MS-Technik – Who are we?

Location: KIEL, Northern Germany

Roots: HDW, Salzgitter Elektronik, Hagenuk

> 40 Years Experience in Cable Measurement Technology Worldwide, Combined with Innovative Capability of Young Engineers

Development / Design of Measurement of Particular Instruments for Cable Measurements

PD Measurements and Experts Opinion with 50Hz Technology according to IEC 60502-4

Training Courses

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MS-Technik – Agency in Netherlands

Heynen B.V., De Groote Heeze 11, NL-6590 AA Gennep

www.heynen.com

Guidance, Sales, Operation Manuals in Netherland Language

Quick Repair and Calibration Service for instruments within only a few days to achieve high availability

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Fault Location during Power Supply
We keep lights burning!

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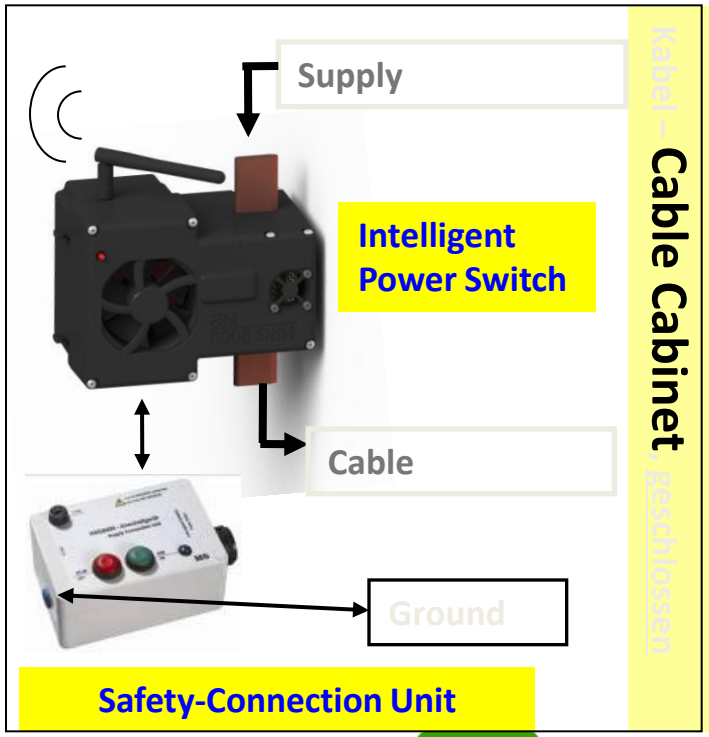
Intelligent Multifunctional Fuse NSG 7000 G/T

Live low voltage cables

Protected Power Supply and Fault Location with GSM, GPS, TDR*



*TDR = Reflection Measurement

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Power Switch mit 10A - 250A continuous Current,7000A Surge

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Small Control for Initial
Start by Standby-
Persons

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Full Function Display

Control for

Maintenance Fault

Location Persons

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2 Sets of Instruments

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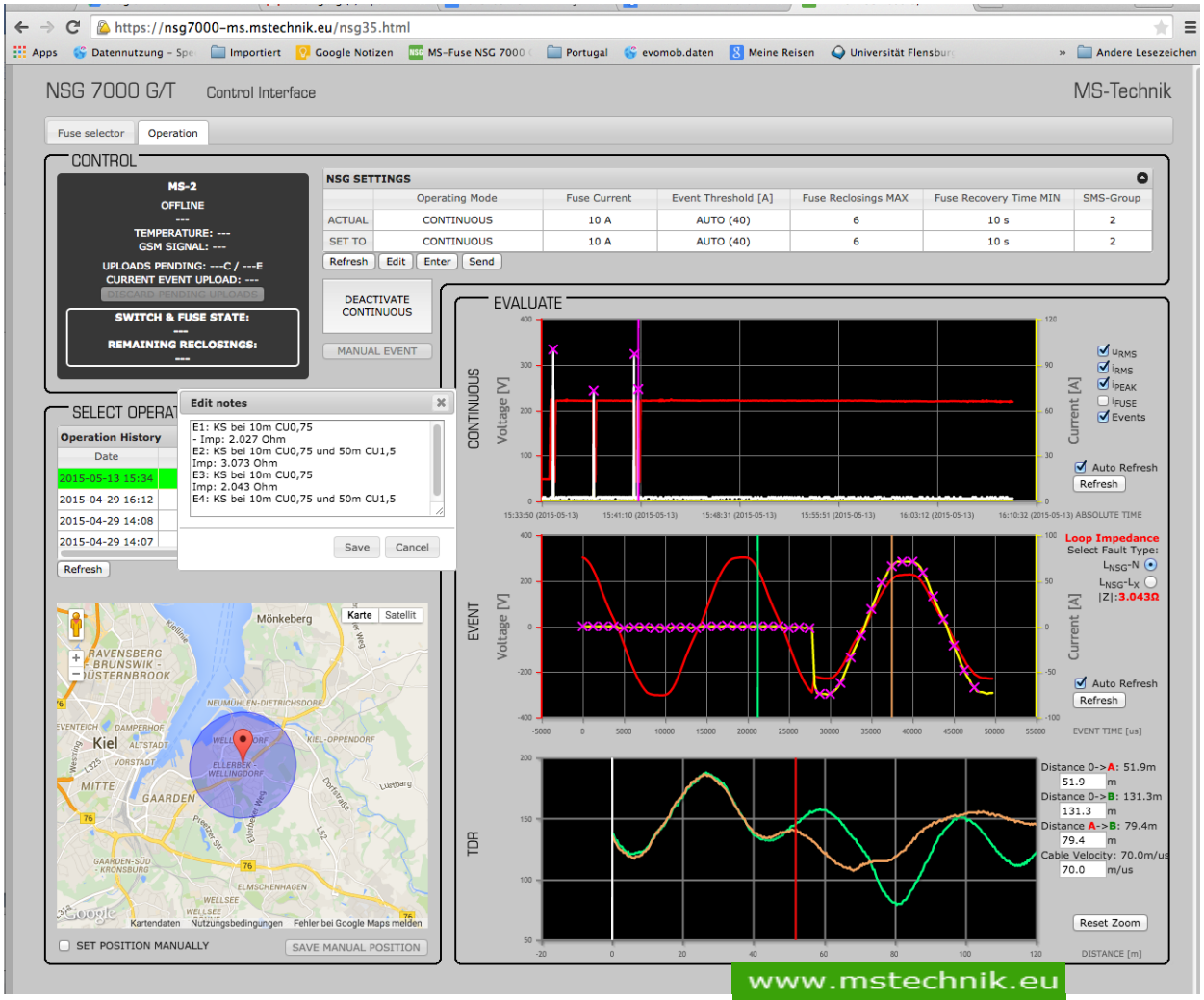

Webcontrol

- Operation Data
- Location

Continuous Data

- Voltage / Current

Event

- Highres. U, I
- TDR arc-reflection
- Impedance

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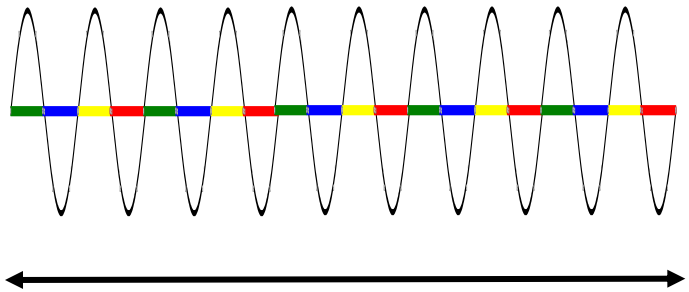
High-Speed Online Calculation of RMS-Current

→ NSG „Fuse“ is less timelag than typical melting Fuse

→ Faults Phase-Phase: only 1 Instrument necessary



$$I_{rms} = \sqrt{1/t \int I^2 dt}$$

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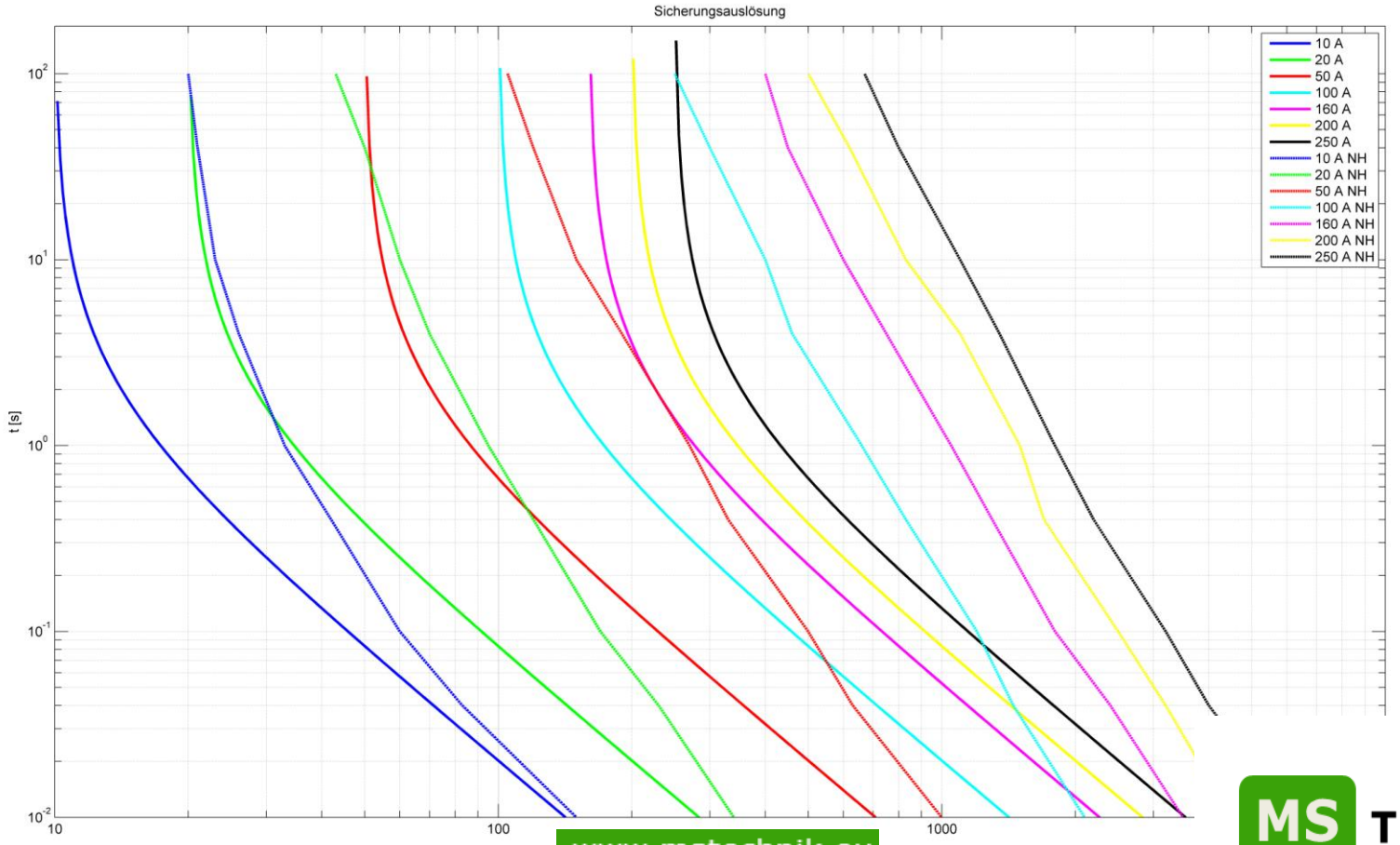
Comparison of melting characteristics: NH Fuse / NSG 7000 G/T



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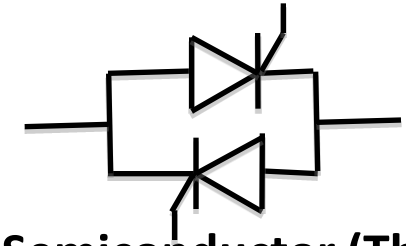
Criteria for Choice of Technology Power Switch NSG7000



Semiconductor (Thyristor)

- Very quick, Switching Characteristic programmable, faster than melting Fuse; → 1 single Instrument possible for 3Phase Cable
- Innovative Additional Functions possible → safety for investments
- Circuit breaking at 0A Current, no inductive Voltage Peaks
- Nearly no Ageing
- Intelligent Control, open for additional innovative Functions
- Small Dimensions even with Cooling System

Mechanical (Vacuum-) Switch

- Min. 20ms
- Circuit breaking mechanical time lag; not guaranteed at 0A Current, inductive Voltage Peaks possible
- Ageing Contacs because of melting, when interrupting high Currents (10.000 Switchings at nominal Current, 50 Switchings at 16kA)
- Simple Control
- Low Power Loss
- Simple mechanical Construction

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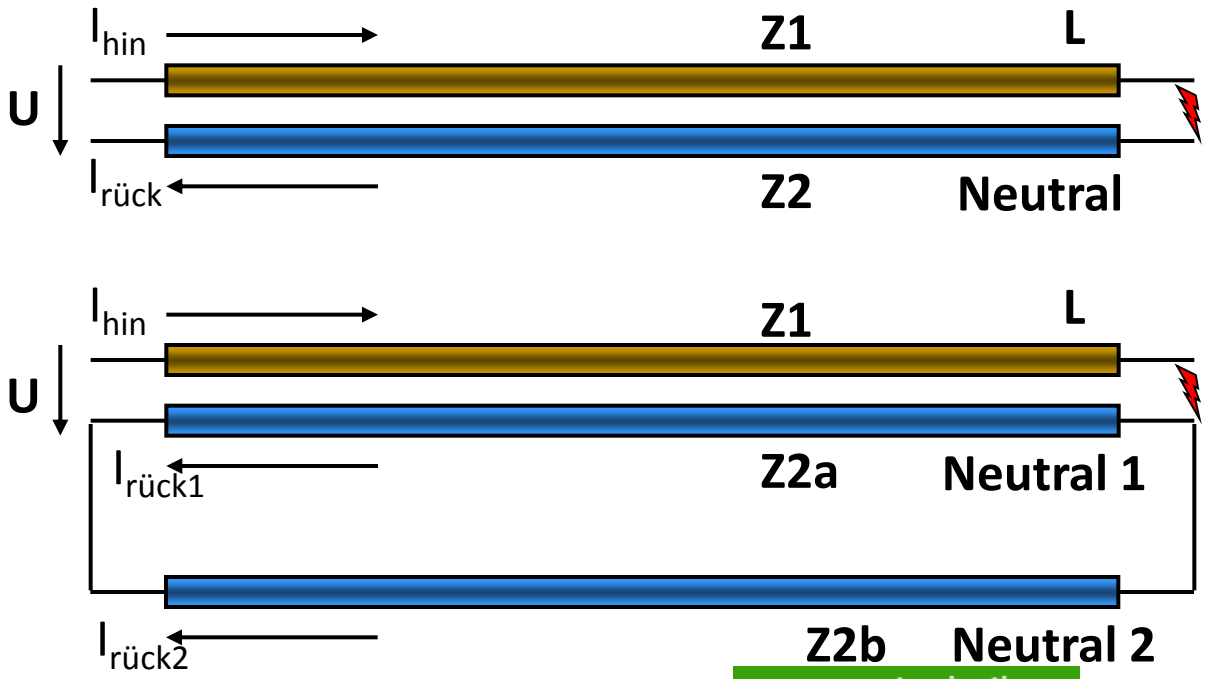
Negative effect of neutral ring net on impedance

Limited value: Calculation of fault distance via impedance

Wishful thinking: Distance ~ Z = U /



Branch line

Zges = Z1+Z2

Ring line (for neutral), often

Zges = Z1+Z2a||Z2b

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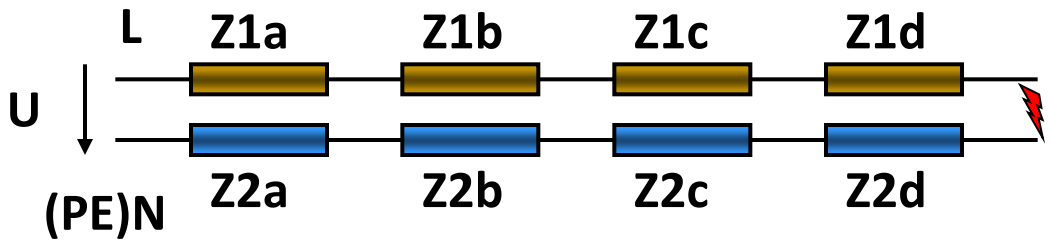
Negative effect of cable type change on impedance



Zges = Z1a+Z2a+Z1b+Z2b+Z1c+Z2c+Z1d+Z2d

Lenghts, diameters, materials (Cu, Al, Pb) must be known → use MS-Tool for Distance Calculation!

When using TDR measurement pulse propagation velocities vary only a few %, i.e. the measurement of fault distance is even the accurate!

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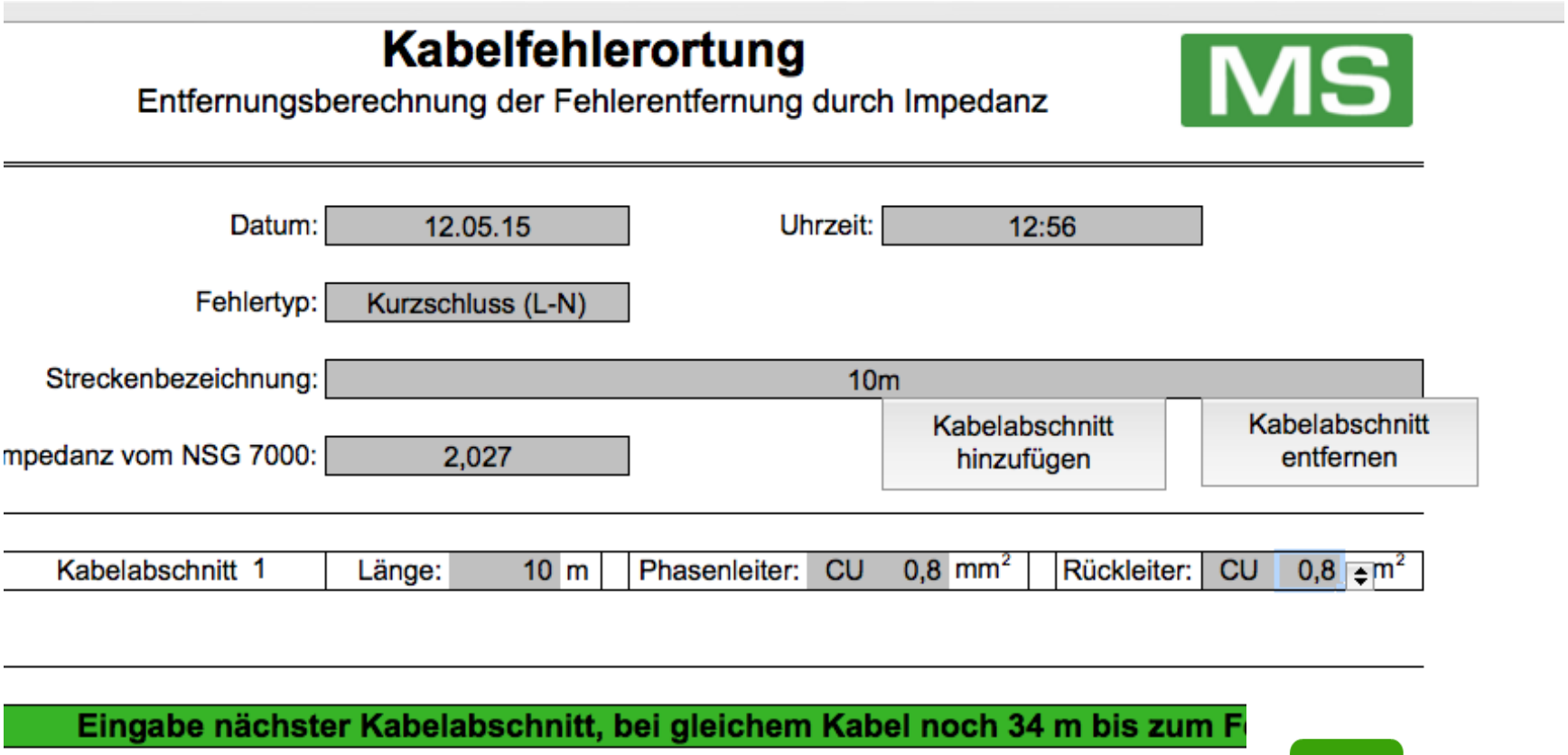
Software Tool: Distance calculation via impedance



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Fault location with clients connected

Acoustic pinpoint location

- **Pinpointing via powerful surging with energy from the mains with usual ground microphones, with clients connected**

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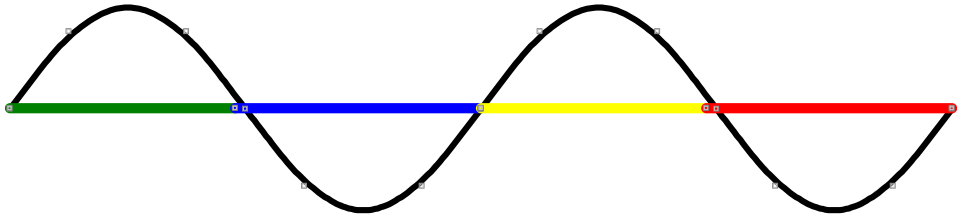
Surge mode / Acoustic pinpoint Location



Longer Duration → more Energy → more Sound

Cable Protection by Fuse Current → Control of Surge Interval

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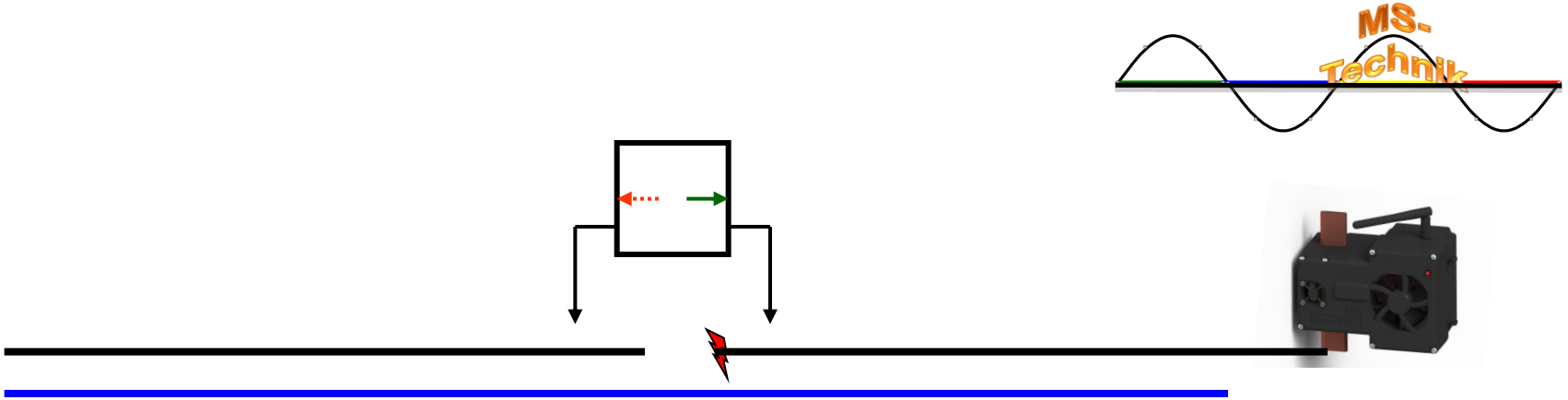
Fault location with clients connected

<u>Pinpoint location with step voltage measurement in continuous supply mode on unshielded cables with insulation fault phase-earth (similar to sheath fault location)</u>



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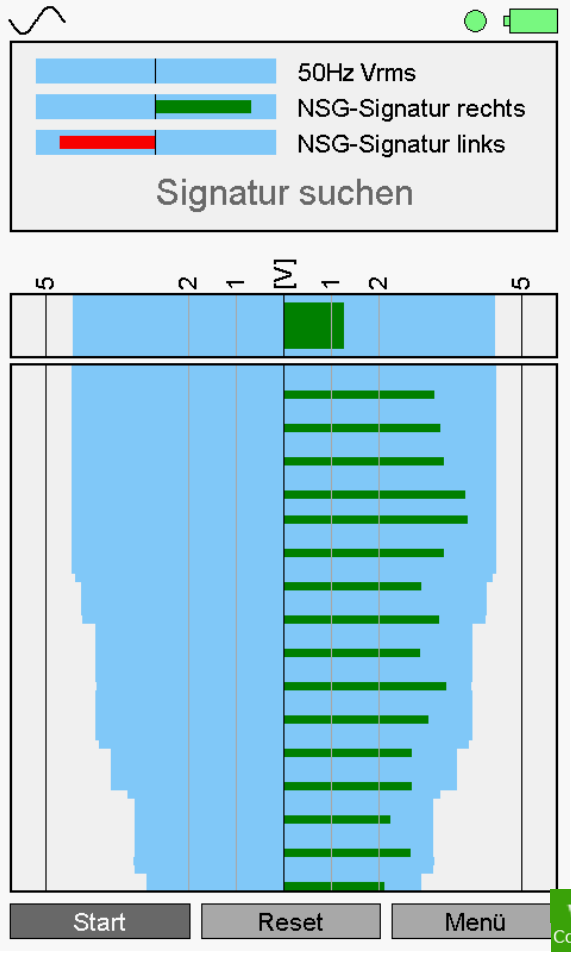
Fault location with clients connected



Screen of Step Voltage Measurement

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Live low voltage cables

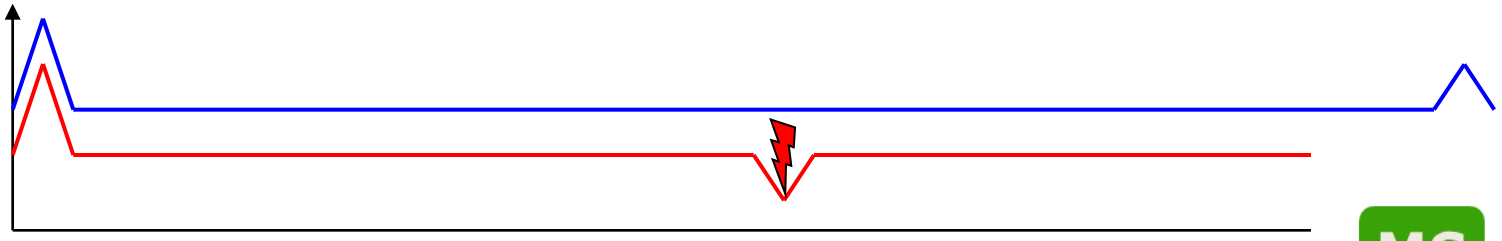
Intelligent Multifunctional Fuse NSG 7000 G/T

Fault location on LV cables with clients connected

TDR arc reflection during continuous supply and during surge mode

- **TDR measurement inside the intelligent fuse allows fault (pre-)location with clients connected**
- **Time consuming installation of additional instruments is avoided**

Changes of cable impedance, material and core diameter have no major effect on the accuracy of fault distance measurement -> except cable map no more details about cable type needed!



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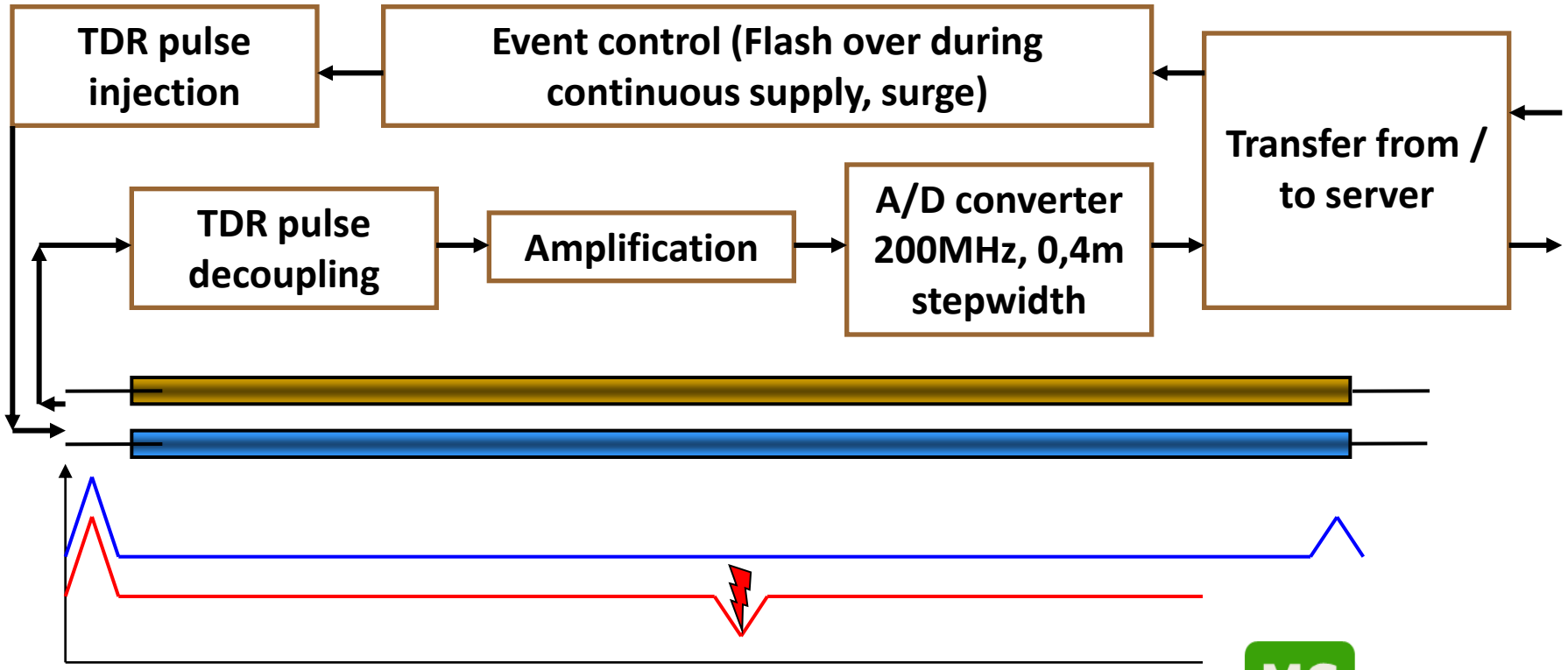
Function of Live Cable Arc TDR Measurement



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