Double Pole Electronic Circuit Breaker ESS22-T

Description

The electronic circuit breaker type ESS22-T extends the E-T-A product range of electronic circuit protection for DC 24 V applications. It is a double pole version providing physical isolation. It meets the requirements of the machinery directive 2006/42/EC and the affiliated standard EN 60204-1 “Safety of Machinery, Electrical Equipment of Machines”, para 9.4.3.1.

The combination of active electronic current limitation in the event of a short circuit and overload disconnection from 1.1 times rated current provides double pole selective protection of DC 24 V load systems.

DC 24 V power supplies, which are widely used in industry today, will shut down the output in the event of an overload with the result that one faulty load in the system can lead to complete disconnection of all loads. As well as an unidentified failure this also means stoppage of the whole system.

Through selective disconnection the ESS22-T responds much faster to overload or short circuit conditions than the switch-mode power supply. This is achieved by active current limitation. The ESS22-T limits the highest possible current to typically 1.4 times the selected rated current. Thus it is possible to switch on capacitive loads of up to 20,000 μF, but they are disconnected only in the event of an overload or short circuit.

For optimal alignment with the characteristics of the application the current rating of the ESS22-T can be selected in fixed values from 0.5 A...10 A. Failure and status indication are by a multicolour LED and integral signal contacts. Remote operation is possible by means of a physically isolated control input. The manual ON/OFF button allows separate actuation of individual load circuits.

The ESS22-T, with a width of only 22.5 mm, can be snapped onto symmetrical rails ensuring ease of installation and saving space in control cabinets.

Upon detection of overload or short circuit in the load circuit, the MOSFET of the load output will be blocked to interrupt the current flow. In addition the load output will be physically isolated by a mechanical switching element. The load circuit can be re-activated via the physically isolated reset input or manually by actuation of the ON/OFF button.

Features

- Double pole electronic circuit breaker with physical isolation at load output
- Double protection of “load+ path” through electronic protection and failsafe element
- Double protection of “load- path” through electronic protection and failsafe element
- Selective load protection, electronic trip curve
- Active current limitation for safe connection of capacitive loads up to 20,000 μF, DC motors and on overload/short circuit
- Fixed current ratings 0.5 A...10 A
- Low voltage monitoring
- Manual ON/OFF button
- Physically isolated control input for ON/OFF optional
- Physically isolated reset input RE optional
- Clear status and failure indication through multicolour LED
- Two signal contacts (break contact and make contact)
- Width per unit 22.5 mm
- Rail mounting

Approvals

<table>
<thead>
<tr>
<th>Authority</th>
<th>Voltage rating</th>
<th>Current ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDE/EN 60934 pending</td>
<td>DC 24 V</td>
<td>0.5...10 A</td>
</tr>
<tr>
<td>UL 1077 pending</td>
<td>DC 24 V</td>
<td>0.5...10 A</td>
</tr>
</tbody>
</table>

Technical data (T_{ambient} = 25 °C, operating voltage U_S = DC 24 V)

Operating data

<table>
<thead>
<tr>
<th>Operating voltage U_S</th>
<th>DC 24 V (18...32 V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current rating I_0</td>
<td>fixed current ratings: 0.5 A, 1 A, 2 A, 3 A, 4 A, 6 A, 8 A, 10 A</td>
</tr>
</tbody>
</table>

Closed current I_0

| ON condition: typically 27 mA with signal output: typically 37 mA |

Status indication by means of

- Green: - unit is ON, load circuit switched on
- Orange: - in the event of overload or short circuit until disconnection
- Red: - after overload/short circuit disconnection
- - upon low voltage in ON condition
- - after switch-on till the end of the ON delay period
- OFF: - switched off by means of switch or control input
- - no operating voltage applied
- - potential-free signal contact
- - ON/OFF condition of switch

Load circuit

Load output

- Power-MOSFET and relay switching output with physical isolation, plus-and minus-switching

Overload disconnection

- typically 1.1 x I_N (1.05...1.35 x I_N)

Short-circuit current I_K

- active current limitation typically 1.4 x I_N (see table 1)

Trip times

- see time/current characteristics
- typically 3 s at I_{load} > 1.1 x I_N
- typically 100 ms...3 s at I_{load} > 1.4 x I_N

Temperature disconnection

- internal temperature monitoring with electronic disconnection

Low voltage monitoring

- OFF at typically < 16.0 V
- ON at typically > 17.0 V
- automatic switch ON or OFF

Starting delay t_{start}

- typically 0.5 sec after every switch-on, after reset and after applying U_S

Disconnection of load circuit

- double pole, with physical isolation
  - manually on the breaker via ON/OFF switch (OFF)
  - after overload/short circuit disconnection
  - via external control input
  - at low voltage
  - no operating voltage applied
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### Technical data (Tambient = 25 °C, operating voltage U_{S} = DC 24 V)

**Reset after overload or short circuit disconnection**
- manual RESET on the breaker via ON/OFF switch
- no reset with voltage interruptions (status memory)
- no reset possible via external control input IN
- external reset possible via reset input RE

**Free-wheeling circuit**
external free-wheeling diode recommended with inductive load

**Load outputs must not be connected in parallel**

**Status output SF** ESS22-TA-0x1

**Electrical data**
potential-free signal contact
1 break contact, terminal 11-12 (closed in OFF or failure condition)
1 make contact, terminal 13-14 (open in OFF or failure condition)
max. DC 30 V / 0.5 A, min. 10 V / 10 mA

**Fault**
signal output fault conditions:
- ON/OFF switch is in OFF position (manually)
- after overload/short circuit disconnection
- low voltage
- no operating voltage U_{S}

**Control input IN+/IN-** ESS22-TA-01x

**Electrical data**
control input (IN+/IN-) is physically isolated from load circuit (optocoupler) voltage max. + DC 32 V
high > DC 12 V < DC 32 V (switch on)
low ≤ DC 5 V > 0 V (switch off)
current consumption typically 3...9 mA (DC +12 V...32 V)

**Links**
manual ON/OFF switch on breaker is linked to the external control input IN+ by means of an AND function

**Reset input RE+/RE-** ESS22-TA-02x

**Electrical data**
reset input (RE+/RE-) physically isolated from load circuit (optocoupler) voltage max. + DC 32 V
high > DC 12 V < DC 32 V
low ≤ DC 5 V > 0 V
power consumption typically 3...9 mA (DC +12 V...32 V)
min. pulse duration for RESET 100 ms

**Reset signal RE**
The electronically blocked load output (blocked after overload/short circuit disconnection) may be reset via an external reset pulse (+ DC 24 V).
A common reset signal can be applied to several devices simultaneously.
RESET - pulse/edge from low (min. 100 ms) to high (min. 100 ms)

### Technical data (Tambient = 25 °C, operating voltage U_{S} = DC 24 V)

**General data**
Fail-safe element failsafe element aligned to rated current (back-up fuse)

**Terminals**
- Screw terminals
- Max. cable cross section Rigid / flexible
- Wire stripping length
- Tightening torque (EN 60934)
- Loop through option
- external reset possible via reset input RE

**Status**
- Status output SF ESS22-TA-0x1
  - potential-free signal contact
    - 1 break contact, terminal 11-12 (closed in OFF or failure condition)
    - 1 make contact, terminal 13-14 (open in OFF or failure condition)
    - max. DC 30 V / 0.5 A, min. 10 V / 10 mA
- SF ESS22-TA-0x2
  - potential-free signal contact
    - 1 break contact, terminal 11-12 (closed in OFF or failure condition)
    - 1 make contact, terminal 13-14 (open in OFF or failure condition)
    - max. DC 30 V / 0.5 A, min. 10 V / 10 mA

**Status output SF** ESS22-TA-0x1

**Electrical data**
potential-free signal contact
1 break contact, terminal 11-12 (closed in OFF or failure condition)
1 make contact, terminal 13-14 (open in OFF or failure condition)
max. DC 30 V / 0.5 A, min. 10 V / 10 mA

**Fault**
signal output fault conditions:
- ON/OFF switch is in OFF position (manually)
- after overload/short circuit disconnection
- low voltage
- no operating voltage U_{S}

**Control input IN+/IN-** ESS22-TA-01x

**Electrical data**
control input (IN+/IN-) is physically isolated from load circuit (optocoupler) voltage max. + DC 32 V
high > DC 12 V < DC 32 V (switch on)
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current consumption typically 3...9 mA (DC +12 V...32 V)

**Links**
manual ON/OFF switch on breaker is linked to the external control input IN+ by means of an AND function

**Reset input RE+/RE-** ESS22-TA-02x

**Electrical data**
reset input (RE+/RE-) physically isolated from load circuit (optocoupler) voltage max. + DC 32 V
high > DC 12 V < DC 32 V
low ≤ DC 5 V > 0 V
power consumption typically 3...9 mA (DC +12 V...32 V)
min. pulse duration for RESET 100 ms

**Reset signal RE**
The electronically blocked load output (blocked after overload/short circuit disconnection) may be reset via an external reset pulse (+ DC 24 V).
A common reset signal can be applied to several devices simultaneously.
RESET - pulse/edge from low (min. 100 ms) to high (min. 100 ms)

### Table 1: voltage drop, current limitation, max. load current

<table>
<thead>
<tr>
<th>Current rating IN</th>
<th>Typical voltage drop U_{ON} at IN</th>
<th>Active current limitation (typically)</th>
<th>Max. load current at 100 % ON duty at Tambient = 40 °C, Tambient = 50 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 A</td>
<td>80 mV</td>
<td>1.4 x IN</td>
<td>0.5 A, 0.5 A</td>
</tr>
<tr>
<td>1 A</td>
<td>110 mV</td>
<td>1.4 x IN</td>
<td>1 A, 1 A</td>
</tr>
<tr>
<td>2 A</td>
<td>140 mV</td>
<td>1.4 x IN</td>
<td>2 A, 2 A</td>
</tr>
<tr>
<td>3 A</td>
<td>100 mV</td>
<td>1.4 x IN</td>
<td>3 A, 3 A</td>
</tr>
<tr>
<td>4 A</td>
<td>130 mV</td>
<td>1.4 x IN</td>
<td>4 A, 4 A</td>
</tr>
<tr>
<td>6 A</td>
<td>180 mV</td>
<td>1.4 x IN</td>
<td>6 A, 6 A</td>
</tr>
<tr>
<td>8 A</td>
<td>130 mV</td>
<td>1.4 x IN</td>
<td>8 A, 7 A</td>
</tr>
<tr>
<td>10 A</td>
<td>170 mV</td>
<td>1.4 x IN</td>
<td>10 A, 9 A</td>
</tr>
</tbody>
</table>

Attention: when mounted side-by-side without convection the ESS22-T should not carry more than 80 % of its rated load with 100 % ON duty due to thermal effects.
Double Pole Electronic Circuit Breaker ESS22-T

Ordering information

Type No.
ESS22 double pole electronic circuit breaker, with current limitation

Mounting and design
TA rail mounting, with ON/OFF switch

Version
0 with double pole physical isolation at load output

Signal input
0 without signal input
1 with control input IN-/IN+
2 with reset input RE-/RE+

Signal output
0 without signal output
1 signal contacts: 1 make contact, 1 break contact

Operating voltage
DC 24 V rated voltage DC 24 V

Current rating
0.5 A
1 A
2 A
3 A
4 A
6 A
8 A
10 A

ESS22 - TA - 0 0 1 - DC 24 V 4 A ordering example

Please note:
● The user should ensure that the cable cross sections of the relevant load circuit are suitable for the current rating of the ESS22-T used.
● Automatic start-up of machinery after shut down must be prevented (Machinery Directive 98/37/EG and EN 60204-1). In the event of a short circuit or overload the ESS22-T ensures double pole physical isolation of the load circuit.

Time/Current characteristic curve (TA = 25 °C)

- The trip time is typically 3 s in the range between 1.1 and 1.4 x I_N
- Electronic current limitation occurs at typically 1.4 x I_N which means that under all overload conditions (independent of the power supply and the resistance of the load circuit) the max. overload before disconnection will not exceed 1.4 x I_N times the current rating. Trip time is between 100 ms and 3 sec (depending on overload or at short circuit).
- Without this current limitation a considerably higher overload current would flow in the event of an overload or short circuit.

Schematic diagram ESS22-TA-011

Dimensions

All dimensions without tolerances are for reference only. In the interest of improved design, performance and cost effectiveness the right to make changes in these specifications without notice is reserved. Product markings may not be exactly as the ordering codes. Errors and omissions excepted.