Managing DC Link Energy

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

www.brakeenergy.com
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.
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.
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

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

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

Energy savings with the DES

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Continuous voltage of the DC link</td>
<td>800 VDC max.</td>
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<td>6.9 kg</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 20</td>
</tr>
</tbody>
</table>

Voltage characteristics of the DC link
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

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

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 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).

**DES**

$U_{BRC_{max}} = 800$ VDC

- **1s-cycle**
  - DES 2.0 B
  - DES 2.0 F
  - DES 3.0 F

**DES**

$U_{BRC_{max}} = 800$ VDC

- **2s-cycle**
  - DES 2.0 B
  - DES 2.0 F
  - DES 3.0 F

**DES**

$U_{BRC_{max}} = 800$ 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**

<table>
<thead>
<tr>
<th>Energy stroke per cycle [Ws]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1600</td>
</tr>
<tr>
<td>2000</td>
</tr>
</tbody>
</table>

**Braking block**

<table>
<thead>
<tr>
<th>Energy stroke per cycle [Ws]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1600</td>
</tr>
<tr>
<td>2000</td>
</tr>
</tbody>
</table>

**DES 2.0 B**

$U_{\text{DCmax}} = 800$ VDC

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

**DES 2.0 F**

$U_{\text{DCmax}} = 800$ VDC

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

**DES 3.0 F**

$U_{\text{DCmax}} = 800$ VDC

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

---

*Initial braking power [kW]*

<table>
<thead>
<tr>
<th>1200</th>
<th>1400</th>
<th>1600</th>
<th>1800</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

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Kindly contact our sales team for this purpose.
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
$U_{\text{RMCmax}} = 800 \text{ V}$
1s-cycle
- 3 DES 3.0F devices in parallel
- 2 DES 3.0F devices in parallel
- DES 3.0F

DES 3.0F
$U_{\text{RMCmax}} = 800 \text{ V}$
2s-cycle
- 3 DES 3.0F devices in parallel
- 2 DES 3.0F devices in parallel
- DES 3.0F

DES 3.0F
$U_{\text{RMCmax}} = 800 \text{ V}$
4s-cycle
- 3 DES 3.0F devices in parallel
- 2 DES 3.0F devices in parallel
- DES 3.0F
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

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

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

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

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

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.

www.brakeenergy.com/dev

www.brakeenergy.com/DEV

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 Supplys 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.

Voltage curve of the DC link
with DEV

— without DEV —— with DEV

Support time [s]     Power per 2kWs unit [kW]
The Dynamic Energy Supply (DEV)

- **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

### Technical specifications

**Active supply module** for DC links
- > for single and multiple axes systems
- > no buttons, displays, other controls
- > provides support during power failures or interruptions

#### 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

#### 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

#### 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.

### 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.

### 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.

### 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 Supplys 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.
Managing DC Link Energy

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

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.

Technical specifications

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

DEV + extension module

<table>
<thead>
<tr>
<th>Required energy [kWs]</th>
<th>DEV 2.0B</th>
<th>EM2.0 A20</th>
<th>EM2.0 A2020</th>
<th>Space requirement/total width [mm]</th>
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<tr>
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<table>
<thead>
<tr>
<th>Required energy [kWs]</th>
<th>DEV 2.0F</th>
<th>EM2.0 A20</th>
<th>EM2.0 A2020</th>
<th>Space requirement/total width [mm]</th>
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<td>38</td>
<td>1</td>
<td>0</td>
<td>14</td>
<td>1400</td>
</tr>
</tbody>
</table>

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.

Technical specifications DEV 3.0

<table>
<thead>
<tr>
<th>Parameter</th>
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<tr>
<td>Useful energy approx.</td>
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</tr>
<tr>
<td>Continuous voltage of the DC link</td>
<td>800 VDC max.</td>
</tr>
<tr>
<td>Working voltage</td>
<td>470 VDC (other possible)</td>
</tr>
<tr>
<td>Output</td>
<td>18 kW max.</td>
</tr>
<tr>
<td>Built-in PTC discharge resistor</td>
<td>+</td>
</tr>
<tr>
<td>Dimensions H x W x D</td>
<td>300 x 100 x 201 mm</td>
</tr>
<tr>
<td>Weight approx.</td>
<td>6.9 kg</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP 20</td>
</tr>
</tbody>
</table>

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 Supplys 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

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.

www.brakeenergy.com/dek

Dimensions and mounting holes (mm)

Energy savings with the DEK

Voltage curve of the DC link

Technical Specifications DEK

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available storage capacity, up to</td>
<td>2,000 Ws</td>
</tr>
<tr>
<td>Continuous voltage DC link Output power</td>
<td>max. 800 VDC</td>
</tr>
<tr>
<td>Output</td>
<td>max. 18 kW</td>
</tr>
<tr>
<td>Digital interface</td>
<td>24 VDC (for function monitoring)</td>
</tr>
<tr>
<td>Built-in PTC braking resistor</td>
<td>+</td>
</tr>
<tr>
<td>Dimensions H x W x D</td>
<td>300 x 100 x 201 mm</td>
</tr>
<tr>
<td>Weight approx.</td>
<td>6.9 kg</td>
</tr>
<tr>
<td>Protection Class</td>
<td>IP 20</td>
</tr>
</tbody>
</table>
Energy savings with the DEK

Available storage capacity, up to 2,000 Ws
Continuous voltage DC link
Output power max. 800 VDC
Output max. 18 kW
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
Digital interface 24 VDC (for function monitoring)

Parameter
Value

Technical Specifications DEK

Voltage curve of the DC link

<table>
<thead>
<tr>
<th>Time</th>
<th>Voltage (U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P[W]</td>
<td>without DEK</td>
</tr>
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</table>

Active supply module
for DC links
> for single axis and multi axes
> buffers braking energy for use
> no buttons, display indicators, other controls
> provides support during power failures or interruptions
> with a digital interface

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.
Managing DC Link Energy

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

$U_{BRC_{max}} = 800$ VDC

1s-cycle

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

DEK

$U_{BRC_{max}} = 800$ VDC

2s-cycle

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

DEK

$U_{BRC_{max}} = 800$ 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.

**DEK 2.0B**

\[ U_{\text{ERC_{max}}} = 800 \text{ VDC} \]

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

**DEK 2.0F**

\[ U_{\text{ERC_{max}}} = 800 \text{ VDC} \]

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

**DEK 3.0F**

\[ U_{\text{ERC_{max}}} = 800 \text{ VDC} \]

- 1s-cycle
- 2s-cycle
- 4s-cycle
Managing DC Link Energy

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.
**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**

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

**Braking ramp**

Energy stroke per cycle [Ws]

**Braking block**

Energy stroke per cycle [Ws]

**DEK 3.0F**

- with EM2.0A20
  - $U_{\text{EMCmax}} = 800 \text{ V}$
  - 1s-cycle
  - 2s-cycle
  - 4s-cycle

**DEK 3.0F**

- with EM2.0A2020
  - $U_{\text{EMCmax}} = 800 \text{ V}$
  - 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

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.

Installation dimensions and mounting-holes (mm)

Technical specifications KES

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

Energy savings with the KES

Voltage characteristics in the DC link
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, $U_{\text{ac min}} = 540$ VDC
Braking block

<table>
<thead>
<tr>
<th>Initial braking power [kW]</th>
<th>Energy stroke per cycle [Ws]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1400</td>
</tr>
<tr>
<td>2</td>
<td>1200</td>
</tr>
<tr>
<td>4</td>
<td>1000</td>
</tr>
<tr>
<td>6</td>
<td>800</td>
</tr>
<tr>
<td>8</td>
<td>600</td>
</tr>
<tr>
<td>10</td>
<td>400</td>
</tr>
</tbody>
</table>

KES 2.0F, $U_{\text{ac min}} = 540$ VDC
Braking ramp

<table>
<thead>
<tr>
<th>Initial braking power [kW]</th>
<th>Energy stroke per cycle [Ws]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1400</td>
</tr>
<tr>
<td>2</td>
<td>1200</td>
</tr>
<tr>
<td>4</td>
<td>1000</td>
</tr>
<tr>
<td>6</td>
<td>800</td>
</tr>
<tr>
<td>8</td>
<td>600</td>
</tr>
<tr>
<td>10</td>
<td>400</td>
</tr>
</tbody>
</table>

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

Installation dimensions and mounting-holes (mm)

![Diagram of installation dimensions and mounting-holes](image)

Technical specifications KEV

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

Voltage curve of the DC link with KEV

![Graph of Voltage curve of the DC link with KEV](image)

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.
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

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.

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 Suplys 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.

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

<table>
<thead>
<tr>
<th>Required energy [kWs]</th>
<th>Module KEV</th>
<th>Module KEM2.0</th>
<th>Module KEM2.0B16</th>
<th>Space requirement/total width [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6</td>
<td>1</td>
<td>0</td>
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<td>3.2</td>
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<td>4.8</td>
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<td>0</td>
<td>1</td>
<td>200</td>
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<tr>
<td>6.4</td>
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<td>300</td>
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<tr>
<td>8</td>
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<td>2</td>
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<th>Module KEM2.0B16</th>
<th>Space requirement/total width [mm]</th>
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<td>12.8</td>
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<td>1</td>
<td>3</td>
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<td>14.4</td>
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</table>

Parameter

Technical specifications

KEV + extension module

<table>
<thead>
<tr>
<th>Required energy [kWs]</th>
<th>Module KEV</th>
<th>Module KEM2.0</th>
<th>Module KEM2.0B16</th>
<th>Space requirement/total width [mm]</th>
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<tbody>
<tr>
<td>1.6</td>
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<td>100</td>
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<td>4.8</td>
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<td>6.4</td>
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<td>300</td>
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<table>
<thead>
<tr>
<th>Required energy [kWs]</th>
<th>Module KEV</th>
<th>Module KEM2.0</th>
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<th>Space requirement/total width [mm]</th>
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<tr>
<td>14.4</td>
<td>1</td>
<td>0</td>
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<td>500</td>
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</table>

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEV</td>
<td>Weight approx</td>
</tr>
<tr>
<td>KEM 2.0B16</td>
<td>4.1 kg</td>
</tr>
<tr>
<td>KEM 2.0B1616</td>
<td>6.2 kg</td>
</tr>
</tbody>
</table>

Weight approx. 6.9 kg

Built-in PTC discharge resistor + Digital interface 24 VDC (for function monitoring)

Output 10.4 kW max.

Working voltage 270 VDC (other possible)

Cycle time of use 30 minutes

Continuous voltage of the DC link 540 VDC max.

Restart is possible without any effort.

brought into a defined state from which a question with the implementation of the withdrawal of atomic energy. Broken down on electrical drives power failures present a special challenge for drive controllers up to 230V KEV Dynamic Energy Supply

4. Connection of the RS422 interface (optional)

3. Positive terminal of the DC link

2. Discharge resistor

The KEV is extremely easy to connect Simple connection I

or interruptions elements

13
12
6.5
10
10
10
(Bottom side)

1. Interface secured against polarity reversal

2. Digital interface for function monitoring

3. Safety-relevant LED: Flashes, as long as the storage unit is charged

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 the initiation of the established measures. Over the evaluation of the signal as well as the storage is charged either.

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.

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.

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 Suplys 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

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?

Technical Specifications KEK

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

Energy savings with the KEK

- with KEK
- without KEK

Voltage characteristics of the DC link

- without KEK
- with KEK
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, \(U_{\text{BRCH}} = 540\ \text{VDC}\)
Braking block

<table>
<thead>
<tr>
<th>Initial braking power [kW]</th>
<th>Energy stroke per cycle [Ws]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1400</td>
</tr>
<tr>
<td>1</td>
<td>1200</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
</tr>
<tr>
<td>3</td>
<td>800</td>
</tr>
<tr>
<td>4</td>
<td>600</td>
</tr>
<tr>
<td>5</td>
<td>400</td>
</tr>
<tr>
<td>6</td>
<td>200</td>
</tr>
</tbody>
</table>

KEK 2.0F, \(U_{\text{BRCH}} = 540\ \text{VDC}\)
Braking ramp

<table>
<thead>
<tr>
<th>Initial braking power [kW]</th>
<th>Energy stroke per cycle [Ws]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1400</td>
</tr>
<tr>
<td>1</td>
<td>1200</td>
</tr>
<tr>
<td>2</td>
<td>1000</td>
</tr>
<tr>
<td>3</td>
<td>800</td>
</tr>
<tr>
<td>4</td>
<td>600</td>
</tr>
<tr>
<td>5</td>
<td>400</td>
</tr>
<tr>
<td>6</td>
<td>200</td>
</tr>
</tbody>
</table>

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

Technical Specifications NEV

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical power ratings</td>
<td>22 VDC...26 VDC</td>
</tr>
<tr>
<td>Input voltage (terminal X2)</td>
<td>6A (up to 150VA) for failure operation</td>
</tr>
<tr>
<td>Rated current</td>
<td>5A (up to 120VA) for mains operation</td>
</tr>
<tr>
<td>Standby power dissipation</td>
<td>&lt; 1 W</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>III (altitude up to 2000 m above sea level)</td>
</tr>
<tr>
<td>Immunity to interference</td>
<td>II (altitude about 2000 m above sea level)</td>
</tr>
<tr>
<td></td>
<td>Industries in accordance with EN 6100-6-2-205 and EN 6100-6-4-2007</td>
</tr>
</tbody>
</table>

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
24 Volt Emergency Power Supply

**Parameters**

- **Active 24-Volt support power supply**
- **Space-saving without further manual configuration**
- **No keys**
- **Provides support when power failures or interruptions occur**

**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 X1 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

Integrating energy storage systems into a control cabinet

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

www.brakeenergy.com/kts

Technical specifications small variant

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

Dimensions and mounting holes (mm)

Dimensions and mounting holes (mm)
large variant
open bottom for individual cable entry (optional with a bottom plate)

Technical specifications large variant

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

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 unstable 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?

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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"* under persistent overloads
- no short-circuit
- no fault to frame
- self-extinguishing

* "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 mm²

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.

**Technical specifications**
($\theta_a = 20^\circ$C, unless otherwise stated)

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

**Versions**

- PTC
- PTC with connector
- PTC with custom specific connector
- PTC with custom specific connector

**Dimensions and mounting holes (mm)**

<table>
<thead>
<tr>
<th>Case temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake resistor PTC8006xx</td>
</tr>
<tr>
<td>Resistance-temperature characteristic</td>
</tr>
<tr>
<td>Type specific of request</td>
</tr>
<tr>
<td>$R(\Omega/mm)$</td>
</tr>
<tr>
<td>$T(\degree C)$</td>
</tr>
</tbody>
</table>
PTC – 35 W
(J, = 20°C, unless otherwise stated)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistances</td>
<td>R</td>
<td>175, 350, 1750</td>
<td>Ω</td>
<td></td>
</tr>
<tr>
<td>Rated power</td>
<td>P</td>
<td>10</td>
<td>W</td>
<td>unobstructed convection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35</td>
<td>W</td>
<td>on heat sink (70 °C)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>L</td>
<td>59.5 ± 1</td>
<td>mm</td>
<td>no mounting holes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>89.0 ± 0.4</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>34.0 ± 0.3</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>10.5 ± 0.5</td>
<td>mm</td>
<td>alternatively</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.5 ± 0.5</td>
<td>mm</td>
<td></td>
</tr>
</tbody>
</table>

PTC – 70 W
(J, = 20°C, unless otherwise stated)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistances</td>
<td>R</td>
<td>90, 175, 875</td>
<td>Ω</td>
<td></td>
</tr>
<tr>
<td>Rated power</td>
<td>P</td>
<td>20</td>
<td>W</td>
<td>unobstructed convection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70</td>
<td>W</td>
<td>on heat sink (70 °C)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>L</td>
<td>115.0 ± 0.5</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>34.0 ± 0.3</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>10.5 ± 0.5</td>
<td>mm</td>
<td></td>
</tr>
</tbody>
</table>

PTC – 105 W
(J, = 20°C, unless otherwise stated)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistances</td>
<td>R</td>
<td>60, 120</td>
<td>Ω</td>
<td></td>
</tr>
<tr>
<td>Rated power</td>
<td>P</td>
<td>30</td>
<td>W</td>
<td>unobstructed convection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>105</td>
<td>W</td>
<td>on heat sink (70 °C)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>L</td>
<td>139.0 ± 0.4</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>34.0 ± 0.3</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>10.5 ± 0.5</td>
<td>mm</td>
<td></td>
</tr>
</tbody>
</table>

PTC – 140 W
(J, = 20°C, unless otherwise stated)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistances</td>
<td>R</td>
<td>44, 88</td>
<td>Ω</td>
<td></td>
</tr>
<tr>
<td>Rated power</td>
<td>P</td>
<td>40</td>
<td>W</td>
<td>unobstructed convection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>140</td>
<td>W</td>
<td>on heat sink (70 °C)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>L</td>
<td>167.0 ± 0.4</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>W</td>
<td>34.0 ± 0.3</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>10.5 ± 0.5</td>
<td>mm</td>
<td></td>
</tr>
</tbody>
</table>

* 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%, θ, = 20°C)

Resistance (Ohm)
75, 300

Dimensions (mm)
Enclosure: 80 x 52 x 110
Wiring: length 510±40 mm
Ø AWG16 or 1.5 mm²

Technical specifications
(θ, = 20°C, unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance (resistance)</td>
<td>TK</td>
<td>± 5</td>
<td>%</td>
<td>Room temperature</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>θ,</td>
<td>20 ... 100</td>
<td>10 °/K</td>
<td></td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>Rₙₜ₀</td>
<td>≥ 100</td>
<td>MΩ</td>
<td></td>
</tr>
<tr>
<td>Inductance</td>
<td>L</td>
<td>≤ 30</td>
<td>μH</td>
<td></td>
</tr>
<tr>
<td>Capacity against enclosure</td>
<td>C</td>
<td>≤ 300</td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>Thermal time constant</td>
<td>τ</td>
<td>approx. 250</td>
<td>s</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>m</td>
<td>230</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>Certifications</td>
<td>cCSAus</td>
<td>2,2</td>
<td>kJ</td>
<td>Standard CSA-C22.2</td>
</tr>
<tr>
<td>Energy absorption</td>
<td>Q</td>
<td>≤ 700</td>
<td>kJ</td>
<td>with 1.2 s (1% duty cycle)</td>
</tr>
<tr>
<td>Maximum permissible</td>
<td>Uₚ</td>
<td>1,000</td>
<td>V</td>
<td>with 7.2 s (6% duty cycle)</td>
</tr>
<tr>
<td>operating voltage</td>
<td>Uₚ</td>
<td>≤ 600</td>
<td>DC</td>
<td>Taking into consideration</td>
</tr>
<tr>
<td>Isolation voltage</td>
<td>Uₘₜₜ</td>
<td>≥ 850</td>
<td>AC</td>
<td>the “intrinsic safety”</td>
</tr>
<tr>
<td>Max. permissible case temp.</td>
<td>Tₚ</td>
<td>≤ 250</td>
<td>°C</td>
<td>cCSAus certification</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>θₛ</td>
<td>-25 ... +85</td>
<td>°C</td>
<td>cCSAus certification</td>
</tr>
</tbody>
</table>

Dimensions and mounting holes (mm)

Pulse loading capacity
Brake resistor BWx150
With duty cycle ED = 100%
Maximum permissible temperature T = 250 °C

Case temperature
Brake resistor BWx150

Certifications
- cCSAus
- Standard CSA-C22.2
- UL certification
- UL certification
- UL certification
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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance (resistance)</td>
<td>( \Delta R )</td>
<td>± 5</td>
<td>%</td>
<td>Room temperature</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>( T_K )</td>
<td>20 ... 100</td>
<td>°C</td>
<td>( 10^\circ \text{K} )</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>( R_{\text{in}} )</td>
<td>≥ 100</td>
<td>MΩ</td>
<td>( U_{\text{in}} = 1,000 \text{ VDC} )</td>
</tr>
<tr>
<td>Inductance</td>
<td>( L )</td>
<td>≤ 30</td>
<td>( \mu \text{H} )</td>
<td>( f = 300 \text{ kHz}, U_{\text{in}} = 50 \text{ mV} )</td>
</tr>
<tr>
<td>Capacity against enclosure</td>
<td>( C )</td>
<td>≤ 300</td>
<td>( \text{pF} )</td>
<td>( f = 300 \text{ kHz}, U_{\text{in}} = 50 \text{ mV} )</td>
</tr>
<tr>
<td>Thermal time constant</td>
<td>( \tau )</td>
<td>approx. 550</td>
<td>s</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>( m )</td>
<td>280</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>Certifications</td>
<td></td>
<td></td>
<td></td>
<td>Standard CSA-C22.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>UL 508</td>
</tr>
<tr>
<td>Energy absorption</td>
<td>( Q )</td>
<td>4</td>
<td>kJ</td>
<td>with 1.2 s (1% duty cycle)</td>
</tr>
<tr>
<td>Maximum permissible operating voltage</td>
<td>( U_p )</td>
<td>≤ 700 AC</td>
<td>V</td>
<td>Taking into consideration</td>
</tr>
<tr>
<td>Isolation voltage</td>
<td>( U_{\text{iso}} )</td>
<td>≥ 4,000 AC</td>
<td>V</td>
<td>AC; ( f = 50 \text{ Hz}; t = 1 \text{ min} )</td>
</tr>
<tr>
<td>Max. permissible case temp.</td>
<td>( \theta_{\text{c}} )</td>
<td>≤ 250</td>
<td>°C</td>
<td>unobstructed convection</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>( \theta_s )</td>
<td>-25 ... +85</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

Dimensions and mounting holes (mm)

<table>
<thead>
<tr>
<th>67</th>
<th>67</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>98</td>
</tr>
<tr>
<td>510±40</td>
<td></td>
</tr>
</tbody>
</table>

Pulse loading capacity

Brake resistor BWx250

Rated power (W)

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

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±40 mm

\( \Omega \) AWG16 or 1.5 mm²

www.brakeenergy.com/

single-resistors

Versions

BWD250

BWG250

BWS250

BWT250*

*without CSA and UL approval
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%, θ_2 = 20°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 mm²

**Technical specifications**
(θ_1 = 20°C, unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance (resistance)</td>
<td>TK</td>
<td>± 5</td>
<td>%</td>
<td>Room temperature</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>J</td>
<td>20 ... 100</td>
<td></td>
<td>10°C/K</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>R_∞</td>
<td>≥ 100</td>
<td>MΩ</td>
<td>U_max = 1,000 VDC</td>
</tr>
<tr>
<td>Inductance</td>
<td>L</td>
<td>≤ 30</td>
<td>µH</td>
<td>f = 300 kHz, U_max = 50 mV</td>
</tr>
<tr>
<td>Capacity against enclosure</td>
<td>C</td>
<td>≤ 300</td>
<td>pF</td>
<td>f = 300 kHz, U_max = 50 mV</td>
</tr>
<tr>
<td>Thermal time constant</td>
<td>τ</td>
<td>approx. 550</td>
<td>s</td>
<td>UL certification</td>
</tr>
<tr>
<td>Weight</td>
<td>m</td>
<td>550</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>Certifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cCSAus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cURus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy absorption</td>
<td>Q</td>
<td>7.5</td>
<td>kJ</td>
<td>with 1.2 ± (1% duty cycle)</td>
</tr>
<tr>
<td>Maximum permissible operating voltage</td>
<td>U_p</td>
<td>≤ 700 AC</td>
<td>V</td>
<td>with 7.2 ± (6% duty cycle)</td>
</tr>
<tr>
<td>Isolation voltage</td>
<td>U_∞</td>
<td>≥ 4,000 AC</td>
<td>V</td>
<td>Taking into consideration</td>
</tr>
<tr>
<td>Max. permissible case temp.</td>
<td>T_c</td>
<td>≤ 250</td>
<td>°C</td>
<td>the “intrinsic safety”</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_s</td>
<td>-25 ... +85</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

**Versions**

- BWx500
- BWD500
- BWG500
- BWS500
- BWT500*

*without CSA and UL approval

**Dimensions and mounting holes (mm)**

**Pulse loading capacity**
Brake resistor BWx500

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

**Case temperature**
Brake resistor BWx500

- With duty cycle 70°C
- Maximum permissible 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
(\(T_0 = 20\, ^\circ\text{C}\), unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance (resistance)</td>
<td>(\Delta R)</td>
<td>± 5</td>
<td>%</td>
<td>Room temperature</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>(T_K)</td>
<td>20 ... 100</td>
<td>K</td>
<td>10(^5)/K</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>(R_{\text{ins}})</td>
<td>(\geq 100)</td>
<td>M(\Omega)</td>
<td>(U_{\text{ins}} = 1,000) VDC</td>
</tr>
<tr>
<td>Inductance</td>
<td>(L)</td>
<td>(\leq 30)</td>
<td>(\mu)H</td>
<td>(f = 300) kHz, (U_{\text{ins}} = 50) mV</td>
</tr>
<tr>
<td>Capacity against enclosure</td>
<td>(C)</td>
<td>(\leq 300)</td>
<td>pF</td>
<td>(f = 300) kHz, (U_{\text{ins}} = 50) mV</td>
</tr>
<tr>
<td>Thermal time constant</td>
<td>(\tau)</td>
<td>approx. 600</td>
<td>s</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>(m)</td>
<td>1,050</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>Certifications</td>
<td>CUL</td>
<td>508</td>
<td></td>
<td>Standard CSA-C22.2</td>
</tr>
<tr>
<td>Energy absorption</td>
<td>(Q)</td>
<td>13</td>
<td>kJ</td>
<td>with 1.2 s (1% duty cycle)</td>
</tr>
<tr>
<td>Maximum permissible operating voltage</td>
<td>(U_i)</td>
<td>(\leq 700) AC</td>
<td>V</td>
<td>with 7.2 s (6% duty cycle)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(\leq 1,000) DC</td>
<td>V</td>
<td>Taking into consideration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(\leq 600) AC</td>
<td>V</td>
<td>the &quot;intrinsic safety&quot; (4kW)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(\leq 850) DC</td>
<td>V</td>
<td>UL certification</td>
</tr>
<tr>
<td>Isolation voltage</td>
<td>(U_{\text{iso}})</td>
<td>(\geq 4,000) AC</td>
<td>V</td>
<td>AC; (f = 50) Hz; (t = 1) min</td>
</tr>
<tr>
<td>Max. permissible case temp.</td>
<td>(\Theta_{jc})</td>
<td>(\leq 250)</td>
<td>(\circ)C</td>
<td>unobstructed convection</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>(\Theta_s)</td>
<td>(-25 ... +85)</td>
<td>(\circ)C</td>
<td></td>
</tr>
</tbody>
</table>

Dimensions and mounting holes (mm)

Pulse loading capacity
Brake resistor BWx600

Case temperature
Brake resistor BWx600
With duty cycle ED = 100%
Maximum permissible temperature \(T = 250\) \(\circ\)C

Rated power (W)
240 (600 with duty cycle ED = 35\%\(, \Theta_s = 20\)\(\circ\)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
\(\phi\) AWG14 or 2.5 mm²

Versions
BWD600
BWG600
BWS600
BWT6000*
*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%, \( \theta_a = 20^\circ \text{C} \))

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
\( \Omega \) AWG14 or 2.5 mm²

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance (resistance)</td>
<td>TK</td>
<td>± 5</td>
<td>%</td>
<td>Room temperature</td>
</tr>
<tr>
<td>Temperature coefficient</td>
<td>( T_K )</td>
<td>20 ... 100</td>
<td>( \text{°C} )</td>
<td>100% ED</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>( R_{so} )</td>
<td>( \geq 100 )</td>
<td>( \text{MΩ} )</td>
<td>( U_{max} = 1,000 \text{ VDC} )</td>
</tr>
<tr>
<td>Inductance</td>
<td>L</td>
<td>( \leq 30 )</td>
<td>( \mu \text{H} )</td>
<td>( f = 300 \text{ kHz}, U_{max} = 50 \text{ mV} )</td>
</tr>
<tr>
<td>Capacity against enclosure</td>
<td>C</td>
<td>( \leq 300 )</td>
<td>( \text{pF} )</td>
<td>( f = 300 \text{ kHz}, U_{max} = 50 \text{ mV} )</td>
</tr>
<tr>
<td>Thermal time constant</td>
<td>( \tau )</td>
<td>approx. 850</td>
<td>( \text{s} )</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>( m )</td>
<td>1,050</td>
<td>( \text{g} )</td>
<td>with 1.2 s (1% duty cycle)</td>
</tr>
<tr>
<td>Energy absorption</td>
<td>( Q )</td>
<td>13</td>
<td>( \text{kJ} )</td>
<td>with 7.2 s (6% duty cycle)</td>
</tr>
<tr>
<td>Maximum permissible operating voltage</td>
<td>( U_o )</td>
<td>( \leq 700 \text{ AC} )</td>
<td>( \text{V} )</td>
<td>Taking into consideration</td>
</tr>
<tr>
<td>Isolation voltage</td>
<td>( U_{iso} )</td>
<td>( \leq 1,000 \text{ DC} )</td>
<td>( \text{V} )</td>
<td>the “intrinsically safe”</td>
</tr>
<tr>
<td>Max. permissible case temp.</td>
<td>( \theta_c )</td>
<td>( \leq 300 )</td>
<td>( \text{°C} )</td>
<td>AC; ( f = 50 \text{ Hz}; t = 1 \text{ min} )</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>( \theta_s )</td>
<td>-25 ... +85</td>
<td>( \text{°C} )</td>
<td>unobstructed convection</td>
</tr>
</tbody>
</table>

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 \( T = 300 \text{ °C} \)
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

(\(T_0 = 20^\circ\text{C}\), unless otherwise specified)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tolerance (resistance)</td>
<td>(R_{\text{max}})</td>
<td>(\pm 5)</td>
<td>%</td>
<td>Room temperature</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>(R_{\text{ins}})</td>
<td>(\geq 100)</td>
<td>M(\Omega)</td>
<td></td>
</tr>
<tr>
<td>Inductance</td>
<td>L</td>
<td>(\leq 30)</td>
<td>(\mu)H</td>
<td>f = 300 kHz, (U_{\text{max}} = 50) mV</td>
</tr>
<tr>
<td>Capacity against enclosure</td>
<td>C</td>
<td>(\leq 300)</td>
<td>pF</td>
<td>f = 300 kHz, (U_{\text{max}} = 50) mV</td>
</tr>
<tr>
<td>Thermal time constant</td>
<td>(\tau)</td>
<td>approx. 550</td>
<td>s</td>
<td>BWD250/500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>approx. 600</td>
<td>s</td>
<td>BWD600</td>
</tr>
<tr>
<td></td>
<td></td>
<td>approx. 850</td>
<td>s</td>
<td>BWD1000</td>
</tr>
<tr>
<td>Energy absorption BWD250</td>
<td>Q</td>
<td>4</td>
<td>kJ</td>
<td>with 1.2 s (1% duty cycle)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>kJ</td>
<td>with 7.2 s (6% duty cycle)</td>
</tr>
<tr>
<td>Energy absorption BWD500</td>
<td>Q</td>
<td>7.5</td>
<td>kJ</td>
<td>with 1.2 s (1% duty cycle)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>15</td>
<td>kJ</td>
<td>with 7.2 s (6% duty cycle)</td>
</tr>
<tr>
<td>Energy absorption BWD600/1000</td>
<td>Q</td>
<td>13</td>
<td>kJ</td>
<td>with 1.2 s (1% duty cycle)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26</td>
<td>kJ</td>
<td>with 7.2 s (6% duty cycle)</td>
</tr>
<tr>
<td>Maximum permissible operating voltage</td>
<td>(U_{\text{op}})</td>
<td>(\leq 700) AC</td>
<td>V</td>
<td>Taking into consideration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(\leq 1,000) DC</td>
<td>V</td>
<td>the “intrinsic safety”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(\leq 600) AC</td>
<td>V</td>
<td>UL certification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(\leq 850) DC</td>
<td>V</td>
<td>UL certification</td>
</tr>
<tr>
<td>Isolation voltage</td>
<td>(U_{\text{is}})</td>
<td>(\geq 4,000) AC</td>
<td>V</td>
<td>f = 50 Hz; (t = 1) min</td>
</tr>
<tr>
<td>Max. permissible case temp.</td>
<td>(T_0)</td>
<td>(\leq 250)</td>
<td>°C</td>
<td>unobstructed convection</td>
</tr>
<tr>
<td></td>
<td>(T_0)</td>
<td>(\leq 300)</td>
<td>°C</td>
<td>Unobstructed conv. (BWD1000)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td></td>
<td>(-25\ldots+85)</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>
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

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

**Dimensions (mm)**
Individual 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)**
Type-specific sizes available upon request.

**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`

| Individual design |
| Design for 1 or 2 resistors each |
| Frame width in mm |
| Letter code for product frame |
| 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 (0, 0, 5, 1) |
| Product name braking/ballast resistor |
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.

Dimensions and mounting holes (mm)
Mounting bracket for brake resistor combinations BWX ... K...
Detailed dimensions for specific versions available upon request.

Rated power (kW)
0.1 - 7.2

Resistance (Ohm)
1 - 14,940

Dimensions (mm)
Upon request

Example based on BWD500:
www.brakeenergy.com/combination-bwd-500

Individual solutions

Brake resistor combination BWx...K...

Nomenclature
Brake resistor combination BWx...K...

BWD1000200K01ALV

Connections:
V: in IP20
WP65: 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
With: A

Radiating panels:
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

**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.

**Nomenclature**
Brake resistor combination BAx...

**Example BAF:**
www.brakeenergy.com/combinations-baf

**Example B2P:**
www.brakeenergy.com/combinations-b2p

### Mounting plates for brake resistor combinations BxP.

- Mounting plate P250D
- Mounting plate P250
- Mounting plate P250H

### 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
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.

Dimensions and mounting holes (mm)
Mounting plates for brake resistor combinations BxP. Detailed dimensions for specific versions available upon request.

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions (mm)</th>
<th>Resistance (Ohm)</th>
<th>Rated power (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAF2.4100D-1000TS</td>
<td>209 x 175 x 740</td>
<td>12 - 7400</td>
<td>Upon request</td>
</tr>
<tr>
<td>B2P3.2100-1000H</td>
<td>246 x 259 x 170</td>
<td>6.5 - 250</td>
<td>0.4 - 4.8</td>
</tr>
</tbody>
</table>

Nomenclature
Brake resistor combination BxP...

B2P3.2100-1000H

Example B2P: 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
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.

Detailed views

Detailed view of a terminal box

H305 cover not installed

Structure without cover

Nomenclature
Brake resistor combination BxH...V...

B3H0.7100–600IP65VS

- Individual design
- Module installation type
- Protection class
- 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 H: at right angles to the individual resistors
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.

<table>
<thead>
<tr>
<th>Rated power (kW)</th>
<th>0.4 – 3.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance (Ohm)</td>
<td>1 – 7,400</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>Upon request</td>
</tr>
</tbody>
</table>

Nomenclature
Brake resistor combination BxH...H...

B3H3.6100-600IP65HS

- Individual design
- Module installation type
- Protection class
- 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 H at right angles to the individual resistors

Cover H320

Mounting plate P550

Detailed views
Detailed view of a terminal box
H320 cover not installed
Structure without cover
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

**Dimensions and mounting holes (mm)**

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

**Individual solutions**

**BWK2.0047-1000H**
Brake resistor combination in an enclosure to IP20

**Nomenclature**
- 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
- Metal enclosure
- Product name braking/ballast resistor

www.brakeenergy.com/combations-bwk
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 \(9 \times 150 \, \text{Ohm}\) \(4 \times 100 \, \text{Ohm}\) \(2 \times 72 \, \text{Ohm}\)
Prot. class: IP 20
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 BWD600100K18KDVF
Power rating: 4.32 kW \(5.6 \, \text{Ohm}\)
Prot. class: IP 20
RoHS-conform 2002/95/EG

Brake resistor combination BAS0.5033-600IP65
Power rating: 0.48 kW \(16.5 \, \text{Ohm}\)
Prot. class: IP 65
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.
Tel. +49 7251/962620, mail@breakenergy.com, Fax +49 7251/962621

<table>
<thead>
<tr>
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<th>Phone</th>
<th>E-mail</th>
</tr>
</thead>
<tbody>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**www.breakenergy.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.

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**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.
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.

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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 or simply scan the QR code shown alongside.

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Communication channels

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

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- 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
  www.brakeenergy.com

We look forward to hearing from you!