002/95/EG



## Accessories

We provide a full set of accessories such as brackets, spacers, temperature switches, base frames, flat connectors, etc., an almost unlimited variety of installation and combination options.

### Brackets



### Radiating plates



### Mounting plates



### Connectors and connector housings



### Standoffs, screws, etc.



## Do you have questions about products, technology or applications? Communication channels

There are many ways to get in contact. Direct personal contact is most easily accomplished by phone and/or e-mail. Here you can obtain all the support on the interpretation and the application of our products. Numerous sources of information are available on the Internet where you can gain an overview by yourself. Take advantage of our offer!

### Direct contact

Call us, send us an e-mail or a fax. We will respond immediately.

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### www.brakeenergy.com

Use our website to get an overview of our services by yourself. You will find all information about individual modules, accessories and more than 60,000 data sheets of the available combinations online. And if you should not be able to find a solution for your application, just ask us! We will most certainly find an appropriate response for your requirements.



### www.blog.bremsenergie.de

Would you like to learn more about the DES or the DEV? Or about current developments in our braking resistors? You might also want to get a different impression of our company. We provide you with the opportunity to learn more about us. Our blog contains a wide variety of information about our company, our products and all our activities. Take some time and visit us at [www.blog.bremsenergie.de](http://www.blog.bremsenergie.de).



### www.newsletter.bremsenergie.de

You want to receive all the information about our company free of charge? You wish to be up to date without having to search? No problem. Our newsletter will always provide you with the latest information, as it were "hot off the press" and delivered to you digitally. You can register directly at [www.newsletter.bremsenergie.de](http://www.newsletter.bremsenergie.de) or simply scan the QR code shown alongside.



### Braking energy – App

"Bremsenergie" is the name of the App that is available free of charge in the Apple App Store. This provides the link between the iPhone and/or iPad and the DES, the Dynamic Energy Storage. The app enables users to calculate the savings that may be achieved by means of the DES in advance. This assists the user to decide whether the DES is a solution for his specific application or not. Interested and curious persons can find interpretations regarding the different technical details about all the relevant aspects of the device.





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## LinkedIn

The same as for Xing: Professional users want professional information. That is our approach. If your opinion is different, please contact us. Then we will expand our communication. [www.linkedin.com/company/michael-koch-gmbh](http://www.linkedin.com/company/michael-koch-gmbh)



## Facebook

All the News on the fastest way. Short, concise, often visualised. Just like Facebook. No matter if it is about training, trips or shows, but also technology, new products or happy events - we post everything on our fanpage. Comments are always welcome and if you share our posts, we will be very pleased! [www.facebook.com/michaelkochgmbh](http://www.facebook.com/michaelkochgmbh)



## YouTube

And if you like video clips, then you will find a small collection of videos on our YouTube Channel. Product launches, celebrations, the Grand Prix of medium-sized enterprises, the final construction phase as well as "Kim bei Koch". Be curious and take a look: [www.youtube.com/user/MichaelKochGmbH](http://www.youtube.com/user/MichaelKochGmbH).



## Managing DC Link Energy

Energy storage solutions and safe brake resistors in wire-wound and PTC technology

We offer:

- **Tested product quality**
- **Certified processes**  
– we undergo regular inspections by third parties
- **Individual application support**  
– owing to our modular system we can offer more than 60.000 solutions
- **Machine-specific implementation**  
– we match our products with your machines
- **High reaction rate**  
– we provide you with a suitable offer in the shortest possible time
- **Short delivery times**  
– all components are in stock
- **On-time deliveries every time**  
– we deliver on schedule in optimal lot sizes
- **Reliable partner**  
– we strive for long-term business relationships
- **Direct customer relationships**

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We look forward to hearing from you!



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Subject to technical changes. MK\_KAT\_GESAMT\_ENG\_R00\_0

