Applications of Online Partial Discharge Monitoring in Japan

SC B1 Insulated Cables - PS1 - Q1
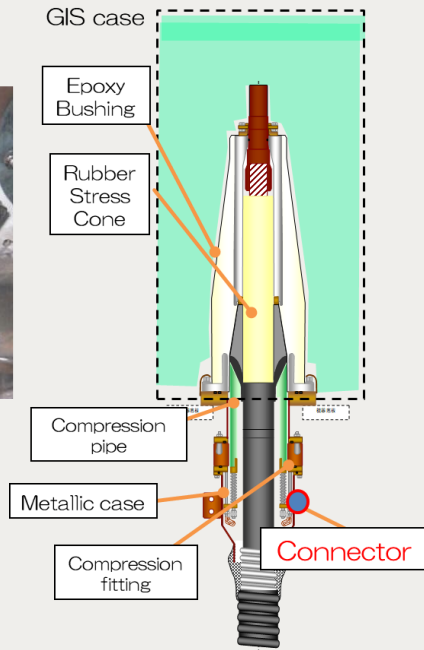
Kozo Suzuki (Japan)

SUMITOMO ELECTRIC

Application1: 154 kV XLPE cable Dry Type Termination monitoring

(1)GAS Analysis

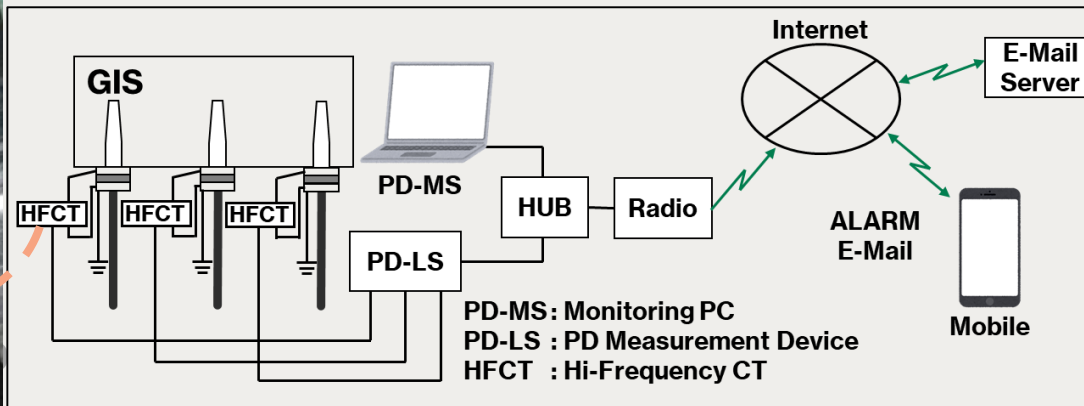The gas in the cable termination is collected through the connector and analyzed.

Gas sampling

GIS case

- Epoxy Bushing
- Rubber Stress Cone
- Compression pipe
- Metallic case
- Compression fitting
- Connector

(2)PD monitoring method

HFCT on Arrester lead can detect the PD pulse signal on cable side.

HFCT

GIS

HFCT   HFCT   HFCT

PD-MS

PD-LS

HUB   Radio

Internet

E-Mail Server

ALARM E-Mail

Mobile

PD-MS：Monitoring PC
PD-LS ：PD Measurement Device
HFCT ：Hi-Frequency CT

(3)Result

	White phase	Red phase	Black phase
Gas Analysis [Acetylene Gas]	0.053ppm	0.592ppm	0.426ppm
Partial Discharge	Not detected	Detected	
Dismantling Investigation	No deposits	Deposits of silicone oil wax	

At the XLPE cable termination, the effectiveness of gas analysis and PDM was confirmed by the fact that the **three types** of analysis result are matched at the same phases - **gas analysis**, **PDM (Partial Discharge Monitoring)** and the **dismantling examination**.

Application2: 154 kV XLPE cable joint monitoring
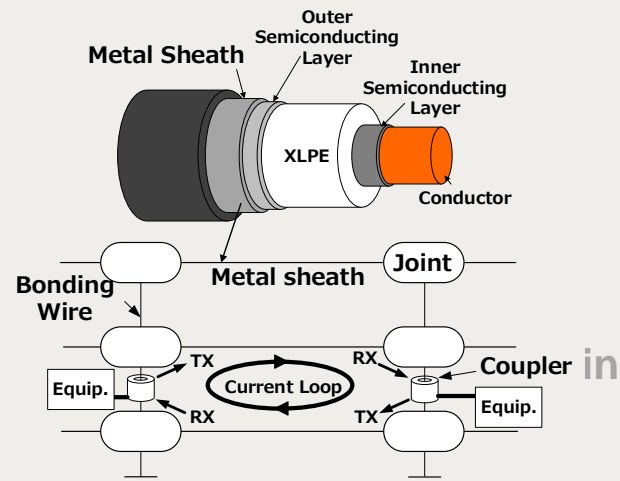
(1)Issue in Conduit installation

・ No effective communication method
・ No power sources
・ High water resistance required

Conduit installation cable

(2)Developed Communication method

・ Metallic Sheath of the Existing Power
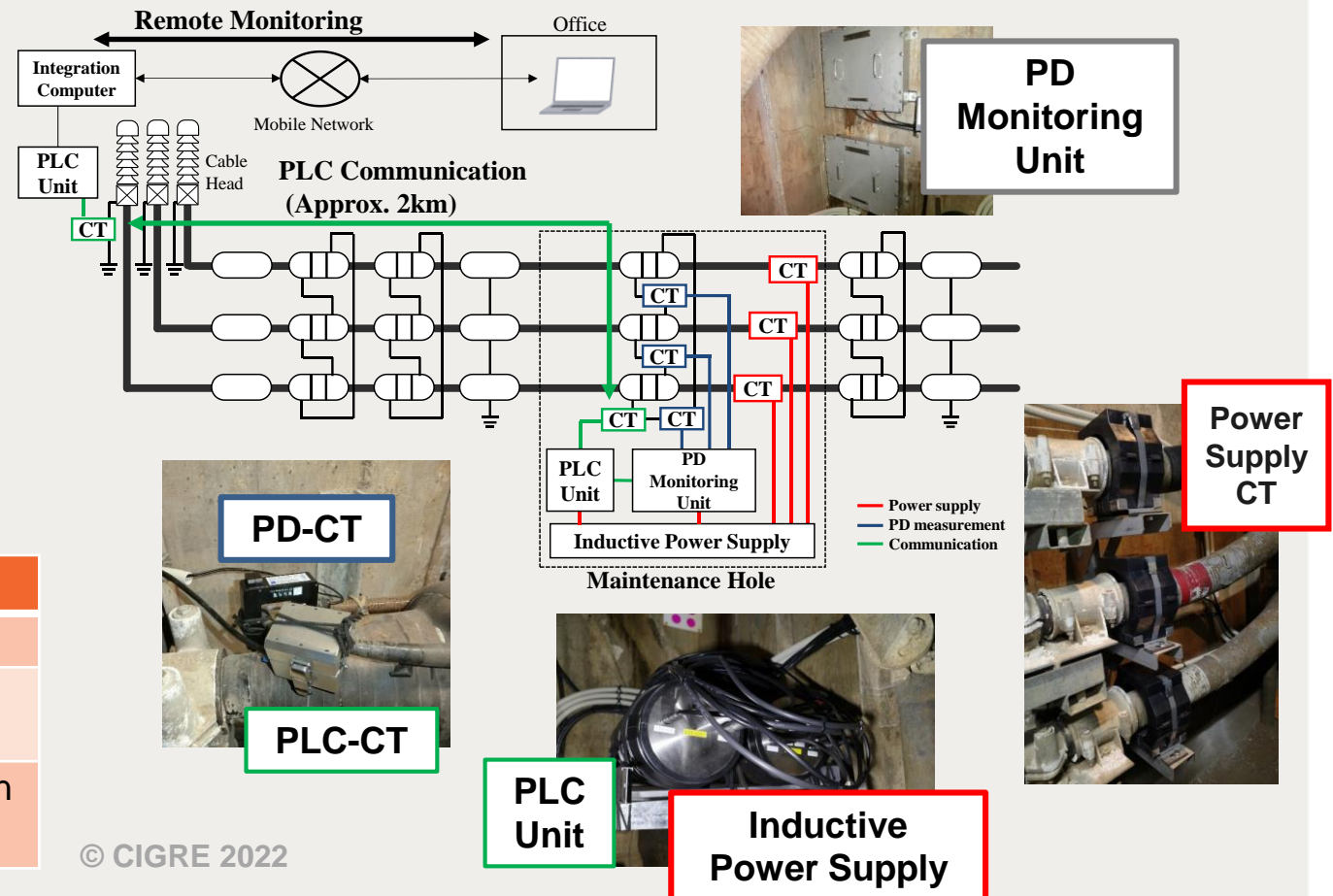 Cables as Communication Line
  by power line communication(PLC)

Overview of communication method

(3)PD remote monitoring configuration

PD monitoring system combining PLC for communication and
inductive coupling for power sources.

Remote Monitoring

Office

Integration Computer

Mobile Network

PLC Unit

Cable Head

PLC Communication (Approx. 2km)

CT

Maintenance Hole

PLC Unit

PD Monitoring Unit

Inductive Power Supply

— Power supply
— PD measurement
— Communication

PD Monitoring Unit

PD-CT

PLC-CT

PLC Unit

Inductive Power Supply

Power Supply CT

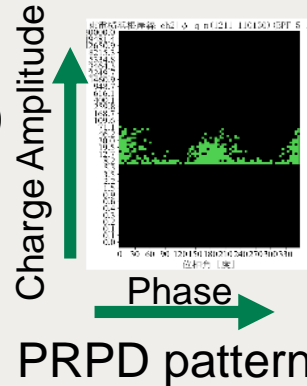| Advantages |
|---|
| Connectable at each joint |
| Safety, Easy Installation and Low cost |
| Not affecting PD detection of 1-30 MHz band |

© CIGRE 2022

Challenges for PD detection with time series PRPD pattern data

(1)PD detection

PRPD (Phase Resolved Partial Discharge) pattern is widely used to detect partial discharges
→ PD occur in the first and third quadrants.

PRPD pattern

(2)Problem

PD Signals are time-dependent and intermittent, however they are not identical.

Therefore, there are the following problems.
- NN (Neural Network) have difficulty separating PD signals from noise without training on a large number of data
- False positives occur depending on the pattern.

Thus, we are developing
Real-time AI based judgment logic focusing on time-Series analysis.

(3)What is Real-time AI?

Automatic learning of noise and other features in time series and sequential updating of the AI
Thus, it is expected that
- **Can be developed with a small number of data.**
- **Can improve detection accuracy**

Overview of Real-time AI based judgment logic