



Power factor monitoring ($\cos\varphi$) in 1- or 3-phase mains

G4CM690V16ATL20

Art. No. 2394600

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.



Danger!

Never carry out work on live parts! Danger of fatal injury! The product must not be used in case of obvious damage. To be installed by an authorized person.

Technical data

1. Functions

Load monitoring ($\cos\varphi$) of inductive and capacitive consumers in 1- or 3-phase mains with adjustable thresholds ($\cos\varphi 1$, $\cos\varphi 2$), 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:

2MIN	Minimum monitoring
2MIN+I< ON	Minimum monitoring and recognition of disconnected consumers (relay ON if I<)
2MIN+I< Inv.	Minimum monitoring and recognition of disconnected consumers (relay OFF if I< Inv.)
2MAX	Maximum monitoring
2MAX+I< ON	Maximum monitoring and recognition of disconnected consumers (relay ON if I<)
2MAX+I< Inv.	Maximum monitoring and recognition of disconnected consumers (relay OFF if I< Inv.)
WIN	Monitoring the window between MIN and MAX
WIN+I< ON	Monitoring the window between MIN and MAX and recognition of disconnected consumers (relay ON if I<)
WIN+I< Inv.	Monitoring the window between MIN and MAX and recognition of disconnected consumers (relay OFF if I< Inv.)
MIN/MAX	Minimum- and maximum monitoring
MIN/MAX+I< ON	Minimum- and maximum monitoring and recognition of disconnected consumers (relay ON if I<)
MIN/MAX+I< Inv.	Minimum- and maximum monitoring and recognition of disconnected consumers (relay OFF if I< Inv.)

2. Time ranges

	Adjustment range	
Start-up suppression time:	3s	180s
Tripping delay:	1s	50s

3. Indicators

Green LED U/t ON:	indication of supply voltage
Green LED U/t 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 $\cos\varphi 1$ or/and $\cos\varphi 2$
Red LED Failure flashes:	indication of tripping delay of the corresponding threshold $\cos\varphi 1$ or/and $\cos\varphi 2$
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

Tightening torque:

Terminal capacity:

- 1 x 0.5 to 2.5mm²
- 1 x 4mm²
- 2 x 0.5 to 1.5mm²
- 2 x 2.5mm²

max. 1Nm

with/without multicore cable end
without multicore cable end
with/without multicore cable end
flexible without multicore cable end

5. Input circuit

Supply voltage:

12 to 500V a.c.

Tolerance:

Rated frequency:

Rated consumption:

Duration of operation:

Reset time:

Ripple and noise:

Drop-out voltage:

Overvoltage category:

Rated surge voltage:

terminals A1-A2 (galvanically separated)
selectable via power module type TR3
according to specification of power module
according to specification of power module
3.5VA (3W)
100%
500ms
-
>30% of the supply voltage
III (in accordance with IEC 60664-1)
4kV

6. Output circuit

2 potential free change over contacts

Rated voltage:

Switching capacity:

If the distance between the devices is less than 5mm!

Rated voltage:

If the distance between the devices is greater than 5mm!

Fusing:

Mechanical life:

Electrical life:

Switching capacity:

max. 60/min at 100VA resistive load
max. 6/min at 1000VA resistive load
(in accordance with IEC 60947-5-1)

Withstand voltage across open contacts:

1000V_{eff} a.c.

Overvoltage category:

Rated surge voltage:

III (in accordance with IEC 60664-1)

4kV

7. Measuring circuit

Measuring ranges:

reversible between 8A (4,8kW)
and 16A (19,6kW)

Wave form:

AC Sinus:

Measuring input voltage:

1-phase load:

3-phase load:

Overload capacity:

1-phase load:

3-phase load:

Input resistance:

Measuring input current:

Measuring range 8A:

Measuring range 16A:

Overload capacity:

10 to 100Hz
terminals L1-L2-L3
85 to 690V a.c.
3~ 85 to 690/400V

796V a.c.
3~ 796/460V a.c.
1.25M Ω
terminals i-k
1 to 8A
2 to 16A (for I>16A distance >5mm)
20A permanent
128A (8x16A) maximum 7 seconds,
Cooldown for minimum 2 minutes!

Technical data

< - 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 $\cos\phi 1$: 0.3 to 1 (inductive)

1 to 0.3 (capacitive)

Switching threshold $\cos\phi 2$: 0.3 to 1 (inductive)

1 to 0.3 (capacitive)

Hysteresis:

approx. 5% ($\cos\phi$)

Temperature monitoring:

Terminals: T1-T2 (max. 6 PTC)

Initial resistance: <1.5k Ω

Response value (Relais in on-position): $\geq 3.6k\Omega$

Release value (Relais in off-position): $\leq 1.8k\Omega$

Disconnection (short circuit thermistor): no

Measuring voltage T1-T2: $\leq 7.5V$ at $R \leq 4.0k\Omega$

(in accordance with EN 60947-8)

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

9. Accuracy

Base accuracy: $\pm 3\%$ (of maximum scale value)

Frequency response: $\pm 0.025\%$ / Hz

Adjustment accuracy: $\leq 5\%$ (of maximum scale value)

Repetition accuracy: $\pm 2\%$

Voltage influence: -

Temperature influence: $\leq 0.02\%$ / $^{\circ}C$

10. Ambient conditions

Ambient temperature: -25 to +55 $^{\circ}C$

(in accordance with IEC 60068-1)

-25 to +40 $^{\circ}C$ (in accordance with UL 508)

Storage temperature: -25 to +70 $^{\circ}C$

Transport temperature: -25 to +70 $^{\circ}C$

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 $\cos\phi 1$ always has to be adjusted more to the right than $\cos\phi 2$. Otherwise both output relays switch into off-position (both red LEDs Failure flash alternately). The following specifications should avoid incorrect settings:

Monitoring of inductive loads: Both thresholds have to be adjusted in the left half (IND) of the $\cos\phi$ -scale.

Monitoring of capacitive loads: Both thresholds have to be adjusted in the right half (KAP) of the $\cos\phi$ -scale.

Monitoring of loads that can be both inductive as well as capacitive: $\cos\phi 1$ has to be adjusted in the right half (KAP) and $\cos\phi 2$ in the left half (IND) of the $\cos\phi$ -scale

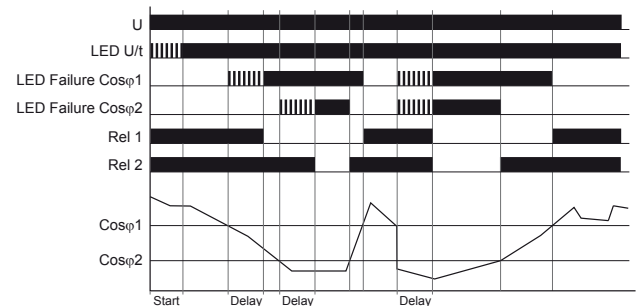
For the selection of the monitoring function it has to be taken into account that disconnected consumers effect that a measured $\cos\phi = 1$ is assumed. A measured $\cos\phi = 0.95$ up to 1 is assumed as $\cos\phi = 1$ by the device.

Minimum monitoring (2MIN) for inductive loads

When the measured power factor falls below the value adjusted at the $\cos\phi 1$ -regulator (e.g. electronic load of motor drops), the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold $\cos\phi 1$ flashes). After the interval has expired (red LED Failure of the corresponding threshold $\cos\phi 1$ 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 $\cos\phi 2$ -regulator, the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold $\cos\phi 2$ flashes). After the interval has expired (red LED Failure of the corresponding threshold $\cos\phi 2$ 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 $\cos\phi 1$ or $\cos\phi 2$ (red LED Failure of the corresponding threshold $\cos\phi 1$ or $\cos\phi 2$ not illuminated), the output relay Rel 1 or Rel 2 switches into on-position again (yellow LED Rel 1 or Rel 2 illuminated).



Minimum monitoring (2MIN) for capacitive loads

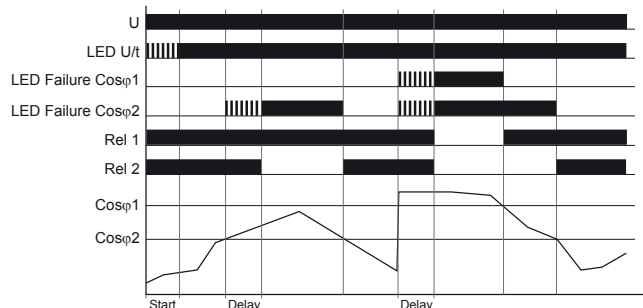
The function 2MIN can also be used to monitor capacitive loads. In this case the monitoring function doesn't applies if the power factor falls below the selected threshold but applies if the power factor falls below the corresponding phase angle.

Maximum monitoring (2MAX) for inductive loads

When the measured power factor exceeds the value adjusted at the $\cos\phi 2$ -regulator (e.g. electronic load of motor increases), the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold $\cos\phi 2$ flashes). After the interval has expired (red LED Failure of the corresponding threshold $\cos\phi 2$ 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 $\cos\phi 1$ -regulator, the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold $\cos\phi 1$ flashes). After the interval has expired (red LED Failure of the corresponding threshold $\cos\phi 1$ 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 $\cos\phi 1$ or $\cos\phi 2$ (red LED Failure of the corresponding threshold $\cos\phi 1$ or $\cos\phi 2$ not illuminated), the output relay Rel 1 or Rel 2 switches into on-position again (yellow LED Rel 1 or Rel 2 illuminated).



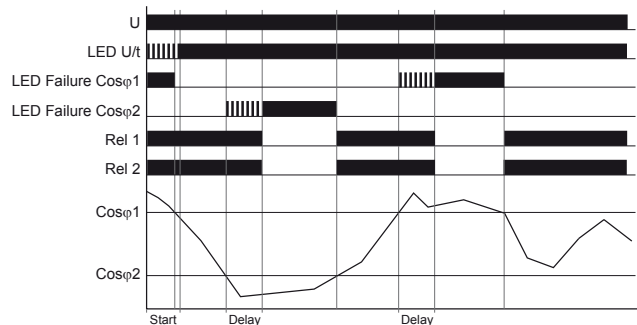
Maximum monitoring (2MAX) for capacitive loads

The function 2MAX can also be used to monitor capacitive loads. In this case the monitoring function doesn't applies if the power factor exceeds the selected threshold but applies if the power factor exceeds the corresponding phase angle.

Functions

Window function (WIN) for inductive loads

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

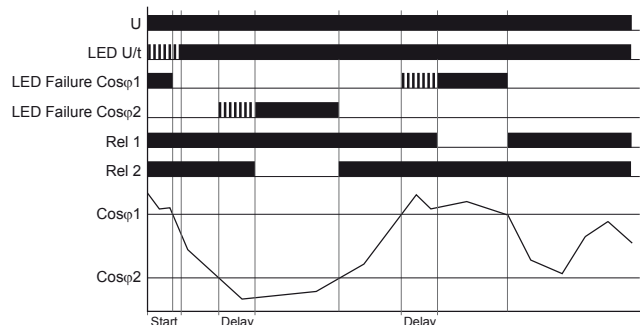


Window function (WIN) for capacitive loads

The function WIN can also be used to monitor capacitive as well as inductive/capacitive loads. In this case $\cos\phi 1$ monitors the more capacitive part and $\cos\phi 2$ the more inductive part of the window. Within this window the output relays Rel1 and Rel2 remain in on-position. If the measured power factor falls below or exceeds the adjusted window both output relays switch into off-position.

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

When the measured power factor falls below the value adjusted at the $\cos\phi 2$ -regulator (e.g. electronic load of motor drops), the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold $\cos\phi 2$ flashes). After the interval has expired (red LED Failure of the corresponding threshold $\cos\phi 2$ illuminated), the output relay Rel 2 switches into off-position (yellow LED Rel 2 not illuminated). The output relay Rel 2 switches into on-position again (yellow LED Rel 2 illuminated), as soon as the the measured power factor exceeds the adjusted value at the $\cos\phi 2$ -regulator (red LED Failure of the corresponding threshold $\cos\phi 2$ not illuminated). When the measured power factor exceeds the value adjusted at the $\cos\phi 1$ -regulator, the set interval of the tripping delay (Delay) begins (red LED Failure of the corresponding threshold $\cos\phi 1$ flashes). After the interval has expired (red LED Failure of the corresponding threshold $\cos\phi 1$ 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 value adjusted at the $\cos\phi 1$ -regulator (red LED Failure of the corresponding threshold $\cos\phi 1$ 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 $\cos\phi 1$ monitors the more capacitive part and $\cos\phi 2$ the more inductive part of the window. Within this window the output relays Rel1 and Rel2 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.

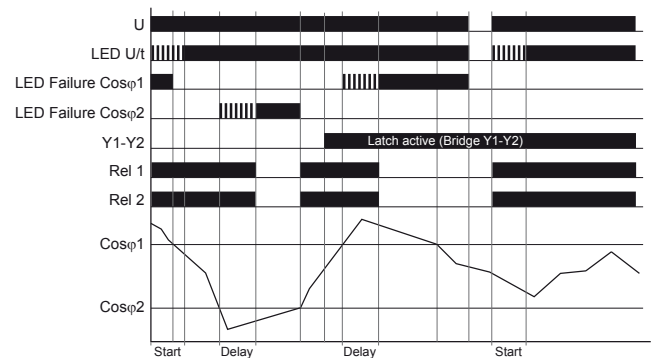
If the fault latch is activated and a failure has occurred (red LED of the corresponding threshold or red LED Temp illuminated), the failure can only be reset if no fault is active any more and by interrupting the supply voltage, by pressing the reset-key or by opening the bridge. After resetting the 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!

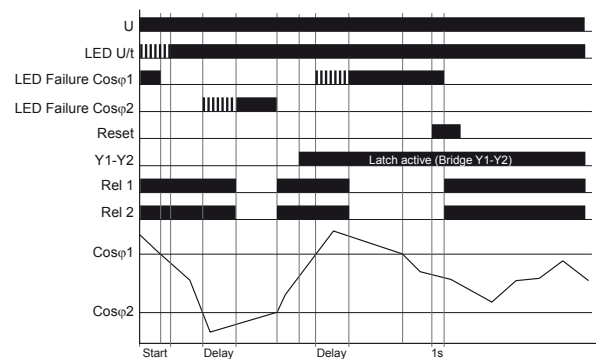
Example: Window function (WIN) - Resetting the fault latch by interrupting the supply voltage

WIN+L



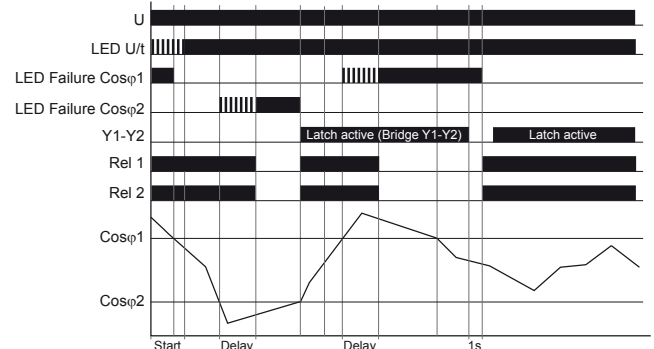
Example: Window function (WIN) - Resetting the fault latch by pressing the reset-key for minimum 1 second

WIN+L



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

WIN+L



Functions

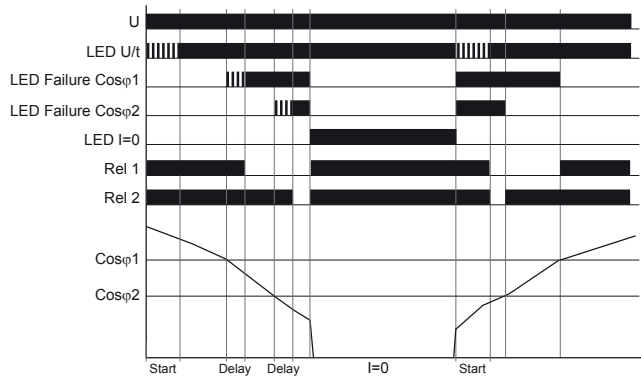
Recognition of disconnected consumers

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).

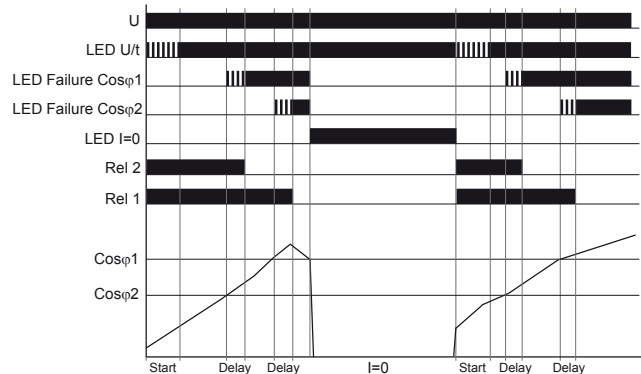
When the maximum function is activated (2MAX+I=0), the output relays Rel 1 and Rel 2 switches into off-position (yellow LED Rel 1 and LED Rel 2 not illuminated).

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)



I=0 with maximum monitoring (2MAX+I=0)



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

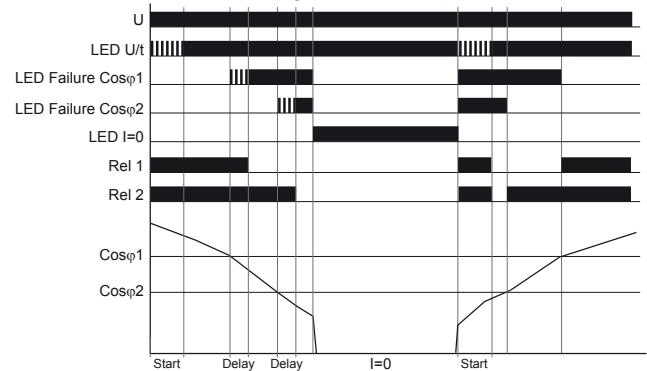
When the current flow between i and k is interrupted (yellow LED I=0 illuminated), the output relays behaves inverse to the above mentioned function.

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).

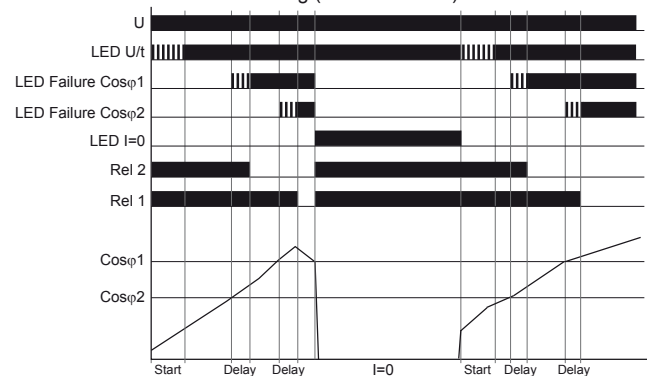
When the maximum function is activated (2MAX+I=0 Inv.), the output relays Rel 1 and Rel 2 remains in on-position (yellow LED Rel 1 and LED Rel 2 illuminated).

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.)



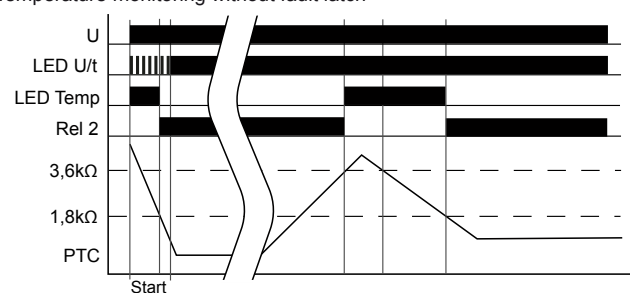
I=0 Inv. with maximum monitoring (2MAX+I=0 Inv.)



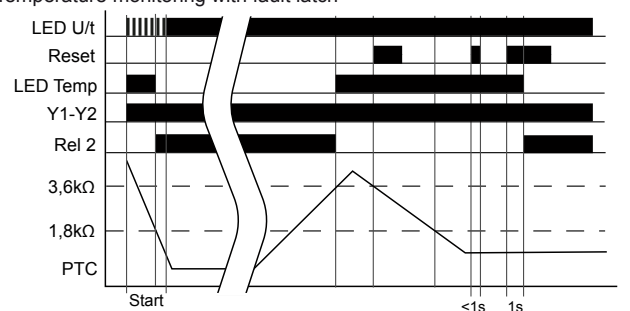
Temperature monitoring of the motor winding

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 cut-off 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



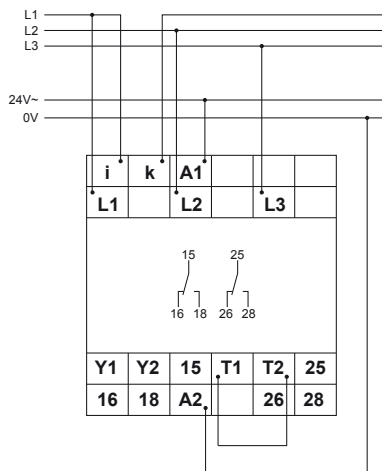
Temperature monitoring with fault latch



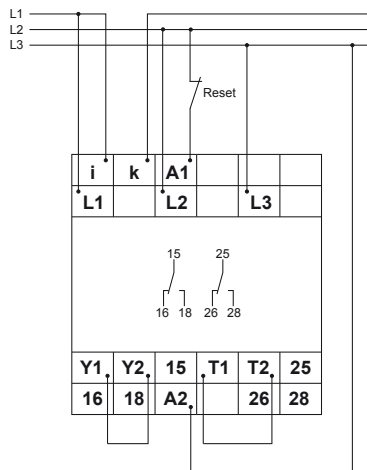
Note: If the output relay Rel 2 should switch into on-position again, no other failure should be applied!

Connections

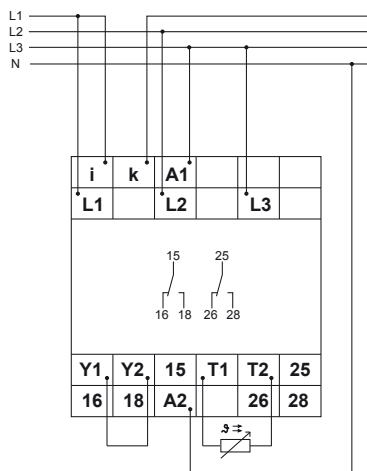
Connected 3~ 400/690V with power module 24V a.c. without fault latch $I_N < 16A$



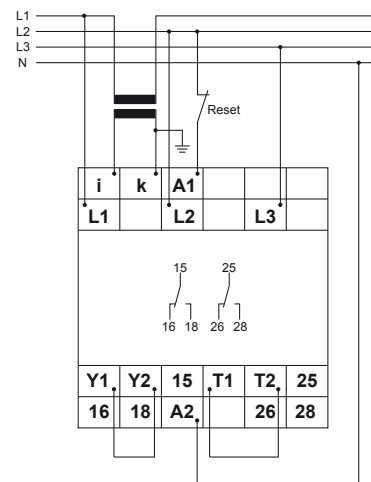
Connected 3~ 500V with power module 500V a.c. with fault latch $I_N < 16A$



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



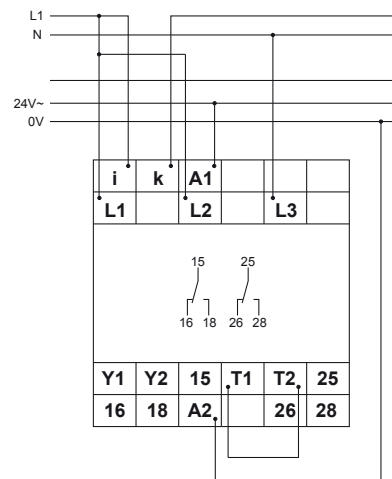
Connected 3~ 400/690V with power module 400V a.c. with fault latch and current transformer $I_N > 16A$



Note:

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

Connected 1~ 230V with power module 24V a.c. without fault latch $I_N < 16A$



Dimensions

