NORTROLL

CableTroll 3500

February 2001

INTELLIGENT DIRECTIONAL FAULT-CURRENT INDICATOR FOR 10-24kV UNDERGROUND CABLE NETWORKS

- **Detects and indicates phase to ground and phase to phase (PTP) faults.**
- **Directional indication for phase to ground (PTG) faults.**
- **Insensitive to capacitive discharge currents and change of feeding direction.**
- **Internal fault counter and log.**
- **Multiple power-supply solutions.**
- **External indication unit.**
- **Relay output for connection to Communication devices and SCADA RTU's.**

CableTroll 3500 is suitable in electricity distribution networks with resistor earthed neutral, isolated neutral as well as compensated networks (Petersen coil). State of the art technology allowing the utilities the possibility to program the operational parameters to suit their own demands for functionality and complexity.

Established in 1977, **Nortroll** has gained considerable experience within fault finding, automation and surveillance of distribution networks**.**

CABLETROLL 3500

CABLETROLL 3500 is used to locate short-circuit /Phase To Phase (PTP)- and earth faults/Phase To Earth (PTG) in underground cable distribution networks. The indicator can be used in networks with isolated or impedance earthed neutral as well as compensated (Petersen coil) networks.

The indicators are placed at substations, ringmain units or any installation where you have a cable termination and access to capacitive test points for measuring the phase voltage.

Upon detecting a fault in the cable, the indicator gives off an intermittent red or green light-flash (LED). One LED flashing indicating an earth-fault and both LED flashing indicating a short-circuit fault. External indication units for mounting outside the station can be supplied as an option. The colours of the LED will also indicate direction to the fault location for earth-faults with reference to the busbar where the indicator is situated.

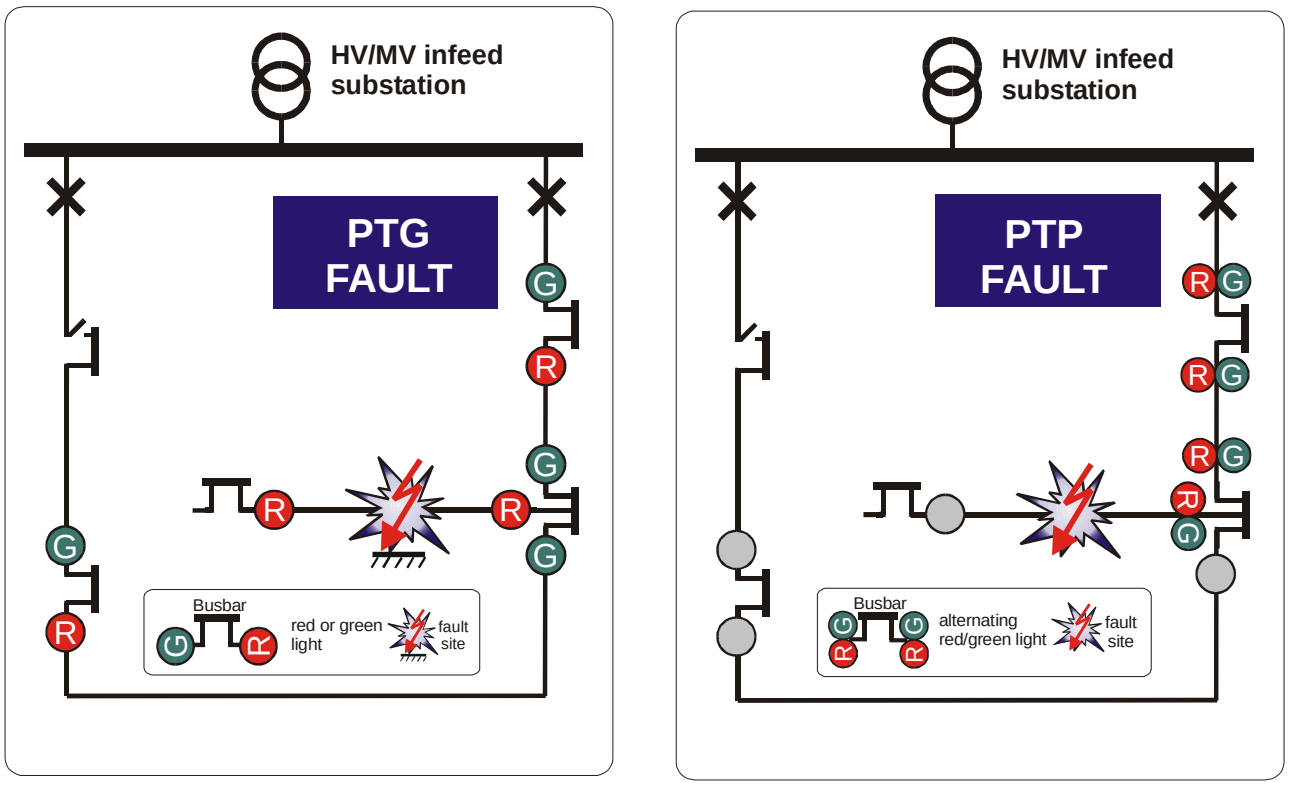


Fig. 1. Indicators during a fault situation

Upon sensing an earthfault (PTG) all indicators installed on the feeder with fault, both upstream and down stream will operate. Upon sensing a short circuit fault (PTP) only indicators installed between the feeding transformer and the fault location will operate

CABLETROLL 3500 provides fast fault location enabling reduction in outage times. This represents enhanced service to the customers thereby improving the quality of electricity-supply.

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

FUNCTIONAL DESCRIPTION

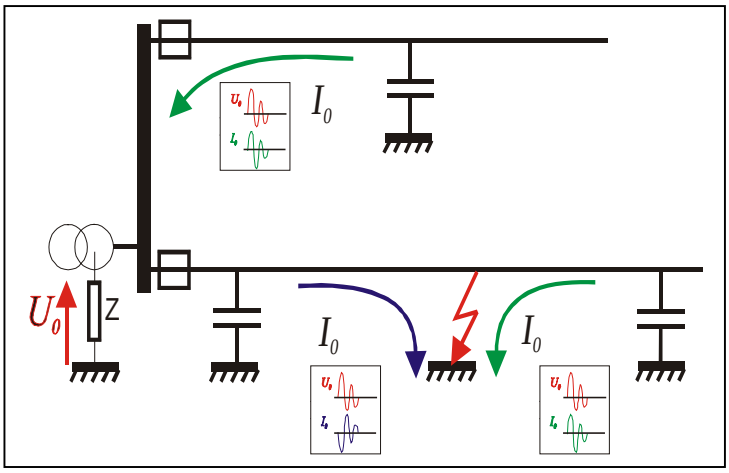
CABLETROLL 3500's fault sensing is based on analyses of the current discharge transient and the residua voltage at the time of the fault appearance.
The fault current is picked up by three current sensors, one for each phase and the voltage is measured at the capacitive testpoints.

Sensor principle

The processor in the Indicator uses approx. 60ms to detect the fault. It analyses the signals from the current sensors and the capacitive test points before starting indication.

Detection of PTP faults is based on Current measurement (ampermetric).

Detection of PTG is based on Analyses of residual current and voltage. This will tell indicators where the earth-fault is with reference to the busbar at the location of the indicator.



Application

The application of CABETROLL 3500 usually requires no previous survey of the cable network. The indicator can be installed:

- In general, anywhere where you have access to a cable termination and capacitive testpoints.
- In location with reclosers or sectionalises to rapidly pinpoint and isolate the fault to facilitate rapid reconnection the healthy sections.
- In connection with remotely controlled outstations where the indicator can be connected to an RTU giving the SCADA operators immediate information of the fault location.

CableTroll 3500 Connected to a SCADA RTU:

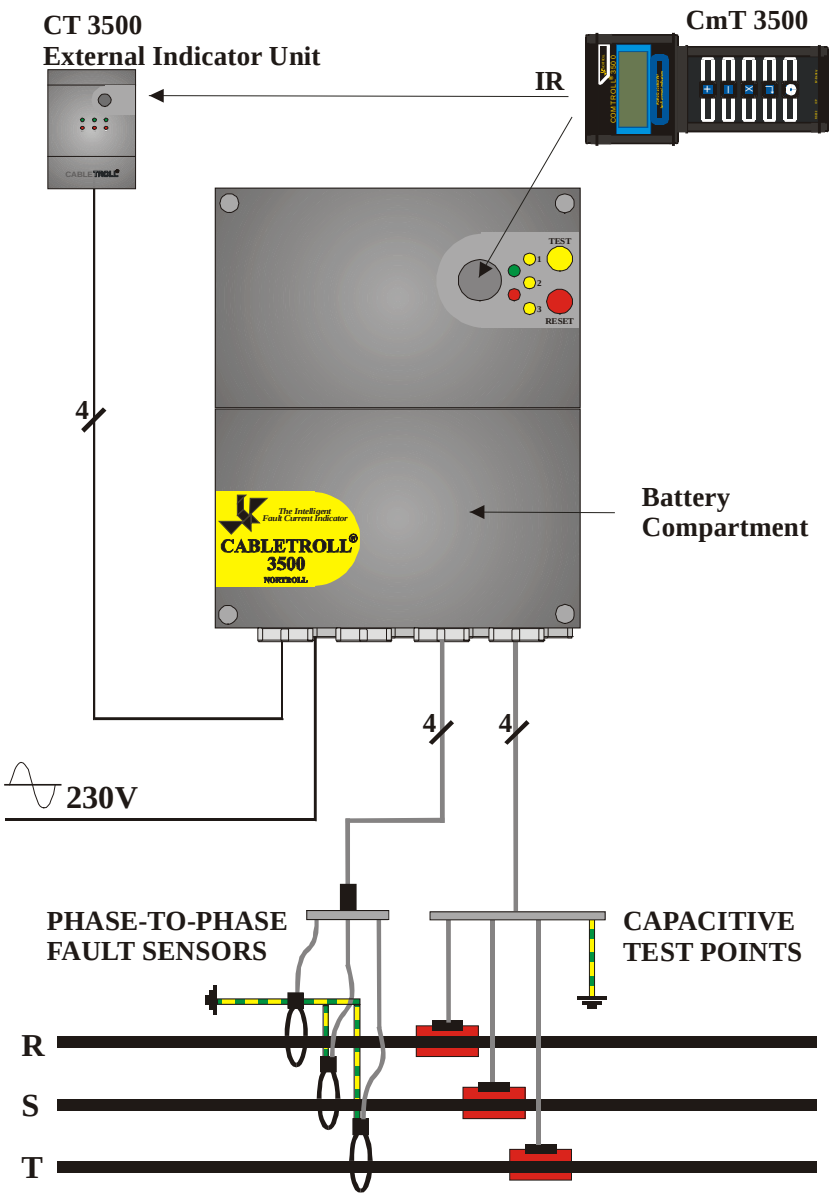
The CT 3500 are equipped with internal relays, situated in the indicator housing, giving the possibility of four different relay-output's to a SCADA RTU.

The different output signals can be:

- Transient Fault in red direction
- Transient Fault in green direction
- Permanent Fault in red direction
- Permanent Fault in green direction

There is in addition an input for external reset from a SCADA RTU.

CableTroll 3500 System Overview



CT 3500 TECHNICAL SPECIFICATIONS

BLOCKING TIME FOR INRUSH:
5 seconds

INDICATION CRITERIA PTP (SHORT CIRCUIT) FAULT
1) Line energised for more than 5 seconds
   - followed by a
2) Fault current (50Hz) exceeding a preset value (500A) within 60 ms.

INDICATION CRITERIA PTG (EARTH) FAULT
1) Line energised for more than 5 seconds
   - followed by a
2) Fault current discharge transient exceeding a preset value within 60 ms.
3) 50% increase in the residual voltage

REQUIRED FAULT DURATION:
Minimum 60 ms

INDICATION:
1) Indication by high intensity LED (1Hz);
   - Two colours, RED and GREEN.

   The LED flashes for the elapse of the timer, until voltage is restored (if voltage reset is programmed to ON or until the indicator is reset manually.

RESET:
1) Voltage reset, delayed 5sec. or disabled.
2) Timer reset:
   LED factory set to 6 hours. (The number of hours can be changed by Nortroll personnel)
3) Manual reset reset button.

CURRENT CONSUMPTION:

Non-activated:	250 uA
IR activated:	300 uA
Flash activated:	125 mA

BATTERY:
Lithium battery; 3.6V 16.5Ah at
5mA @ 20^{o}C, type KBB-12.
NiCd battery:

EXTERNAL DC:
External DC input 10-24 VDC

AMBIENT AND STORAGE TEMP:
-40^{o}C to + 74^{o}C