Loadmonitors - GAMMA series
Monitoring of inductive and capacitive consumers (up to 19.6kW)

Multifunction
Temperature monitoring of the motor winding
Reset-key, Fault latch
Recognition of disconnected consumers as „good“ or „fault” state
Suitable for VFI (10 to 100Hz)
Supply voltage selectable via power modules
2 change over contacts
Width 45mm
Industrial design

Read and understand these instructions before installing, operating or maintaining the equipment.

**Technical data**

1. **Functions**
Load monitoring (cosφ) of inductive and capacitive consumers in 1- or 3-phase mains with adjustable thresholds (cosφ1, cosφ2), timing for start-up suppression and tripping delay separately adjustable, selectable fault latch, temperature monitoring of the motor winding with max. 6 PTC, reset-key and the following functions which are selectable by means of rotary switch:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2MIN</td>
<td>Minimum monitoring</td>
</tr>
<tr>
<td>2MIN+I&lt;</td>
<td>Minimum monitoring and recognition of disconnected consumers (relay ON if I&lt;)</td>
</tr>
<tr>
<td>2MAX</td>
<td>Maximum monitoring</td>
</tr>
<tr>
<td>2MAX+I&lt;</td>
<td>Maximum monitoring and recognition of disconnected consumers (relay OFF if I&lt; Inv.)</td>
</tr>
<tr>
<td>WIN</td>
<td>Monitoring the window between MIN and MAX</td>
</tr>
<tr>
<td>WIN+I&lt; Inv.</td>
<td>Monitoring the window between MIN and MAX and recognition of disconnected consumers (relay OFF if I&lt; Inv.)</td>
</tr>
<tr>
<td>MIN/MAX</td>
<td>Minimum- and maximum monitoring</td>
</tr>
<tr>
<td>MIN/MAX+I&lt; ON</td>
<td>Minimum- and maximum monitoring and recognition of disconnected consumers (relay OFF if I&lt;)</td>
</tr>
<tr>
<td>MIN/MAX+I&lt; Inv.</td>
<td>Minimum- and maximum monitoring and recognition of disconnected consumers (relay OFF if I&lt; Inv.)</td>
</tr>
</tbody>
</table>

2. **Time ranges**
Start-up suppression time: 3s 180s
Tripping delay: 1s 50s

3. **Indicators**
- Green LED U/I ON:
  - indication of supply voltage
- Green LED U/I flashes:
  - indication of start-up suppression time
- Yellow LED I=0 ON/OFF:
  - indication of disconnected consumers
- Red LED Failure ON:
  - indication of failure of the corresponding threshold cosφ1 or/and cosφ2
- Red LED Failure flashes:
  - indication of tripping delay of the corresponding threshold cosφ1 or/and cosφ2
- Red LED Temp ON/OFF:
  - indication of overtemperature
- Yellow LED Rel 1 ON/OFF:
  - indication of relay output Rel 1
- Yellow LED Rel 2 ON/OFF:
  - indication of relay output Rel 2

4. **Mechanical design**
Self-extinguishing plastic housing, IP rating IP40
Mounted on DIN-Rail TS 35 according to EN 60715
Mounting position: any
Shockproof terminal connection according to VBG 4 (PZ1 required), IP rating IP20

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<tr>
<td>Tightening torque:</td>
<td>max. 1Nm</td>
</tr>
<tr>
<td>Terminal capacity:</td>
<td>1 x 0.5 to 2.5mm² with/without multicore cable end</td>
</tr>
<tr>
<td></td>
<td>1 x 4mm² without multicore cable end</td>
</tr>
<tr>
<td></td>
<td>2 x 0.5 to 1.5mm² with/without multicore cable end</td>
</tr>
<tr>
<td></td>
<td>2 x 2.5mm² flexible without multicore cable end</td>
</tr>
</tbody>
</table>

5. **Input circuit**
Supply voltage: 12 to 500V a.c.
Tolerance: according to specification of power module
Rated frequency: according to specification of power module
Rated consumption: 3.5VA (3W)
Duration of operation: 100%
Reset time: 500ms
Ripple and noise: >30% of the supply voltage
Drop-out voltage: 1000V
Overvoltage category: III (in accordance with IEC 60664-1)
Rated surge voltage: 4kV

6. **Output circuit**
2 potential free change over contacts
Rated voltage: 250V a.c.
Switching capacity:
- 1250VA (5A / 250V a.c.)
- 2000VA (8A / 250V a.c.)
If the distance between the devices is less than 5m!
Rated voltage: 20 to 1000V a.c.
Fusing: 5A fast acting
Mechanical life: 20 x 10^6 operations
Electrical life: 2 x 10^7 operations at 1000VA resistive load
Switching capacity: max. 60/min at 1000VA resistive load
Rated surge voltage: 4kV

7. **Measuring circuit**
Measuring ranges:
- reversible between 8A (4,8kW) and 16A (19,6kW)
Wave form:
- AC Sinus: 10 to 100Hz
Measuring input voltage:
- 1-phase load: 85 to 690V a.c.
- 3-phase load: 3~ 65 to 690/400V
Overload capacity:
- 1-phase load: 796V a.c.
- 3-phase load: 3~ 796/480V a.c.
Input resistance:
- 1.25MΩ terminals i-k
Measuring input current:
- Measuring range 8A: 1 to 8A
- Measuring range 16A: 2 to 16A (for I>16A distance >5mm)
Overload capacity:
- 20A permanent
- 128A (8x16A) maximum 7 seconds,Cooldown for minimum 2 minutes!
Technical data

I< - recognition:
Current flow interruption:
- Measuring range 8A: 200mA
- Measuring range 16A: 400mA
Current flow recognition:
- Measuring range 8A: 240mA
- Measuring range 16A: 480mA
Switching threshold:
- Switching threshold cosϕ1: 0.3 to 1 (inductive)
- Switching threshold cosϕ2: 1 to 0.3 (capacitive)
Hysteresis: approx. 5% (cosϕ)

Temperature monitoring:
- Initial resistance: <1.5kΩ
- Release value (Relays in on-position): ≥3.8kΩ
- Disconnection (short circuit thermostat): no
- Measuring voltage T1-T2: ≤7.5V at R ≤4.0kΩ
- Overvoltage category: III (in accordance with IEC 60664-1)
- Rated surge voltage: 4kV

8. Control contact Y (equipotential with measuring circuit)
- Function: latch (terminal Y1-Y2 bridged)
- Loadable: no
- Control pulse length: -
- Reset: normally closed contact in the input circuit

Accuracy
- Base accuracy: ±3% (of maximum scale value)
- Frequency response: ±0.025% / Hz
- Adjustment accuracy: ±5% (of maximum scale value)
- Repetition accuracy: ±2%
- Voltage influence: -
- Temperature influence: ≥0.02% / °C

10. Ambient conditions
- Ambient temperature: -25 to +55°C (in accordance with IEC 60068-1)
- Storage temperature: -25 to +70°C (in accordance with UL 508)
- Transport temperature: -25 to +70°C
- Relative humidity: 15% to 85% (in accordance with IEC 60721-3-3 class 3K3)
- Pollution degree: 2 (in accordance with EN 60255-27)
- Vibration resistance: class 1 (in accordance with EN 60255-22-1)
- Shock resistance: class 1 (in accordance with EN 60255-22-2)

Functions

When the supply voltage U is applied (green LED U/t illuminated) the output relays Rel 1 and Rel 2 switches into on-position (yellow LED Rel 1 and Rel 2 illuminated) and the set interval of the start-up suppression time (Start) begins (green LED U/t flashes). Changes of the measured power factor during this period don’t affect the state of the output relays Rel 1 and Rel 2. After the interval has expired the green LED U/t illuminates steadily.

Applies to all cases of applications: The adjusted threshold cosϕ1 always has to be adjusted more to the right than cosϕ2. Otherwise both output relays switch into off-position (both red LEDs Failure flash alternately).

The following specifications should avoid incorrect settings:
- As soon as the measured power factor exceeds the adjusted value at the corresponding regulator cosϕ1 or cosϕ2 (red LED Failure of the corresponding threshold cosϕ1 or cosϕ2 not illuminated), the output relay Rel 1 or Rel 2 switches into off-position again (yellow LED Rel 1 or Rel 2 illuminated).
- The function 2MIN can also be used to monitor capacitive loads. In this case the monitoring function doesn’t applies if the power factor falls below the selected threshold but applies if the power factor falls below the corresponding phase angle.

Minimum monitoring (2MIN) for inductive loads
When the measured power factor falls below the value adjusted at the cosϕ1-regulator (e.g. electronic load of motor drops), the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold cosϕ1 flashes). After the interval has expired (red LED Failure of the corresponding threshold cosϕ1 illuminated), the output relay Rel 1 switches into off-position (yellow LED Rel 1 not illuminated).

When the measured power factor exceeds the value adjusted at the cosϕ2-regulator, the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold cosϕ2 flashes). After the interval has expired (red LED Failure of the corresponding threshold cosϕ2 illuminated), the output relay Rel 2 switches into off-position (yellow LED Rel 2 not illuminated).

As soon as the measured power factor exceeds the adjusted value at the corresponding regulator cosϕ1 or cosϕ2 (red LED Failure of the corresponding threshold cosϕ1 or cosϕ2 not illuminated), the output relay Rel 1 or Rel 2 switches into on-position again (yellow LED Rel 1 or Rel 2 illuminated).

Maximum monitoring (2MAX) for capacitive loads
When the measured power factor exceeds the value adjusted at the cosϕ2-regulator (e.g. electronic load of motor increases), the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold cosϕ2 flashes). After the interval has expired (red LED Failure of the corresponding threshold cosϕ2 illuminated), the output relay Rel 2 switches into off-position (yellow LED Rel 2 not illuminated).

When the measured power factor exceeds the value adjusted at the cosϕ1-regulator, the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold cosϕ1 flashes). After the interval has expired (red LED Failure of the corresponding threshold cosϕ1 illuminated), the output relay Rel 1 switches into off-position (yellow LED Rel 1 not illuminated).

As soon as the measured power factor falls below the adjusted value at the corresponding regulator cosϕ1 or cosϕ2 (red LED Failure of the corresponding threshold cosϕ1 or cosϕ2 not illuminated), the output relay Rel 1 or Rel 2 switches into on-position again (yellow LED Rel 1 or Rel 2 illuminated).

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When the measured power factor exceeds the value adjusted at the cosϕ2-regulator (e.g. electronic load of motor increases), the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold cosϕ2 flashes). After the interval has expired (red LED Failure of the corresponding threshold cosϕ2 illuminated), the output relay Rel 2 switches into off-position (yellow LED Rel 2 not illuminated).

When the measured power factor exceeds the value adjusted at the cosϕ1-regulator, the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold cosϕ1 flashes). After the interval has expired (red LED Failure of the corresponding threshold cosϕ1 illuminated), the output relay Rel 1 switches into off-position (yellow LED Rel 1 not illuminated).

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As soon as the measured power factor exceeds the adjusted value at the corresponding regulator cosϕ1 or cosϕ2 (red LED Failure of the corresponding threshold cosϕ1 or cosϕ2 not illuminated), the output relay Rel 1 or Rel 2 switches into off-position again (yellow LED Rel 1 or Rel 2 illuminated).
Delay 1s

Start Delay

The output switches into on-position again (yellow LED Rel 1 illuminated). The corresponding threshold cosφ1 not illuminated) the output relay Rel 1 (yellow LED Rel 1 not illuminated). cosφ1 illuminated), the output relay Rel 1 switches into off-position when the interval has expired (red LED Failure of the corresponding threshold cosφ1 flashes). After the interval has expired (red LED Failure of the corresponding threshold cosφ2 not illuminated). The measured power factor exceeds the adjusted value at the cosφ2-regulator (red LED Failure of the corresponding threshold cosφ2 not illuminated). The output relays Rel 1 and Rel 2 switches into off-position (yellow LED Rel 1 and Rel 2 not illuminated). As soon as the measured power factor falls below the value adjusted at the cosφ1-regulator (red LED Failure of the corresponding threshold cosφ1 not illuminated) the output relays Rel 1 and Rel 2 switches into on-position again (yellow LED Rel 1 and Rel 2 illuminated).

Window function (WIN) for inductive loads

When the measured power factor falls below the value adjusted at the cosφ2-regulator (e.g. electronic load of motor drops), the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold cosφ2 flashes). After the interval has expired (red LED Failure of the corresponding threshold cosφ2 not illuminated). The output relays Rel 1 and Rel 2 switches into on-position (yellow LED Rel 1 and Rel 2 illuminated), as soon as the the measured power factor exceeds the adjusted value at the cosφ2-regulator (red LED Failure of the corresponding threshold cosφ2 not illuminated). The output relays Rel 1 and Rel 2 switches into off-position (yellow LED Rel 1 and Rel 2 not illuminated). As soon as the measured power factor falls below the value adjusted at the cosφ1-regulator (red LED Failure of the corresponding threshold cosφ1 not illuminated) the output relays Rel 1 and Rel 2 switches into off-position (yellow LED Rel 1 and Rel 2 not illuminated).

Window function (WIN) for capacitive loads

The function WIN can also be used to monitor capacitive as well as inductive/capacitive loads. In this case cosφ1 monitors the more capacitive part and cosφ2 the more inductive part of the window. Within this window the output relays Rel 1 and Rel 2 remain in on-position. If the measured power factor falls below or exceeds the adjusted window both output relays switch into off-position.

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Minimum- and maximum monitoring (MIN/MAX) for inductive loads

When the measured power factor falls below the value adjusted at the cosφ2-regulator (e.g. electronic load of motor drops), the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold cosφ2 flashes). After the interval has expired (red LED Failure of the corresponding threshold cosφ2 not illuminated). The output relay Rel 2 switches into on-position (yellow LED Rel 2 illuminated). When the interval has expired (red LED Failure of the corresponding threshold cosφ2 not illuminated). The measured power factor exceeds the adjusted value at the cosφ2-regulator (red LED Failure of the corresponding threshold cosφ2 not illuminated). The output relay Rel 2 switches into off-position (yellow LED Rel 2 not illuminated). As soon as the the measured power factor exceeds the adjusted value at the cosφ1-regulator (red LED Failure of the corresponding threshold cosφ1 not illuminated) the output relay Rel 1 switches into on-position again (yellow LED Rel 1 illuminated).

Minimum- and maximum monitoring (MIN/MAX) for capacitive loads

The function MIN/MAX can also be used to monitor capacitive as well as inductive/capacitive loads. In this case cosφ1 monitors the more capacitive part and cosφ2 the more inductive part of the window. Within this window the output relays Rel 1 and Rel 2 remain in on-position. If the measured power factor falls below or exceeds the adjusted window both output relays switch into off-position.

Fault latch

The fault latch can be activated via bridge between the terminals Y1 and Y2. If the fault latch is activated and a failure has occurred (red LED of the corresponding threshold or red LED Temp illuminated), the failure can only be reset if no fault is active any more and by interrupting the supply voltage, by pressing the reset-key or by opening the bridge. After resetting the failure and re-applying to the supply voltage, the output relays Rel 1 and Rel 2 switch into on-position again and the measuring cycle begins with the set interval of the start-up suppression time (Start).

Note:
The fault latch remains active inspite of a I=0 recognition!

Example: Window function (WIN) - Resetting the fault latch by interrupting the supply voltage

WIN+L

Example: Window function (WIN) - Resetting the fault latch by pressing the reset-key for minimum 1 second

WIN+L

Example: Window function (WIN) - Resetting the fault latch by opening the bridge between Y1 and Y2

WIN+L

Example: Window function (WIN) - Resetting the fault latch by opening the bridge between Y1 and Y2

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WIN+L

Example: Window function (WIN) - Resetting the fault latch by opening the bridge between Y1 and Y2

WIN+L

Example: Window function (WIN) - Resetting the fault latch by opening the bridge between Y1 and Y2
Functions

Recognition of disconnected consumers

The following applies for functions, where the I=0 recognition is activated:

When the current flow between i and k is interrupted (yellow LED I=0 illuminated) and the minimum-, window- or minimum- and maximum function is activated (2MIN+I=0, WIN+I=0, MIN/MAX+I=0), the output relays Rel 1 and Rel 2 remains into on-position (yellow LED Rel 1 and LED Rel 2 illuminated).

When the maximum function is activated (2MAX+I=0), the output relays Rel 1 and Rel 2 switches into off-position (yellow LED Rel 1 and LED Rel 2 not illuminated).

When the current flow restores, the measuring cycle is restarted with the set interval of the start-up suppression time (Start) (green LED U/t flashes).

I=0 with minimum monitoring (2MIN+I=0)

The following applies for functions, where the inverted I=0 recognition is activated:

When the current flow between i and k is interrupted (yellow LED I=0 illuminated), the output relays behaves inverse to the above mentioned function.

If the minimum-, window- or minimum- and maximum function (2MIN+I=0 Inv., WIN+I=0 Inv., MIN/MAX+I=0 Inv.) is activated, the output relays Rel 1 and Rel 2 switches into off-position (yellow LED Rel 1 and LED Rel 2 not illuminated).

When the maximum function is activated (2MAX+I=0 Inv.), the output relays Rel 1 and Rel 2 remains in on-position (yellow LED Rel 1 and LED Rel 2 illuminated).

When the current flow restores, the measuring cycle is restarted with the set interval of the start-up suppression time (Start) (green LED U/t flashes).

I=0 Inv. with minimum monitoring (2MIN+I=0 Inv.)

Temperature monitoring of the motor winding

If the supply voltage U is applied (green LED U/t illuminated) and the cumulative resistance of the PTC-circuit is less than 3.6kΩ (standard temperature of the motor), the output relay Rel 2 switches into on-position if no other failure is applied! When the cumulative resistance of the PTC-circuit exceeds 3.6kΩ (at least one of the PTCs has reached the cutoff temperature), the output relay Rel 2 switches into off-position (yellow LED Rel 2 not illuminated) and a failure will be indicated (red LED Temp illuminated). The output relay Rel 2 switches into on-position again (yellow LED Rel 2 illuminated) respectively the failure will be cancelled (red LED Temp not illuminated), if the cumulative resistance drops below 1.8kΩ by cooling down of the PTC. If the fault latch is activated, a press of the reset-key is required to cancel the temperature failure.

Temperature monitoring without fault latch

Temperature monitoring with fault latch

Note: If the output relay Rel 2 should switch into on-position again, no other failure should be applied!
Connections

Connected 3~ 400/690V with power module 24V a.c. without fault latch $I_n \leq 16A$

Connected 3~ 500V with power module 500V a.c. with fault latch $I_n \leq 16A$

Connected 3~ 230/400V with power module 230V a.c. with fault latch and temperature monitoring sensor $I_n \leq 16A$

Connected 3~ 400/690V with power module 400V a.c. with fault latch and current transformer $I_n > 16A$

Connected 1~ 230V with power module 24V a.c. without fault latch $I_n \leq 16A$

Note:
Before working on current transformer circuits, these shall be short-circuited.

Dimensions

Dimensions:

- Length: 103mm
- Width: 90mm
- Height: 45mm

Note:
Before working on current transformer circuits, these shall be short-circuited.

Subject to alterations and errors