

FAULT INDICATOR TYPE FLA4

for overhead-lines

General description

The fault indicator type FLA4 is designed to be used on overhead lines of a medium voltage network. The type FLA4 can detect faults with two methods. The short-circuit detection method monitors the network current with a fixed threshold and a response delay filter. The fixed threshold can be manually adjusted or automatically calculated on basis of the current load and an adjustable factor.

The earth-fault detection method monitors the deviation of the current load within a certain amount of time with a di/dt algorithm. If the increase of the load current exceeds an adjustable current value, the voltage status of the network is monitored. In case of a voltage loss a fault is detected.

Configuration by remote control

All settings of the indicator can be adjusted very flexibly with the help of a remote control. In this way, the configuration of the device can be adjusted at any time without removing the indicator from the network.

The bidirectional short-range radio communication between indicator and remote control also allows to read out the configuration of the indicator, temperature values, the voltage status of the network and current measurements from the network.

Installation and indication

The indicator can be mounted under live conditions with the help of an adapter and a hot stick. The indication of faults is performed by an ultra bright flashing LED with focussing lens for optimized light distribution for enhanced visibility in the distance.

SCADA integration

The fault indicator type FLA4 can be connected to the remote indication interface type RIS via the integrated short-range radio module. This allows an easy-to-install and retrofittable integration of the overhead line indicators into remote monitoring systems.

Features and Options

Fault detection by threshold:	Manually adjustable trip current with adjustable response delay filter
Automatic mode:	Trip current can be calculated with a factor on basis of the current load with adjustable upper limit.
di/dt fault detection:	Faults detection on basis of current load deviation with subsequent voltage loss.
Temporary fault detection:	Detects situations when the network recovers after fault detection, e.g. by automatic reclosing of the network
Inrush current detection:	Overcurrents are filtered up to 5sec after network energization
Current-on filter:	This filter helps to filter out high currents which trigger the indicator but do not shut down the network.
Enhanced power supply:	Internal super-capacitors are charged by the network current. The device is self-sustained from a network current load of 4A upwards. Lithium batteries will supply the device during longer downtimes as fallback power supply.
Full wireless configuration:	All settings can be changed and read-out with the handheld remote type HS control or by the remote indication interface type RIS-FS.
Live data read-out:	Current load, voltage status and conductor and system temperature read-outs can be wirelessly read-out by remote control or remote indication interface.



figure 1: Fault indicator type FLA4

Internal log:	Up to 100 log entries for events and configuration changes with date and time stamp
Voltage detection:	Two threshold levels can be selected for a better detection of the voltage status: - voltage off level: percentage of U_n when the voltage is considered as off - voltage on level: percentage of U_n when the voltage is considered as on
Remote indication:	Faults, resets and voltage or current status changes can be remotely indicated.
Remote data-logging:	Regular remote transmissions for data read-outs of current loads, voltage status and internal temperature are configurable in short intervals. (Please see the data sheet of the remote indication interface type RIS-FS for more information.)



figure 2: Remote control type HS

Advanced features

Enhanced automatic mode with upper limit

The automatic mode of the type FLA4 continuously calculates an absolute threshold on basis of the current load. It uses an adjustable factor between 1.5 and 5.0 to calculate the trip current. In this way, the absolute threshold adapts automatically to the network conditions which can be useful in networks with strong fluctuations of the load current.

But this could result in very high trip currents on higher current loads which may not be suitable. Therefore an upper limit for the calculation of the trip current can be adjusted as shown in figure 3.

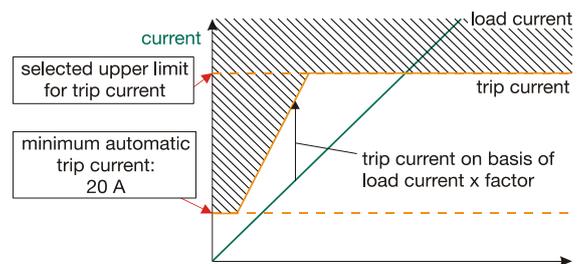


figure 3: automatic mode with maximum trip current (shaded area = fault currents)

Internal log and real-time clock

The fault indicator features an internal log with 100 entries. In this log the following events and configuration changes are recorded.

- Detected faults including type of fault and fault current
- Reset of the indication including the trigger for the reset
- Remote indications (if activated)
- Network current drop and recovery / voltage drop and recovery (if activated)
- Configuration changes of the trip currents, the response delay time and the current-on-filter

A real-time clock provides date and time stamps for each log entry.

Voltage detection with two thresholds

The type FLA4 has a voltage detection module with two thresholds. The voltage-off threshold is adjusted through a percentage value of the existing voltage level. The percentage value can be selected in a range from 20% to 90% of U_n . This means that the voltage is considered to be off when the voltage drops below the selected level of U_n .

In order to avoid detecting fluctuating voltage on and off states a voltage-on threshold can be selected. This second threshold determines when the voltage is to be considered as on. This should be selected on a higher percentage value of U_n than the voltage-off threshold.

In this way, the fault indicator can detect clearly distinguished voltage states as shown in figure 4.

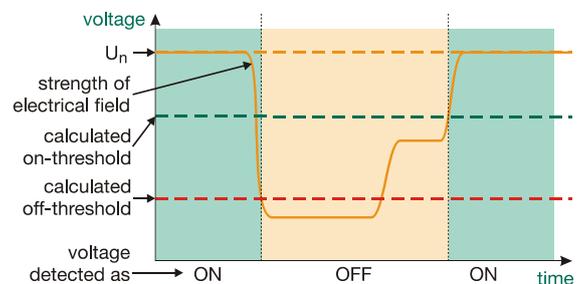


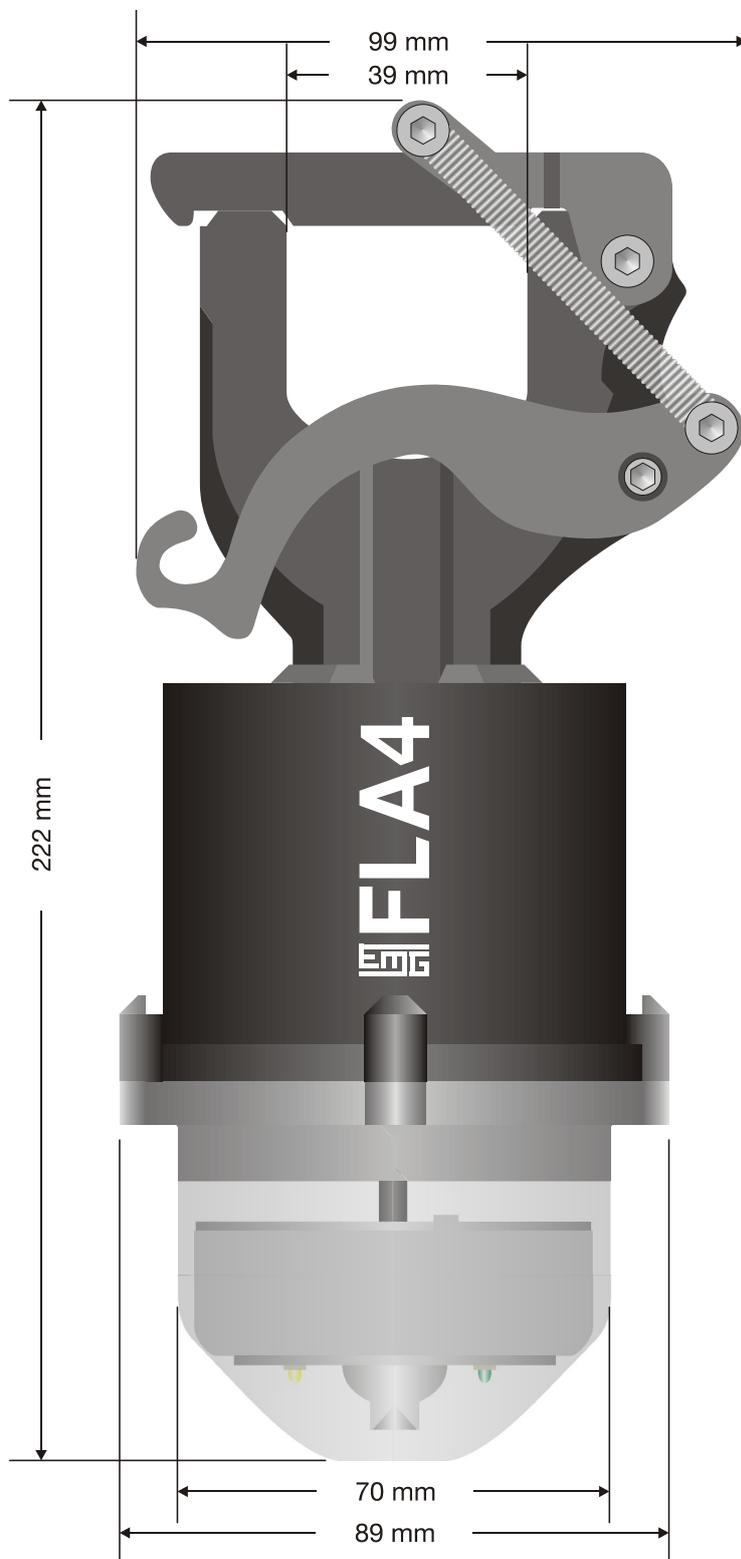
figure 4: Voltage-on and voltage-off detection

General Data

Subject	Value
Absolute threshold detection method (can be disabled)	<ul style="list-style-type: none"> a) standard mode: fixed trip value 20A to 1500A (in steps of 10A) b) automatic mode: automatically adjusted factor 1.5 to 5.0 (in steps of 0.5) of service current with optional adjustable maximum threshold
di/dt detection method (can be disabled)	di/dt measurement and subsequent voltage loss: di: 5A to 160A (in steps of 5A) dt: 20ms at 50Hz / 16ms at 60Hz
Response delay	selectable between 20ms and 300ms (in steps of 10ms)
Voltage detection	two thresholds selectable: a) voltage off detection level: from 20% to 90% of U_n (in steps of 10%) b) voltage on detection level: from 20% to 90% of U_n (in steps of 10%)
Indication of a) all faults b) status c) temporary faults	<ul style="list-style-type: none"> a) ultra-bright red LED b) yellow LED c) additional blinking of green LED
Blinking frequency	30 per minute (0.5 Hz)
Visibility	170m at day time in bright sunshine 2km at night time
Reset of the indicator	<ul style="list-style-type: none"> a) by remote control b) by time: selectable from 0.5h to 24h (in steps of 0.5h) c) by recovering service current: optional yes/no d) by recovering net voltage: optional yes/no
On site function test	by remote control
Temperature read-out	by remote control of a) conductor temperature b) system temperature
Dimensions	(WxDxH) 98mm x 89mm x 222mm
Weight	630g
Protection class	IP65
Housing material	PA66, Carbotex K20 UVR
Internal type tests	According to IEEE 495-2007
Operation temperature range	-20°C to +70°C
Cable diameter ranges	5 mm - 38 mm
Power supply	<ul style="list-style-type: none"> a) super-capacitors charged by energy harvesting from network b) 2x lithium batteries (LiSOC12) type A / 3.6V / 3600 mAh (extendable to 3x lithium batteries)
Maximum operating voltage	$\leq 40kV$
Current withstand	25 kA / 170ms Sym. RMS
Communication	433MHz bidirectional radio interface to remote control type HS and remote indication interface type RIS

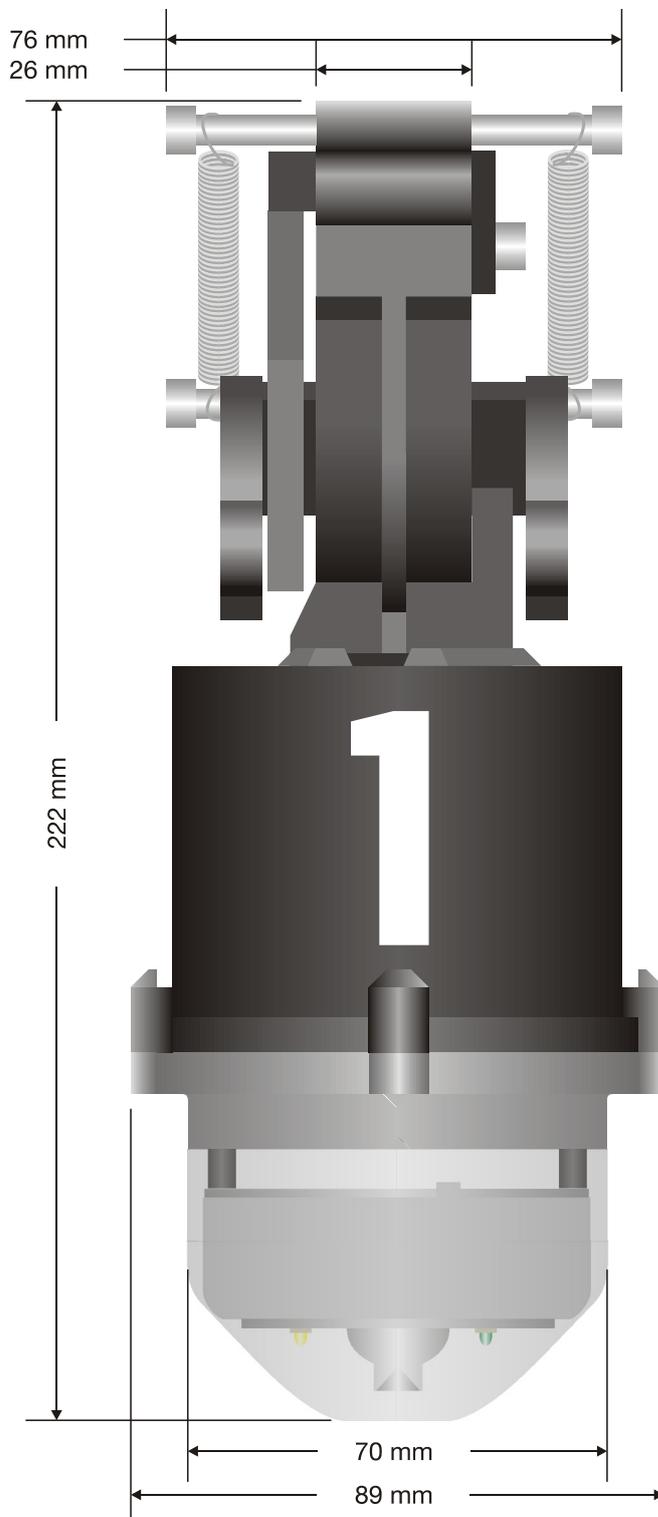
Subject	Value
Remote indication	<ul style="list-style-type: none">a) faults and the reset of the indicatorb) current on/off events or voltage on/off eventsc) data-logging of current loads, voltage status, internal temperature
Internal log	<p>100 log entries with date and time stamp for:</p> <ul style="list-style-type: none">a) events (fault indications, resets, remote indications)b) changes of important settings (trip current, response delay, current-on filter)

Front view



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Side view



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