RACO


**Power Monitoring Relay**

- Industrial Design
- Width 55 mm
- True Power Monitoring
- Motor Temperature Monitoring
- Fault Latch
- Form C Output Contact
- Analog Output 0 to 10 V

# Thrust Overload Protection via Power Monitoring

## Introduction

The thrust level the electro-mechanical actuator is developing has a direct relationship with the electrical power consumption of the actuator motor. By monitoring and comparing the power consumption to a preset threshold value a precise maximum thrust value can be defined.

## Function

The actuator motor true power and winding temperature monitoring relay (PMR) operates in the fail safe mode for single and three phase power systems. When the actuator motor power is initially applied, a time delay begins to suppress the power spike due to the additional acceleration and inertia power requirements. The delay time is factory set and slightly longer than the inrush time

After the delay time has expired the relay de-energizes when the actuator motor power rises above the preset trip point ( his represents an over-thrust condition) or if the winding temperature is exceeded (this indicates a duty cycle abuse). The PMR unit remains locked-out with the dry relay contacts open until the reset button is pressed or the control voltage is interrupted and re-applied. An external CT may be used to extend the power range of the PMR

**Coal Unloading Facility**

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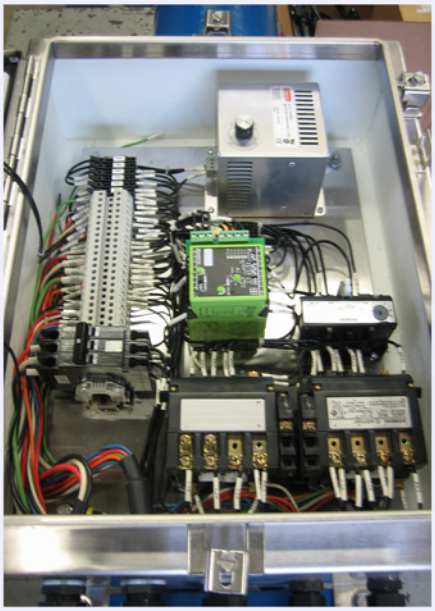
# Thrust Overload Protection via Power Monitoring

## DIP Switch Functions:



**Actuator Mounted Control Pannel:**
- **UL 508 Circuit Breaker**
- **Reversing Motor Starter**
- **Overload**
- **Power Monitoring Relay**
- **Break Rectifier**
- **Pannel Heater**

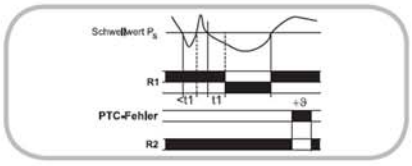
## Connection:

True power monitoring (overload or underload) of 1- and 3-phase motors with adjustable threshold, temperature monitoring of the motor winding (maximum 6 PTC), timing for start-up suppression and tripping delay separately adjustable

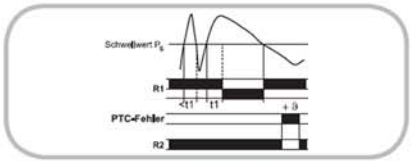
When the supply voltage U is applied, the set interval of the start-up suppression ($t_2$) begins (green LED flashes). Changes of the true power during this period do not affect the state of the output relay R. After the interval has expired the green LED is illuminated steadily.

The following functions can be selected by means of DIP-switches:

**Underload monitoring (DIP-switch 1 MIN in position ON)**
When the measured value for the true power falls below the value adjusted at the $P_S$-regulator, the set interval of the tripping delay ($t_1$) begins (red LED FAILURE flashes). After the interval has expired and if the DIP-switch RELAY (2) is in the position ON (n.c.), the output relay R1 (terminals 15-16-18) switches into off-position (red LED illuminated). When the measured value for the true power again exceeds the set value, the output relay switches into on-position (red LED not illuminated).
When the DIP-switch RELAY (2) is in the position OFF (n.o.), the mode of operation of the device remains unchanged, but the operation of the output relay is inverted.




**Overload monitoring (DIP-switch 1 MIN in position OFF)**
When measured value for the true power exceeds the value adjusted at the $P_S$-regulator, the set interval tripping delay ($t_1$) begins (red LED FAILURE flashes). After the interval has expired and if the DIP-switch RELAY (2) is in the position ON (n.c.), the output relay R1 (terminals 15-16-18) switches into off-position (red LED illuminated). When the measured value for the true power again falls below the set value, the output relay switches into on-position (red LED not illuminated).
When the DIP-switch RELAY (2) is in the position OFF (n.o.), the mode of operation of the device remains unchanged, but the operation of the output relay is inverted.



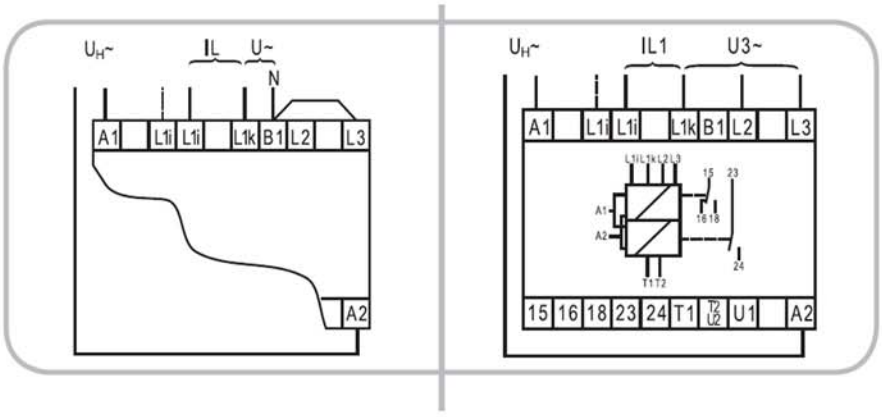

**Temperature monitoring of the motor winding**
If the cumulative resistance of the PTC-circuit is less than 1.8kΩ (standard temperature of the motor) and the DIP-switch RELAY in the position ON (n.c.) when the supply voltage U is applied (green LED illuminated), the output relay R2 (terminals 23-24) switches into on-position.
When the cumulative resistance of the PTC-circuit exceeds 3.3kΩ (at least one of the PTCs has reached the nominal cut-off temperature), the output relay switches into off-position (red LED SPTC illuminated). The output relay again switches into on-position (red LED not illuminated), if the cumulative resistance drops below 1.8kΩ by cooling down of the PTC.
When the DIP-switch RELAY (2) is in the position OFF (n.o.), the mode of operation of the device remains unchanged, but the operation of the output relay is inverted.

**Disconnected consumer (DIP-switch I=0 in position ON)**
When the current in the phase L1 is less than 5 % of the nominal value of the selected current range and the DIP-switch RELAY (2) is in the position ON (n.c.), the output relay R switches into off-position (irrespective of the actual position) and both LEDs flash.
When the current flow is restored, the measuring cycle is restarted with the set interval of the start-up suppression ($t_2$) (green LED flashes).
When the DIP-switch RELAY (2) is in the position OFF (n.o.), the mode of operation of the device remains unchanged, but the operation of the output relay is inverted.

**Fault latch true power monitoring (DIP-switch P-MEM in position ON)**
For both functions (overload as well as underload monitoring) it is possible to activate a fault latch.
When the DIP-switch P-MEM is in the position ON, a short-term error will be stored after the expiration of the tripping delay ($t_1$). The measuring cycle is restarted with the set interval of the start-up suppression ($t_2$) (green LED flashes) after activating the internal reset key or after disconnecting and re-applying the supply voltage.

**Fault latch motor temperature (DIP-switch ϑ-MEM in position ON)**
When the DIP-switch ϑ-MEM is in the position ON, a thermistor fault will be stored. The measuring cycle is restarted with the set interval of the start-up suppression ($t_2$) (green LED flashes) after activating the internal reset key or after disconnecting and re-applying the supply voltage.

**Test function (DIP-switch TEST in position ON)**
Pressing the internal test key forces the output relay R to switches into off-position, if the measured value of the true power is within the admissible range and if the DIP-switch RELAY (2) is in the position ON (n.c.).
When the DIP-switch RELAY (2) is in the position OFF (n.o.), the mode of operation of the device remains unchanged, but the operation of the output relay is inverted.

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# Thrust Overload Protection via Power Monitoring

## Technical Data:

### 1. Functions

True power monitoring (overload or underload) of 1- and 3-phase motors with adjustable threshold, temperature monitoring of the motor winding (max. 6 PTC), timing for start-up suppression and tripping delay separately adjustable

The following functions can be selected by means of DIP-switches:

| | |
|---|---|
| DIP-Switch 1 | underload monitoring (ON)<br>or overload monitoring (OFF) |
| DIP-Switch 2 | relay in on-position if fault occurs - n.o. (OFF)<br>or relay in off-position if fault occurs - n.c. (ON) |
| DIP-Switch 3 | alarm for disconnected consumer (I = 0) |
| DIP-Switch 4 | fault latch of true power monitoring (P-MEM) |
| DIP-Switch 5 | fault latch of motor temperature (θ-MEM) |
| DIP-Switch 6 | fault simulation |
| DIP-Switch 7 | time range of start-up suppression time |
| DIP-Switch 8,9 | time range of tripping delay |

### 2. Time ranges

| | Adjustment range | |
|---|---|---|
| Start-up suppression time: | 1s | 20s |
| | 5s | 100s |
| Tripping delay: | 0.1s | 5s |
| | 1s | 50s |

### 3. Indicators

| | |
|---|---|
| Green LED ON: | indication of supply voltage |
| Green LED flashes: | indication of start-up suppression time |
| Red LED flashes: | indication of tripping delay |
| Red LED ON: | indication of fault |
| All LEDs flashing: | indication of disconnected consumer (if I = 0) |

### 4. Mechanical design

Self-extinguishing plastic housing, IP rating IP40
Mounted on DIN-Rail TS 35 according to EN 50022
Mounting position: any
Shockproof terminal connection according to VBG 4 (PZ1 required), IP rating IP20
Initial torque: max. 1Nm
Terminal capacity:
1 x 0.5 to 2.5mm² with/without multicore cable end
1 x 4mm² without multicore cable end
2 x 0.5 to 1.5mm² with/without multicore cable end
2 x 2.5mm² flexible without multicore cable end

### 5. Input circuit

Supply voltage:

| | | |
|---|---|---|
| 12 to 440V AC | terminals A1-A2 | (BUT400V5X) |
| 12 to 500V AC | terminals A1-A2 | (BUT500V5X) |
| | (galvanically separated) | |
| | selectable via transformer modules TR3 | |

| | |
|---|---|
| Tolerance: | -15% to +10% |
| Rated frequency: | 48 to 63Hz |
| Rated consumption: | 4VA (3W) |
| Duration of operation: | 100% |
| Reset time: | <1s |
| Residual ripple for DC: | - |
| Drop-out voltage: | >30% of the supply voltage |

### 6. Output circuit

1 analog output: 0 to10V DC / 1mA, terminals U1-U2
1 potential free change over contact and
1 potential free normally open contact

| | |
|---|---|
| Switching capacity : | 1200VA (5A / 250V AC) |
| Fusing: | 5A fast acting |
| Mechanical life: | 20 x $10^6$ operations |
| Electrical life: | 2 x $10^5$ operations<br>at 1000VA resistive load |
| Switching frequency: | max. 60/min at 100VA resistive load<br>max. 6/min at 1000VA resistive load<br>(according to IEC 947-5-1) |
| Insulation voltage: | 250V AC (according to IEC 664-1) |
| Surge voltage: | 4kV, overvoltage category III<br>(according to IEC 664-1) |

### 7. Measuring circuit

| | | | |
|---|---|---|---|
| Input: | 1-phase mains: | voltage: | terminals L1i-B1 |
| | | current: | terminals L1i-L1k |
| | 3-phase mains: | voltage: | terminals L1i-L2-L3 |
| | | current: | terminals L1i-L1k |
| | Thermistor: | | terminals T1-T2 |
| Voltage range: | | | |
| | 1-phase mains: | 100 to 230V AC | (BUT400V5X) |
| | | 120 to 289V AC | (BUT500V5X) |
| | 3-phase mains: | 3~ 100/58 to 400/230V | (BUT400V5X) |
| | | 3~ 120/69 to 500/288V | (BUT500V5X) |
| Overload capacity: | | | |
| | 1-phase mains: | 256V AC | (BUT400V5X) |
| | | 320V AC | (BUT500V5X) |
| | 3-phase mains: | 3~ 450/259V | (BUT400V5X) |
| | | 3~ 550/316V | (BUT500V5X) |

| | |
|---|---|
| Current range: | 1 to 10A |
| Overload capacity: | 12A |
| Input resistance: | <20mΩ |
| Switching threshold $P_s$: | 0% to 100% |
| Initial resistance: | <1.5kΩ |
| Response value (relay in off-position): | ≥3.6kΩ |
| Release value (relay in on-position): | ≤1.8kΩ |
| Disconnection (short circuit thermistor): | No |
| Terminal voltage T1-T2: | max. 6V DC |

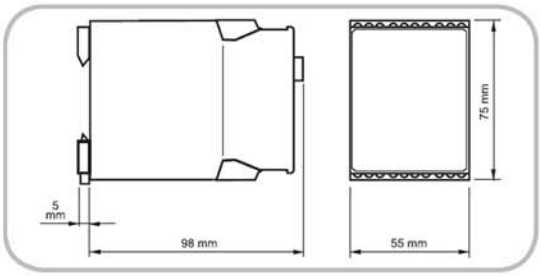
### 8. Accuracy

| | |
|---|---|
| Base accuracy: | ±5% (of maximum scale value) |
| Adjustment accuracy: | ±5% (of maximum scale value) |
| Repetition accuracy: | ±2% |
| Voltage influence: | - |
| Temperature influence: | ≤0.03% / °C |

### 9. Ambient conditions

| | |
|---|---|
| Ambient temperature: | -25 to +55°C (according to IEC 68-1) |
| Storage temperature: | -25 to +70°C |
| Transport temperature: | -25 to +70°C |
| Relative humidity: | 15% to 85%<br>(according to IEC 721-3-3 class 3K3) |
| Pollution degree: | 3 (according to IEC 664-1) |

### 10. Dimensions

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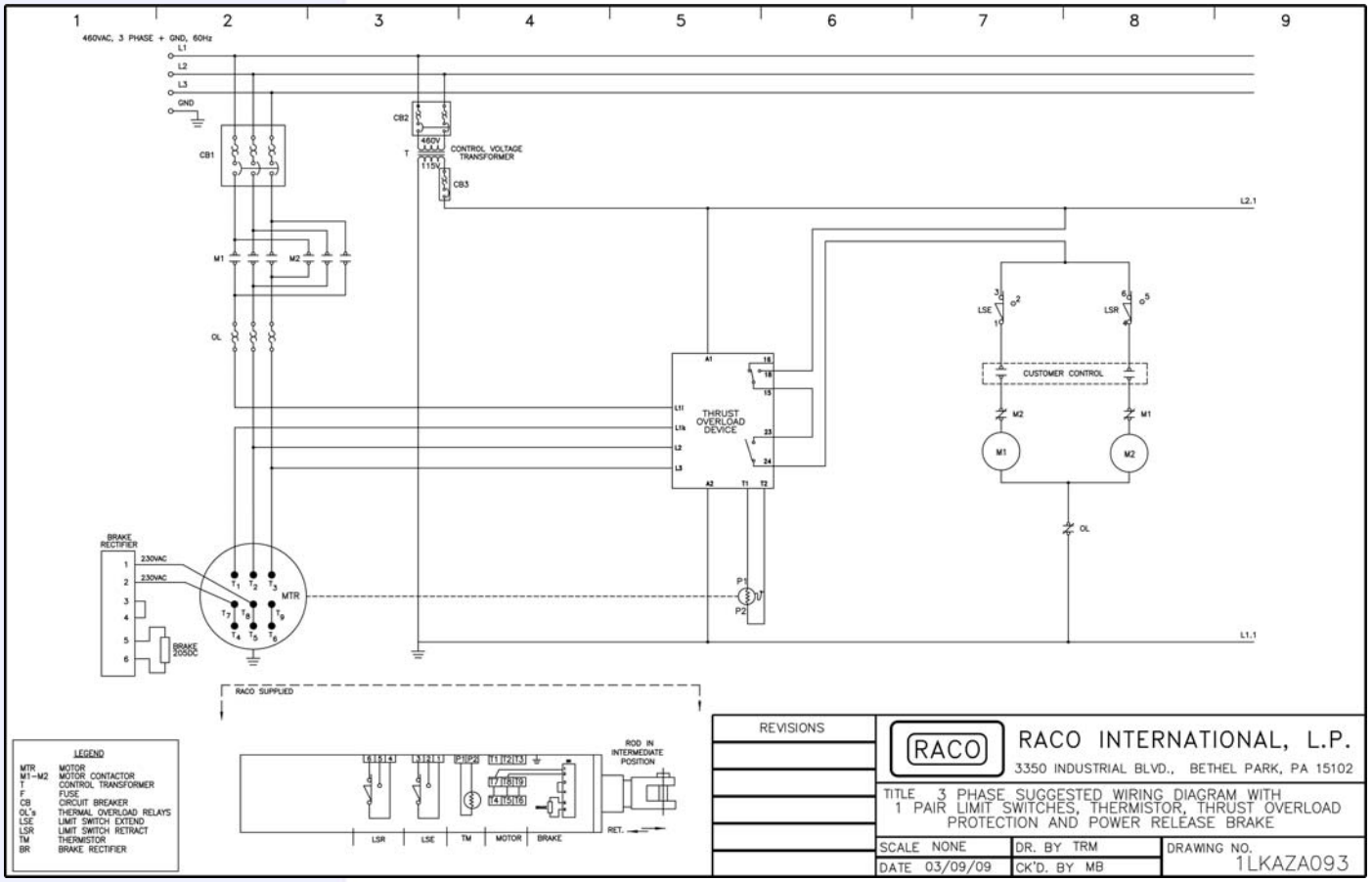
# Wiring Diagram Example




**Thrust Overload Protection via Power Monitoring and Thermal Protection**