



# Introduction to Cable Fault Location



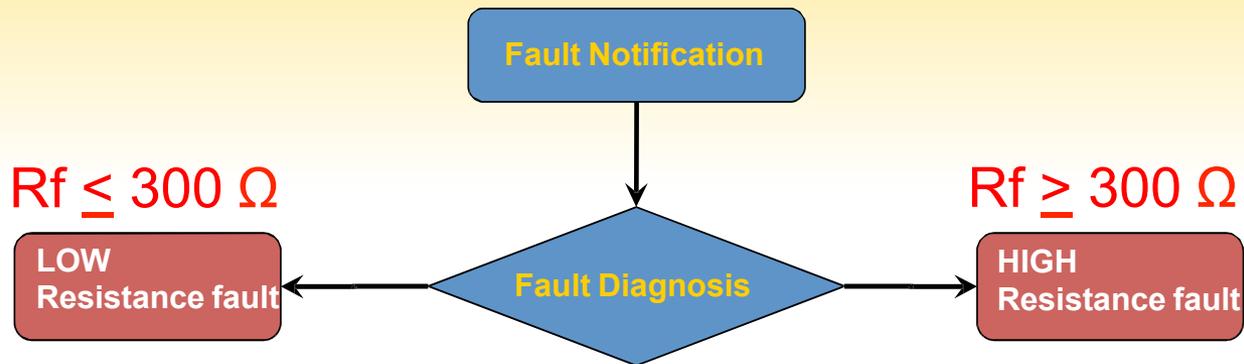
**HIGH VOLTAGE INC.** 31 County Rt. 7A • Copake, NY • 12516  
t. 518-329-3275 • f. 518-329-3271 • sales@hvinc.com • hvinc.com



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# Cable Fault Diagnosis



For cable fault location, we distinguish in:

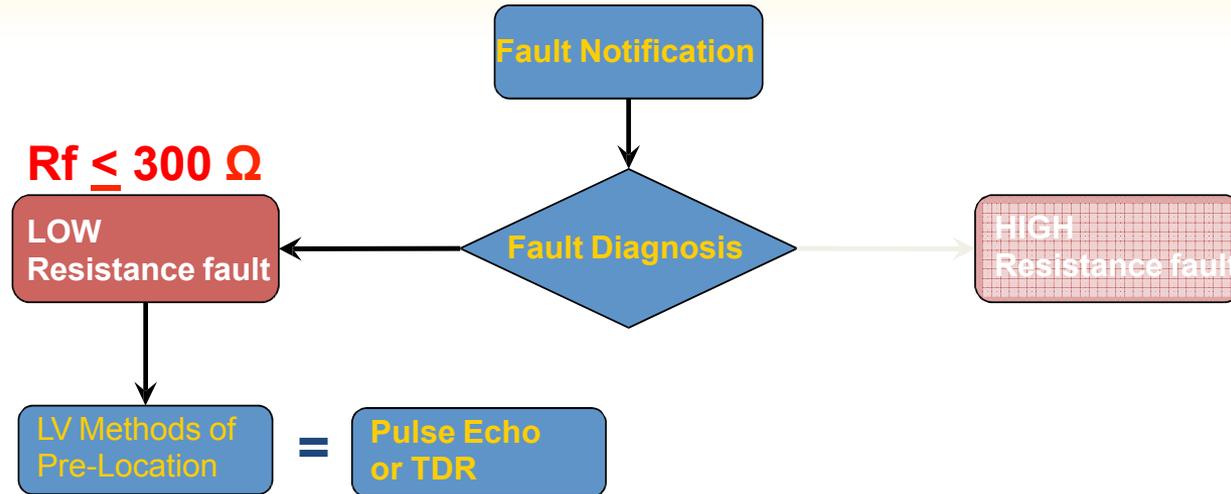
- ▶ Parallel Faults:
  - Low resistance :  $R_f \leq 300 \Omega$
  - High resistance:  $R_f \geq 300 \Omega$
- ▶ Series Faults:
  - Low resistance :  $R_f \leq 10 \Omega$
  - High resistance:  $R_f \geq 10 \Omega$

Low resistance means: Standard pulse echo method should be possible

High resistance means: High Voltage Methods should be applied

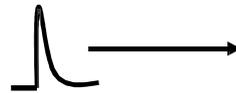
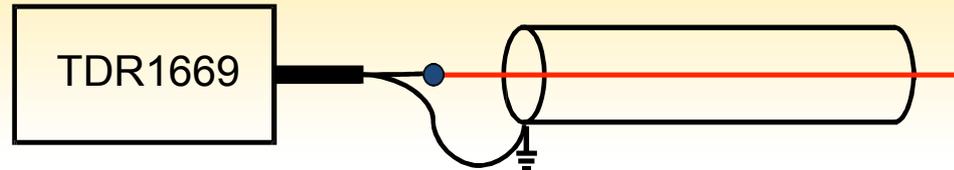
# Decision – Low Resistance Fault?

Yes, then TDR



# Decision – Low Resistance Fault?

## Yes, then TDR



It is like radar:  
A pulse is send into the cable

A change of cable impedance  
will reflect this pulse.  
In this case: The reflection is caused  
by the end of the cable



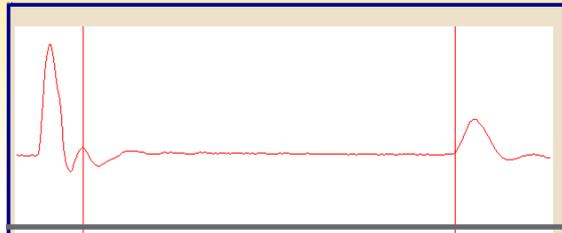
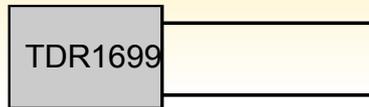
Pulses visible on the screen of the TDR

- ▶ **PULSE ECHO: Low resistance Fault <math><300\Omega</math>**
  - ▶ TDR stands for Time Domain Reflection
  - ▶ model TDR1699: High Voltage Inc.

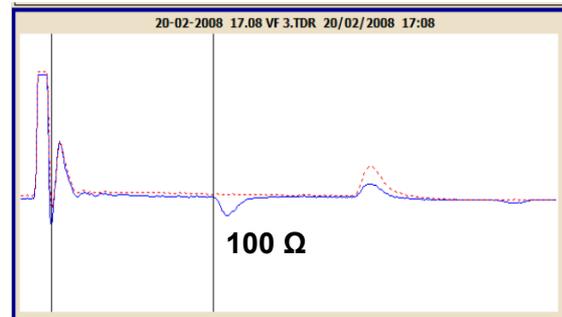
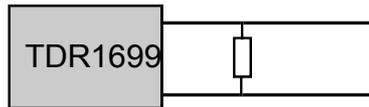
# Decision – Low Resistance Fault?

## Yes, then TDR

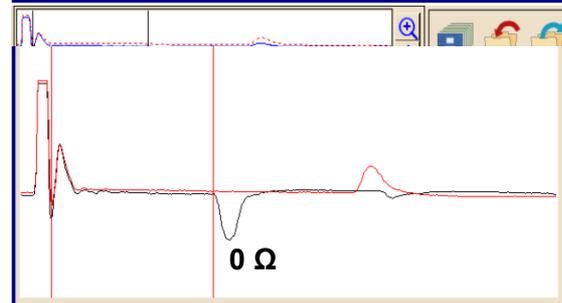
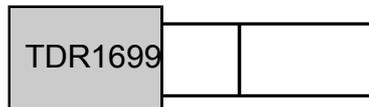
### Typical Traces



Cable without fault  
(start / end of  
cable)



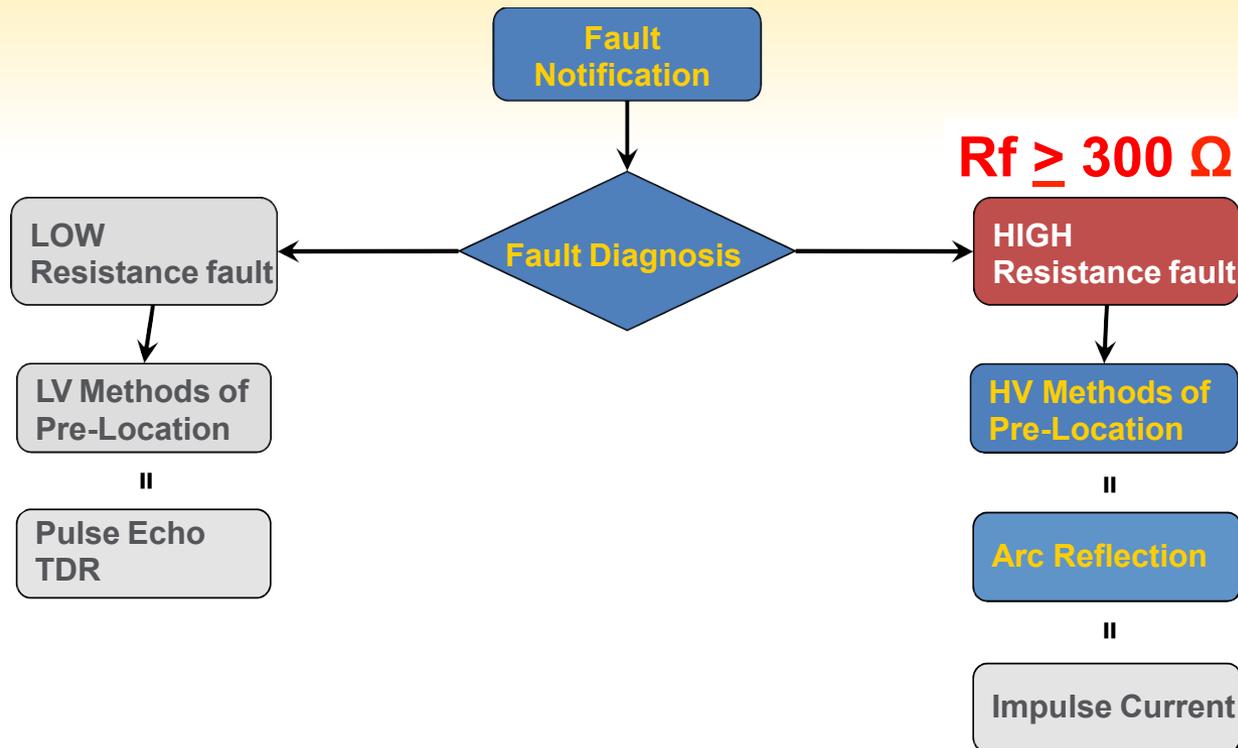
Parallel Resistance  
Fault



Short circuit  
Fault

# Decision – High Resistance Fault?

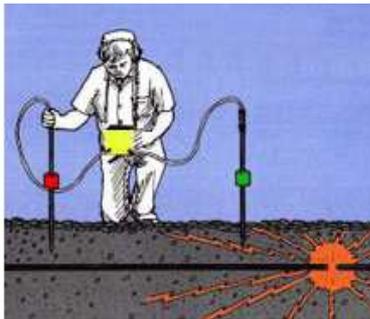
Yes, then HV Methods



# 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.



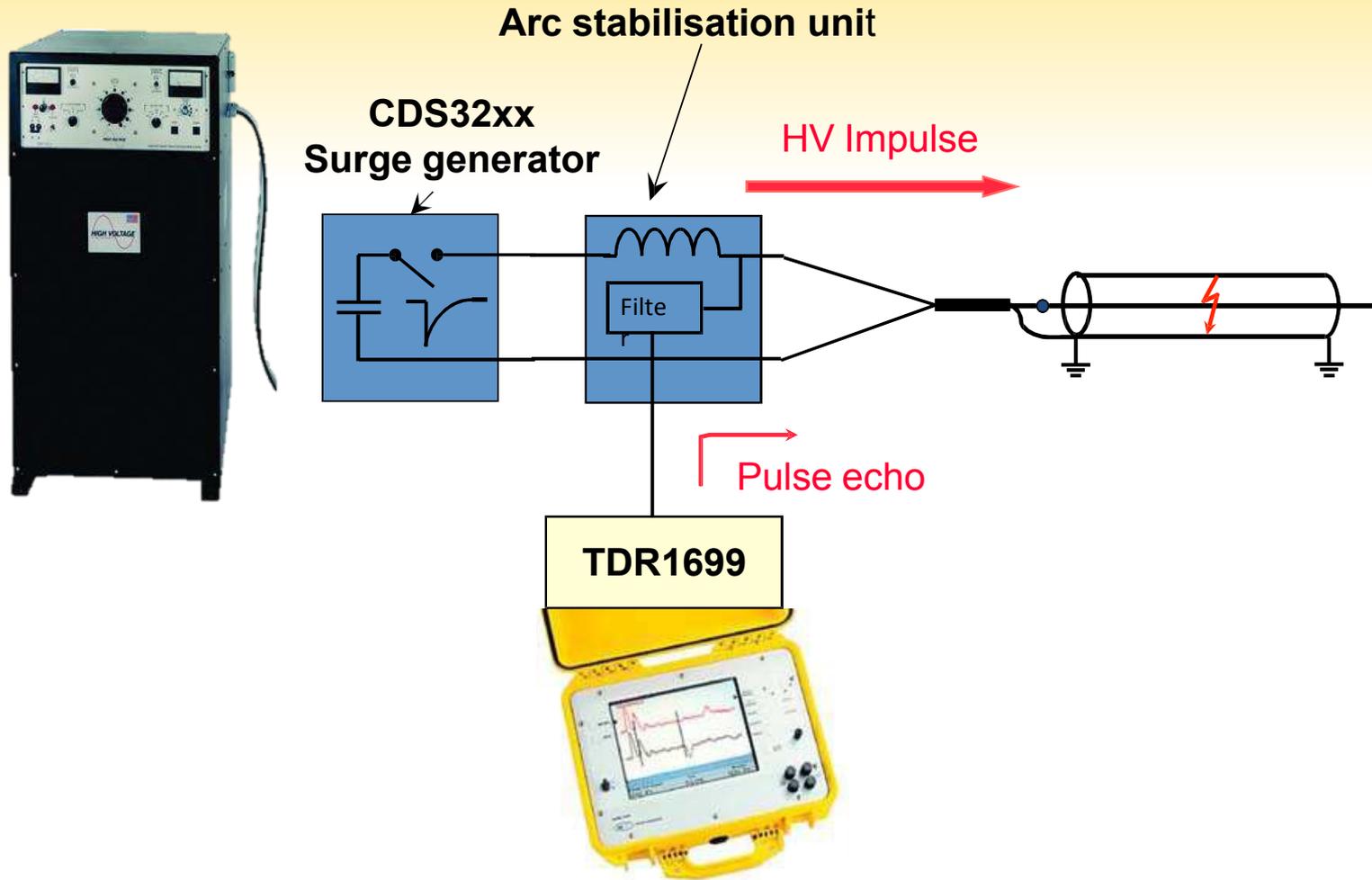
CDS3632U



CDS2016U



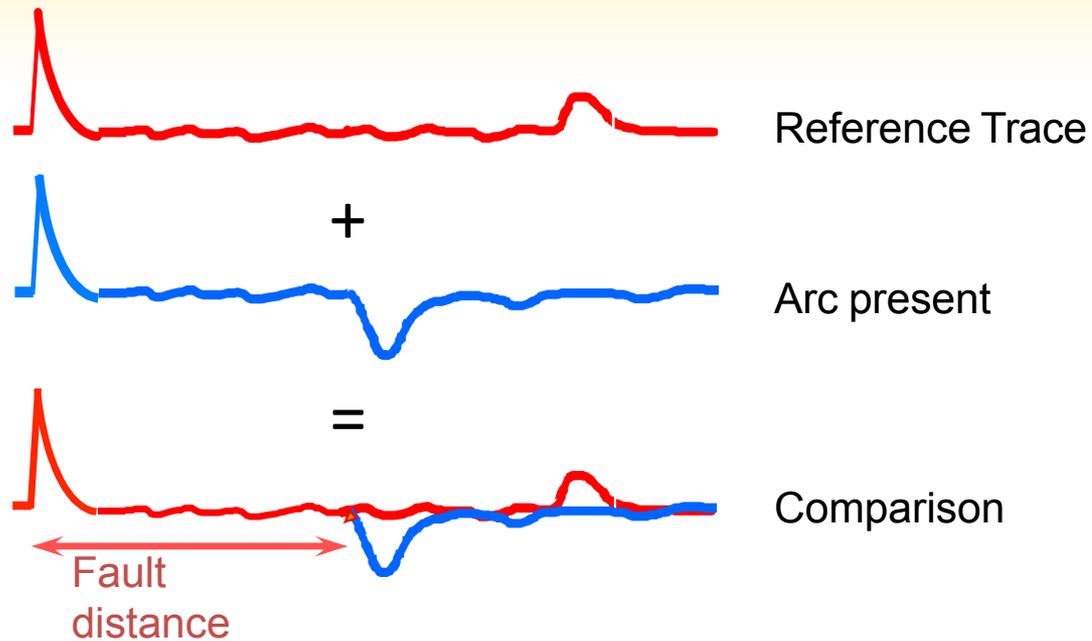
# CDS3632U Arc Reflection





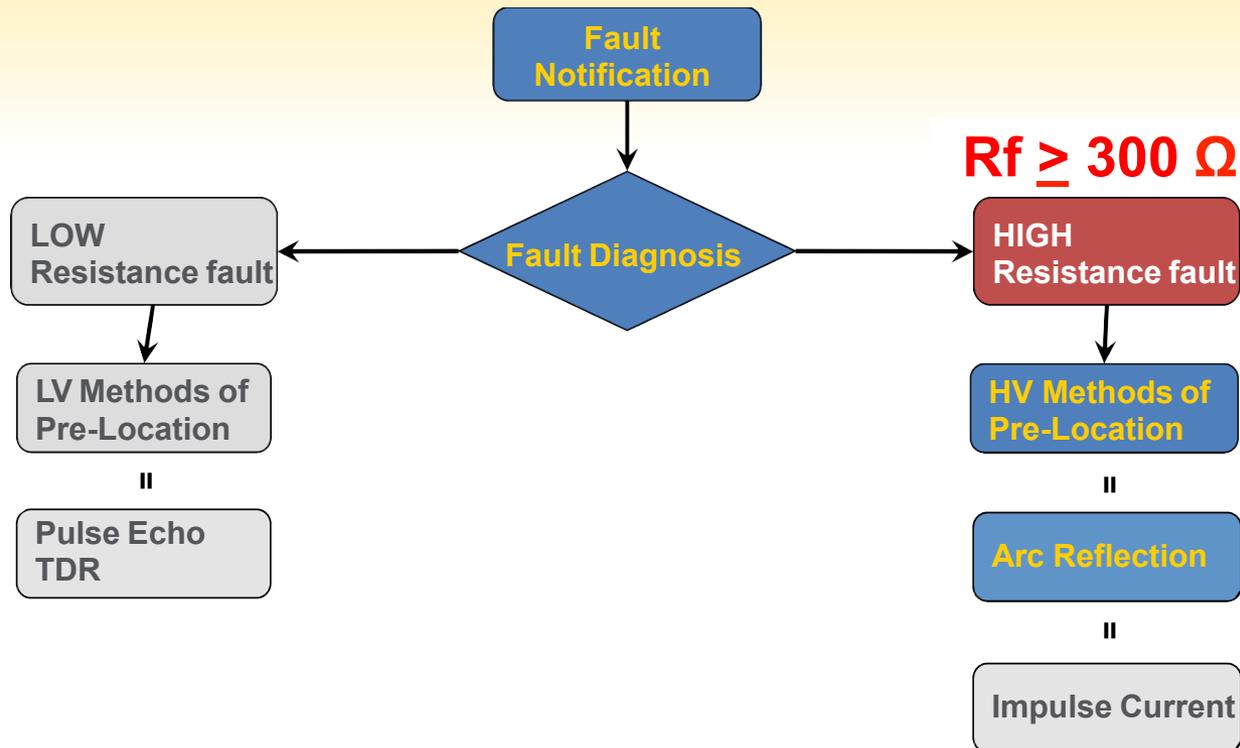
# CDS3632U Arc Reflection

## Typical Traces



# Decision – High Resistance Fault?

Yes, then HV Methods



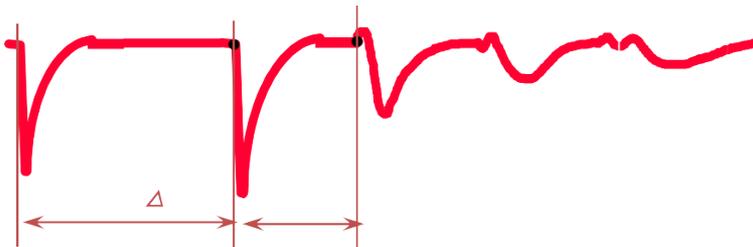
# Decision – High Resistance Fault?

## 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



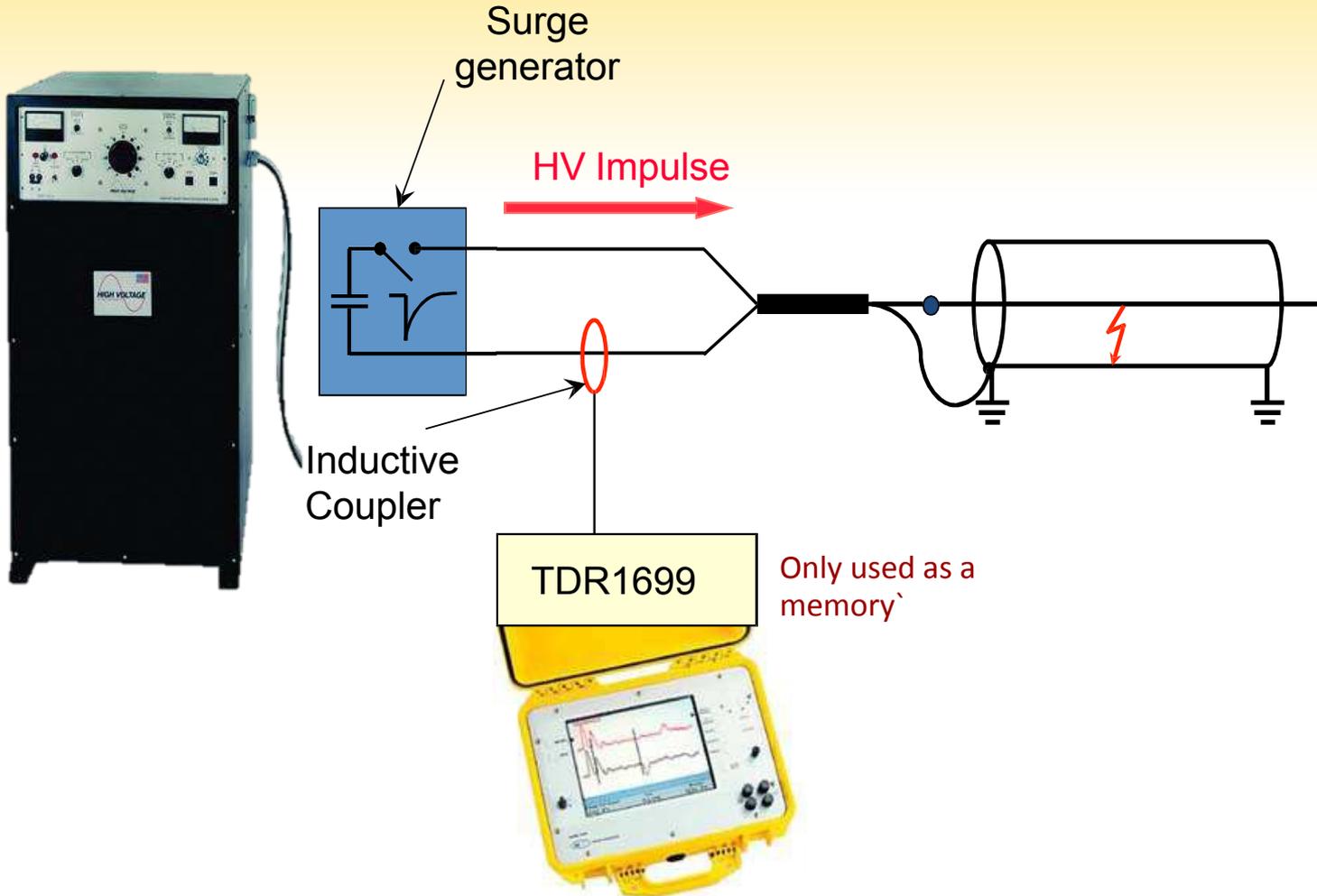
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# CDS3632U Impulse Current ICE



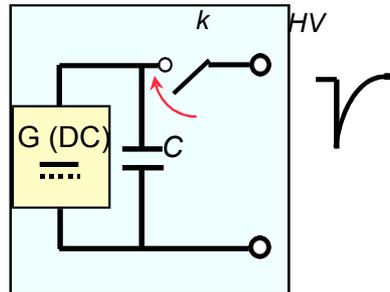


# CDS3632U Impulse Current ICE

The surge generator sends a HV Impulse into the cable.  
This creates a spark at the faulty spot.

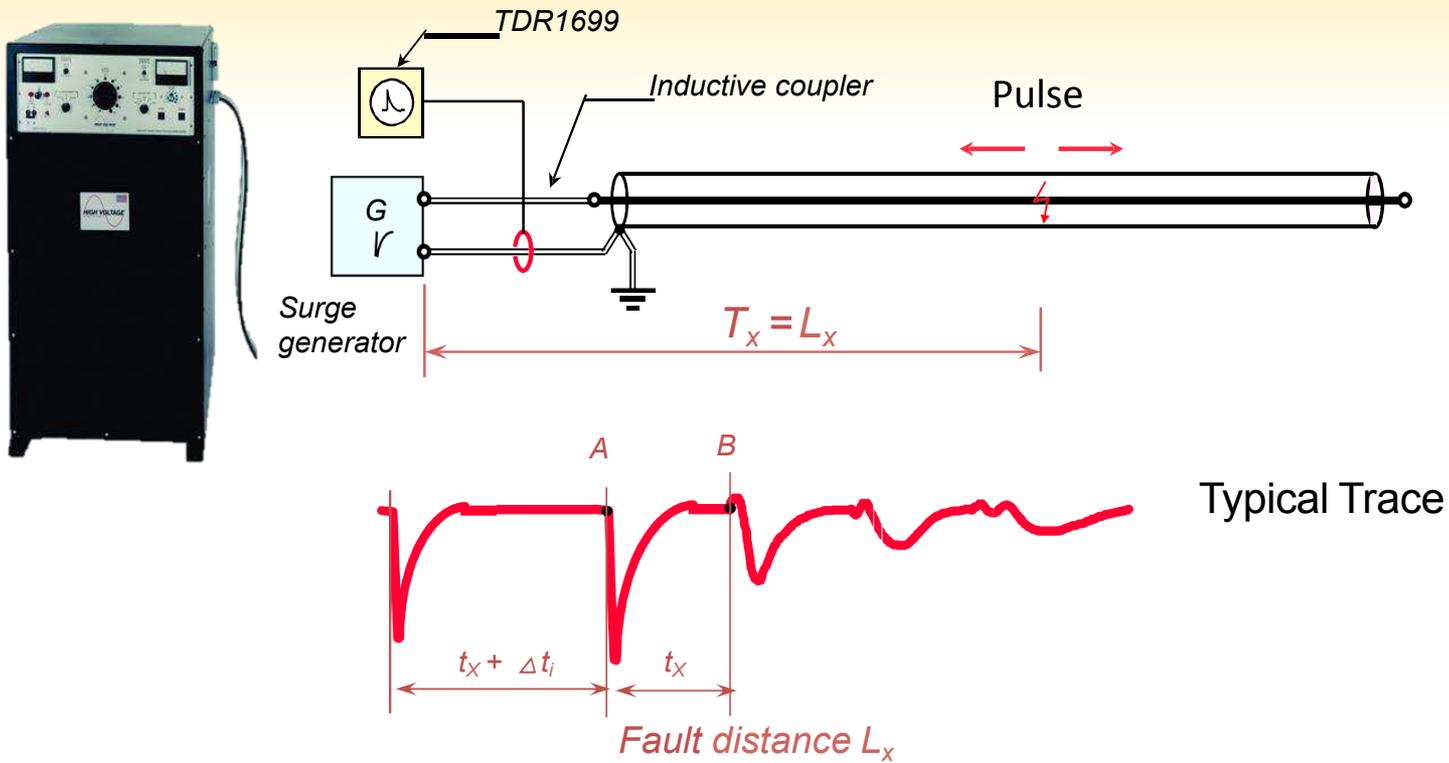
This spark is a source for an impulse which is used to  
measure the fault distance

**Shock Discharge Generator:**



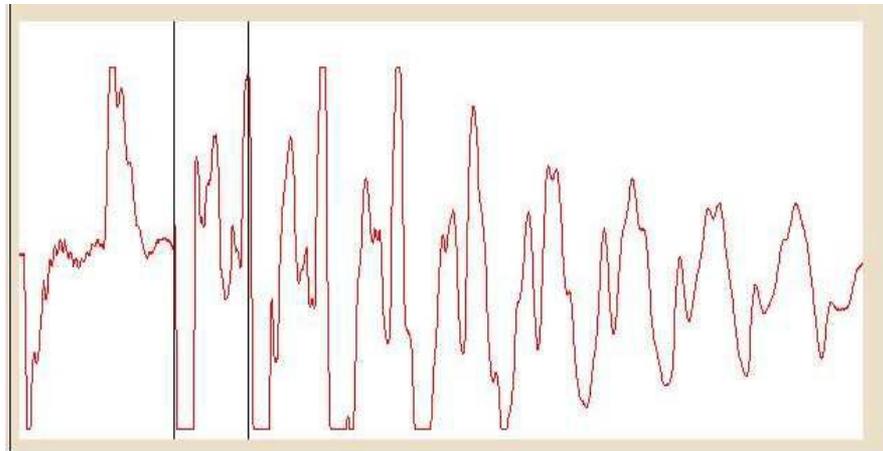
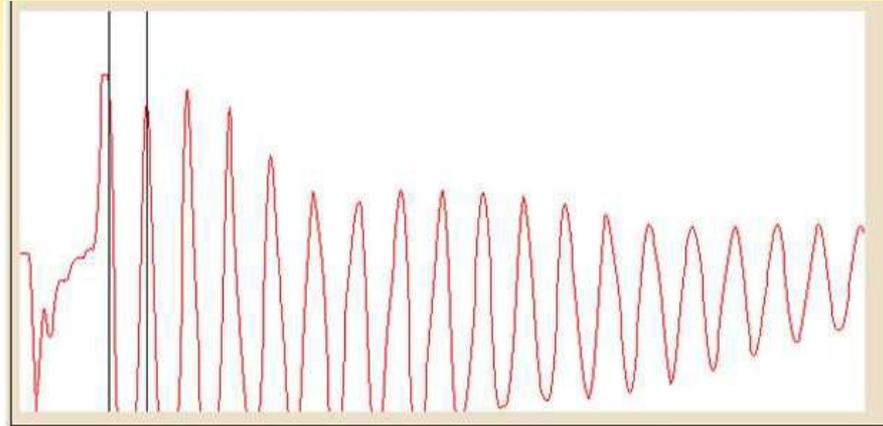


# CDS3632U Impulse Current ICE

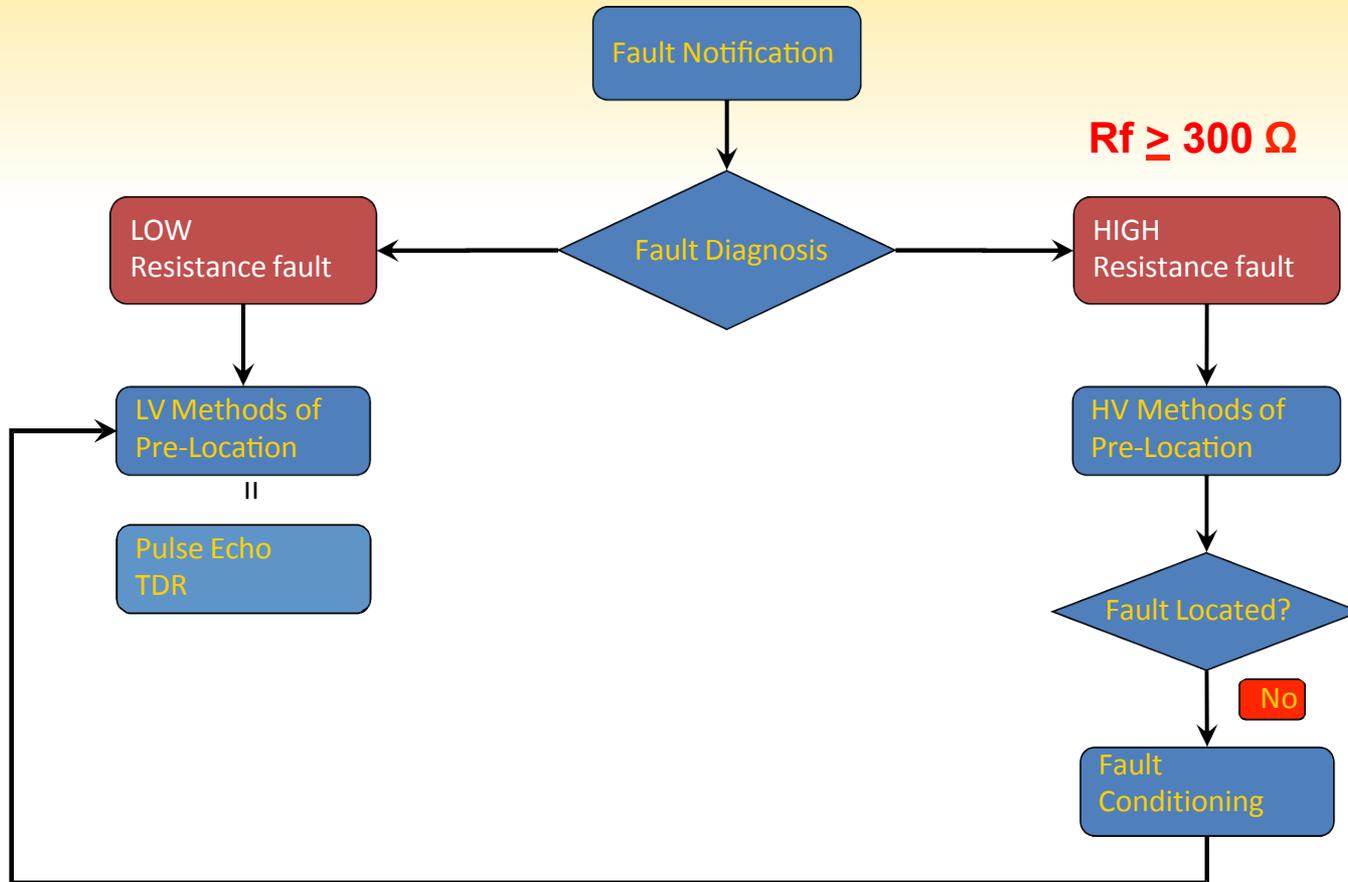




# Impulse Current ICE Standard Method – Results 1 & 2



# Cable Fault Location



# PIN POINT Fault Location

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 !

