



GDCO-301 Online Monitoring System of Circulating Current on Cable Sheath



General Information

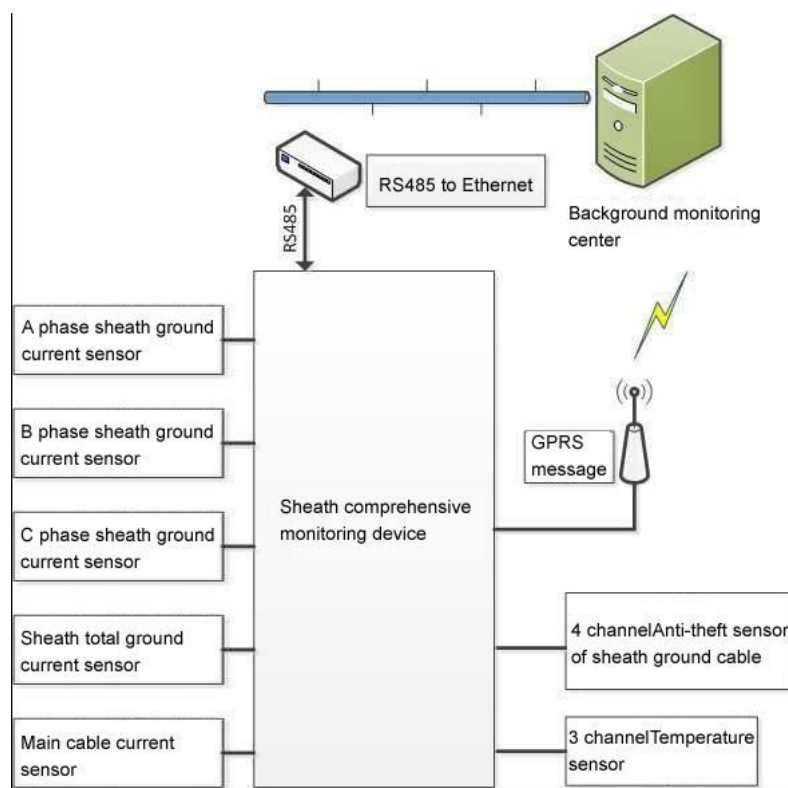
Cables above 35kV are mainly single-core cables with metal sheath. Since the metal sheath of the single-core cable is hinged with the magnetic field line generated by the AC current in the core wire, the two ends of the single-core cable have a high induced voltage. Therefore, appropriate grounding measures should be taken to keep the induced voltage within the safe voltage range (usually no more than 50V, but no more than 100V with safety measures). Usually, the metal sheath of short line single-core cable is grounded directly at one end and grounded through gap or protection resistor at the other end. The metal sheath of long line single - core cable is grounded by three - phase segmental cross - connection. No matter which kind of grounding method is adopted, good sheath insulation is necessary. When the insulation of the cable is damaged, the metal sheath will be grounded at multiple points, which will generate the circulating current, increase the loss of the sheath, affect the current carrying capacity of

the cable, and even cause the cable to be burned due to overheat. At the same time, guarantee the high voltage cable metal sheath grounding directly connect site is also very important, if the ground point cannot effectively be grounded for various reasons, the cable metal sheath potential will rise sharply to several kilovolts even tens of thousands of volts, it is easy to lead to outer sheath breakdown and continuous discharge, causing the rise of the temperature of cable outer sheath or even burning.

GDCO-301 uses the circulating current method. When the single-core cable metal sheath is under normal conditions (i.e., one-point grounding), circulating current on the sheath, mainly capacitive current, is very small. Once multi-point earthing occurs on the metal sheath and forms a loop, circulating current will increase significantly and can reach more than 90% of the main current. Real-time monitoring of metal sheath circulation and its changes can realize on-line monitoring of multi-point earth fault of single-core cable metal sheath, so as to timely and accurately find the earth fault, fundamentally avoid the occurrence of cable accident and ensure the safe and reliable operation.

It uses GSM or RS485 as communication mode. It is suitable for multi-point ground fault monitoring of single core cables above 35kV.

System configuration



GDCO-301 Online Monitoring System of Circulating Current on Cable Sheath includes: main unit of integrated monitoring device and current transformer, temperature and anti-theft sensor. The open type current transformer is installed on the ground line of the cable sheath and is converted into a secondary signal before the monitoring device is introduced. The temperature sensor is used to monitor the cable temperature, and the anti-theft sensor is used to monitor the circulation grounding line. The composition of comprehensive online monitoring system of cable sheath is as follows:

Features

- Real-time monitoring of the ground current of three phase cable sheath, the total ground current and the operating current of any phase main cable;
- Real-time monitoring of three-phase cable temperature;
- Real-time anti - theft monitoring of cable sheath grounding;
- Time interval can be set;
- Alarm parameters and whether corresponding monitoring parameters are allowed to generate alarm can be set;
- Set the maximum value, minimum value and average value in the preset period;
- Real-time monitoring of the ratio of maximum and minimum value of single-phase ground current within the statistical period, and alarm processing;
- Real-time monitoring of the ratio of ground current to load within the statistical period, and alarm processing;
- Real-time monitoring of the change rate of single-phase ground current within the statistical period, and alarm processing;
- The measurement data can be sent at any time.
- Can specify one or more monitoring parameters to alarm, send alarm information to the designated mobile phone;
- Real-time measurement of input voltage;

- All monitoring data have time labels to ensure the uniqueness of the data;
- All monitoring sensors can be configured according to user requirements;
- Multiple data transmission interfaces: RS485 interface, GPRS, GSM SMS, can use one or more data transmission modes at the same time;
- Support remote maintenance and upgrade;
- Low power consumption design, support a variety of power input: CT induction power, AC-DC power and battery power;
- With industrial grade components, with good reliability & stability;
- Modular fully enclosed structure, easy to install, locking measures are taken on all parts, good anti-vibration performance, and easy to replace and disassemble;
- Support IP68 protection level.

Specification

Item		Parameters
Current	Operating current	1 channel, 0.5~1000A (Can be customized)
	Sheath ground current	4 channel, 0.5~200A (Can be customized)
	Measurement accuracy	$\pm(1\%+0.2A)$
	Measurement period	5~200s
Temperature	Range	-20°C~+180°C
	Accuracy	$\pm 1^{\circ}C$
	Measurement period	10~200s

RS485 port

- Baud rate: 2400bps, 9600bps and 19200bps can be set.
- Data length: 8 bit;
- Start bit: 1 bit;
- Stop bit: 1 bit;
- Calibration: no calibration;

GSM/GPRS port

- Working frequency: Quad-band, 850 MHz/900 MHz/1800 MHz/1900 MHz;
- GSM Chinese/English short messages;
- GPRS class 10, Max. download speed 85.6 kbit/s, Max. upload speed 42.8 kbit/s, support TCP/IP, FTP and HTTP protocol.

Power supply

AC power supply

- Voltage: 85~264VAC;
- Frequency: 47~63Hz;
- Power: $\leq 8W$

Battery

- Voltage: 6VDC
- Capacity: determined by continuous working time of battery
- Battery compatibility

Electrostatic discharge immunity	Class 4 : GB/T 17626.2
Radio-frequency electro-magnetic field radiation immunity	Class 3 : GB/T 17626.3

Electric fast transient/burst immunity	Class 4 : GB/T 17626.4
Surge immunity	Class 4 : GB/T 17626.5
Radio-frequency field inductive conduction immunity	Class 3 : GB/T 17626.6
Power frequency magnetic field immunity	Class 5 : GB/T 17626.8
Pulse magnetic field immunity	Class 5 : GB/T 17626.9
Damping oscillation magnetic field immunity	Class 5 : GB/T 17626.10

Reference standard:

Q/GDW 11223-2014: Technical Specification for state detection for high voltage cable lines

General requirements of cable state detection

4.1 Cable state detection can be divided into two categories: online detection and offline detection. The former includes infrared detection, ground current detection of cable sheath, partial discharge detection, while the offline detection contains partial discharge detection under variable frequency series resonant test, oscillation cable partial discharge detection.

4.2 Cable state detection modes include general test on a large scale, retest on suspected signals, test focused on faulty equipment. In this way, cable normal operation can be guaranteed.

4.3 Detection staff should attend technical training of cable detection and hold certain certificates.

4.4 Basic requirement of terminal infrared imager and ground current detector refer to Appendix A. Basic requirement of high voltage partial discharge detection, ultra high

voltage partial discharge detection and ultrasonic partial discharge detector refer to Q/GDW11224-2014.

4.5 Range of application refers to Table 1.

Method	Voltage grade of cable	Key detection point	Defect	Online/offline	Remarks
Thermal infrared image	35kV and above	Terminal, connector	Poor connection, damped, insulation flaw	Online	Compulsory
Metal sheath ground current	110kV and above	Grounding system	Insulation flaw	Online	Compulsory
High frequency partial discharge	110kV and above	Terminal, connector	Insulation flaw	Online	Compulsory
Ultra high frequency partial discharge	110kV and above	Terminal, connector	Insulation flaw	Online	Optional

Ultrasonic wave	110kV and above	Terminal, connector	Insulation flaw	Online	Optional
Partial discharge under variable frequency series resonant test	110kV and above	Terminal, connector	Insulation flaw	Offline	Compulsory
OWTS oscillation cable partial discharge	35kV	Terminal, connector	Insulation flaw	Offline	Compulsory

Table 1

Voltage grade	Period	Remarks
110(66)kV	<ol style="list-style-type: none"> 1. Within 1 month after operation or major repair 2. Once for other 3 months 3. If required 	<ol style="list-style-type: none"> 1. Detection period should be shortened when there is heavy load on cable lines or during summer peak.

220kV	<ol style="list-style-type: none"> 1. Within 1 month after operation or major repair 2. Once for other 3 months 3. If required 	<ol style="list-style-type: none"> 2. Detection should be done more frequently based on bad work environment, outdated equipment and defective device.
500kV	<ol style="list-style-type: none"> 1. Within 1 month after operation or major repair 2. Once for other 3 months 3. If required 	<ol style="list-style-type: none"> 3. Proper adjustments should be made based on equipment's conditions and work environment. 4. Online monitoring system of ground current on cable sheath can replace its live detection.

Table 4

5.2.3 Diagnostic criteria

It is necessary to combine load of cable and abnormal current trend of cable sheath with measurement data of cable sheath.

Diagnostic criteria refers to Table 5.

Test	Result	Advice
<p>If all requirements below are met:</p> <ol style="list-style-type: none"> 1. Absolute value of ground current <50A; 	Normal	Operate as normal

<p>2. The ratio between ground current and load <20%;</p> <p>3. Max. value/ Min. value of single phase ground current <3</p>		
<p>If any requirement below is met:</p> <p>1. $50A \leq$ absolute value of ground current $\leq 100A$;</p> <p>2. $20\% \leq$ the ratio between ground current and load $\leq 50\%$;</p> <p>3. $3 \leq$ Max. value/Min. value of single phase ground current ≤ 5;</p>	Caution	Strengthen monitoring and shorten detection period
<p>If any requirement below is met:</p> <p>1. Absolute value of ground current > 100A;</p> <p>2. The ratio of ground current and load > 50%;</p> <p>3. Max. value/Min. value of single phase ground current > 5</p>	Defect	Power off and check.

Table 5