Cable Fault Location
Cable Fault Location Procedure

Fault Indication

Disconnecting and Earthing
(according to local standards and safety regulations)

Fault Analyses and Insulation Test

Cable Fault Prelocation

Cable Tracing

Precise Cable Fault Location (Pin Pointing)

Cable Identification

Fault Marking and Repair

Cable Testing and Diagnosis
(according to local standards and safety regulations)

Switch on Power
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Switch on Power
Cable Fault Types

- low resistant faults ($R < 100\Omega$)
  - short circuit
- high resistant faults ($R > 100\Omega$)
  - intermittent faults (break down or flash faults)
  - interruptions (cable cuts)
- cable sheath faults

- faults between core-core or/and core-sheath
- defects on the outer protective shield (PVC, PE)
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Switch on Power
# Methods of Cable Fault Prelocation

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Impulse Reflection Method

\[ l = t \times \frac{v}{2} \]

- high \( \Omega \), open end
- low \( \Omega \), short circuit fault
- change of impedance, e.g. joint

\[ r = \frac{Z_2 - Z_1}{Z_2 + Z_1} \]

reflection factor

LV pulse max. 160V
Impulse Reflection Method, comparison method

Trace description:
1. positive reflection at the cable end **healthy core**
2. negative reflection at the faulty point (short circuit) **faulty core**
Secondary Impulse Method - SIM

\[ l = t \times \frac{v}{2} \]
Secondary Impulse Method - SIM

First measurement: positive reflection of the cable end
Second measurement: negative reflection from the arcing fault
Multiple Impulse Method - MIM

TCL positive reflection of the far cable end (total cable length)

1 – 5  5 echograms of the arcing fault are recorded
MIM applied on a wet high resistant cable fault (measurement 1 – cable fault not yet arcing)
MIM applied on a wet high resistant cable fault (measurement 2 – cable fault not yet arcing)
MIM applied on a wet high resistant cable fault (measurement 3 – cable fault arcing)
MIM applied on a wet high resistant cable fault
(measurement 4 – cable fault arcing)
MIM applied on a wet high resistant cable fault (measurement 5 – cable fault no more arcing, extinguished)
DC Application of MIM (advanced SIM)
Time Domain Reflectometer IRG 3000
IRG 3000 with 15“ stand alone monitor
Worldwide unique features IRG 3000

The unique Multiple Impulse Method – MIM ensures highest performance.

Fully automatic measuring sequences and fully automatic setting of all measuring parameters assure most efficient and successful cable fault location.

Fully automatic setting of the measuring cursors allows fully automatic assessment of the fault distance in meters.

200 MHz real time sampling rate leads to highest accuracy of 0,1% and highest resolution of 0,1 m.
Measuring ranges from 10 m up to several 100 km and a memory for more than 100 000 echograms enable universal application.

Windows 2000 Multilanguage allows worldwide software translations and ensures max. comfort for operators.

Simultaneous display of up to 8 measurement traces provides highest performance and comfort in comparisons with old measuring results.
Time Domain Reflectometer IRG 2000

Features

• portable, easy to use
• interactive menu-guidance
• operated via knob and function keys
• battery operated
• measuring range up to 65 km (213,000 ft)
• measuring input voltage proof up to 400 V
• printer connection via RS 232
• memory up to 100 echogramms
Impulse Current Method

\[ I = \frac{t \times v}{2} \]
Impulse Current Method, measurement example
Decay Method

intermittent fault
break down fault

\[ l = t \times v/4 \]
Decay Method, measurement example
Differential Impulse Method
Differential Decay Method

Fault distance from cable end
The bridge is in balance if both measuring points a) and b) have the same value. The galvanometer shows a value of zero.

The measuring points a) and b) have the same value if:

\[
\frac{R_1}{R_3} = \frac{R_2}{R_4}
\]

\[
R_4 = \frac{R_2}{R_1} \cdot R_3
\]

If \( R_4 \) is an unknown resistance \( R_x \), the value \( R_x \) is defined:

\[
R_x = \frac{R_2}{R_1} \cdot \frac{R_3}{R_1}
\]
The distance to the cable fault point is:

\[ I_x = \frac{2 \cdot \alpha}{1000} \cdot I_0 \]

\( \alpha \): Scale division of measuring ten turn potentiometer (000,0,...,999,0)
Bridge Method (Glaser)

with two auxiliary lines and constant cross section

The distance to the cable fault point is:

\[ I_x = \frac{\alpha}{1000} \cdot I_0 \]

\( \alpha \): Scale division of measuring ten turn potentiometer (000,0...,999,0)
Measuring Bridge

Shirla
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Switch on Power
Cable Tracing

1. Galvanic connection

2. Inductive connection with current clip on device

3. Inductive connection with frame antenna

Important: correct positioning of transmitter $a > 10m$
Cable Tracing (TG + UL + SP or CL 20)

1. Minimum Method

2. Maximum Method

3. Depth Measurement according to the Minimum Method
Locator Set
Cable Locator
Cable Fault Location Procedure

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Switch on Power
Acoustic Fault Location
Propagation Time Measurement, pick up of magnetic and acoustic signal
Acoustic Fault Location at Manholes

Measuring point 1: result $t_1 = 150 \text{ ms}$
Measuring point 2: result $t_2 = 400 \text{ ms}$

Distance of cable shafts = 200 m

54.5 m 145.5 m
Pin Pointing Set UL and BM

- Distance indication in m
- Acoustic and magn. Pick up
- High noise suppression
- Manhole feature
- Multi receiver UL
- Light weight
- whether proof
- digital backlit display
Cable Sheath Fault Location

Shirla Cable sheath fault locator
(H.V. DC source)

1 cable sheath
2 shield
3 conductor
4 cable sheath fault
5 receiver with earth gradient voltage pick up
6 receiving signal (bi-directional)
Cable Sheath Fault Location
Shirla, Cable Test and Fault location system

- Cable and cable sheath testing
  - up to 10kV
- Fault prelocation / Measuring bridge
  - up to 10kV
- Fault pinpointing / step voltage method
  - up to 10 kV
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Switch on Power
Cable Identification

Single core cable

Multi core cable
Cable Identification Instrument
KSG 100

- Flexible Rogowsky coil
- Single and 3-core cables
- Reliable signal acquisition via digital analysis of direction, amplitude and synchronisation
Fault location system for low voltage networks
STG 600 / 1000

Cable testing, prelocation and pin-pointing
Test voltage up to 5 kV
Pulse voltage up to 4 kV
Energy up to 1000 J
Fault location system for medium voltage networks
Syscompact 2000M

- Cable testing, prelocation and pin-pointing
- Voltage range 8/16 kV adjustable in 0.1 kV steps
- Energy 1000J
- Weight ~85 kg
Fault location system for medium voltage networks
Syscompact 2000 / 32 kV portable version

Cable testing, prelocation and pin-pointing

Voltage range 8/16/32 kV step less adjustable

Energy up to 2100 J

IRG 2000
Fault location system for medium voltage networks
Syscompact 2000 / 32 kV portable version with wheels

Cable testing, prelocation and pin-pointing

Voltage range 8/16/32 kV step less adjustable

Energy up to 2100 J

IRG 2000
Fault location system for medium voltage networks
Syscompact 2000 / 32 kV

Cable testing, prelocation and pin-pointing

Voltage range 8/16/32 kV step less adjustable

Energy up to 2100 J

IRG 2000
Fault location system for medium voltage networks  
Syscompact 3000

Cable testing, prelocation and pin-pointing

Voltage range  8/16/32 kV  
step less adjustable

Energy up to 2100 J  
IRG 3000
TRANSCABLE
Cable Test Van TRANSCABLE including Cable Diagnosis
References

Thousand’s of BAUR Cable fault location systems are in daily use all over the world.

60 years of experience.