

MV Fault Indicator Cabletroll 3600



Directional fault current indicator
for underground systems

Presentation

CABLETROLL 3600 directional Fault Current Indicators (FCI) are designed to help the operator locate faults on underground lines. They detect both single phase-to-ground (PTG) and phase-to-phase (PTP) faults in systems with 300A impedance or compensated neutral grounding. And they use a brand-new detection technique that offers significant advantages over the conventional technique of existing detectors working on current thresholds. That new technology means that unlike conventional detectors, they can operate on systems with high capacitive current (combined overhead/underground networks with a high proportion of cable, very long underground networks).

The CABLETROLL 3600 FCI is capable of discriminating between PTP and PTG faults, and indicating the direction of the latter type.

It can be used on networks from 6 to 36 kV for the following applications:

CABLETROLL 3600 LDAC:

installed on strategic points in the network (switching points, branching points), it assists the operator by visually signaling the passage of a PTG or PTP fault current.

CABLETROLL 3600 LDAC LV:

when used in combination with remote-controlled switchgear, it assists the operator in remote control by providing contacts that alert the remote control system to the passage of a PTG or PTP fault current.

CABLETROLL 3600 LDAU:

installed temporarily on a disturbed network, it identifies what sections are responsible for faults and gives a time and date system the data required to analyze faults, whether persistent or transient.

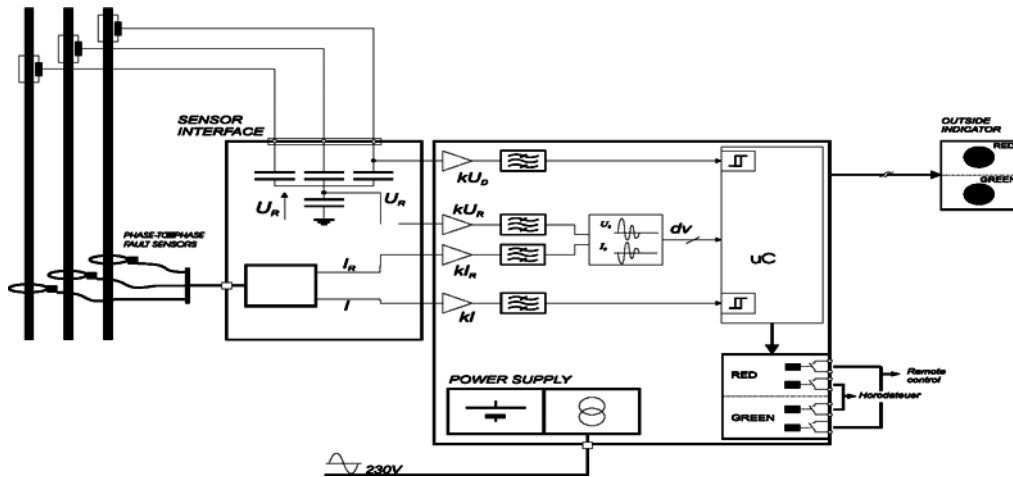
Medium voltage fuses

MV Fault Indicator Cabletrol 3600

Description and working principle

The CABLETROLL 3600 works on the principle of directional fault indication described in EDF patent 9209549.

The following block diagram shows the CABLETROLL 3600 indicator's main circuits.



In the initial milliseconds after a PTG fault, voltage and current transients are generated on the system. Using a microprocessor to interpret the phase displacement between residual voltage and residual current, the circuit can indicate in which direction the PTG fault is located (up-line or down-line of the indicator's pick-up coils).

For PTP faults the working principle is that of an ammeter (current threshold).

There are 6 standard models:

Function	Power supply	Outside connections	Designations	References number	Catalog number
Assistance in autonomous operation	Batteries (power for 4 years in operation)	None	CABLETROLL 3600 LDAC	S 210765	CT3600LDAC
Assistance in autonomous operation with counter Requires remote control unit COMTROLL 3600 W210768	Batteries (power for 4 years in operation)	None	CABLETROLL 3600 LDAC counter	W 210998	CT3600LDAC-CP
Assistance in operation with LV power supply	230 VAC	Outside contacts provided to transmit indicator light data	CABLETROLL 3600 LDAC BT	T 210766	CT3600LDACBT
Assistance in autonomous operation with counter Requires remote control unit COMTROLL 3600 W210768	230 VAC	Outside contacts provided to transmit indicator light data	CABLETROLL 3600 LDAC BT Counter	X 210999	CT3600LDACBT-CP
Autonomous diagnosis Requires remote control unit COMTROLL 3600 W210768	Batteries (power for 4 years in operation)	Connection to a time and date system provided	CABLETROLL 3600 LDAU	Y 211000	CT3600LDAU
Diagnosis with LV power supply Requires remote control unit COMTROLL 3600 W210768	230 VAC	Connection to a time and date system provided	CABLETROLL 3600 LDAU BT	V 210767	CT3600LDAUBT

MV Fault Indicator Cabletroll 3600

Application of a CABLETROLL 3600 FCI

General

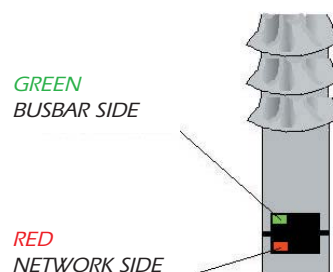
When a CABLETROLL 3600 detects a fault current, it alerts the operator either visually with a signal light or through contacts (CABLETROLL 3600 AC LV or AU).

As soon as the existence of a fault is confirmed, the signal light on the CABLETROLL 3600 lights up and stays lit until one of the following events occurs:

- Forward voltage returns to the HV line (voltage reset).
- The internal 2 hour time delay ends (timer reset).
- The indicator is reset by the operator using either the reset button on the front of the main box or the COMTROLL infrared remote control unit (manual reset).

PTG fault indication

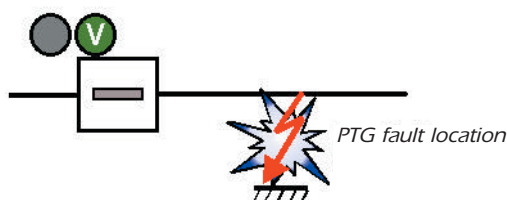
The principle of directional PTG fault indication is to locate what part of the line is the origin of a PTG fault. To do this each pick-up coil has a GREEN signal and a RED signal. The coils must be mounted in such a way that the GREEN signal is on the BUSBAR side and the RED signal is on the NETWORK side.



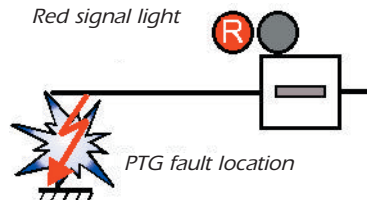
If the GREEN signal light is lit up, the fault is on the GREEN side, i.e. the BUSBAR side.

If the RED signal light is lit up, the fault is on the RED side, i.e. the NETWORK side.

Green signal light



Red signal light



PTP fault indication

In this case the CABLETROLL 3600 FCI works like a conventional fault indicator and no direction is indicated. All the fault indicators between the feeding substation and the fault flash the green signal light and the red signal light alternately (once every second).



MV Fault Indicator Cabletroll 3600

Fault indication characteristics

PTG faults

Any PTG fault characterized by a residual current over 60A peak + 10A and a residual voltage of 9kV + 2kV is detected.

Once those thresholds are exceeded, the fault indicator waits 40 ms to detect a residual voltage V_r greater than $3.5kV \pm 0.5kV$ before indicating that there is indeed a fault.

Double PTG faults

A fault considered as a "double PTG fault" consists of a simultaneous PTG fault on two different phases in a system powered by the same HV transformer but grounded at two geographically distant points.

The two faults may be located on the same feeder or on two different feeders. In this case any fault characterized by a residual current over $250Arms \pm 50A$ is detected.

PTP faults

Any PTP fault characterized by a current over $450Arms + 80A$ is detected.

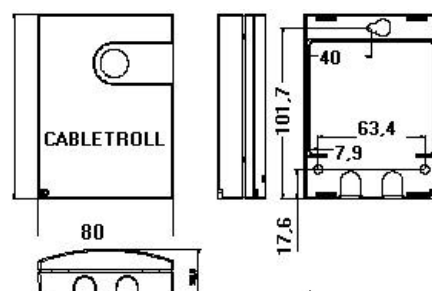
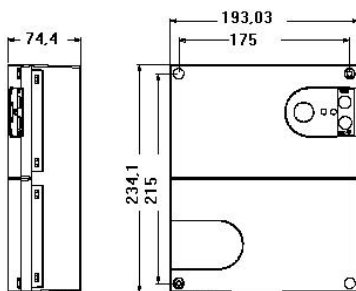
Return of forward voltage

The return of forward HV voltage (resetting the FCI) is accepted when voltage on the system is at least $10kVrms + 2kV$.

FCI construction

The CABLETROLL 3600 FCI consists of six parts:

- **Voltage measurement:** subassembly consisting of a male WAGO-type termination ref. 723-604/000-042 (see connection diagram) connected to a 7 m (or optional 12 m) cable. This cable is then connected to the terminal block on the main unit of the FCI. The male connector is connected to a female part (not supplied with the FCI) that leads to the portable terminations for disconnectable connectors (not supplied with the indicator).
- **Current measurement:** subassembly consisting of three current sensors, each with a detection element with its own cable and a collar to fasten the sensor on the HV cables. The three cables running out from the sensors are fitted with a current transformer (CT) connector (see connection diagram) that must be connected to the current sensor cable (see hereafter).
- **Current sensor cable:** 7 m (or optional 12 m) cable connected to a connector. One end of this cable must be connected via CT connectors to the current sensors and the other to the terminal block of the main FCI unit.
- **Multi-core cable:** 7 m (or optional 12 m) cable to connect the display unit to the main FCI unit.
- **Main unit containing:** the electronic board, the power supply, the TEST and RESET buttons and the terminal blocks for connection to outside elements.



- Display unit consisting of a weatherproof and impact resistant casing containing the green and red signal lights. This unit must be installed outside the substation or the cubicle.

MV Fault Indicator Cabletroll 3600

