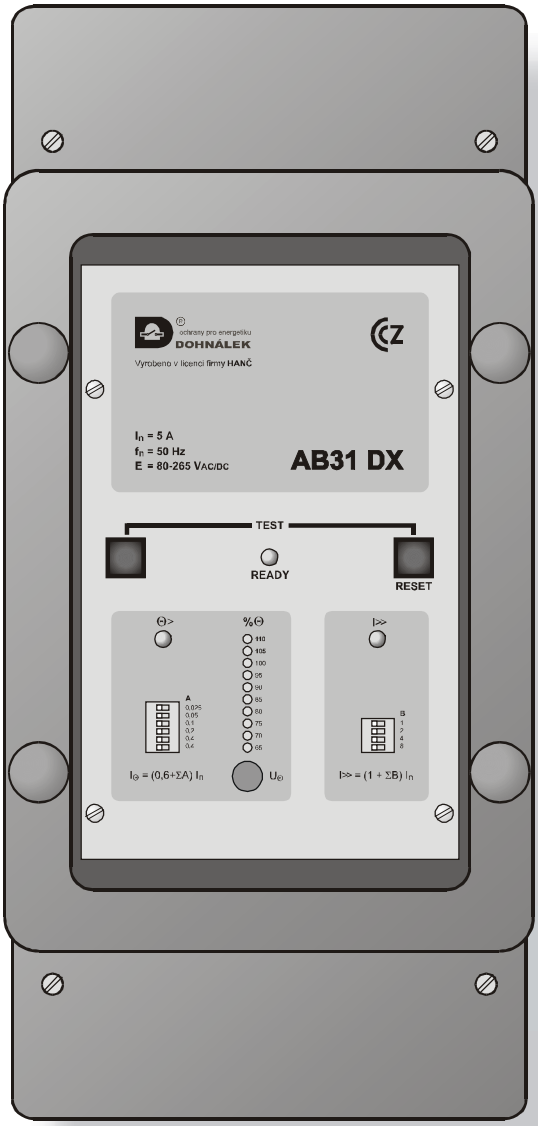


# Motor Protection

# AB 31 DX

***DOHNÁLEK, Úpská 132, 542 23 Mladé Buky, Czech Republic***

tel.: +420 499 873 443 fax: +420 499 873 442 e-mail: dohnalek@dohnalek.cz website: www.dohnalek.cz

**Application:**

AB 31 DX is a three phase steady-state protection. It protects power devices at overload and short-circuit. The protection is applicable where there is a need to protect devices against overload as regards to previous loading such as motors, cables, ground resistances, etc. AB 31 DX protection replaces AB 21 and AB 31 types used so far.

**Description:**

Signals from three measuring elements corresponding to input currents are galvanically separated, rectified and conducted to the overloading element Θ> and the short-circuit element I>>. The overloading element operates at overrange 1.05 multiple of the setting value. The short-circuit element operates after overranging a preset value with the delay cca 50 ms. Both elements have the separate LED signalling with the memory and own output relay with the break-make contact.

The memory of a operation is shut down by the RESET push-buttons situated on the front panel and on the casing as well. When a auxiliary feeding drop-out is longer (more than 1s), the memory automatically fades. If a feeding drop-out is longer than several seconds, the overloading element „cools down" at the same time. After feeding reset a setting of this component corresponds to a cold state of a protected device.

The immediate state of the overloading element Θ> is displayed at the signalling column %Θ located on the front panel. The 65 - 100 % warming is indicated by yellow LEDs, 105 - 110 % indicate the red flashing LEDs. The 2,5 mm JACK connector is located bellow this column. Here is possibility to external measuring the voltage UΘ directly corresponding to the warming value. (The UΘ voltage measuring can be used with advantage during a protection setting).

The protection needs auxiliary voltage for its operation. The protecion is equipped with the signalling of auxiliary voltage loss. The relay Z for this function has break contact between terminals 7 and 8. An auxiliary voltage presence is indicated by the green LED.

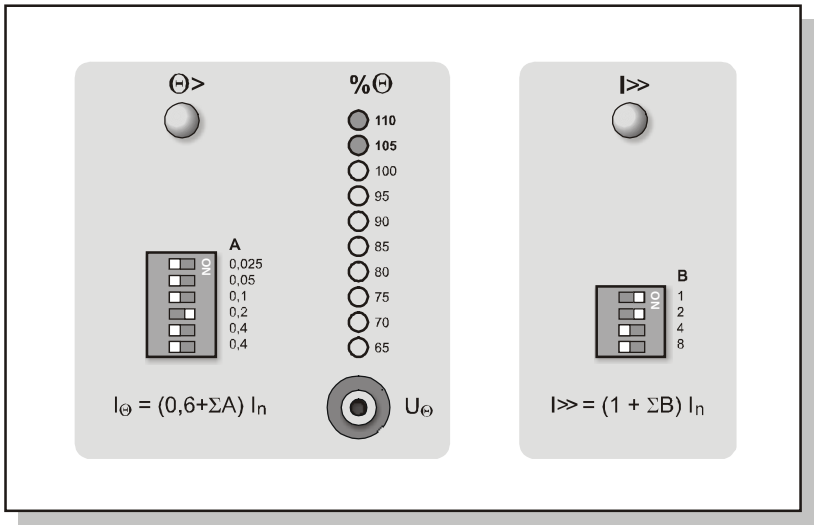


**Fig. 1** The view of the front panel a protection AB 31 DX - the setting example

The overloading element Θ> - setting at IΘ = 0,8 In

The short-circuit element I>> - setting at I>> = 4 In

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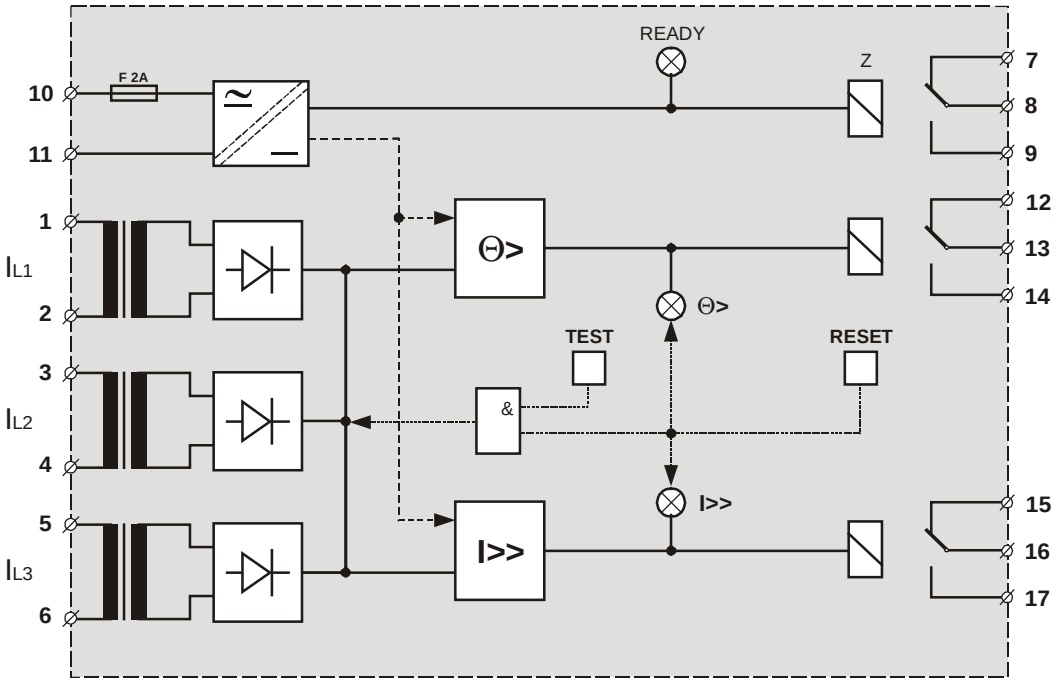
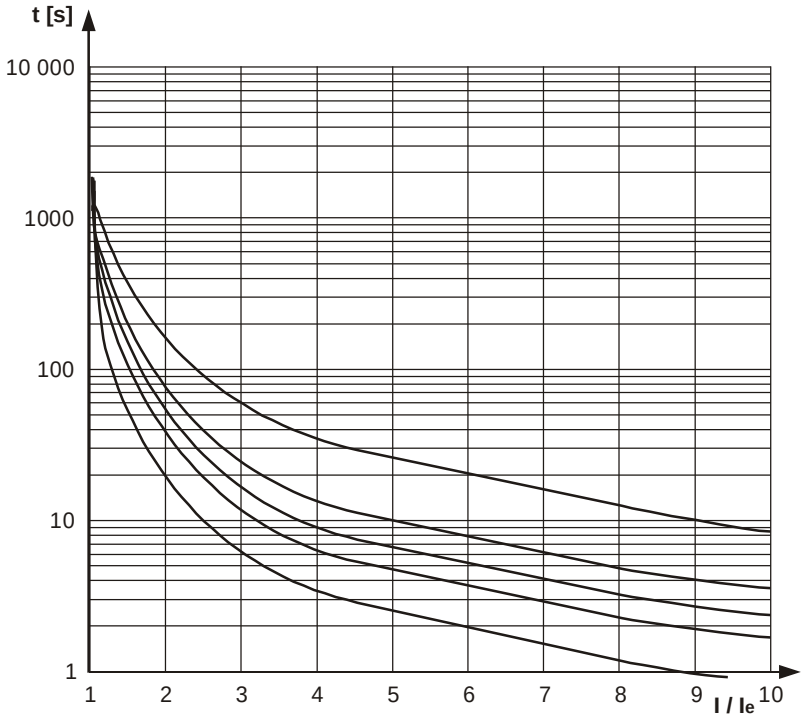



**Fig. 2** The block diagram of the protection AB 31 DX




**Ie** - protection setting corresponding to In protection

**Ip** - previous motor´s current state

cold state Ip = 0

warm state Ip = 0,8 Ie
warm state Ip = 0,9 Ie
warm state Ip = 0,95 Ie

warm state Ip = 1,0 Ie

**Fig. 3** The time characteristics of protection AB 31 DX

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**Testing:**

The protection testing is possible with removed cover and coincident pressing TEST and RESET push-buttons. Both measuring elements start in operation. The element I>> starts with the time delay cca 50 ms. The element Θ> operates after several seconds. After testing the element Θ> will remain in operation as long as it „cools down".

**Technical data:**

| | |
|---|---|
| Rated current In | 5 A |
| Nominal frequency fn | 50 Hz |
| Current circuit consumption | < 0,1 VA / phase |

*Auxiliary voltage E*

| | |
|---|---|
| Voltage range | 80 - 265 V DC, AC |
| Auxiliary circuit consumption | 5 W |
| Overshoot time to current reduced: | tp < 0,2 s at 110 V DC, AC; tp < 0,9 s at 220 V DC, AC |
| Ground terminal | on the casing |
| Fuse nominal value | 2 A |

*Overloading element Θ>*

| | |
|---|---|
| Adjustability | from 0,6 to 1,75 In by 0,025 In |
| Accuracy | ± 5 % of the preset value |
| Time delay | see the Fig. 3 (tolerance ±20 %) |
| Voltage output | UΘ = -6,8 V at I = IΘ<br>operation at UΘ = -7,5V, return at UΘ = -6,8V |

*Short-circuit element I>>*

| | |
|---|---|
| Adjustability | from 1 to 16 In by 1 In |
| Accuracy | ± 5 % of the preset value |
| Resetting ratio | 0,95 |
| Operation delay of measuring element | 60 ±5 ms |
| Return time of measuring element | 35 ±5 ms |

| | |
|---|---|
| Overload capacity | |
| - thermal | 4 In / permanently; 16 In / 5 s |
| - dynamic (for half cycle) | 200 In |

*Contacts*

| | |
|---|---|
| Sustained rating | 4 A |
| Switching capacity and rating for time 0,5 s | 20 A |
| Shock loading for time 30 ms | 100 A |
| Switching capacity for 110 V AC | 2000 VA |
| Maximum switching voltage | 250 V DC, AC |
| Breaking capacity for R/L = 40 ms | 1,5 A at U = 50 V DC<br>0,3 A at U = 110 V DC<br>0,1 A at U = 220 V DC |
| Material | AgCd0 |

*Signalling LEDs*

| | | |
|---|---|---|
| READY | green | - auxiliary voltage presence |
| Θ> | red | - overloading element operation |
| I>> | red | - short-circuit element operation |
| %Θ | 8x yellow | - from 65 to 100 %¨ |
| | 2x flashing red | - 105 and 110 % |

*Working environment*

| | |
|---|---|
| Temperature range | from -25 to +55 ℃ |
| Working position | arbitrary |
| Operation type | continual |

*Insulating tests*

| | | |
|---|---|---|
| Insulation strength | 2 kV, 50 Hz, 1 min | IEC 60255-5 |
| Pulse voltage test | 5 kV; 1,2/50 µs | IEC 60255-5 |

*Electromagnetic compatibility (EMC)*

| | | |
|---|---|---|
| Electrostatic discharge | 6/8 kV (10 cycles) | IEC 1000-4-2 |
| Interference of radio frequency | 10 V/m | IEC 1000-4-3 |
| Impulse group | 2/4 kV / 5 kHz | IEC 1000-4-4 |
| Induced HF field propagate by line | from 150 kHz to 80 MHz / 10 V | IEC 1000-4-6 |
| Magnetic field disturbance | 100 A/m | IEC 1000-4-8 |

*Mechanical performance*

| | |
|---|---|
| IP code | IP 20 |
| Terminals | one conductor from 1,5 to 6 $mm^2$<br>two conductors from 1 to 2,5 $mm^2$ |
| Weight | 2 kg |

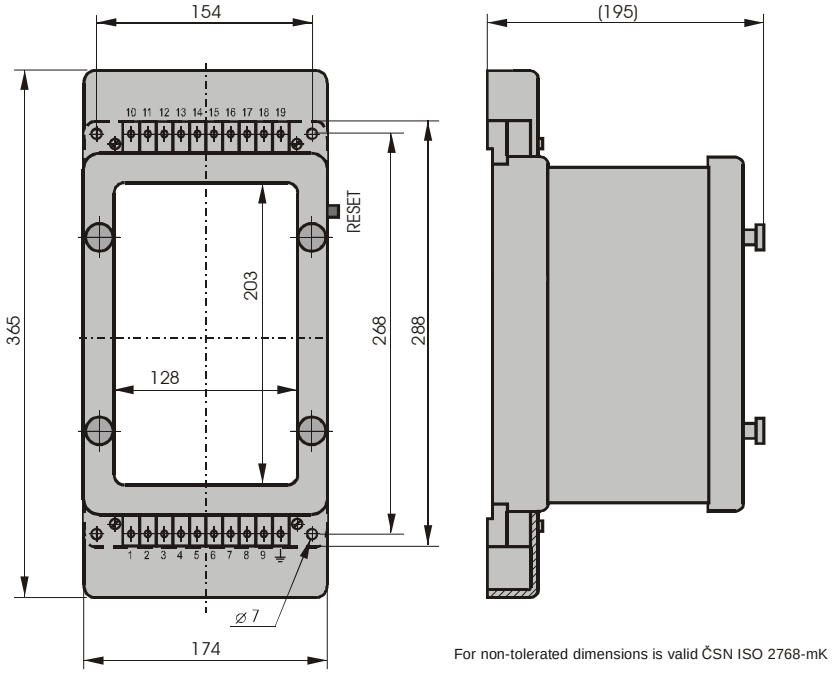


**Fig. 4** The terminals position and dimensions protections AB 31 DX

**The protection setting:**

*Overloading element Θ>*

The following relation applies to the element setting:

$I\Theta = (0,6+\Sigma A) . In$ where A = 0,025 - 0,05 - 0,1 - 0,2 - 0,4 - 0,4 a In = In of protection

It is necessary to consider the number of connected phases:

$I\Theta = m . I_{prim} / k_i$ where IΘ the element setting
m the coefficient of connected phases number with phase difference 120°el.
one phase m =1
two phases m = 1,2
three phases m = 1,3
$I_{prim}$ primary value (usually rated) of protected device
$k_i$ current transformer conversion

The example:
For three-phase connection, $I_{prim} = 60 A$, $k_i = 75 / 5 A = 15$
$I\Theta = 1,3 . 60 A / 15 = 5,2 A \Rightarrow 1,04 In = (0,6 + 0,44)$ In protection $\Rightarrow \Sigma A = 0,44 \cong 0,4 + 0,05 = 0,45$

*Short-circuit element I>>*

The following relation applies to the element setting:

$I>> = (1+\Sigma B) . In$ where B = 1 - 2 - 4 - 8 a In = In protection

A number of connected phases isn´t considered at the calculation:

$I>> = I_{prim} / k_i$ where I>> the element setting
$I_{prim}$ primary value (usually rated) of protected device
$k_i$ current transformer conversion

The example:
$I_{prim} = 360 A$, $k_i = 75 / 5 A = 15$
$I>> = 360 A / 15 = 24 A \Rightarrow 4,8 In = (1 + 3,8)$ In protection $\Rightarrow \Sigma B = 3,8 \cong 4$

**Secondary test:**

In general, a secondary test is performed by single phase at individual phases.

The short-circuit element I>> is tested using a standard method for overcurrent protections.

We recommend this process for checking the breaking level of overloading element Θ>:
The thermal state of stabilization with a current IΘ is indicated by yellow LED 100 %. (It is possible to accelerate a measuring by briefly pressing the TEST push-button, whereby we reach the 100 % thermal state more quickly). After the stabilization we measure voltage UΘ, which is -6,8 V for 100 % warming. Breaking level occurs at 110% warming, which corresponds to UΘ = -7,5 V.





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