Introduction to Cable Fault Location
Cable Fault Diagnosis

For cable fault location, we distinguish in:

- **Parallel Faults:**
  - Low resistance: $R_f \leq 300\ \Omega$
  - High resistance: $R_f > 300\ \Omega$

- **Series Faults:**
  - Low resistance: $R_f \leq 10\ \Omega$
  - High resistance: $R_f > 10\ \Omega$

Low resistance means: Standard pulse echo method should be possible
High resistance means: High Voltage Methods should be applied
Decision – Low Resistance Fault?
Yes, then TDR

Rf $\leq 300 \, \Omega$

LOW Resistance fault

LV Methods of Pre-Location = Pulse Echo or TDR

Fault Diagnosis

Fault Notification

HIGH Resistance fault
Decision – Low Resistance Fault?

Yes, then TDR

- PULSE ECHO: Low resistance Fault <300Ω
  - TDR stands for Time Domain Reflection
  - model TDR1699: High Voltage Inc.
**Decision – Low Resistance Fault?**

Yes, then TDR

**Typical Traces**

- **TDR1699**
  - Cable without fault (start / end of cable)

- **TDR1699**
  - Parallel Resistance Fault

- **TDR1699**
  - Short circuit Fault

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**HVI**

www.hvinc.com
Decision – High Resistance Fault?
Yes, then HV Methods

Fault Diagnosis

LOW Resistance fault
LV Methods of Pre-Location
Pulse Echo TDR

Rf > 300 Ω
HIGH Resistance fault

HV Methods of Pre-Location
Arc Reflection
Impulse Current
Decision – High Resistance Fault?

Yes, ARC Reflection

- It is a combination between:
  - TDR
  - Surge generator
  - Arc stabilisation unit.

- This method allows to prelocate high resistance faults and flashing faults, using standard pulse echo techniques.

- This method can be used anywhere where a fault can be ignited.
CDS3632U Arc Reflection

Arc stabilisation unit

CDS32xx Surge generator

HV Impulse

Pulse echo

TDR1699
Typical Traces

Reference Trace

Arc present

Comparison

Fault distance
Decision – High Resistance Fault?

Yes, then HV Methods

LOW Resistance fault

LV Methods of Pre-Location

Pulse Echo

TDR

Fault Diagnosis

Fault Notification

Rf > 300 Ω

HIGH Resistance fault

HV Methods of Pre-Location

Arc Reflection

Impulse Current
Decision – High Resistance Fault?

Yes, Impulse Current

- It is a combination between:
  - Surge generator
  - TDR (Memory)
  - Pulses are detected by an inductive coupler (Current Transformer)

- This method allows to prelocate high resistance faults and flashing faults.

This concept has 2 methods:
- Standard method
- Loop on – Loop off method (Advanced)

Typical Trace
CDS3632U Impulse Current ICE

Surge generator

HV Impulse

Inductive Coupler

TDR1699

Only used as a memory

Only used as a memory`
The surge generator sends a HV Impulse into the cable. This creates a spark at the faulty spot. This spark is a source for an impulse which is used to measure the fault distance.

Shock Discharge Generator:
The diagram illustrates the measurement of fault distance using an impulse current technique. The setup includes a surge generator connected to an inductive coupler. The pulse generated by the surge generator travels along the line, and the time it takes, $T_x$, is equal to the fault distance, $L_x$.

- **Surge generator**
- **Inductive coupler**
- **Pulse**

The typical trace shows the propagation of the pulse along the line. The points A and B mark the arrival of the pulse at different points, with $t_x + \Delta t_i$ and $t_x$ indicating the time delays for different segments of the line.
Impulse Current ICE
Standard Method – Results 1 & 2
Cable Fault Location

Fault Notification

LOW Resistance fault

Fault Diagnosis

LV Methods of Pre-Location

Pulse Echo TDR

HIGH Resistance fault

HV Methods of Pre-Location

Fault Located?

No

Fault Conditioning

Rf ≥ 300 Ω
What is Pinpoint Fault Location?

► It is the technique used to accurately identifying the actual point of fault (all other techniques up to now have been prelocation!)

Basics:

► A Surge generator is used to generate a “flashover” at the point of fault. The noise, created by this flashover, is then detected using a ground microphone + amplifier and headphone.
PIN POINT Fault Location

- Using an Impulse / Surge generator in conjunction with acoustic and electromagnetic detection.
- Dominates fault pinpointing.
- It is the best, accurate way of pinpointing the fault position.
- It has an almost perfect record of success in pinpointing faults.
- A measure of your success is how many excavations there have been!