HERCH

Herch Opto Electronic Technology Co., Ltd

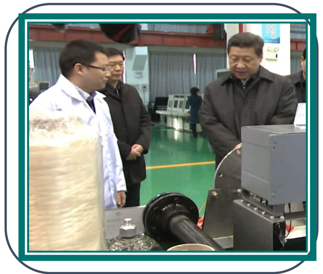
World’s Leading Fiber Optic Temperature Sensing & Measurement Solution Provider

About Us

Incubated by Chinese Academy Of Science in 2011

Biggest fiber optic temperature sensing solution provider in China

Hold over 100 patents, has its own known-how



INSPECTED

by president Xi

REPORTED

by CCTV

1,00,000+

field applications

国家电网有限公司
科学技术进步奖
获奖证书

获奖项目：基于荧光光纤传感的变压器绕组测温关键技术及应用

获奖等级：三等

获 奖 者：西安和其光电科技股份有限公司

奖励年度：2018 年

发证机构：国家电网有限公司

证书号：2018-JB-127-D02

WON

tech innovation award

of China State Grid

APPROVED

vendor of PGCIL

Facilities

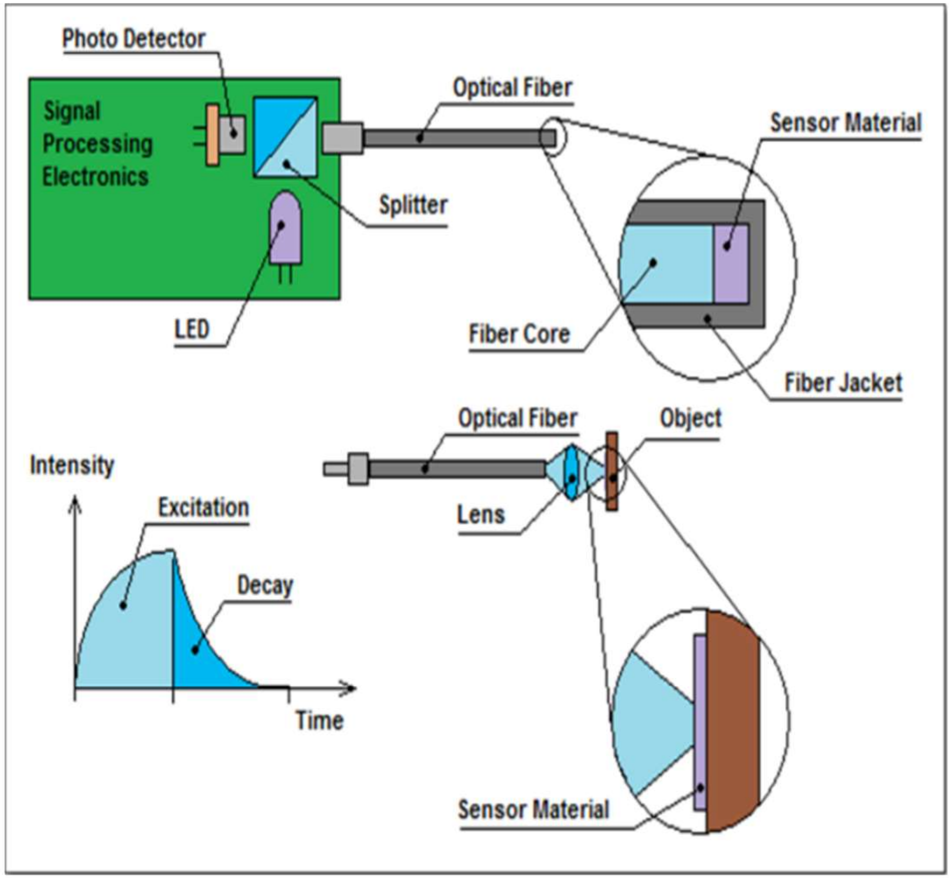
Factory Building

FO Sensor Production Line

Temperature Monitor Production Line

Testing & Calibration

Technology



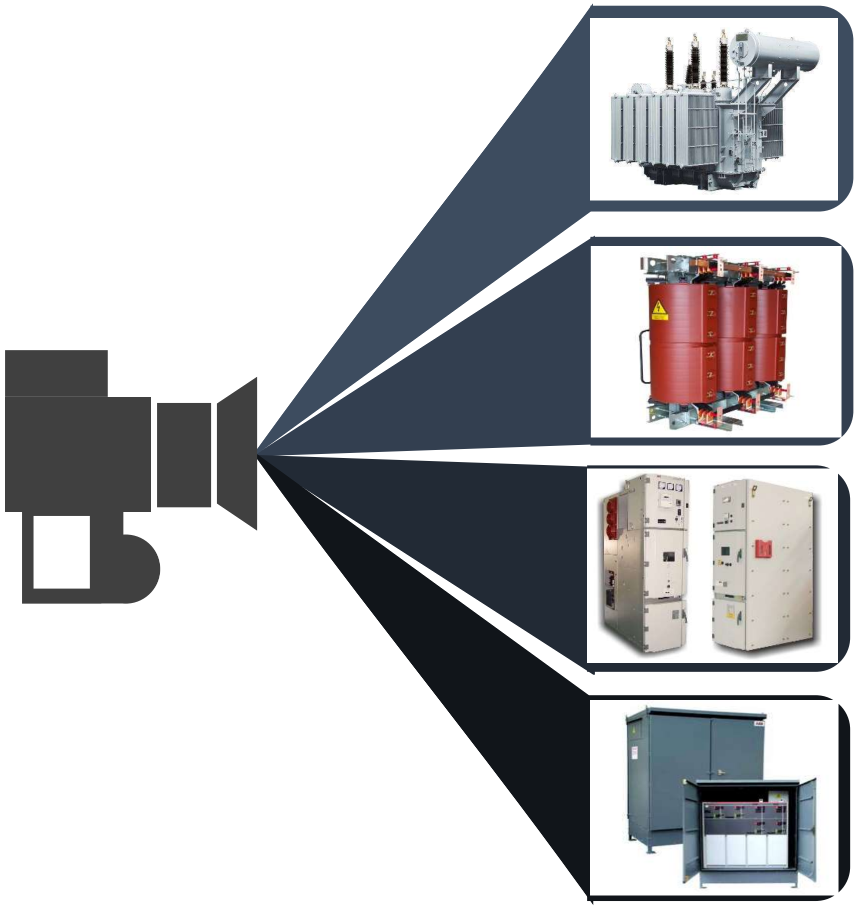
PRINCIPLE

Our fiber optic temperature sensors are based fluorescence decay technology.

Upon being stimulated by a light source, electrons inside the sensitive rare earth material absorbs photons, which move from a low to a high state of energy. When they return to the low state, they fluoresce. When the stimulation stops, the fluorescence begins to attenuate exponentially.

The duration of attenuation is temperature dependent only. And the temperature can be found out by monitoring the duration of the fluorescence.

Products



- Oil immersed transformer temp. measurement
- Cast resin transformer temp. measurement
- Switchgear temperature measurement
- RMU temperature measurement

Product-1

Direct Winding Temp Measurement Solution for Oil Filled Tarfo

Standard Test Procedure for Thermal Evaluation of Oil Filled Transformers

$$LIFE = EXP^{\left[\frac{15\,000}{T+273} - 27.064\right]}$$

where

$LIFE$ is the life in hours
T is the hottest-spot temperature in ºC

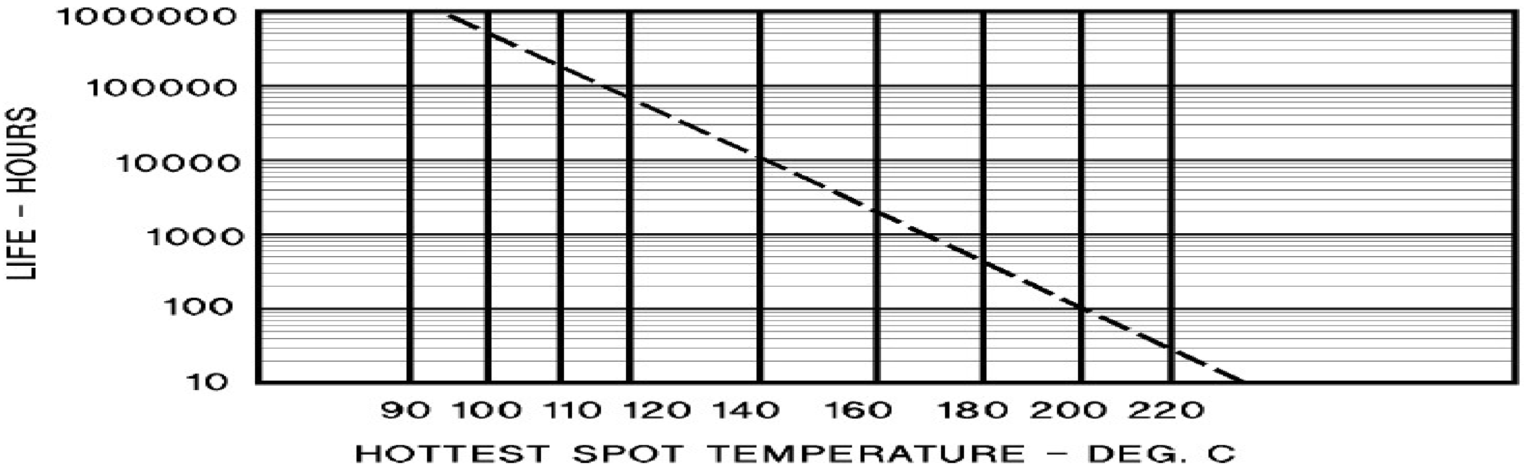
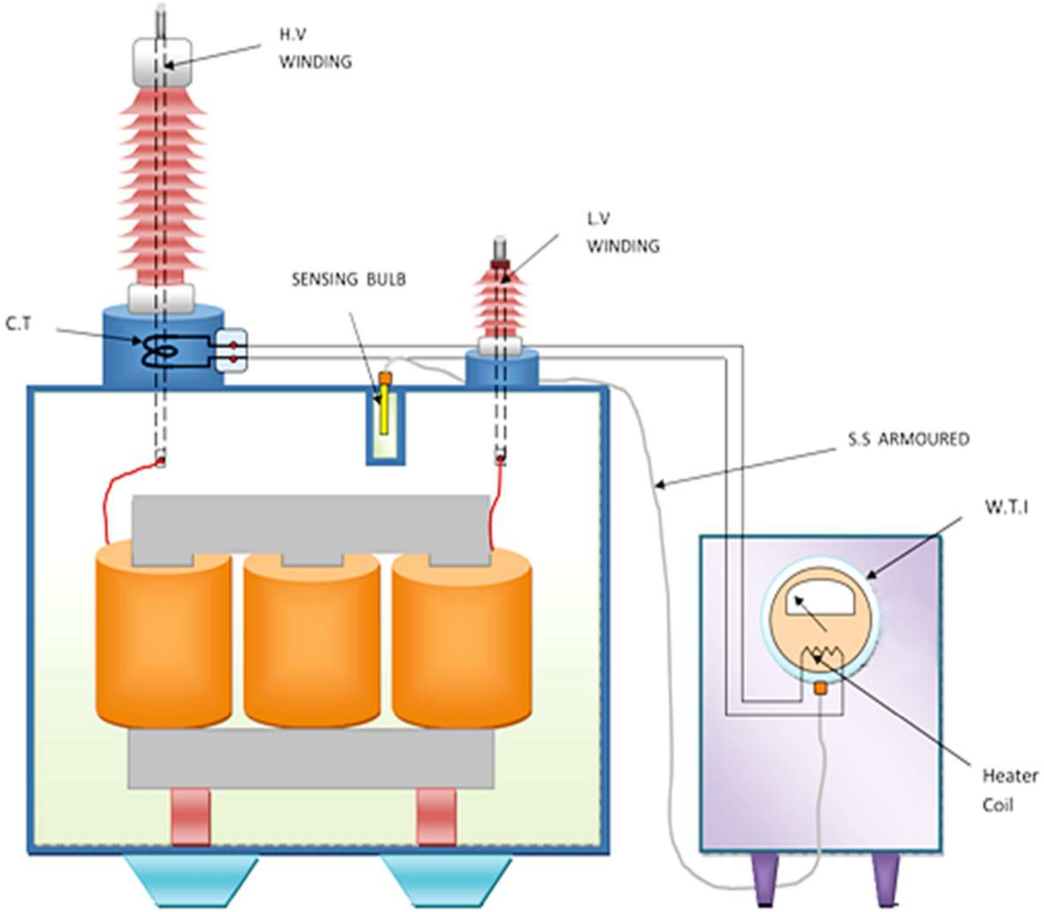


Figure 1—Minimum life expectancy curve for liquid-immersed distribution, power, and regulating transformers rated in accordance with IEEE Std C57.12.00-1993, 65 ºC average rise, 80 ºC hottest-spot rise

Conventional Method-WTI



01 Use CT from one phase and top oil to simulate hot spot

02 Based on simulated values

03 Top oil has significant time lag related to winding real temperature (indicate temperature measurement)

04 Inaccurate range from 5 to 20℃

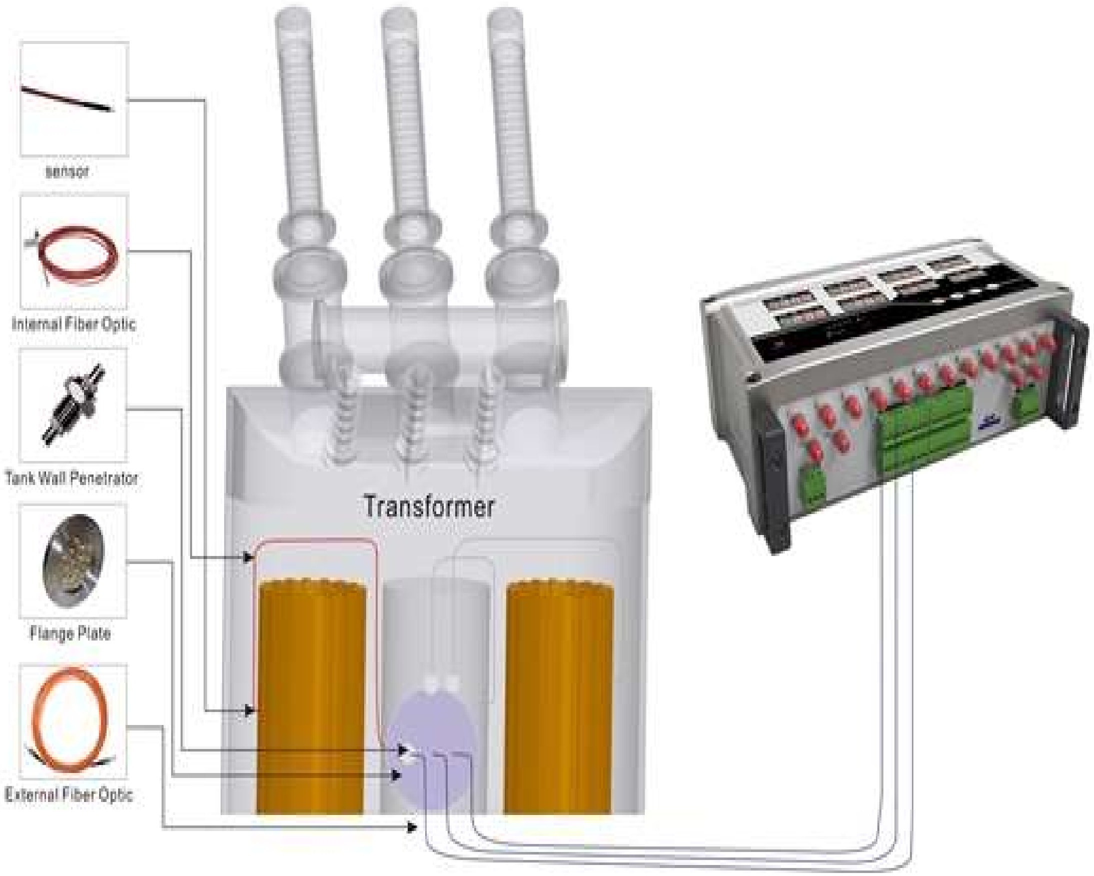
Standard

IEC 60076-2 Recommendations on fiber optic sensors installations

Table E.1 – Minimum recommended number of sensors for three-phase transformers

Rated power MVA	Cooling system	Number and phases of installation				
		Total	On central phase		On each lateral phase	
			HV winding	LV winding	HV winding	LV winding
≥ 100	All system	8	2	2	1	1
From ≥ 20 to < 100	ON.. – OF..	6	1	1	1	1
	OD..	8	2	2	1	1

Fiber Optic Temperature Sensing



Specification

Temperature Range	-40℃-260℃
Temperature Accuracy	±1℃
Temperature Resolution	0.1℃
Number of Channels	Up to 16 channels
Temperature Unit	℃ or ℉
Display Mode	Digital tube display, display directly if less than 8 channels, display in turn if more than 8 channels
Response Frequency	2 seconds per channel (Depend on probes' position)
Power Supply	24V DC (with AC/DC convertor)
Interface	RS-485 Ethernet 4-20mA (each channel) Optical connector 8 programmable relays
Memory	1GB memory space, USB port accessible
Power Consumption	≤10W
Communication Protocol	Modbus, IEC 61850
Fiber Optic Length	1 to 25m

Advantages

01 Does not or will not carry electrical current

02 Immune to EMI, microwave, radio frequency, vibration, radiation

03 Can be positioned in hard-to-reach or view places

04 Can measure small or precise locations

Features

01

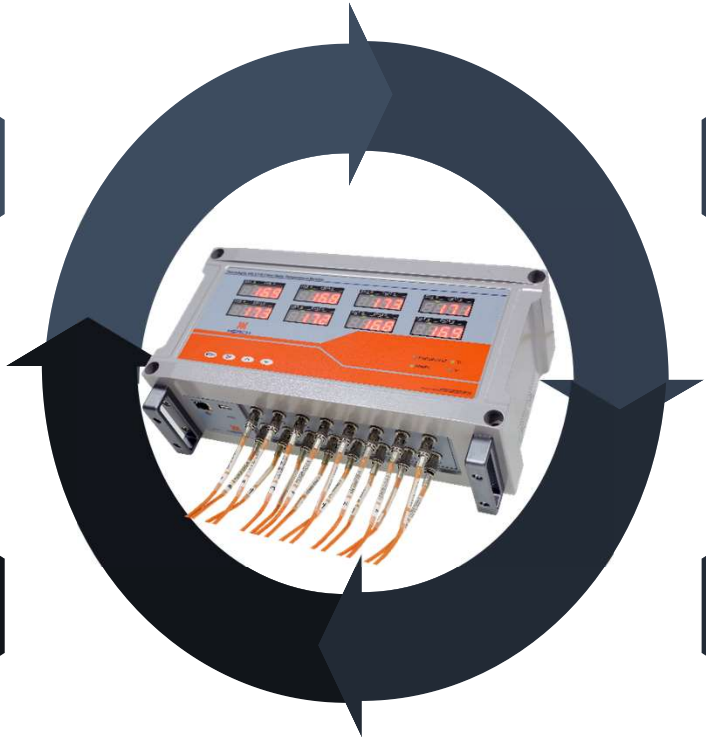
System

Multi-channel, measurement range up to 260 ℃.

02

Sensor

Rugged design, high di-electrical strength, no shifting



03

Monitor

can communicate directly with SCADA system through Modbus or other smart communication protocols.

04

Relay

Allows user to control cooling efficiency and provide alarms in real-time.

User Value

01 *Enhance Design & Manufacturing*

02 *Maximize Dynamical Loading*

03 **Optimize Cooling**

04 *Prevent Early Failure & Sudden Outage*

04 *Increase Life Expectancy*

Dielectric & PD Tests

WEIDMANN

Negative Lightning Impulse:

Ten (10) samples were dried and impregnated per ASTM D2413 and tested per ASTM D3426, *Test Method for Dielectric Breakdown Voltage & Dielectric Strength of Solid Electrical Insulating Materials using Impulse Waves.* Samples were passed through the center of two 51 mm diameter electrodes with a 25 mm gap (Figure 4). For each sample the tip was tested followed by the cable. A standard 1.2 x 50 μs impulse was applied using a Hipotronics 11 stage Marx generator delivering a maximum of 2500 joules discharge energy. A series of 3 impulses at 400 kV were applied followed by a 20 kV increase and an additional series of 3 impulses. This sequence was continued until 3 successful impulses at 500 kV were achieved. After the cable was qualified at 500 kV, the test was stopped.

Negative Switching Surge:

Ten (10) samples were dried and impregnated per ASTM D2413 and tested per ASTM D3426, *Test Method for Dielectric Breakdown Voltage & Dielectric Strength of Solid Electrical Insulating Materials using Impulse Waves.* Samples were passed through the center of two 51 mm diameter electrodes with a 25 mm gap (Figure 4). For each sample the tip was tested followed by the cable. A standard 250 x 2500 μs impulse was applied using a Hipotronics 11 stage Marx generator delivering a maximum of 2500 joules discharge energy. A series of 3 impulses at 300 kV were applied followed by a 20 kV increase and an additional series of 3 impulses. This sequence was continued until 3 successful impulses at 360 kV were achieved. After the cable was qualified at 360 kV, the test was stopped.

Figure 3: AC w/PD test set (left), Negative lightning impulse and switching surge test set (right)

WEIDMANN

Figure 1: Tip of fiber optic cables in T4 mask

After testing the tip of each sample, the cable was strung across the center of the 15 mm gap between the Rogowski electrodes using machined polyethylene blocks to hold them in place (Figure 2, right). The same voltage application and PD measurement techniques that were used for testing the tips were used for the cables.

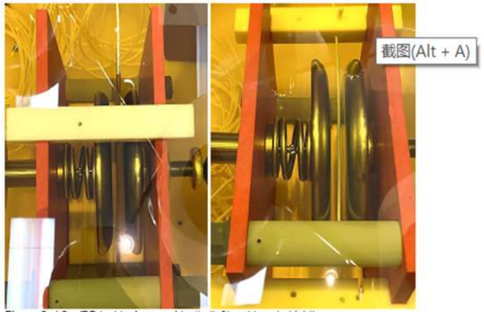


Figure 2: AC w/PD test tank assembly; tip (left), cable only (right)

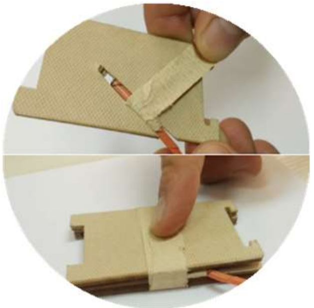
Summary:

There were no breakdowns observed during AC with partial discharge, negative lightning impulse, or switching surge testing. During AC with PD testing there was no observed partial discharge above the acceptable threshold. Therefore all fiber optic probes tested met the qualification voltages for their respective tests:

- AC with PD; 70 kV (4.7 kV/mm)
- Negative lightning impulse; 500 kV (20 kV/mm)
- Negative switching surge; 360 kV (14.4 kV/mm)

Installation Process

Prepare spacer and fix sensor into spacer



Insert spacer into windings

Seal tarfo with tank wall plate, connect inter & exter fiber optic via feedthrough

Connect exter fiber optic cable to temperature monitor

User Reference

ABB

Siemens

Toshiba

TBEA

BTW

China XD

TaiKai

JSHP

Yunnan Transfo

Shandong Electric

Project Reference

OVER 2000 UNITS IN SERVICE

THANK YOU