

# KGT R-15

## Frequency Domain Reflectometer



### Introduction

The R-15 Frequency Domain Reflectometer is a small, lightweight, high-speed device that quickly and accurately locates cable faults in complex environments such as the laboratory or the field. It obtains the cable impedance spectrum data by injecting the sweep signal into the cable, and uses signal processing and algorithms to locate faults. Using the accompanying test software makes the diagnosis process faster and easier. Just connect the device, set the parameters, connect the cable for diagnosis, and in a few minutes, you can easily locate the fault. The product provides an accurate and reliable solution for cable fault location.



- High precision, broadband domain, fast, non-destructive cable local fault location in complex electromagnetic environment.
- The cable diagnosis requirements of signal window function processing, interference point suppression and elimination, and simultaneous location of multiple faults are realized.
- A supporting software testing system with user-friendly user experience and easy operation interface.

### Application

Frequency Domain Reflectometer is a kind of instrument used for testing and analyzing high-voltage cables in power system. Its functions include the following aspects:

- Impedance measurement: The instrument can accurately measure the impedance of the cable and obtain the impedance spectrum of the cable. By analyzing the impedance spectrum, we can determine the types of faults in the cable, such as short circuit, open circuit, partial discharge, etc.
- Fault location: In case of cable fault, the instrument can determine the location of the fault by measuring the impedance spectrum of the cable and provide accurate fault location results.
- Cable quality assessment: Cable quality is one of the important factors affecting the safe operation of power system. The wideband impedance analyzer can measure the impedance spectrum of the cable and then evaluate the quality of the cable, which provides an important reference for the operation of the power system.
- Preventive maintenance: By regularly using the instrument to measure the impedance spectrum of the cable, preventive maintenance of the cable can be achieved. Early detection of cable problems and timely measures can greatly improve the reliability and security of the power system.

In short, the Frequency Domain Reflectometer can detect and analyze the high voltage cables in the power system and provide important support for the safe operation of the power system.

### Feature

- High precision: The cable defect location results are accurate and reliable, the error is less than 0.5%.
- Adjustable frequency: Users can set the test frequency range to adapt to different cables. The positioning accuracy can be adjusted by changing the frequency upper limit of the length and voltage level.
- Easy operation: software operation is simple, user experience is friendly, after setting the parameters, cable defect location map can be obtained with one key without additional operation.
- Historical record: can store the previous detection and positioning results, convenient comparative analysis, and establishment cable health file.
- Non-destructive testing: Fast testing, no damage to the cable, can shorten power failure maintenance time to minimize power outage time and impact.
- Light and portable: The product is light and easy to carry, convenient for daily transportation, installation, and testing operations.

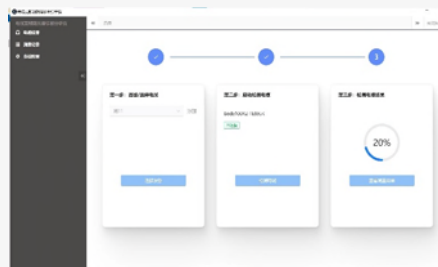
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## Interface

The software is easy to use with a simple and intuitive user interface that does not require expert knowledge.

The built-in intelligent diagnosis and positioning algorithm can automatically form a cable defect location map.



## Specification

### Testing Parameters

The test frequency range	20Hz to 100MHz
The maximum voltage output of excitation source	5V, and the updating rate is 1000MS/s
Dynamic test range	>80dB
Fault location error	less than 0.5%
The effective test length	10m~10km
The operating temperature	-20℃ ~ +60℃
Operating humidity	≤80% (RH, relative humidity)
Operating altitude	≤3000m

### Mechanical Parameters

Weight	3.2kg (excluding measuring cable)
Dimensions (length × width × height)	22×20×8cm
Power supply	DC, 9~24V, 10W

### Attachments

DC power cable, USB data transmission cable, alligator clamp connection cable for cable connection, transport case.

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## Case Analysis

### Case 1

**Test purpose:** To locate the cable discharge defects.

This project successfully located the discharge point in the line based on the cable defect location technology of impedance spectrum and compared the location results with that of the oscillating wave partial discharge detection method (319m). It was found that the two results were relatively close, and the cause of discharge was found to be the abnormal T connection box of the cable in the middle position.

#### Information of cables

Test time: April 8, 2021

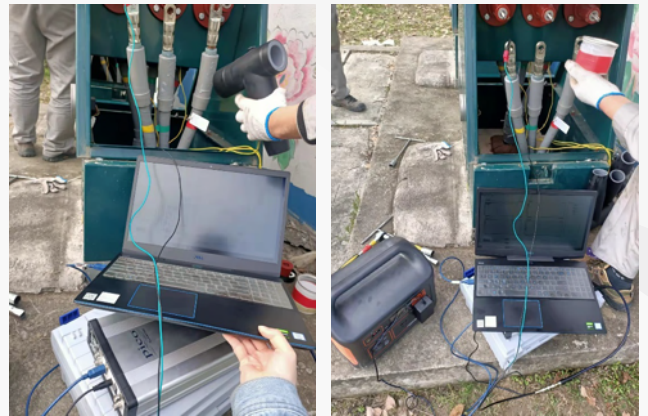
Test location: Jiaxing, Zhejiang

Cable type: XLPE-3×300mm<sup>2</sup>

Test site diagram:

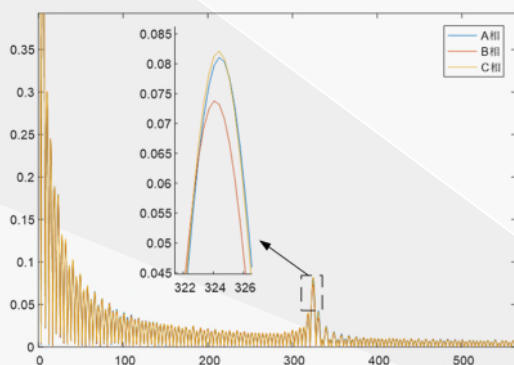


(a) Comparison of local emission detection of oscillating wave

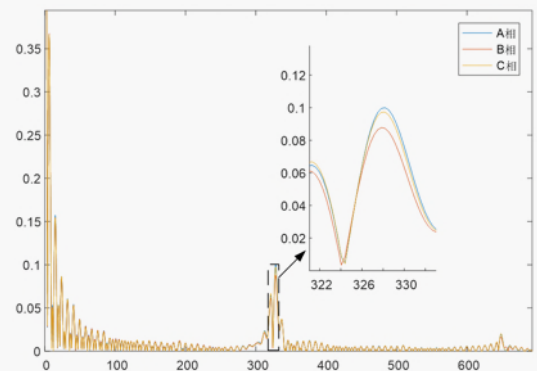


(b) Cable defect location based on FDR

#### Test results:



(a) Impedance amplitude spectrum location curve



(b) Impedance phase spectrum positioning curve

The positioning results based on the impedance amplitude spectrum are all around 324m, and the positioning results based on the impedance phase spectrum are all around 328m, which is close to the results of the oscillating wave partial discharge detection method 319m.

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## Case 2

**Test purpose:** To locate the aging and water inlet defects

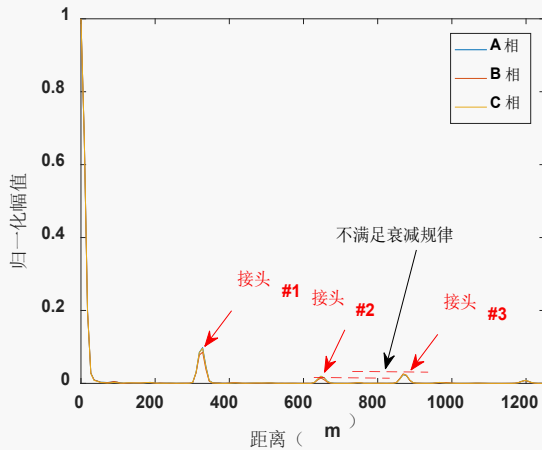
The field test was conducted on June 4, 2022. The total length of the cable is 1205m and there are three intermediate joints. In the test results, it is found that the positioning amplitude of joint #3 exceeds that of joint #2, which does not meet the attenuation law. It is found to be a damp defect after disintegration.

### Information of cables

Test time: June 4, 2022

Test location: Ningbo, Zhejiang

Cable type: XLPE-3×300mm<sup>2</sup>



(a) Test curve



(b) Damp defect

Based on the detection curve, it can be seen that the curve of the joint position obviously does not meet the attenuation law, so it can be judged that there is a defect of aging or water intake at the joint position. The accuracy of the test system of the cable broadband linear impedance spectrum was verified after the disassembling of the defect position in the later period.