



Cases

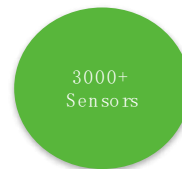
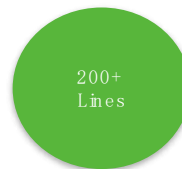
1) Distribution Network

Since April 2015, dozens of Smart Distribution Network Monitoring Systems with thousands of sensors have been put into field operation.

The unknown operational status of distribution network for utilities in the past has become completely visible since the systems are in service. The system monitors the distribution network 24/7 for events and faults. With the help of the system, inspection crews improve their efficiency greatly and the outage time is significantly shortened.



Field operation > 42 months
(By E2018)



10kV QS Line
(Suzou, JS)

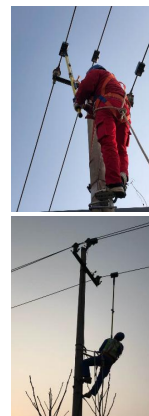
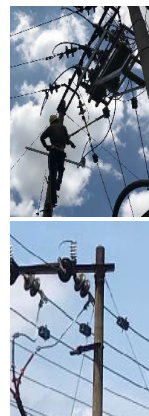
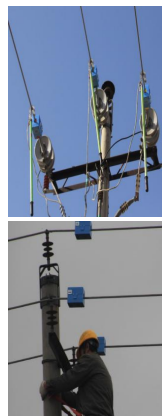
10kV LY Line
(Luohe, HN)

35kV SJ Line
(Erdos)

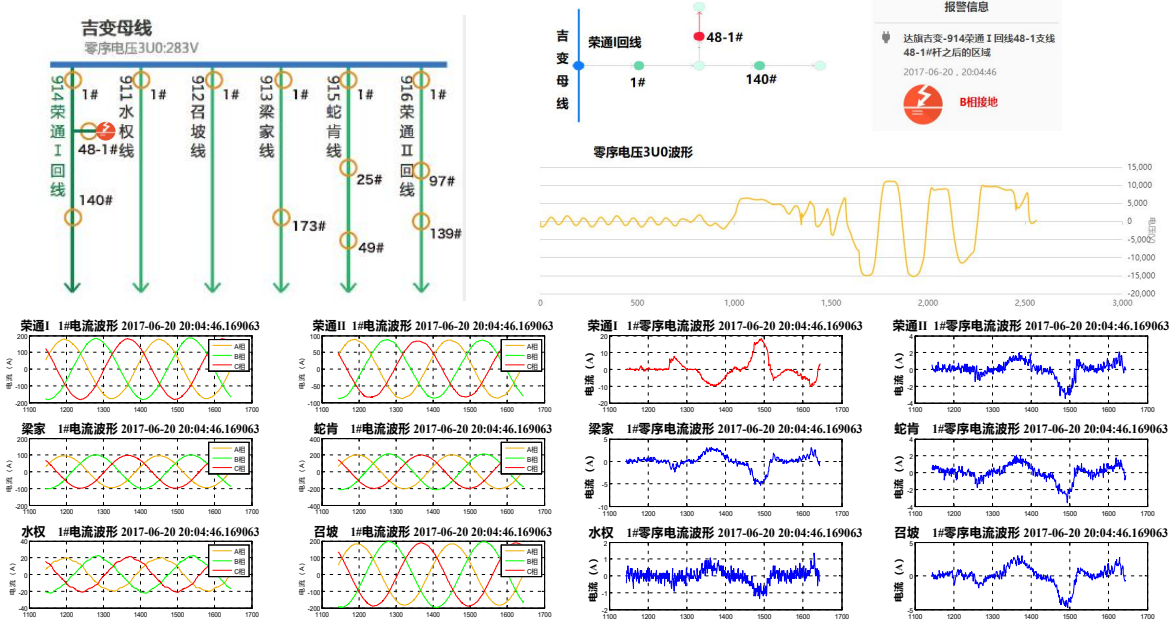
10kV HX Sta.
(Yingtan, JX)

10kV DJ Sta.
(Jinan, SD)

10kV MH Sta.
(Shanghai)



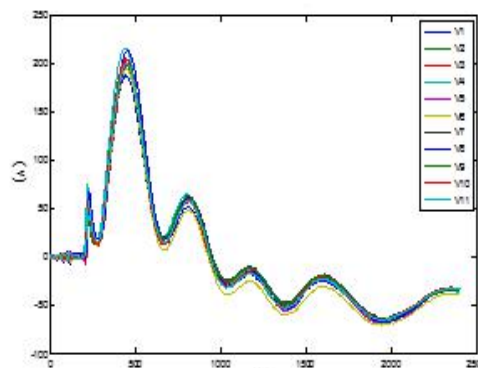
► An Earth Fault Case



The figure above shows a 35kV substation with six 10kV lines. By analyzing the waveforms of three phases current, the zero-sequence voltage and the zero-sequence current, the system automatically outputs the result: B phase earth fault after pole 48-1# of RT I Line @2017-06-20 20:04:46.169063.

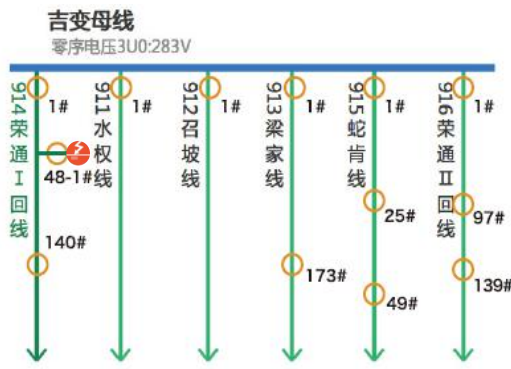
2) HVDC (High Voltage Direct Current) Converter Station

Based on the same principle, a new Online Monitoring System of the Surge Arrester for HVDC Projects has been developed. The system is used to assess the key equipment performance by monitoring the current flow of the parallel arresters applied for overvoltage protection in HVDC converter stations. Once the current deviation between parallel arresters exceed 5%, some of the arresters must be replaced early in order to avoid the unscheduled shutdown of the HVDC transmission caused by the damaged equipment. The monitoring system has been used in 9 HVDC Projects of State Grid, such as Fulong, Yibin, Jinping, East Yinchuan, Tianshan, and Zhalute etc. It guarantees the safety and reliability of the HVDC Transmission System.

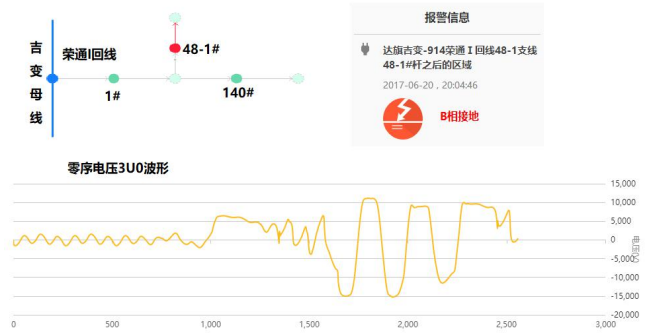


3) Faulted Line Selection and Fault Location

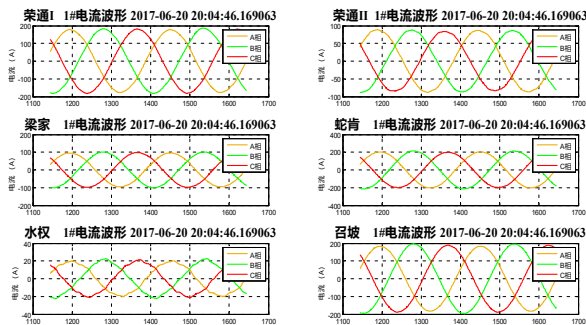
The figure below shows a 35kV substation with six 10kV lines. By analyzing the waveforms of phase current, the zero-sequence voltage and the zero-sequence current, the system automatically outputs the result: B phase earth fault after pole 48-1# of RT I Line @2017-06-20 20:04:46.169063.



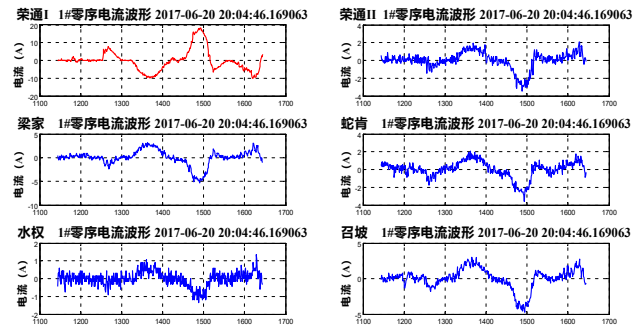
13 SGs installed covering six 10kV lines



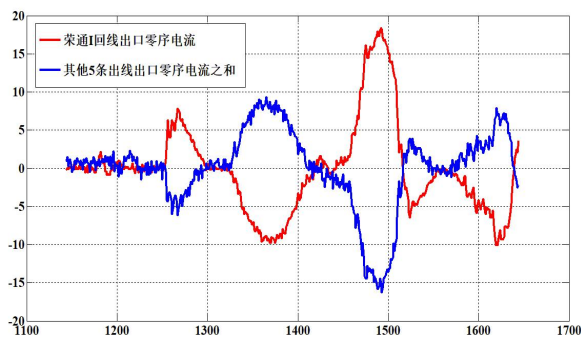
B-phase earth fault located after the pole 48-1# of RT I Line



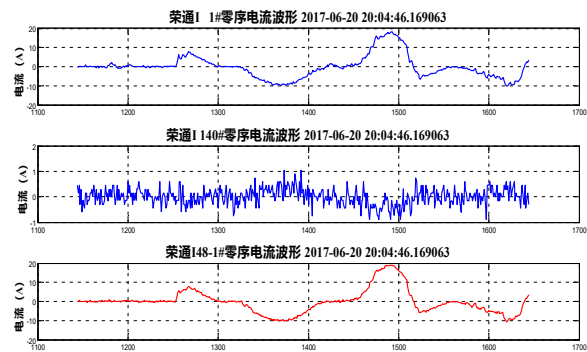
Three Phases Current Waveforms



Zero-Sequence Current Waveforms



Faulted Line Selection Criteria: The faulted line zero-sequence current in red is opposite to the other lines in polarity, and equal to the total sum of all the other lines zero-sequence current.



Fault Location Criteria: The zero-sequence current waveforms on pole 1# and 48-1# are similar and they are different from the one on pole 140#. Therefore, the fault is positioned after the pole 48-1#.