



# LineTroll<sup>®</sup> 3100

User Manual

LineTroll<sup>®</sup>



## **This document describes the Installation-, configuration and use of LineTroll 3100/3100K/3100T**

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<b>Rev.</b>	<b>Date:</b>	<b>Description:</b>	<b>Sign.</b>
2a	24.11.06	Information about the Xenon-flash version added Ext DC +/-GND for relay card corrected	TV
3	06.02.08	Added info reg transient faults, new prog.table, For LT 3100 (not 3100K) manif. From 2008→ possible to choose both 2,5A and 4A + minor corrections	TV
4	04.09.08	Minor changes in description of installation + reset-input	TV

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## Definitions

As the terminology may differ from country to country we will throughout this presentation use the following definitions:

Short circuit fault	- Phase to phase fault
Earth fault	- Single phase to ground fault
Transient fault	- Intermittent fault
LineTroll	- LT
LED	- Light emitting diode
Xenon flash	- High intensity strobe flash
Circuit breaker	- CB
Inrush blocking	- Inrush restraint
Energized	- Line with voltage present
De-energized	-Line with no voltage present

# 1. LineTroll 3100 OVERVIEW.

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LineTroll 3100 series consist of three versions the LineTroll 3100K, 3100 and 3100T (For differences see technical specification)

The LineTroll 3100 is used to locate short-circuit and earth faults in overhead line distribution networks. LineTroll 3100 is a 3-phase unit fully covering the different fault configurations that may occur.

The indicators are placed at strategic locations along the line such as after branching points and sectionalisers.

It mounts on the pole, 3-5 meters below the conductors by means of screws or wrapping-bands. Live line mounting is done safely, easily and rapidly.

Upon detecting a fault on the line, the indicator gives off an intermittent LED flashing or an optional Xenon flash. This flash can be seen within 200-300metres distance (for Xenon up to 1,5 km at night) during night. The lens of the indicator can be turned to either side for optimal visibility

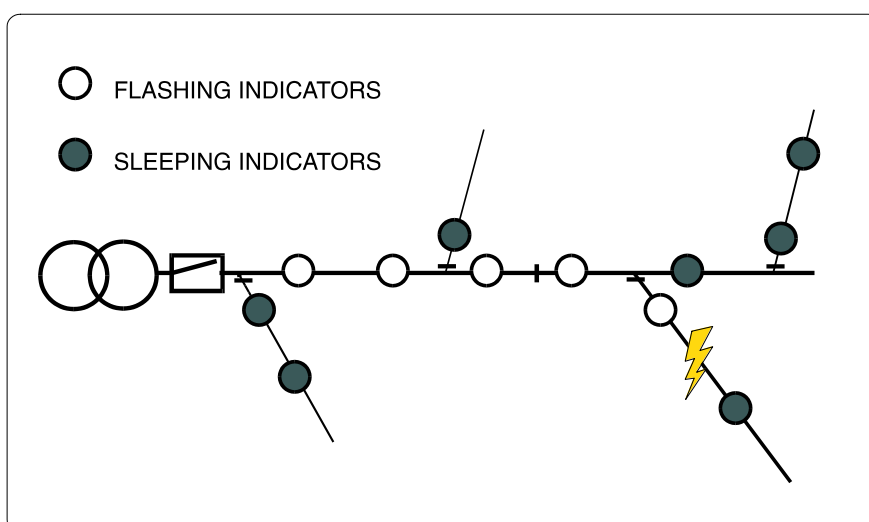


Figure. 1. Indicators during a fault situation

Upon fault sensing, all indicators installed between the feeding substation and the fault will operate. The indicators placed behind the fault remain idle.

LineTroll 3100 provides fast fault location enabling reduction in outage times. This represents enhanced service to the customers thereby improving the utilities image.

Another important aspect of using fault indicators is that unnecessary operations of circuit breakers and sectionalisers to locate faults are avoided. This way the indicators help to reduce wear and tear as the reclosing cycles causes stress to the switchgear.

## 2. Functional Description.

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LineTroll 3100's fault sensing is based on detection of the electromagnetic field below the conductors.

The unit is fully self-contained, no external transformers or connections of any kind are required.

To determine whether or not the line is faulted, the indicator is looking for a specific sequence in the line conditions to happen before it starts flashing. The general sequence is as follows: (ref. fig.2)

1. The line should be energised for at least 5 seconds.
2. The line current should increase rapidly above the value set by the user (the nominal trip level).
3. The line should be de-energised.

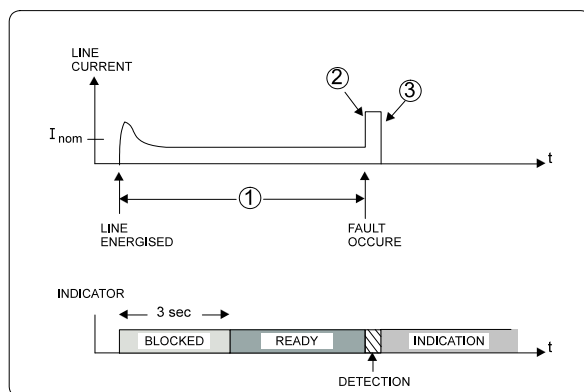


Figure 2. Fault sequence.

However, the user might program the criteria for operation to suit his local requirement by manipulating a bank of micro-switches inside the indicator.

### 2.1 Adaptive detector

The measured magnetic field (=B-field) is applied to an adaptive dB/dt detector.

This detector automatically adjusts to the normal conditions on the line.

Slow variations in load current will not affect the detector.

A fault current will cause a rapid increase in the B-field which the detector will respond to.

The detector will now require that two conditions is satisfied:

1. The relative increase dB[%] is greater than a certain level.
2. The absolute increase dB [ $\mu$ T] is greater than a pre-set value.

The second condition is the trip-level, which can be set by the user to different values; see section for Programming.

The corresponding B-field can be found by using the formula:

$$B[T] = \mu_0 \cdot I_{SET} / (2\pi d)$$

where  $\mu_0 = 4\pi 10^{-7}$  (free space permeability)  
 $I_{SET} = 4, 7, 15$  or 50A  
 $d = 3m$  (distance conductor-indicator)

**Example:**

$$I_{SET} = 7A \Rightarrow B = 0.47 \mu T$$

## 2.2 Operation Criteria

As mentioned the indicator is looking for a specific sequence. This sequence requires the following criterion to be fulfilled to activate the indicator:

### Inrush blocking time:

The line voltage has to be present for approximately 5 sec. before any fault current will be detected.

This blocking time avoids indication upon magnetising inrush currents during line energising.

### Fault current passage:

The fault current has to generate the required increase in the magnetic field as described in section 2.1.

If these two criteria are fulfilled the fault is detected and stored.

Whether the fault should be indicated or not depends on what happens on the line and how the indicator is programmed.

### Circuit Breaker (CB) tripping:

Setting: CB-trip enabled:

Line de-energised within 5/10 sec:  $\Rightarrow$  Indication

Line not de-energised within 5/10 sec:  $\Rightarrow$  No indication

Setting: CB-trip disabled:

$\Rightarrow$  Indication not dependent on de-energised line.

**NB!** If programmed for voltage reset the indicator reset after 15/30 sec if the line is not de-energised within this time.

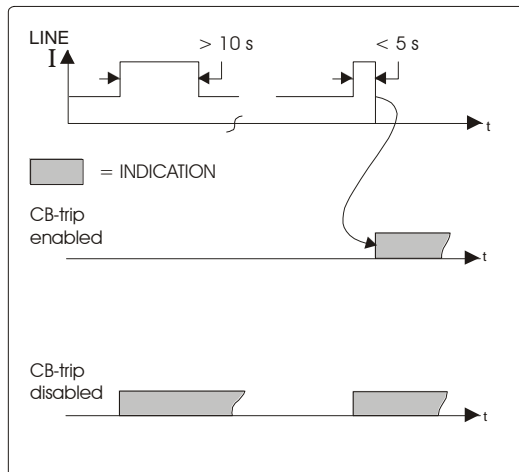


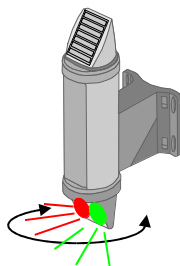
Fig. 3. CB-tripping

If LT 3100 is to be used in a network with no tripping due to earth fault the CB-tripping must be disabled to obtain indication of earth fault.

If these two criteria are met in the correct sequence, the indicator starts indicating.

## Indication

Please note that LT3100 are also available with a Xenon-gastube as the main indication. This is described in next chapter.



### 1. LED indication Dual mode; transient and permanent fault indication

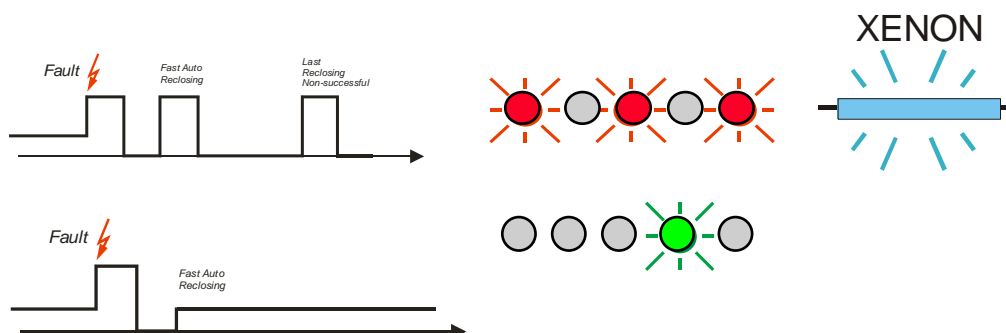
The indicator can be set both to indicate permanent as well as transient faults.

Permanent faults: 3 Red LED's or Xenon-flash

Transients faults: A single Green LED

(Dual mode only activated if CB trip is set to ON)

**NB:** With the optional Xenon flash, the flash pattern follows the **RED** LED's.

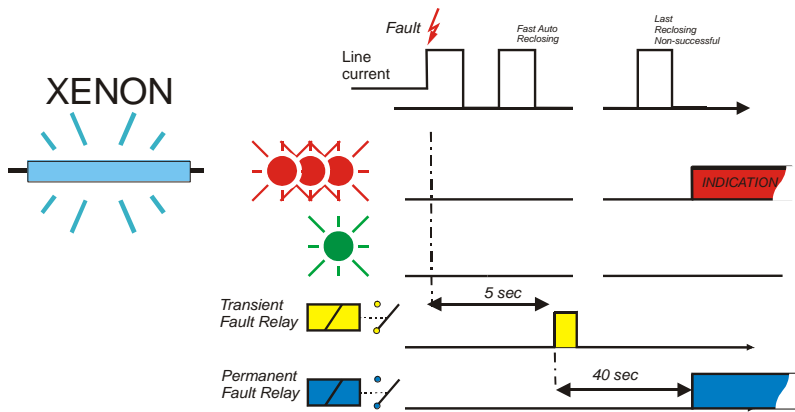




## Relay operation Dual mode:

If indicator supplied with Relay-card, two NO relay contacts are available for connection to a RTU for remote indication.

The transient relay closes (1 sec), 5 sec (or 10) after the fault occur, even if the fault develop to a permanent fault or not.



The Permanent relay closes if the fault sequence is considered as a permanent fault, and remains closed until indicator is reset.

## Reset Criteria

The indicator can be reset in three different ways:

### 1. Voltage reset

Automatic reset on return of voltage:

Voltage reset can be programmed to:

- i) OFF,
- ii) ON, delayed 15 or 30 sec

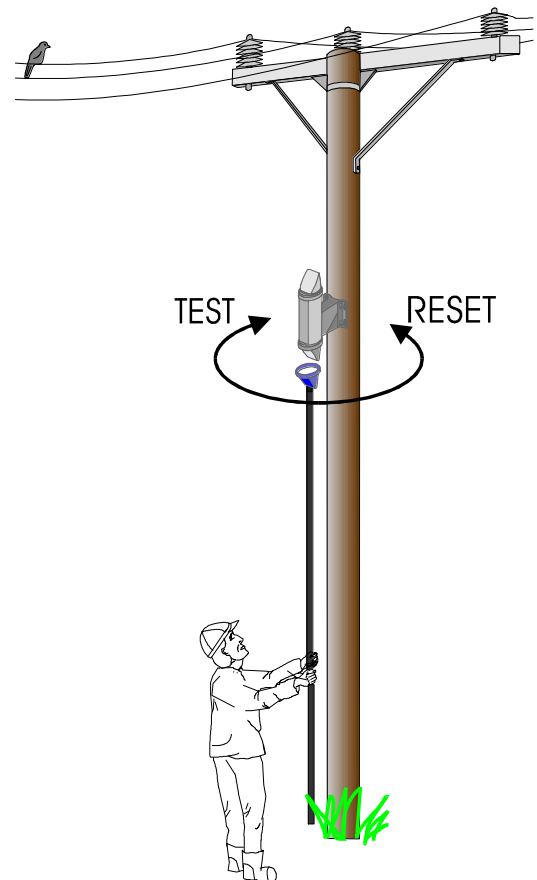
### 2. Automatic timer-reset

Programmable to: 1.5, 3, 6 or 12 hours.

### 3. Manual reset

LineTroll 3100 can be reset by turning the lens clockwise to "RESET" position. A magnet is permanently mounted in the lens.

A special hot-stick-attachable tool is available for resetting of the indicator from the ground when mounted on a pole.



## 3. Applications

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The application of LineTroll 3100 usually requires a previous line survey so that the best use of it may be obtained.

For the best economic benefit it is recommended that the indicators are used:

- In easily accessible line points for easy monitoring of the indicator in case of fault, for instance near the road. It is advisable to take binoculars.
- Before and after line points difficult to reach (mountains, woods, etc.) to quickly locate the fault.
- Next to lines branching points, to easily locate the damaged branch.  
When installing indicators at such points, the use of indicators in every branch is recommended in order to provide complete information in the event of fault. Not doing so may cause confusion since there may be an indication in a branch due to a non-permanent fault while another branch without indicator may be faulty yet considered healthy.
- Near line points with sectionalisers to rapidly pinpoint and isolate the fault to facilitate rapid reconnection the healthy sections.

### LineTroll 3100 is suitable in:

- 6-66kV distribution networks
- 66- 175kV (LT3100-T)
- > 175kV (contact NORTROLL AS)
- Radial lines.
- Isolated-neutral networks.
- Solidly-earthed-neutral networks.
- Resistance-earthed-neutral networks.
- Single and 3-phase network

### Do not use LineTroll 3100 on:

#### 1. Poles:

- with underground cables
- with T-offs
- with double circuit lines
- with sectionalisers
- with distribution transformers
- closer than 300 metres to 220-440 kV lines
- closer than 150 metres to 132 kV lines
- closer than 100 metres to 66 kV lines
- closer than 50 metres to 33 kV lines
- closer than 35 metres to 22 kV lines

2. Lines protected with fuses
3. Ring lines or multiple feed lines.
4. Line points where capacitive discharge current from the network downstream exceeds trip level can activate the indicator.
5. Nearby trees

## 4. Application Notes

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The aim of this section is to describe how the LineTroll 3100 indicator behaves in different service situations and network events.

### Line Switching

#### Connecting a healthy line

As the magnetising inrush current of a line can be very high, the indicator is provided with a 5 seconds blocking of the dB/dt sensor which prevents it from being activated until the line current is stabilised. Once the blocking time has elapsed, the indicator is enabled for fault detection.

See fig. 2.

#### Connecting of faulted line when indicator is not indicating

This will not cause any indication for the same reason as for connection of a healthy line. The blocking time will avoid any indication.

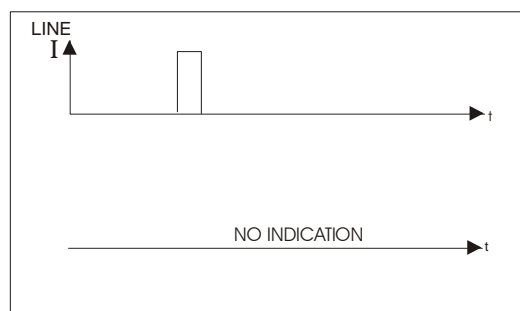


Fig.8. Connecting a faulty line

## Faults

### Permanent fault

Permanent faults will be indicated by red LED's.

The time out for the LED can be set by the user to 1.5, 3, 6, or 12 hours.

If the line is restored within the time-out, the LED's will reset, assuming that the voltage reset is enabled

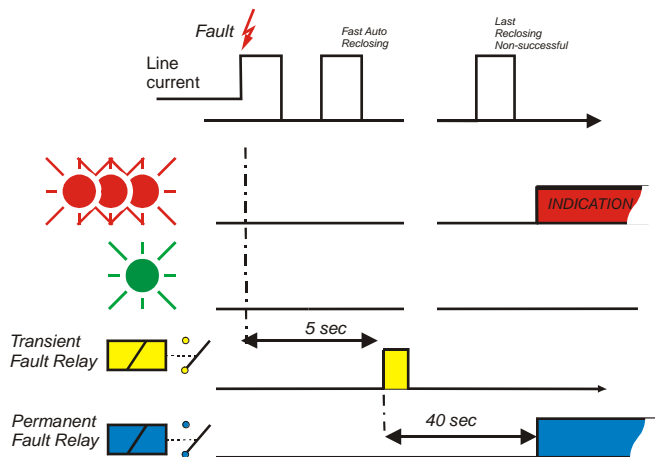


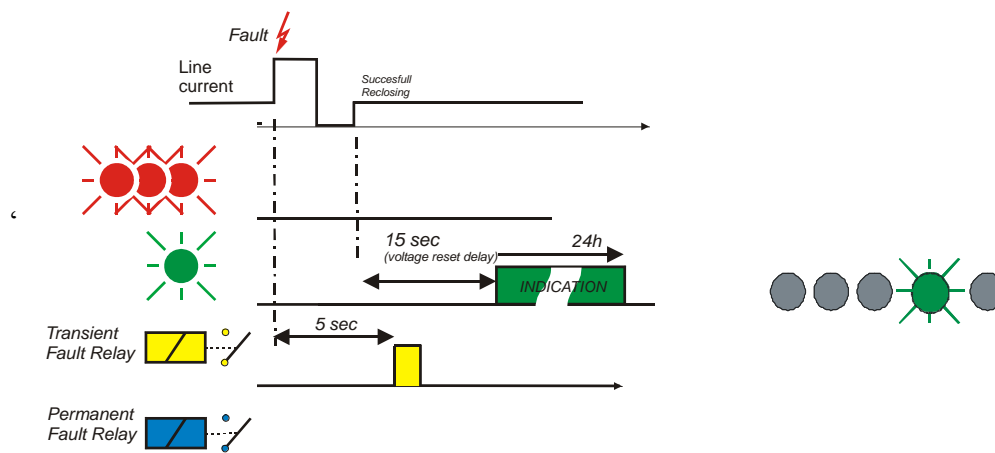
Fig.5 Permanent fault.

### Second fault while indicating a previous fault

If a second fault occurs whilst the LT 3100 is indicating a previous permanent fault the indicator will continue to indicate for the first fault. Before it can detect the next fault while indicating a permanent fault, it must be reset.

### Transient (temporary) faults

If the fault is cleared on the automatic re-closings and the line returns back to normal service; a single green LED will flash for 24 hours. During this 24 hours period the indicator is ready to detect new faults. If the new fault is a permanent fault, the indicator will start indicating the latter permanent fault.



## Automatic reclosing

An automatic reclosing will not activate a non-flashing indicator.

If the indicator is indicating a previous fault, the operation due to a reclosing depends on whether the reclosing is successful or not.

### Non-successful reclosing

Closing a breaker onto a fault leads to another trip almost instantly. As the activated indicator needs either 15/30 seconds with the line energised in order to reset, the indicator remain flashing.

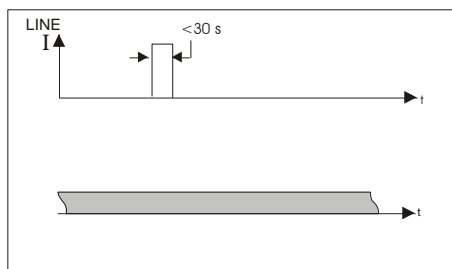


Fig.12. Reclosing upon a faulted line.

### Successful reclosing

The operation due to a successful reclosing depends on the setting of the voltage reset:

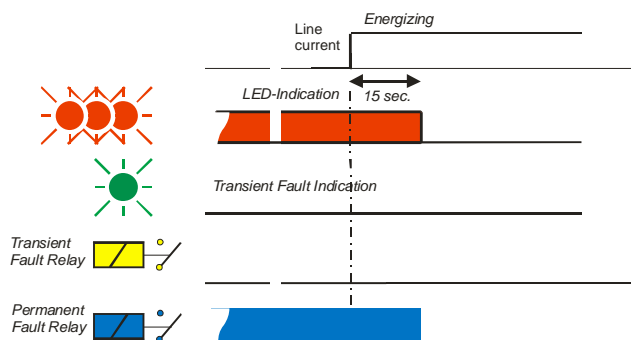


Fig.13. Successful reclosing

## Fused lines

One operation criterion is that, after a fault, a three-phase disconnection of the line has to be carried out. If, instead of a three-phase trip, a fuse operates in one or two phases, the voltage of the healthy phase might reset the indicator. This is true for indicators placed before the fuse as well as after it.

When the criterion CB tripping is enabled, LineTroll 3100 is not activated unless the fault causes a three-phase trip in the feeding within 5 sec (or 10) after the occurrence of the fault.

If CB tripping is disabled, the indicator is activated but will reset after 15/30 sec., unless the fault causes a three-phase trip in the feeding end within this time.

If the voltage reset is switched off, the indicator will continue flashing until it is reset manually or after the automatic timer period has elapsed.

## Multiple faults

Multiple faults may occur. Defective network components may burn or break due to the electro-dynamic force of the fault current and cause a second fault.

Another cause of multiple faults in isolated networks is the rise in voltage in the healthy phases with reference to ground.

The voltage may reach up to 1.7 times the nominal voltage. Weak insulators may not withstand such a voltage increase, and a second fault may occur.

This kind of fault may be difficult to trace as they often are non-permanent and only appear in situations like the ones mentioned here.

## Capacitive discharges

The LineTroll 3100 indicator is not directional, it therefore detects current without discriminating its direction. In case of an earth fault, the capacitive energy of the network discharges in the fault point. It should be checked that the capacitive discharge current downstream the indicator is below pre-set trip level in order to avoid the indicator erroneously activating upon earth faults.

If the total capacitive current exceeds the trip level, it is advisable to change the trip level or install the indicators in the branching points instead of in the main line. The capacitive discharge of a branching point is limited by its own capacitance, while in the main line the capacitive current of all the branches downstream the indicator is added. Underground cables have larger capacitance than overhead lines. This has to be taken into account when an overhead line feeds an underground cable.

The following simplified formula may be used to estimate the capacitive discharge current of a line:

$$I_c = \frac{U \cdot L_L}{300} + \frac{U \cdot L_C}{K}$$

$I_c$  = Capacitive current in A

$U$  = Nominal voltage in kV

$L_L$  = Overhead line length in km

$L_C$  = Cable length in km

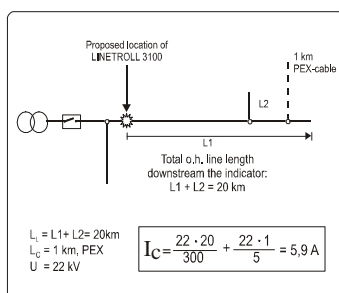
$K$  = 10; for oil impregnated cables, 5; for PEX cables, 3; for PVC cables

In order to avoid the LineTroll 3100 being activated by an earth fault upstreams the indicator, the following criteria have to be met.

$$(1) \quad I_c < I_{SET}$$

$I_c$  = capacitive discharge current      downstream the indicator.  
 $I_{SET}$  = max. sensitivity for      earth fault; 4,7,15 or 50A.

To estimate the capacitive discharge current at any line point, you have to calculate the contribution from all the overhead lines and underground cables lengths only beyond that point.



**Fig.14. Capacitive discharge current calculation example.**

## Setting and location

In network with the feeding transformers neutral isolated from the earth, earth fault current normally is low.

In such network its important to do a thoroughly analysis of the network to find the correct installation and settings.

Two criteria must be satisfied:

In order to **avoid false indication** due to discharge current during earth faults the following criteria have to be met:

$$(1) \quad I_c < I_{SET}$$

$I_c$  = Capacitive discharge current behind the indicator.

$I_{SET}$  = maximum sensitivity for earth fault; 4,7,15 or 50A.

To **obtain correct indication** during earth fault the following criteria have to be met:

$$(2) \quad I_{SET} < I_0 - I_c$$

$I_0$  = Total earth fault current  
in the net.

Comparing (1) and (2) gives the limit for the  $I_{SET}$ :

$$I_c < I_{SET} < I_0 - I_c$$

## Sensitivity

### Earth faults

LineTroll 3100 monitors the resulting

magnetic field under the line.

The sensitivity for earth faults is a function of the following variables:

1. The trip level set on the indicator;  
4, 7, 15 or 50 A. (See section 2.1)
2. Load current of the line when the fault occurs.
3. Line configuration on the pole where the indicator is located.
4. The distance between the conductors and the indicator.

### Short circuit faults

The indicator requires that two conditions is satisfied in order to detect a short circuit fault:

1. The relative increase dB[%] is greater  
than a certain level (100% or 200%)
2. The absolute dB [ $\mu$ T] is greater  
than a pre-set value; 100, 200, 500 or 1000A ref to an indicator located 3 meters below a  
flat line configuration with 1,5m conductor spacing. More narrow spacing will  
increase these values.



The indicator will indicate the fault by flashing the red (or green) LEDs (or Xenon), and closing of the fault relays (i.e. same as for earth fault).

### Recommended distances

The fault current which is necessary to generate a sufficient increase in magnetic field depends on; i) the indicators distance from the conductor, ii) the line configuration and iii) the load current. The distance from the conductors is measured from the lowest conductor.

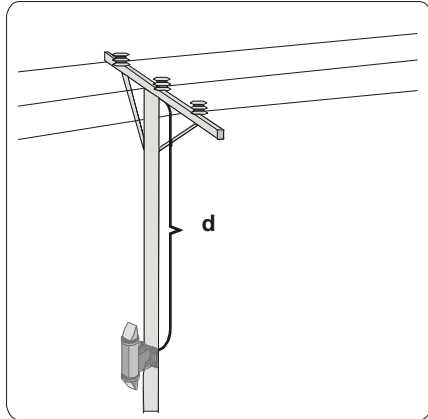
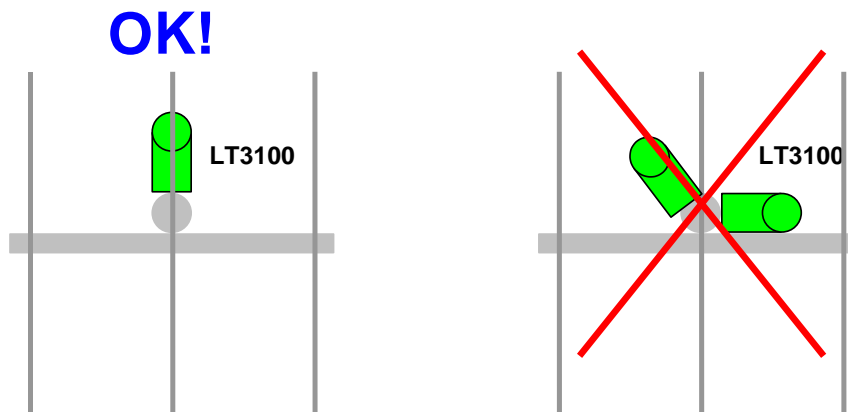


Fig. 16. Distance from conductors

Install the indicator in the line-direction, see below.



## 5. Programming

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Programming of the unit is done from a switch-bank on the printed circuit board located under the top-cap.

*See the figure below for switch ON/OFF definition. Switch combinations which are not shown should not be used.*

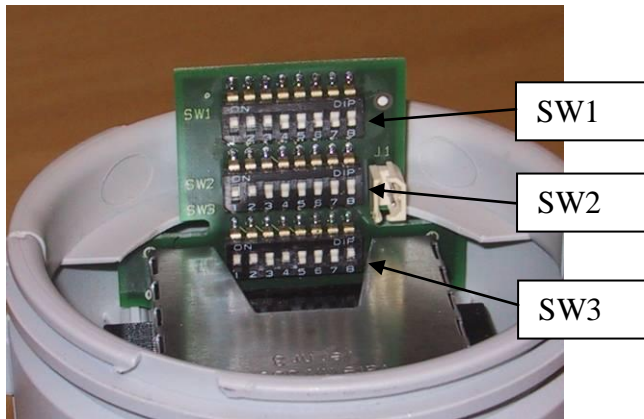


Fig. 17. Setting operation mode with DIP switches

### Sensitivity

The maximum sensitivity (lowest detectable current) for earth fault current can be set to 1 out of 4 nominal values of 2.5A\*) 7A, 15A or 50A. LT3100K max sensitivity is 4A.

### Timer reset

Timer reset can be set from 1.5 to 12 hours.

### CB tripping within 5 or 10 sec.

If enabled, the line must be de-energised within 5 sec or 10sec. after the fault occurrence to give indication.

### Voltage reset.

The voltage reset function works after 15 or 30 sec. The line must have been continuously energised for the programmed period before indicator resets.

The voltage reset can even be disabled.

## Programming parameters:

<b>SW 1 (1=ON,0=OFF)</b>	<b>Values:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
Transient fault relay closing time	1 sec	0							
	3 sec	1							
Threshold Earth Fault (PtG) *) 4A → 2,5A if SW3d7 is ON (1) Valid for LT3100 only (not 3100K & 3100T)	4 A*)		0	0					
	7 A		0	1					
	15 A		1	0					
	50 A		1	1					
Short Circuit dI/dt relative increase	100%				0				
	200%				1				
Absolute threshold PtP-Short Circuit	100 A					0	0		
	200 A					0	1		
	500 A					1	0		
	1000 A					1	1		
Min fault duration PtG (Earth Fault)	60 ms							0	
	120 ms							1	
Min fault duration PtP (Short Circuit Fault)	60 ms								0
	120 ms								1

<b>SW 2 (1=ON, 0=OFF)</b>	<b>Values:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
CB-trip	OFF	0							
	ON	1							
Automatic Voltage reset	OFF		0						
	ON		1						
Delay Voltage reset	15 sec			0					
	30 sec			1					
Automatic timer reset	1,5 h				0	0			
	3 h				0	1			
	6 h				1	0			
	12 h				1	1			
Delay before permanent indication (relay operation) NB! + transient delay time	40 sec						0	0	
	70 sec						0	1	
	120 sec						1	0	
	180 sec						1	1	
Delay (CB-trip) transient indication	5 sec								0
	10 sec								1

<b>SW 3 (1=ON, 0=OFF)</b>	<b>Values:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
Transient indication 24h Green LED	OFF	0							
	ON	1							
Extended indication of perm faults For Xenon only; single Red LED	OFF		0						
	ON		1						
Short range radio address	1			0	0				
	2			0	1				
	3			1	0				
	4			1	1				
Relay card						0			
QuickLink or GSM-modem						1			
Reset of battery counter (see user guide) default = off (0)							0		
High sensitivity PtG: 2,5A. **) SW1d3,4 must both be in pos off (0)	4A							0	
	2,5A**)							1	
Always OFF (Debug info)									0

**NB!** After programming the indicator must be reset in order to save and initiate the new settings.

**\*\*) NB!** This setting (both 4A and 2,5A) is available only for LT-3100 manufactured/delivered from 2008 → and with SW-rev: LT3100\_V2.1 & LT3100\_V2.1X. Previous versions had 2,5A or 4A setting, not both! LT 3100K do not have 2,5A setting.

## 6. Maintenance

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It is advisable to inspect the indicator once a year or 1 year after it was last activated. The inspection should include a functional test to show that the flashlight frequency is normal.

### Battery monitoring

LineTroll3100 is equipped with an internal battery counter that keeps track of battery capacity used. When the counter exceeds a predefined number of mAh, the indicator alarms the user by blinking the yellow LED in a 6 seconds interval.

Low battery warning will be initialized when approximately 80% \*) of the total capacity is used (i.e. two standard lithium batteries).

\*) 94% on version v01a.

### Replacement of batteries

After replacing the batteries, the internal battery counter must be reset. This is done by setting dip switch 3 in position ON, followed by a manual reset (i.e. turning the display-unit clock-wise until it stops and then back to normal position.) The indicator will indicate that the battery counter has been reset by flashing both green and yellow LEDs.

The indicator will remain in this state until the dip is turned in position OFF, and a new RESET operation has been performed.

## 7. LT 3100 TECHNICAL SPECIFICATIONS

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**LT 3100K\*)** for MV networks 6-66KV

**LT 3100** for MV networks 6-66KV

**LT 3100T** for MV networks 6-400KV (Transmission networks)

\*) **The LT 3100K** is a special unit with reduced features, and normally quoted on special tenders only. Of the same reason the specification may be changed and adapted to individual tenders without further notice:

The basic differences compared to LT 3100 are:

- No cable for interface card mounted
- No event log implemented in SW
- 2,5A sensitivity for PtG-faults not available
- No HW for ext DC via relay card (in case of upgraded with cable)

### Maximum sensitivity for magnetic field (B-field):

Ref. distance from conductors: 3m.

I <sub>SET</sub>	B-field: [μT]	
2,5A	0.14	+/-20% (LT3100 only)
4A	0.27	"
7A	0.47	"
15A	1.00	"
50A	3.33	"

If distance is 5m, and setting is 4A => the max sensitivity will be  $(4A/3m) \times 5m = 6,7A$

### Blocking time for inrush:

5 seconds

### Indication criteria:

- 1) Line energised for more than 5 seconds  
- followed by a
- 2) Line current increasing by at least 100% (or 200%) within 20ms and reaching a level that exceeds the programmed trip level and fault duration  
- followed by a
- 3) Circuit Breaker tripping within 5 sec (or 10 sec) after the fault occurrence  
(can be disabled).

### Required fault duration

60 or 120 msec (3 or 6 x 50Hz cycles) programmable

### Indication LED

Indication by a cluster of 5 high intensity LED's:

3 x Red: Permanent Fault Indication

1 x Green : Transient Fault Indication

1 x Yellow : Low battery and Installation information

### Indication Xenon (Optional)

Indication by : Xenon and LED's:

1 x Red : Permanent Fault Indication

1 x Green : Transient Fault Indication

1 x Yellow : Installation information

**Reset:**

- 1) Voltage reset: 15 or 30 sec.
- 2) Timer reset: 1.5, 3, 6 or 12 hours
- 3) Manual reset by rotating the lens.

**Battery**

2 Lithium battery; 3.6V 2x16.5Ah at 5mA @ 20°C.  
Lifetime: 8year, > 5000 flashing hours.  
Space for 1 additional battery on request.  
Current consumption: 400uA in normal state

**External dc:**

External DC input 10-24 VDC

**Ambient and storage temperature**

-40°C to + 74°C

**Built inn short range radio:**

Future option for remote reading of log a, test and reprogramming  
(Normally not activated)

**Battery monitoring:**

LT3100 is equipped with an internal battery counter that keeps track of battery capacity used.  
The indicator alarms the user by blinking the yellow LED in a 6 seconds interval. Low battery warning will be initialized when approx. 80%

**Event log:**

LT 3100 and LT 3100T has built in event LOG that can be read by connecting the unit to a PC via a cable.

**Communication modules: (Optional)**

All versions of LT 3100 can be equipped with communication modules such as relay card, short-range radio and GSM unit.

**Housing Material**

Body & bracket: Polycarbonate (PC) with glass reinforcement.  
Top-cap and lens: Transparent Poly carbonate, UV resistant.  
Flame retardent grades: (V-0 UL) 750 deg. celsius  
Mechanical strength: IK09 (10J impact)  
IP: 55 (Cat.2)

**Dimensions & Weight:**

Complete indicator in cardboard box:      Weight: 1400 grams.  
Volume: (100 x 380 x 200 mm)

### Test standards:

<b>Protection degree of enclosures</b>	
EN50102	Verification of protection degree (IK-choc)
EN60529	Classification of protection degree (IP-ingress)
<b>Climatical test</b>	
IEC 60068-2-1	Test to cold
IEC 60068-2-2	Test to dry heat
IEC 60068-2-78	Continuous test in humid heat
IEC 60068-2-11	Salt mist chamber
<b>Electrical tests</b>	
EN 61000-6-3	Emmision (EN 55022)
EN 61000-6-2	Immunity to electrical disturbances
IEC 61000-4-2	Immunity to electrostatic discharges
IEC 61000-4-3	Immunity to electromagnetic fields
IEC 61000-4-4	Immunity to electrical transients
IEC 61000-4-5	Immunity to voltage impulse waves
IEC 61000-4-8	Immunity to magnetic fields at network frequency
ENV 50204	Immunity to rayed electromagnetic fields by mobile telephones
EN 300 440 – V1.3.1 (2201-09)	Electromagnetic compatibility and Radio spectrum Matters (ERM) Short Range Devices, Radio euipm. To be used in the 1GHz to 40 GHZ freq.range. Part 1.

## 8. Dimensions

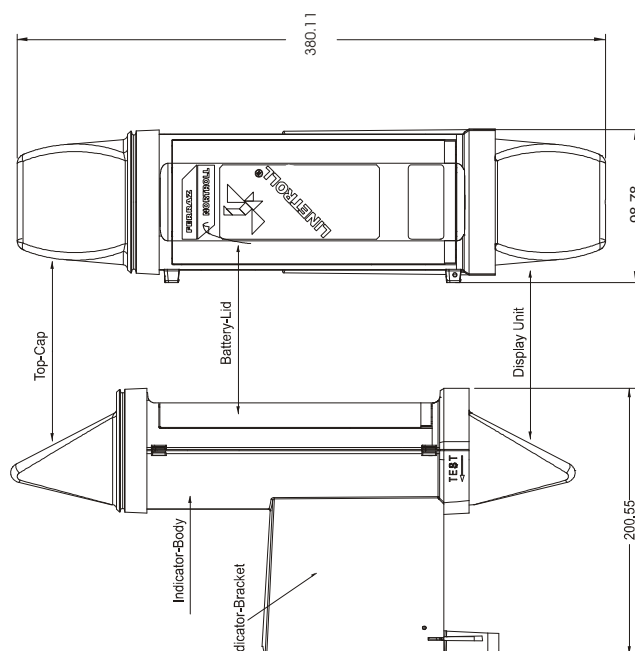


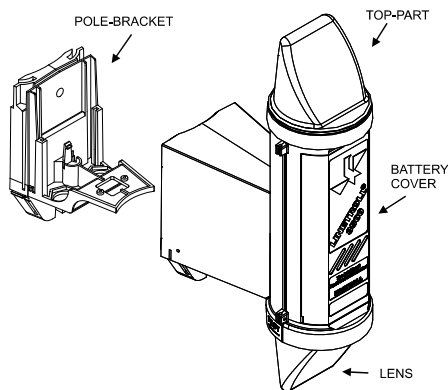
Fig.20. Dimensions

## 9. Mounting Instruction

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### General:

When the LT 3100 detects a fault current it will indicate this by flashing LED's or by closing of relay contacts if connected to an RTU. The LT 3100 will keep flashing until a predetermined automatic reset condition has been fulfilled.



### Commissioning

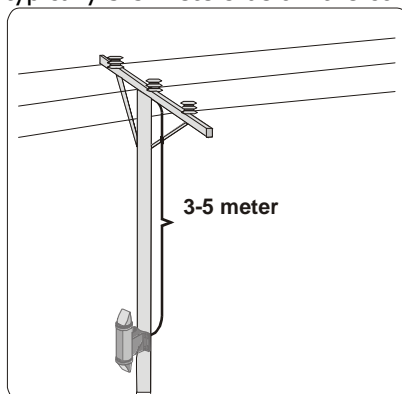
Check that the batteries or the external DC is connected.

If the LT 3100 is not already programmed, this can be done setting the dipswitches located under the top-cap.

NB! If switches are changed, RESET the indicator in order to initiate the new settings.

### Mounting

The LineTroll 3100 mounts on the pole typically 3-5 meters below the conductor.



*Fig.20. Distance on the pole.*

The indicator can be mounted on the pole with French screws or with two cable ties.

#### Note!

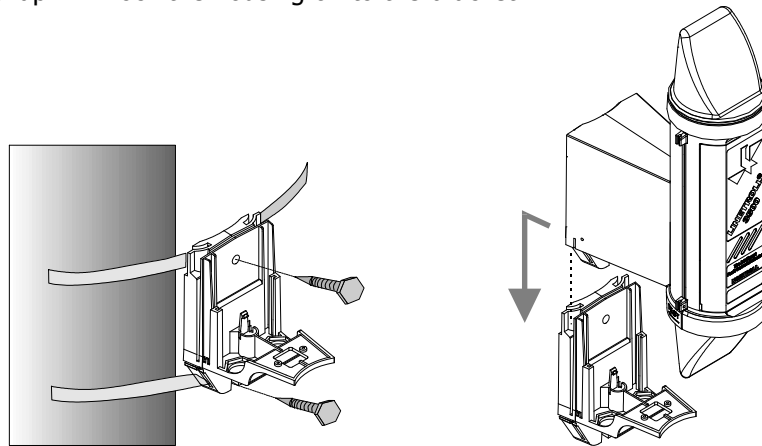
The indicator must be aligned with the direction of line, see fig 20.

Out of alignment will reduce the sensitivity for the fault current.

When the indicator bracket is mounted on the pole with screws it is recommended to first screw the lower screw in to the pole and then put the bracket on to this screw before putting in the second screw.



When the bracket has been mounted on the pole with either screws or cable-ties the indicator housing can be slid down onto the bracket. When the housing is in the correct position a "snap" will lock the housing on to the bracket.



## RESET

The indicator can be RESET by turning the display-unit clock-wise until it stops and then back to normal position.

## TEST

The indicator can be TESTED by turning the display-unit counter-clockwise until it stops and then back to normal position.

## INSTALLATION

The indicator must be installed on an energized line. After the unit is mounted on the pole, and any connection to a RTU is done, the unit has to be adapted to the local Electro-magnetic field, and adjust the internal gain.

1. Turn the display unit counter-clockwise (→ TEST) until it stops. Leave the display unit in the test position, and then climb down minimum 1 m in order to not interfere with the EM-field.
2. After a 10sec with running LED's the results from the adaption will be indicated by one or two LED's:

- a. GREEN: Installation is OK



The green LED flash for approximately 10sec, then it is ready for detecting faults. **Remember to return the lens to normal position.**

- b. RED: E-field too low; the indicator may be installed closer to the lines.  
 c. YELLOW: Setting for *Absolute Short Circuit Fault* level is too low; increase the level (SW1-5 and SW1-6) and repeat the installation.



Indication of incorrect installation remains until reset.

## 10. Relay card connection

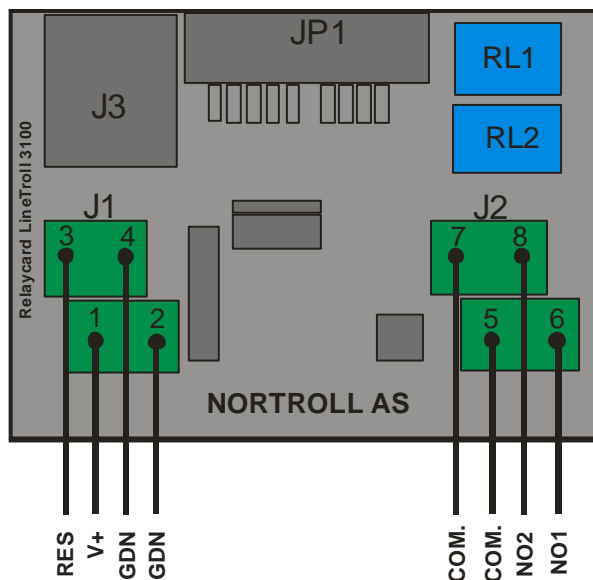
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For LT 3100 only, not LT3100K!

**LineTroll 3100 with relay card**



**Relay card connection diagram**



- |    |      |  |
|----|------|--|
| 1. | V+   | 12 - 24V DC voltage  |
| 2. | GND  | Ground   |
| 3. | RES  | External Reset (active when connected to GND)<br>NB! Do NOT apply any voltage to the rest-input. |
| 4. | GND  | Ground   |
| 5. | COM. | Common   |
| 6. | NO1  | Permanent fault  |
| 7. | COM. | Common   |
| 8. | NO2  | Transient fault  |