LineTroll®

Product Catalog

Fault Passage Indicators to locate short circut and earth faults

ComTroll®
System for Remote Control and Automation of Medium Voltage distribution networks

Contents

SICAME GROUP

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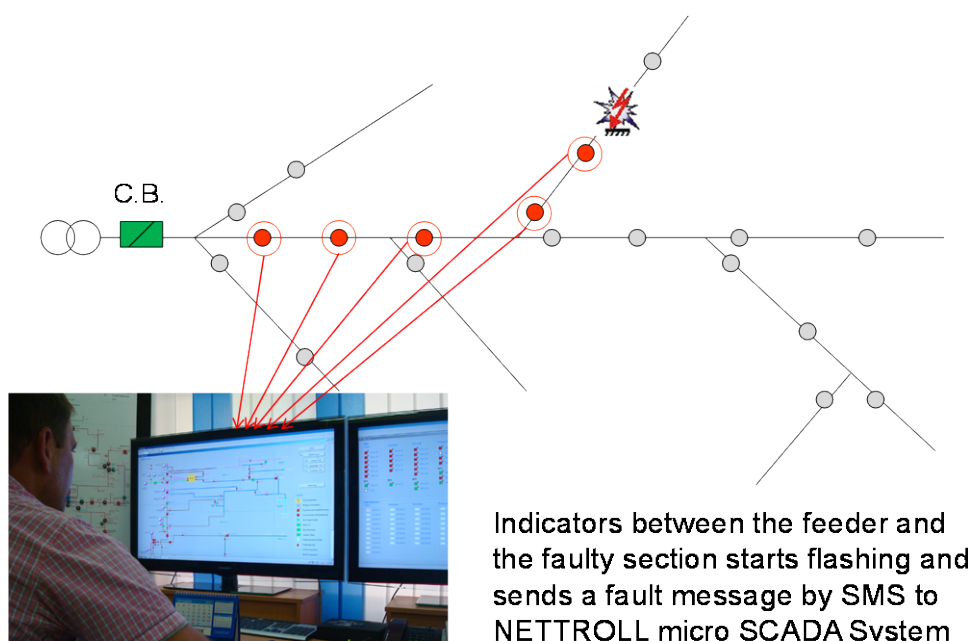
Improve customer satisfaction

Customer satisfaction is often difficult to measure. So one of the key figures used to indicate the performance of a distribution network is SAIDI. SAIDI (System Average Interruption Duration Index) is often measured and monitored every month or as a sum over one year.
SAIDI gives the average outage duration that any customer would experience and is the sum of two factors:

- ✓ The time it takes to find the fault
- ✓ The time it takes to repair the fault.

It is the time to find the fault that often drives the SAIDI in a negative direction. Distribution feeders normally have sectionalizing switches throughout the network. However, sectionalizing can only start when the faulty location is known. It is therefore outmost important to know where the fault is as quickly as possible. Using local indicators will reduce the fault-finding time, because the patrolling down the healthy feeders are avoided.

Using fault indicators with communication will reduce fault-finding time to the absolute minimum. Immediately after the fault is detected, all indicators in the faulty path will send an alarm message to the operation room. The operator will immediately see where the faulty section is and can start sectionalizing.
Using NORTROLL's remote control system for sectionalizing of the network will reduce SAIDI further, as customer on the healthy part of the feeder will have the energy restored within minutes rather than hours.


Indicators between the feeder and the faulty section starts flashing and sends a fault message by SMS to NETTROLL micro SCADA System

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The use if fault indicators will also give other benefits which is also important for a utility:

- ✓ Response time can be reduced without increased staff
- ✓ Call-out time is reduced -> Reduced costs
- ✓ Improved safety for staff
- ✓ Increased revenues due to more delivered energy
- ✓ Improved Shareholder value by cost reductions

An effective deployment of staff is also important to reduce the effect of a fault in the distribution network.

Alarms sent from indicators with communication can be routed to the right person immediately based on information about where in the network the indicators are located and the person which is responsible for that particular area.
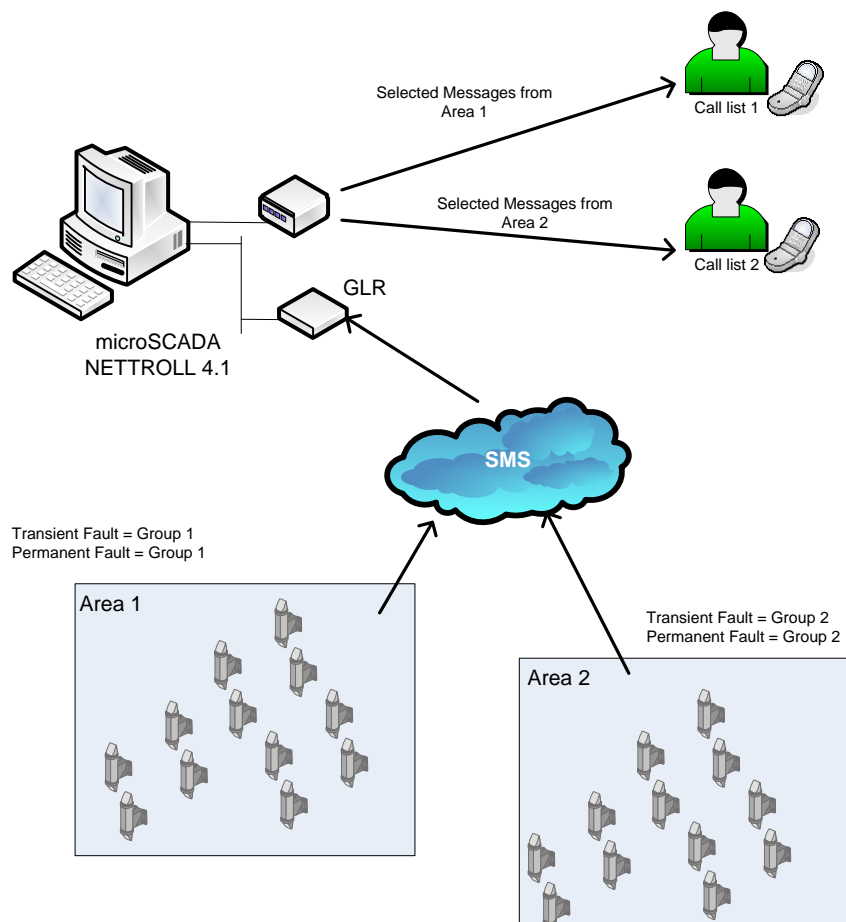
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Functional description

LineTroll fault Passage Indicators are used to locate short-circuit- (PtP) and earth faults (PtG) in overhead line distribution networks. LineTroll product line will fully cover the different fault configurations that may occur.

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

Live line installation makes installation safe, easy and rapid.

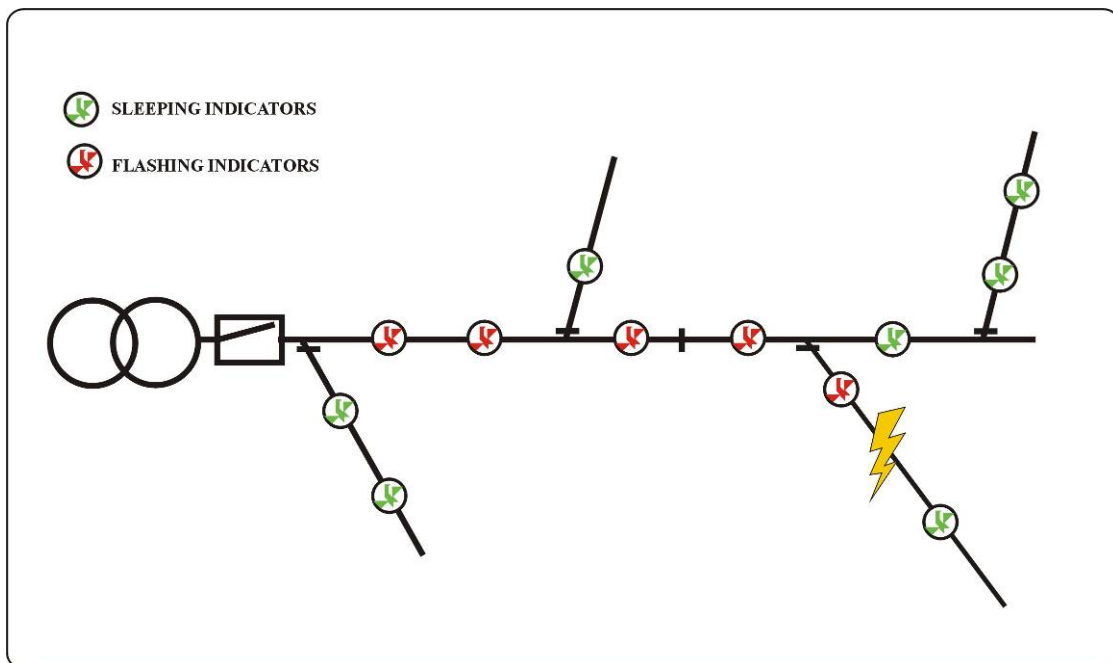Upon detecting a fault on the line, the indicator gives off an intermittent LED and/or Xenon type flashing.

Fig 1: Indicator flashing pattern in a fault situation

All indicators installed between the feeding substation and the fault will operate when a fault occurs. The indicators placed behind the fault and on the T-offs remain idle.

LineTroll fault indicators provide fast fault localisation enabling reduction in outage times. This represents enhanced service to the customers thereby improving the utilities image and significant reduction in the cost related to faults and outages.

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

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Detection principle

LineTroll fault Passage Indicators fault sensing is based on detection of the electromagnetic field below the conductors.

The units are fully self-contained; - no external transformers or connections of any kind are required.

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

1. The line should be energised for a period, normally 5 seconds. (Inrush Blocking)

2. The line current should increase rapidly above the value set by the user (the nominal trip level).

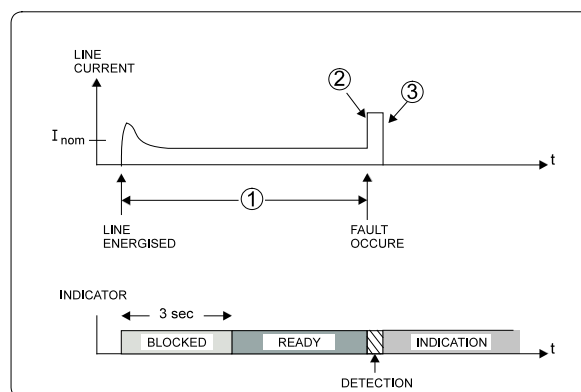3. The line should be de-energised. (Configurable)

Fig. 2. Fault sequence

The user may program the criteria for operation to suit the local requirement by manipulating a bank of micro-switches inside the indicator. On some models, this can be executed remotely from the control center or by a hand-held unit from the ground.

The current flowing in the lines generates a magnetic field (B-field) which is constantly measured by the indicators.

The measured 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. The detector in the indicator will detect this increase and respond accordingly.

The detector will now require that two conditions are satisfied:
1. The relative increase is greater than a certain level.
2. The absolute increase is greater than a pre-set value.

The second condition is the trip-level that can be set by the user to different values.

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Where should indicators be installed and what model should be used

Installation of a fault indicator usually requires a line survey to ensure that the best use of it may be obtained.

Several factors should be considered, such as fault frequency, type of customers, the number of customers, accessibility etc. For the best economic benefit it is recommended that the indicators are used in easily accessibly line points, before and after line segments difficult to access. A general rule of thumb could be to install indicators on each T-off as well as in the main feeder. A combination of local- and remote indicators could also be a good solution in some networks.

Phase mounted indicators can be used in all different pole- and network configurations.

Pole mounted indicators have some limitations to where to install them. If a parallel line runs nearby, if the pole has multiple feeders or the earth-wire is located between the indicator and the three phases, pole mounted indicators cannot be used. Pole mounted indicators requires a pole as "clean" as possible.

It is a significant difference between the benefit of using fault indicators with communication option compared to indicators with a local flash. Nortroll's system for remote indication benefits from an effective communication system which allows powering from ling-life batteries without any external charging.

Indicators with communication with a central monitoring system (or SCADA) reduce the fault-finding time down to driving time to the faulty section.

Phase Mounted Indicators   *Pole Mounted Indicator*

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LineTroll 110Eμ

Distribution Networks (6-69kV)

LineTroll 110Eμ is a conductor mounted indicator for detection of PtG and PtP faults in overhead line networks. The indicator is powered by replaceable long-life lithium batteries which have a life expectancy of 10-15 years. It provides a 360 degree visibility for indication both for transient faults and permanent faults.

Programmable: Dipswitches
Threshold level: 250-1000A
Trip level Di/Dt: 6-60
Reset: Manual, timer & automatic by return of voltage or current
Fault Indication:
    Permanent: Super-intensive Red LED with strobe effect
    Transient: Green LED
    Low Battery: Yellow LED
Mounting: Live-line mounting with hotstick

LineTroll 110Eμ can be used in line systems/configuration as shown below:

SINGLE DISTRIBUTION SYSTEMS

DISTRIBUTION SYSTEMS WITH EART-HWIRE

MULTIPLE DISTRIBUTION SYSTEMS

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LineTroll 111K

LineTroll 111K is a cost effective pole mounted indicator for detection of PtG and PtP faults in 6-69kV overhead line networks. The unit mounts 3-5m below the conductors and monitors all three phases. The indicator is powered by replaceable long-life lithium batteries which have a life expectancy of 10 years. It provides a 360 degree visibility for indication both for transient faults and permanent faults.

Programmable:	By dipswitches
PtG Faults thresholds:	4-50A
PtP Faults Di/dt:	100% relative increase in I_{Load}
Reset:	Manual, timer & automatic on return of voltage.
Fault Indication:	
Permanent:	Two Super-intensive LEDs with strobe effect
Transient:	Red LED
Low Battery:	Yellow LED
Mounting	Live-line mounting with strap-bands or screws
Poles:	Lattice Towers, concrete and wooden poles

LineTroll 111K can be used in line systems/configuration as shown below:

SINGLE
DISTRIBUTION SYSTEMS

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LineTroll L400D

LineTroll L400D is a pole mounted indicator for detection of PtG and PtP faults in 6-66kV overhead line networks. LT L400D have a special Software-algorithm for Load Current Compensation (LCC) in order to maintain the PtG-sensitivity independent of the Load Current. This will make this indicator more sensitive for low PtG fault currents compared to traditional fault indicators.

Programmable:	By cable connection to computer or from a hand-held programming device from ground. (FDP-20)
Trip level PtG:	2.5, 4, 7, 15, 20, 30, 40 or 50A
Trip level PtP:	50,100,200,500 or 1000A
	50%, 100% or 200% relative increase I_{Load}
LCC:	Yes
Reset:	Manual, timer & automatic by return of voltage
Indication:	
Permanent faults	Super-intensive Red LED with strobe effect
Transient faults	Green LED
Low Battery	Yellow LED
Outputs:	Separate outputs for permanent and transient alarms as well as Low Battery Warning for connection to various communication modules.
Mounting:	By strap-bands or screws
Poles:	Lattice towers, concrete, steel and wooden poles

LineTroll L400D can be used in line systems/configuration as shown below:

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LineTroll R400D

LineTroll R400D Fault Indicator indicates earth- and short-circuit faults and can distinguish between permanent and transient faults. The indicator has two sensors and use both the electrical field and the magnetical field to detect faults on all three phases.

A high intensity red strobe-flash LED indicates permanent faults and with the adjustable lens, the indication can be seen from long distance both in day– and night-time. Transient faults and low battery warning are indicated by separate LED's.

LineTroll R400D has a built in GSM modem and GPS which will send time-stamped alarms SMS to one or more recipients upon a fault situation.
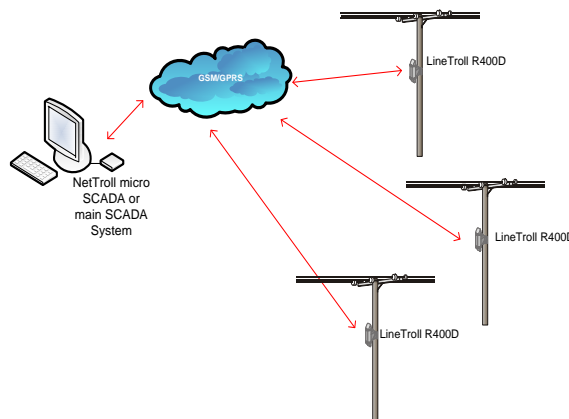
Programmable:	By cable connection to computer or from a hand-held programming device from ground. (FDP-20) and remotely from operation central.
Trip level PtG:	2.5, 4, 7, 15, 20, 30, 40 or 50A
Trip level PtP:	Threshold: 50,100,200,500 or 1000A
	50%, 100% or 200% relative increase
Reset:	Manual, timer & automatic by return of voltage or from SCADA
Indication:	
Permanent faults	Super-intensive Red LED with strobe effect
Transient faults	Green LED
Low Battery	Yellow LED
	Loss of Voltage
Event Log	Stores 128 latest events Upload to PC via GSM
GPS	Built in GPS for time synchronization and positioning

LineTroll R400D can be used in line systems/configuration as shown below:
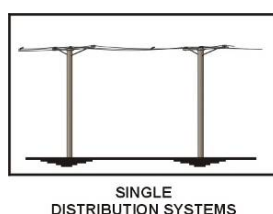
SINGLE
DISTRIBUTION SYSTEMS

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**System for Remote Control and Automation
of Medium Voltage distribution networks**

LineTroll 110EµR

Distribution Networks (6-69kV)

LineTroll 110EµR is a conductor mounted indicator for detection of PtG and PtP faults in overhead line networks. The indicator is powered by replaceable long-life lithium batteries which have a life expectancy of 10-15 years. It provides a 360 degree visibility for indication both for transient faults and permanent faults.

The indicator unit has the same detection/sensing principles as the local indicator **LineTroll 110Eµ**. The difference is that it is equipped with a built-in 2.4GHZ radio device that can communicate with a receiver located underneath the indicators.

The LineTroll 110Eµr can communicate with to different types of receiver models

ComTroll 115C   General-purpose digital interface with four relay outputs for connection to RTU's etc.
It has also two digital inputs for TEST/RESET function

LineTroll R110C   Communicatioin module with built-in GSM module for two-way communication with a central unit/SCADA.

Programmable:	Dipswitches or remotely through GSM or hand-held unit from ground
Threshold level:	250-750A
Trip level Di/Dt:	6-120A
Reset:	Manual, timer & automatic by return of voltage or current or from SCADA
Fault Indication:	
Permanent:	Super-intensive Red LED with strobe effect
Transient:	Green LED
Low Battery:	Yellow LED
Mounting:	Live-line mounting with hotstick

LineTroll 110Tµr can be used in line systems/configuration as shown below:

SINGLE
DISTRIBUTION SYSTEMS

DISTRIBUTION SYSTEMS
WITH EART-HWIRE

MULTIPLE
DISTRIBUTION SYSTEMS

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LineTroll 110Tµr

Transmission Networks (66-132kV)

LineTroll 110Tµr is a conductor mounted indicator for detection of PtG and PtP faults in overhead line networks. The indicator is powered by replaceable long-life lithium batteries which have a life expectancy of 10-15 years. It provides a 360 degree visibility for indication both for transient faults and permanent faults.

The LineTroll 110Eµr can communicate with to different types of receiver models

ComTroll 115C
General-purpose digital interface with four relay outputs for connection to RTU's etc. It has also two digital inputs for
TEST/RESET function

LineTroll R110C
Communicatioin module with built-in GSM module for two-way communication with a central unit/SCADA.

Sub Transmission lines:	66-132KV
Programmable:	Dipswitches
Threshold level:	500 or 1000A
Trip level Di/Dt:	500 or 1000A
Reset:	Manual, timer & automatic by return of voltage or current
Fault Indication:	
Permanent:	Super-intensive Red LED with strobe effect
Transient:	Green LED
Low Battery:	Yellow LED
Mounting:	Live-line mounting with hotstick

LineTroll 110Tµr can be used in line systems/configuration as shown below:

SINGLE DISTRIBUTION SYSTEMS

DISTRIBUTION SYSTEMS WITH EART-HWIRE

MULTIPLE DISTRIBUTION SYSTEMS

ComTroll®
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ComTroll 115C

The receiver, **ComTroll 115C** has a general digital interface that can be connected to any Nortroll- or third parties RTU for communication to a SCADA system.
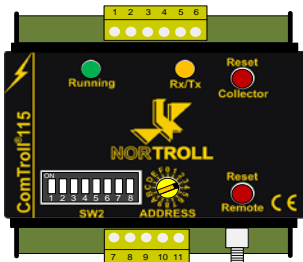
ComTroll 115C monitors up to 9 LineTroll 110EμR or LineTroll 110Tμr indicators in the range of maximum 40m line-of-sight. A configuration with three indicators (one for each phase) and one "collector" the SCADA will receive information about which of the phase(s) the fault has occurred on. If more than three indicators are connected, SCADA center will receive which T-off or branch the fault has occurred on.
New settings for the indicators is possible to upload from the collector.
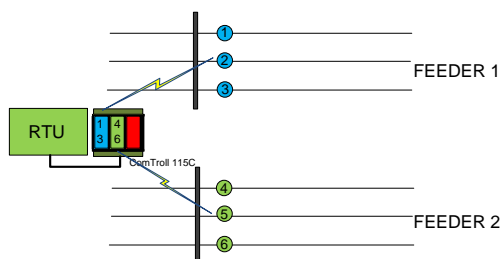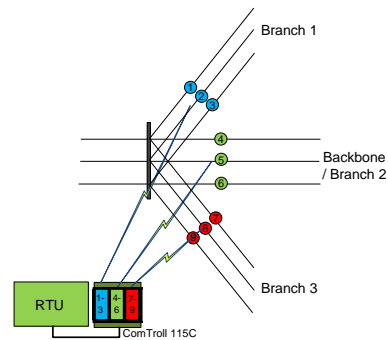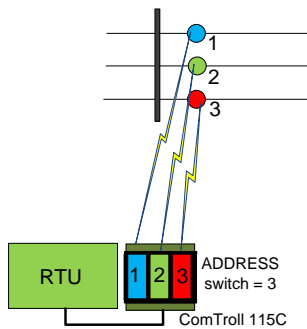
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LineTroll R110C

The **LineTroll R110C** "Collector" is a pole mounted communication device used for communication with up to 9 fault LineTroll 110Eµr/LineTroll 110Tµr conductor mounted fault passage indicators. The fault indicator use a 2.4GHz ISM band short-range radio to communicate with the collector mounted on the pole. Long-life lithium batteries are used for long and maintenance free operation, both in the indicators and the collector.

LineTroll R110C sends the following alarms/messages to the receiver:

·   Status OK (no faults and line energized)
·   Transient Fault Alarm
·   Permanent Fault Alarm
·   Loss of Voltage (line de-energized)
·   Low Battery Warning from Indicators
·   Low Battery Warning from Collector unit
·   Communication lost with indicator(s)
·   Heartbeat message (health check)

The alarm messages sent to the control center will contain information about which phase the fault is on as well as the time the event occurred.
All events will also be stored in the Collector (128 last events) and the log can be uploaded to a computer through the GSM interface.

The collector can store the configuration settings for the indicators and all configuration settings are possible to upload to the connected indicators at any time.
Configuration settings are also possible to be changed from the central unit making it unnecessary to go out in the field to change any configuration in the collector or the indicators.

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LINETROLL R110C

The LineTroll R110C can communicate with 3, 6 or 9 fault indicators (LineTroll 110Eµr and LineTroll 110Tµr).

The collector sends alarms through SMS and can be setup with three different recipient numbers. In case of more recipient numbers are required, this can be facilitated with the NetAlert 3.5 software.

The LineTroll R110C have also a message-forwarding filter where it is possible to route specific alarms to specific numbers. This feature is very useful when important alarms such as Permanent Fault should be sent to the SCADA system and less important alarms (e.g. low battery) to the maintenance department.
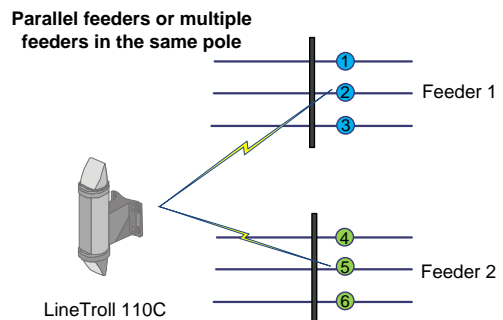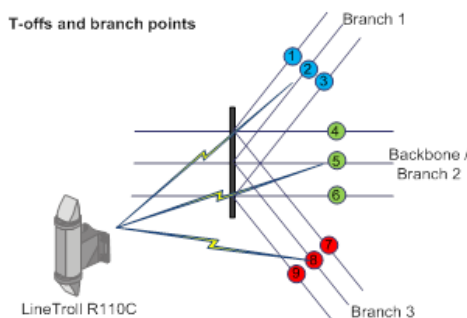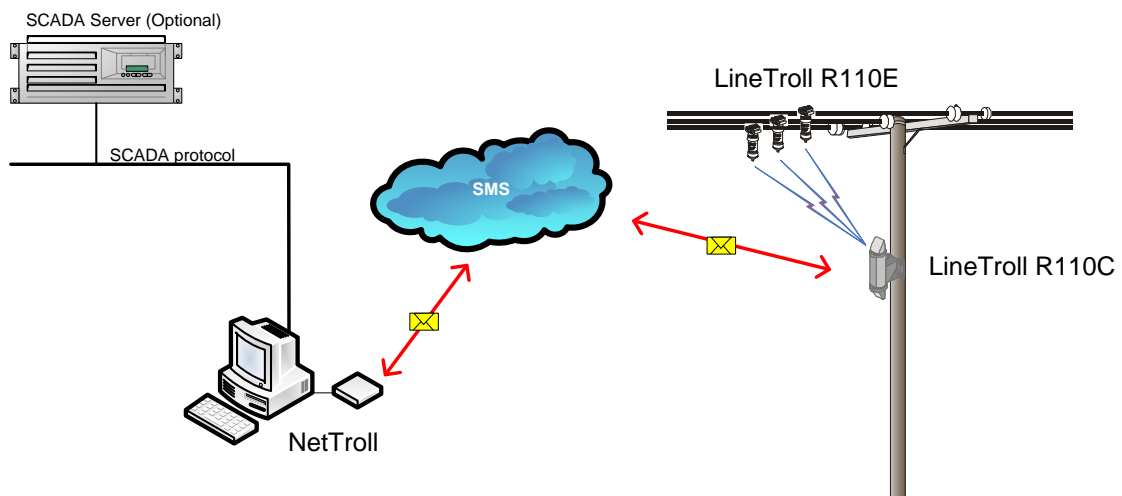
Accessories

KBN-4

Mounting tool for LineTroll 110E/ 110Eμ/ 110Eμr
and R110E.
The KBN-4 can be used with a standard hot-stick
as shown in the picture.
The KNB-4 have a built-in magnet for Test/reset
of the indicator.
It is however possible to mount/dismount the
Indicators without the KBN-4, using a "grip-all-clamp"
hot-stick.

FDP-20

The FDP-20 hand-held configuration tool is a field
programming device where up to 8 different configurations
can be stored. It can also be used to download up to 8
different configuration settings in already installed devices.

Uploading parameters to FDP-20 is done by connecting it to a
PC with USB-cable running NetTroll FDP configuration utility.

NetTroll FDP configuration utility can also be used to send
configuration settings directly to indicators in the field from
the control center.

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NetTroll

In a remote indication system, it is necessary to have a monitoring system where alarms and indications can be logged and presented in a single line diagram, network diagram or in a geographical map etc.

NetTroll microSCADA system is a program especially designed for all of NorTrolls field devices with communication.
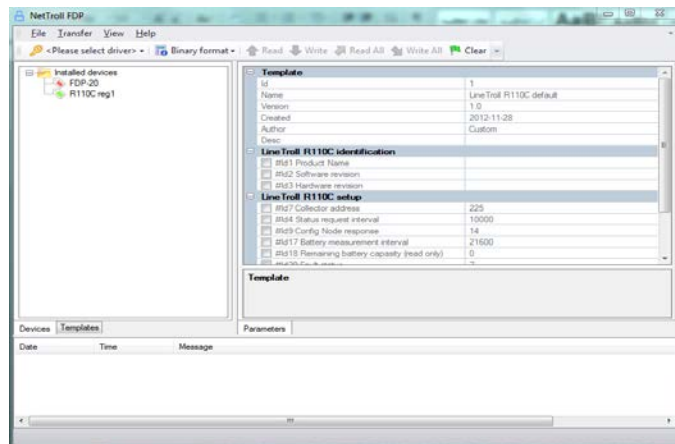
Features

- ✓ Runs on a standard Windows PC platform.
- ✓ Easy installation and configuration.
- ✓ Easy-to-use operator interface.
- ✓ User defined logs for monitoring of specific events.
- ✓ Advanced Alarm Management
- ✓ Built-in Conditional Actions Module (CAM)
- ✓ Ideally suited for monitoring and control of report-by-exception fault passage indicators and RTU's.
- ✓ Secure password protected user levels.
- ✓ Advanced graphical features.
- ✓ Built-in bitmap editor for creating user defined symbols.
- ✓ Device specific message properties.
- ✓ Unlimited number of devices can be installed.
- ✓ Easy Master SCADA integration with a wide range of SCADA protocols.
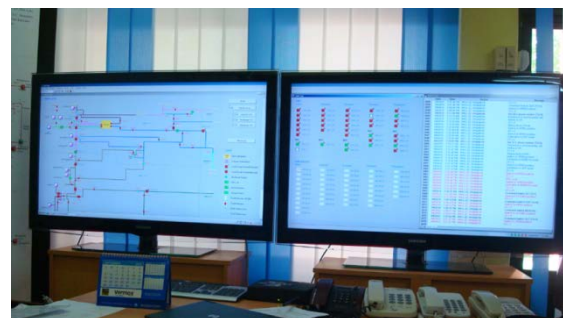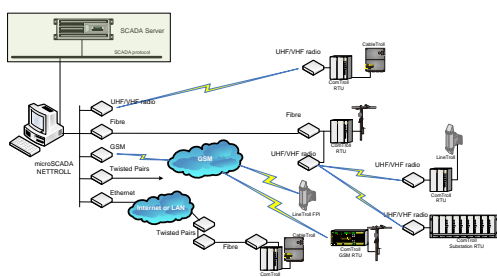
NetAlert is a supplementary software that can be installed together with NetTroll. Messages defined as an alarm (e.g. permanent fault) will be forwarded by SMS to one or more recipients based on where the alarm comes from.

SICAME GROUP

Nortroll AS has since the foundation in 1977, offered a wide range of products aiming to improve the distribution network reliability by means of effective fault localization and remote sectionalising in case of a fault.

Nortroll's range of product comprises

LineTroll Product range   Fault Passage Indicators for overhead lines

CableTroll Product range   Fault Passage Indicators for cable Networks

ComTroll Product range   RTU's for substations and motorized switchgear, communication equipment for fault passage indicators and RTU's, MicroSCADA System for surveillance and control and NetTroll SCADA Gateway

This catalouge does not contain all of Nortrolls products, but lists our main products for SMARTER NETWORK MANAGEMENT in overhead line networks.
For furter information goto our web-site www.nortroll.no or contact your local sales representative or NORTROLL AS.

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