PCS-9250

DC Electronic and Optical CT/VT

NR Electric provides DC electronic and optical CT, electronic VT and DC filter electronic CT for double-line commutation converter (LCC) and voltage source converter (VSC-based) HVDC transmission projects. The DC electronic transformers have advantages of small size, light weight, and no ferromagnetic resonance problems.

DC Electronic CT

DC electronic CTs are intended for applications in HVDC converter stations. They measure DC current, harmonic current, and output digital signals for the protection and control devices in the converter station.

Configuration

The DC electronic CTs are composed of the following four parts:

- Primary Sensor
  The primary sensor includes one current divider and one air core coil. The current divider is used to measure DC current and the air core coil is used to measure harmonic current.

- Remote Module
  DC electronic CTs have multiple identical remote end modules, which can backup each other to guarantee high reliability. The remote module receives and processes the output signals from the current divider and the air core coil. It outputs serial digital optical signals.

- Composite Insulator with Embedded Optical Fiber
  This insulator adopts the composite material, while several multimode optical fibers are embedded inside as signal transmission media.

- Merging Unit
  The merging unit is placed in control room. In one hand, it works as power supply for remote module by laser sending, in the other hand, it receives data from remote module. The output of merging units is sent to the protection and control devices using the specified protocol (IEC60044-8 protocol or TDM bus protocol). Merging units are connected to remote modules via optic fibers.

Figure 1 800kV DC ECT

Features

- The highest voltage rate of DC electronic CT is 1100kV.
- The insulator adopts composite silica gel, with high reliability and light weight, and it is easy to transportation and installation.

DC Optical CT

DC electronic CTs adopts Faraday magneto-optic effect to measure DC current and harmonic current, it is applicable to high-voltage DC converter stations, and the output signals are sent to protection and control devices in the converter station.

Figure 2 DC OCT

Configuration

Optical DC CT is composed of the following three parts

- Sensing fiber ring: is composed of multi-turn winding of sensing fiber and is used to sense the current to be measured. The sensing fiber is located on the top of optical fiber insulator, it is without requiring power source, without heating and has good anti-interference ability. Moreover, it is small in size, light in weight, and flexible in installation, it can designed as fixed structure with primary conductor and wiring palm, or as through-core structure without primary conductor. The number of fiber rings for each transformer can be configured according to engineering requirements.
- Optical fiber insulator: is a composite insulator with embedded polarization maintaining fiber. It is used for ensuring the insulation between HV side and LV side and transmitting the measured current information induced by the sensing fiber ring to LV-side sampling unit. Optical fiber insulator can be designed as suspended type or column type, it is without oil or gas, and the insulation is simple and reliable.
- Sampling unit: is generally located in outdoor cabinet, and it is comprised of optical path module and signal processing circuit. Sampling unit is used to transmit the polarized light signal to the sensing fiber ring, receive the modulated optical signal with the primary current information from the sensing fiber ring, calculate the primary current value, and send the current value to merging unit through optical fiber.

Features

- Fast response, minimum step response time (including step response rise time, processing and transmission delay) is less than 40us.
- Large dynamic range, it can meet the current measurement accuracy requirements from several amps to tens of thousands of amps.
- Good frequency characteristics, it can realize indiscriminate monitoring of DC current, power frequency and harmonic current.
- The highest voltage rate of DC electronic CT is 1100kV.
- The insulator adopts composite silica gel, with high reliability and light weight, and it is easy to transportation and installation.
- The diverter uses Manganin as a material, which has a good temperature stability.
- The structure of the sensor provides great performance in heat dissipation.
- The air-core coil is used here for harmonic current measurement, and the wide-frequency band can be obtained with good dynamic performance.
- The remote module uses redundant configuration with high reliability.
- 16-bit A/D signals are adopted in the remote module with high precision.
- Laser power supply is used for remote modules with self-checking function.

DC Electronic VT

DC electronic VT is used to measure and transmit DC voltage signals to control and protection devices in the converter station. DC electronic VT consists of DC divider, resistor box, remote module and merging unit. The sampling data is sent to the merging unit in the control room via optical fiber.

Configuration

- DC Divider
  DC divider is composed of precise resistor and shunt capacitor, the former is used to measure DC voltage and the latter can

achieve equalized voltage distribution and ensure its frequency characteristics

- Resistor Box
  The resistor box is a low voltage divider, which can convert the measured voltage to multiple channel signals sent to the remote module.

- Remote Module
  DC electronic VTs also have multiple identical remote end modules, which can backup each other to guarantee high reliability. The remote module receives and processes the output signals from the voltage divider, and it outputs serial digital optical signals.

- Merging Unit
  The merging unit is placed in control room. In one hand, it works as power supply for remote module by laser sending, in the other hand, it receives data from remote module. The output of merging units is sent to the protection and control devices using the specified protocol (IEC60044-8 protocol or TDM bus protocol).

Features

- The highest voltage rate of DC electronic VT is 1100kV.
- The DC electronic VT adopts HV resistor in high precision with metallic film as a voltage divider resistor. The measurement accuracy can reach Class 0.2;
- The HV side and LV side of the capacitance divider are designed with the same time constant, and thus the transformer has good frequency characteristics and transient characteristics as well as rapid response;
- The remote-end in the high voltage side is powered by laser supply. The laser power can be adjusted in real- time according to the operating situation of the remote-end module;
- The remote module is extensible, and can be flexibly combined with merging units to meet various application demands of the DC control & protection system;
- The DC electronic VT is equipped with complete self- monitoring functions to perform operation monitoring and maintenance.

DC Filter Electronic CT

DC filter electronic CT uses the low power CTs (LPCT) to convert primary current to digital signals. DC filter electronic CT can be used for current measurement in the high voltage side, low voltage side and imbalance branch for DC filter.

The filter electronic CT is composed of LPCTs, remote- end modules, merging units, and composite insulators with embedded optical fibers. The output signals of LPCT are processed by the remote module and transmitted via optical fibers. The filter electronic CT has the same features as the DC electronic CT does.

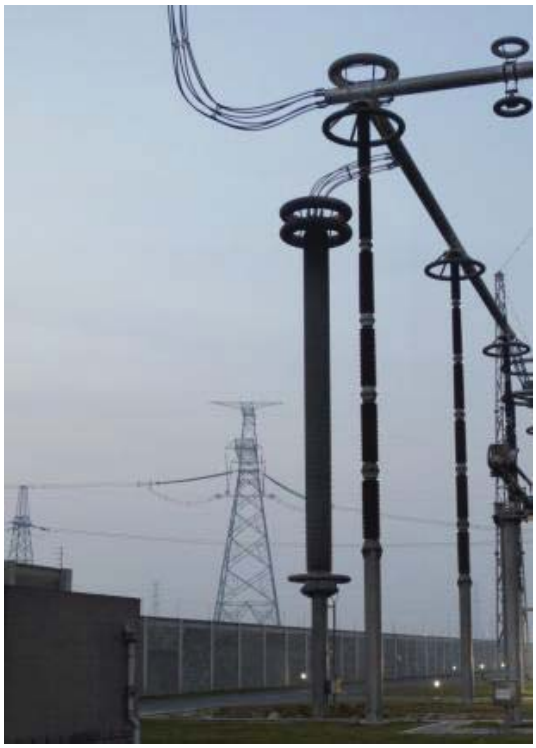

Figure 3 800kV DC EVT

Figure 4 Filter Imbalance ECT in Support Type

Technical Data

DC Electronic CT

Rated voltage	1100kVdc, 800kVdc, 500kVdc
Rated primary current Ipr	0 ~ 6250A
Maximum measurement current	6Ipr
Measurement accuracy	10%~120% Ipr: ±0.2% 200% Ipr: ±1.5% 600% Ipr: ±3%
Step response	Maximum overshoot: 20% Maximum rise time (to 90% of step): 200us
Cut-off frequency	4kHz

DC Optical CT

Rated voltage	1100kVdc, 800kVdc, 500kVdc
Rated primary current Ipr	0 ~ 6250A
Maximum measurement current	15Ipr
Measurement accuracy	10%~120% Ipr：±0.2% 200% Ipr：±1.5% 600% Ipr：±3%
Step response	Maximum overshoot: 20% Maximum rise time (to 90% of step): <200us Minumum rise time(to 90% of step)：<20us
Cut-off frequency	4kHz

DC Electronic VT

Rated voltage Upr	1100kVdc, 800kVdc, 500kVdc
Measurement range	0.1Upr~1.5Upr
Measurement accuracy	10%~110% Upr：±0.2% 110%~150% Upr：±0.5%
Step response	Maximum overshoot: 20% Maximum rise time (to 90% of step): 200us
Cut-off frequency	4kHz

DC Filter Electronic CT

Rated voltage	800kVdc, 500kVdc
Rated frequency	600Hz (customizable)
Measurement accuracy	0.2/5P15
Frequency range	50Hz~2000Hz
Cut-off frequency	4kHz