

# Global Trend for Surge Protection in Process Industry



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Rahul Yadav / Vice President – ICE



# Agenda

1. Basic of Surge

2. International Standards

3. Surge Voltage Limiting Technology

4. Application Areas

5. Conclusion

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1. Basic of Surge

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3. Surge Voltage Limiting Technology

4. Application Areas

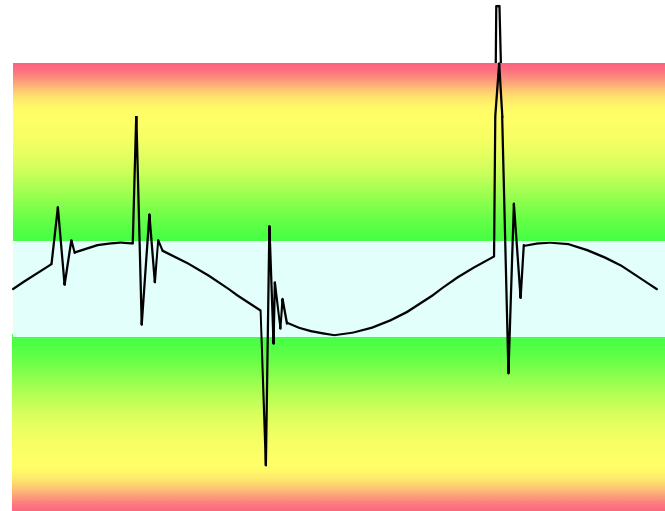
5. Conclusion

## What is Surge ???

- Fundamentally Its a High amplitude and high frequency waveform which dissipates high energy inside the system.

- FEATURES

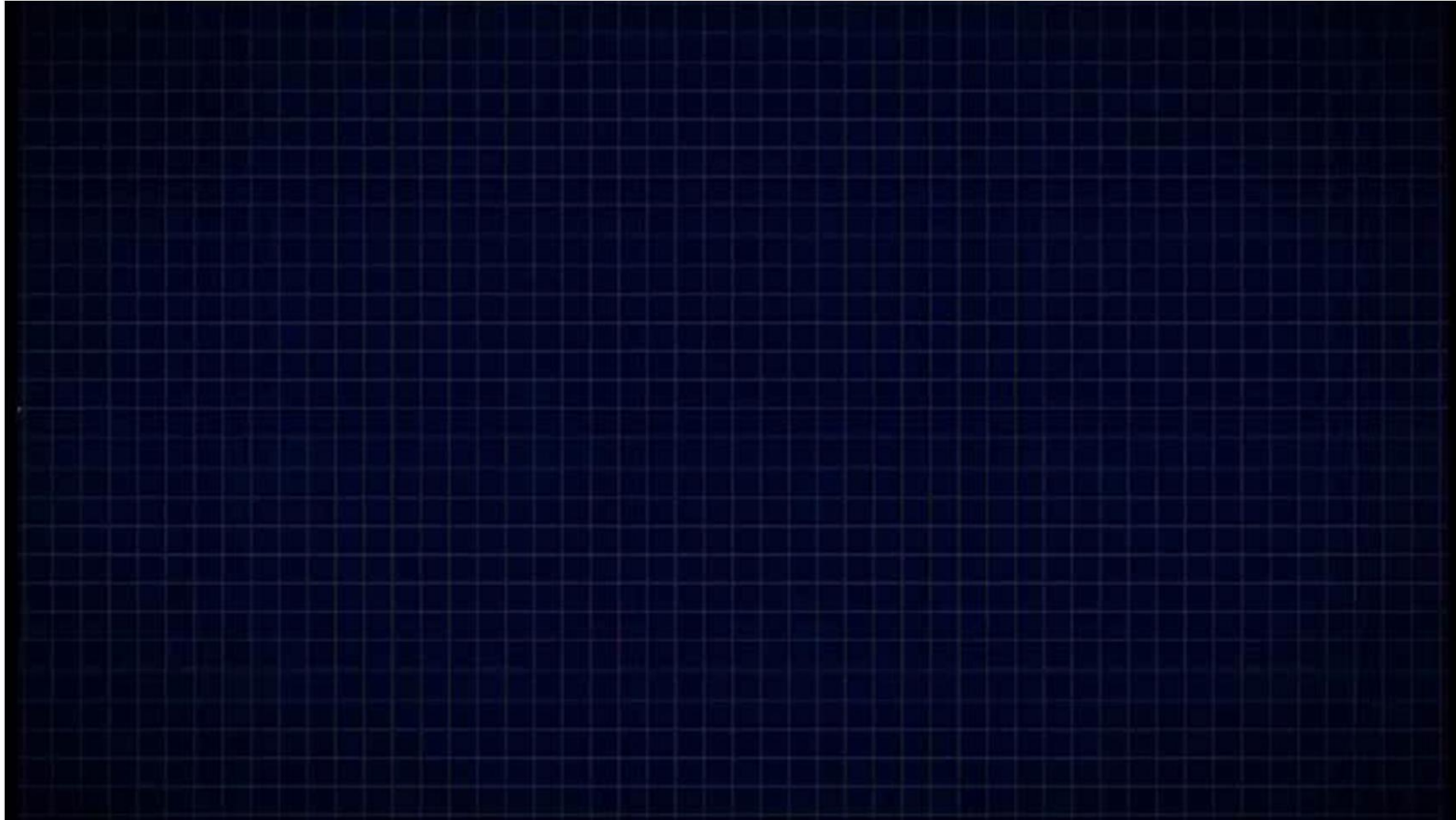
- Short Duration
- High Amplitude
- High frequency
- High Energy



Surges are round the clock phenomena

# TRANSIENT

Passing or disappearing with time



# Source Of Transients

## LEMP



Lightning Electromagnetic Pulse

Extremely high surge voltages

Occur only rare as compared to other types

## SEMP



Switching Electromagnetic Pulse

Switching of high-capacity machines

Short circuits in the power supply network

Occurrence of extremely high current changes

## ESD



Electrostatic Discharge

Discharge between bodies

Generally not harmful to human beings

## Lightning strikes are unpredictable



Photo By Kane Quinnell  
21:38 14 January 2005



## Destruction due to direct lightning strike



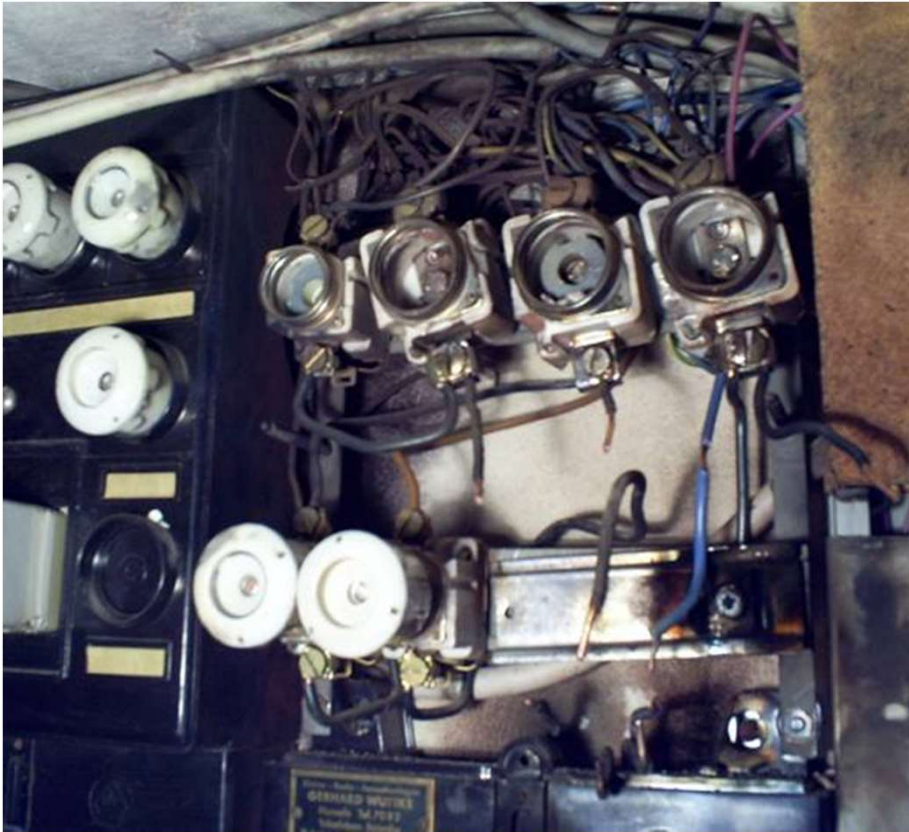
# Damage Caused By Lightning Strike

Service entrance

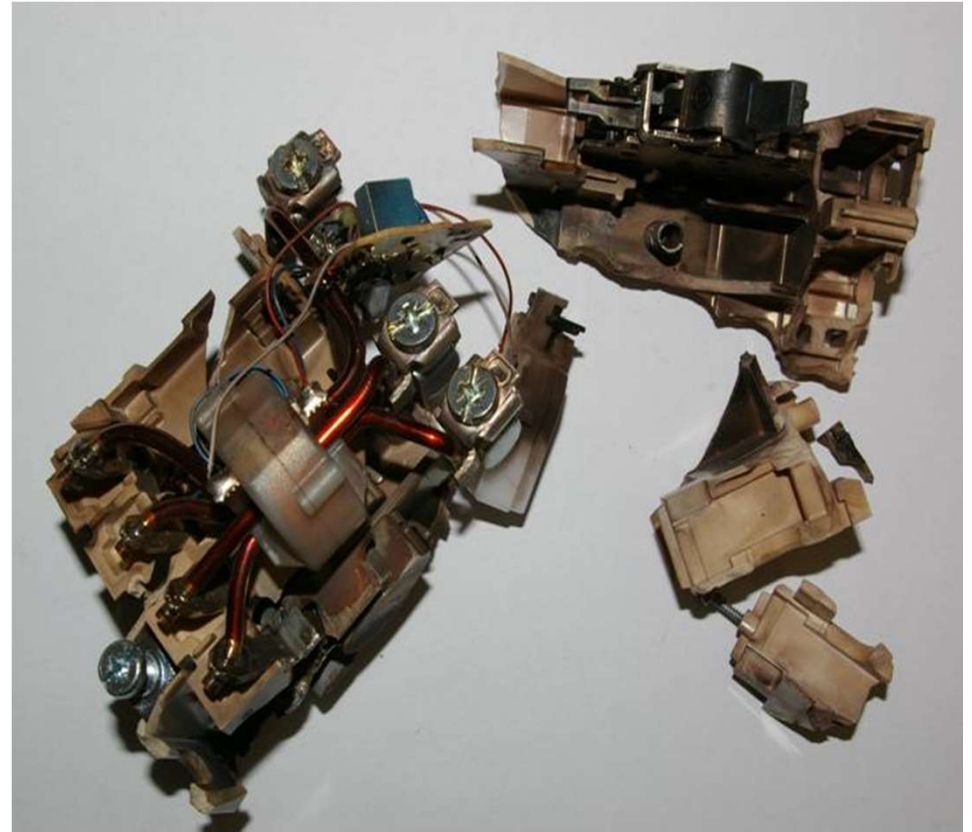


# Damage Caused By Lightning Strike

Main Distribution Panel



Residual Current Device (RCD)



# Damage Caused By Lightning Strike

Junction box first floor

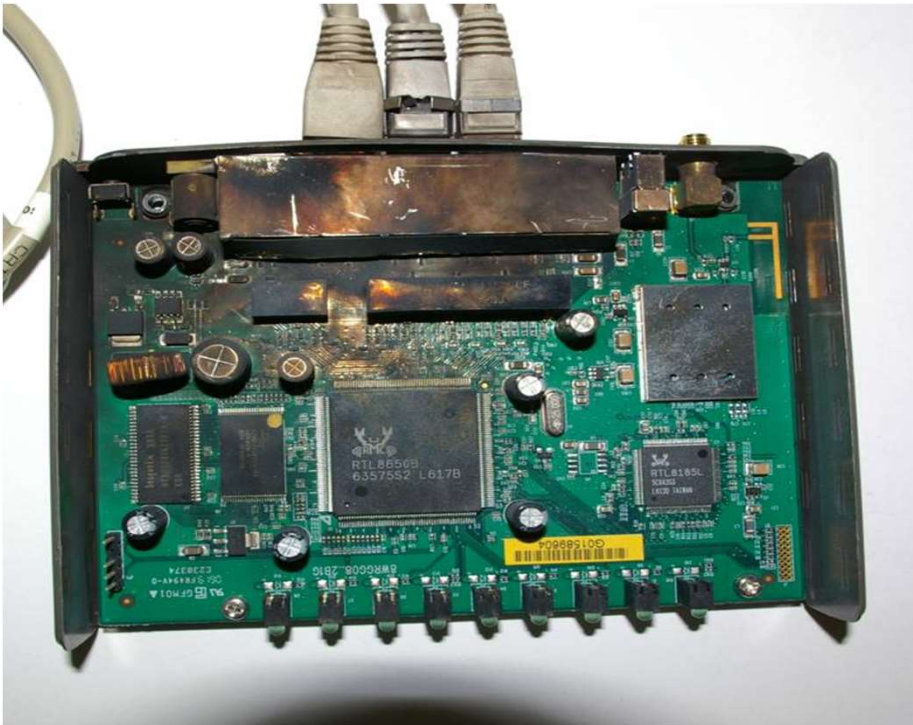


Junction box basement



# Damage Caused By Lightning Strike

Wireless LAN Router



Private Branch Exchange (PBX)



## Surge Current Test On Main Distribution



# Overvoltages Due To Switching Action

Transformer substation switchgear



Switching devices

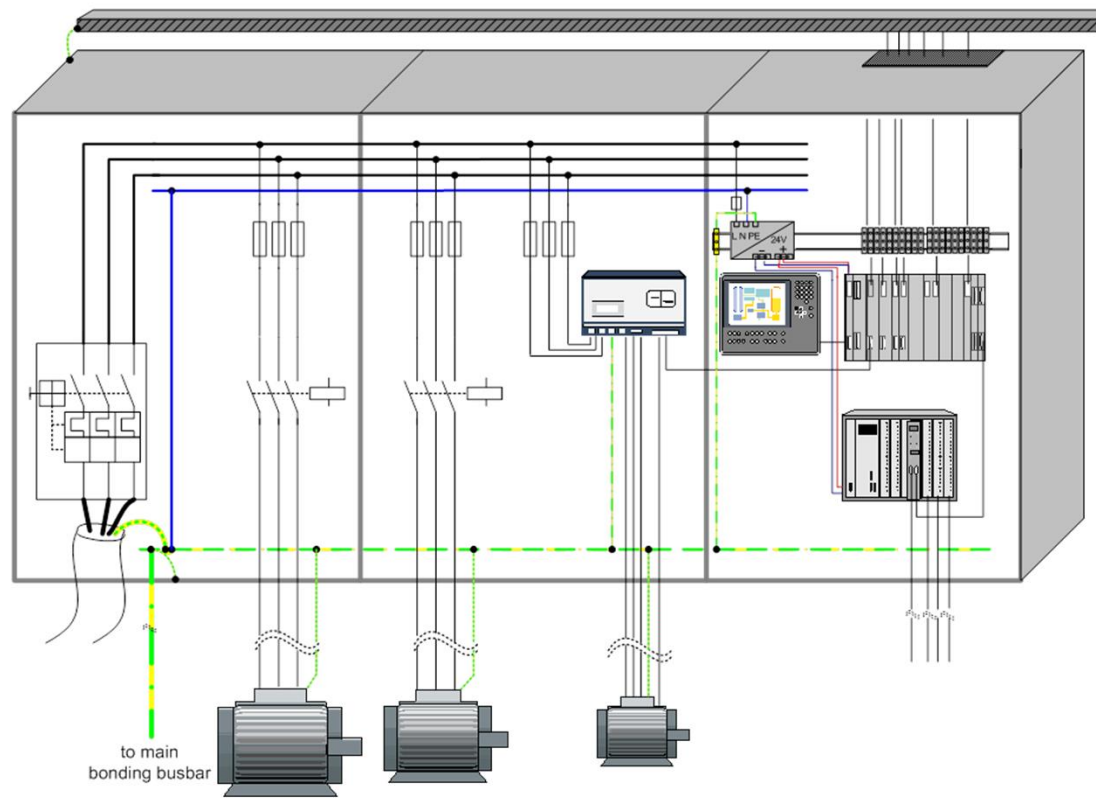


## Switching 500kV

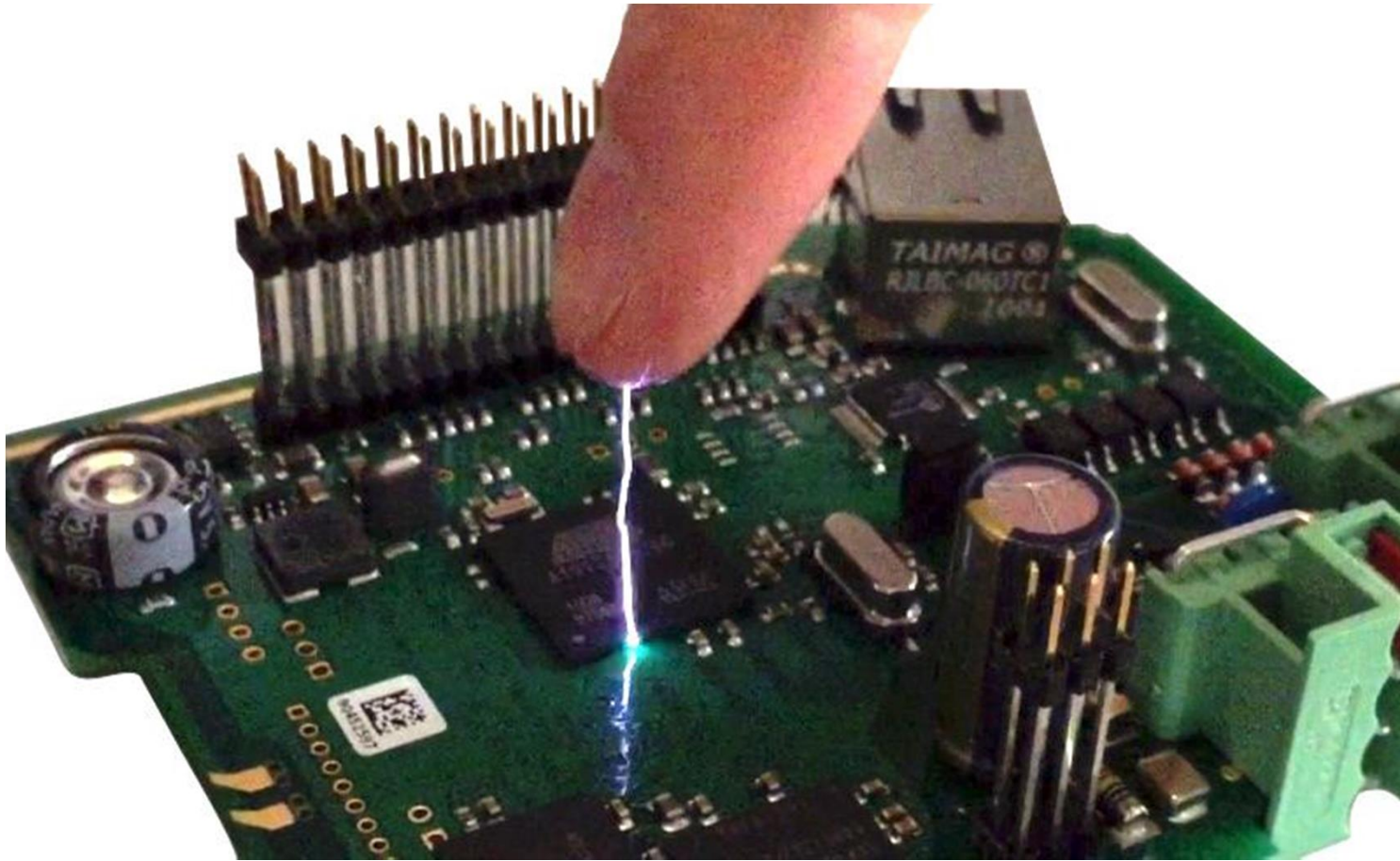




# Switching Electromagnetic Pulse (SEMP)



## Electrostatic Discharge (ESD)

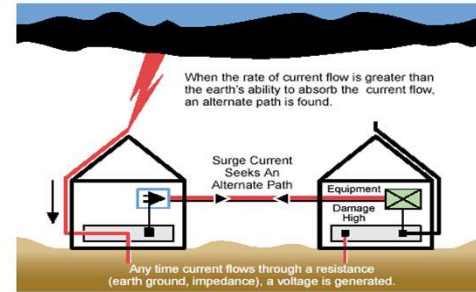
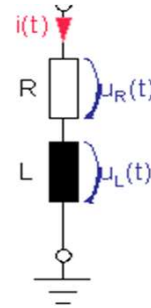


## Electrostatic Discharge (ESD)

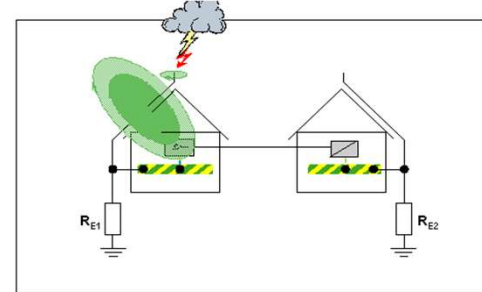
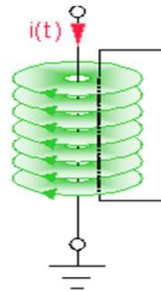


# Coupling of Surge

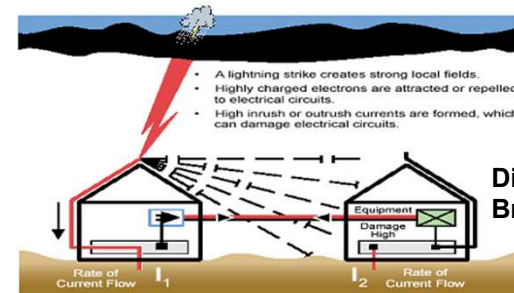
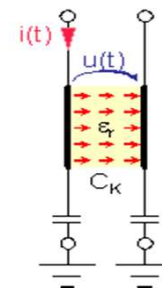
**GALVANIC**



**INDUCTIVE**



**CAPACITIVE**



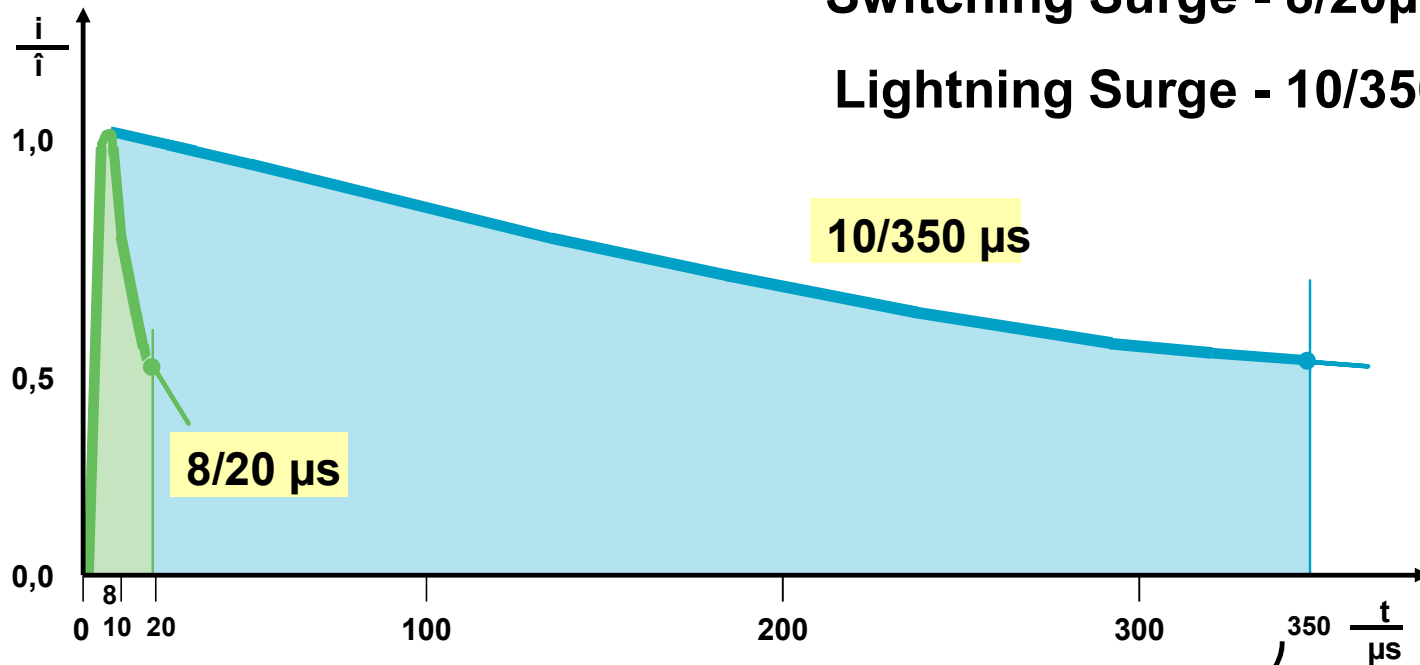
**Dielectric Breakdown**

# Lightning vs Surge Current - In Relation

As Per IEC 62305

Switching Surge - 8/20 $\mu$ s

Lightning Surge - 10/350 $\mu$ s



10/350 LIGHTNING WAVE CONTAINS MUCH HIGHER ENERGY

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# International Standards

## ■ Protection against Lightning:

- General principles
- Risk management
- Physical damages to structures and life hazards
- Electrical and electronic systems within structures

## IEC 62305 series

- IEC 62305-1
- IEC 62305-2
- IEC 62305-3
- IEC 62305-4

## ■ SPD for LV network : Tests

IEC 61643-11

## ■ SPD for LV network : Selection and Application

IEC 61643-12

## ■ SPD for communication lines : Tests

IEC 61643-21

## ■ SPD for communication lines : Selection/Application

IEC 61643-22

## ■ SPD for Photo Voltaic : Test

IEC 61643-31

## ■ SPD for Photo Voltaic : Selection/Application

IEC 61643-32

## ■ Equipment immunity

IEC 61000-4-5

## ■ Insulation of AC equipment

IEC 60664

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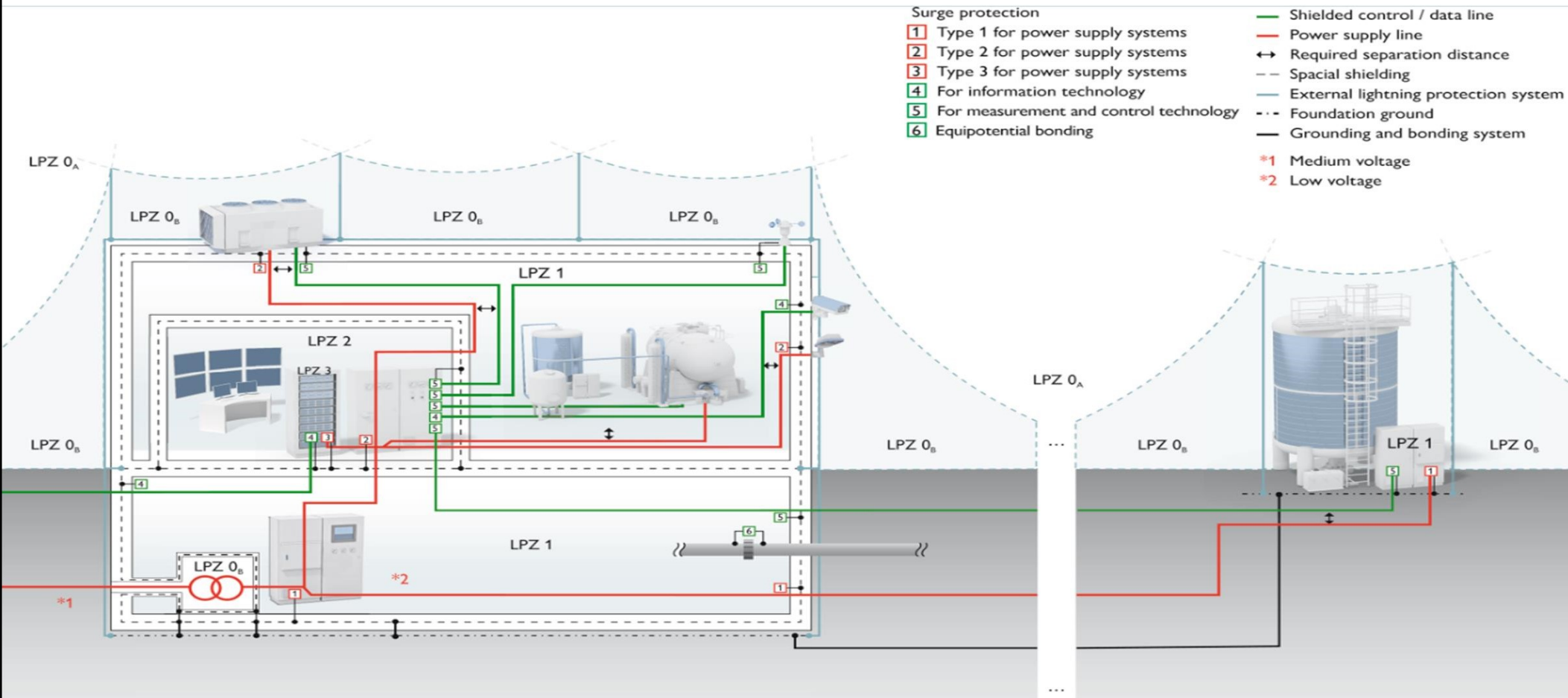
**3. Surge Voltage Limiting Technology**

4. Application Areas

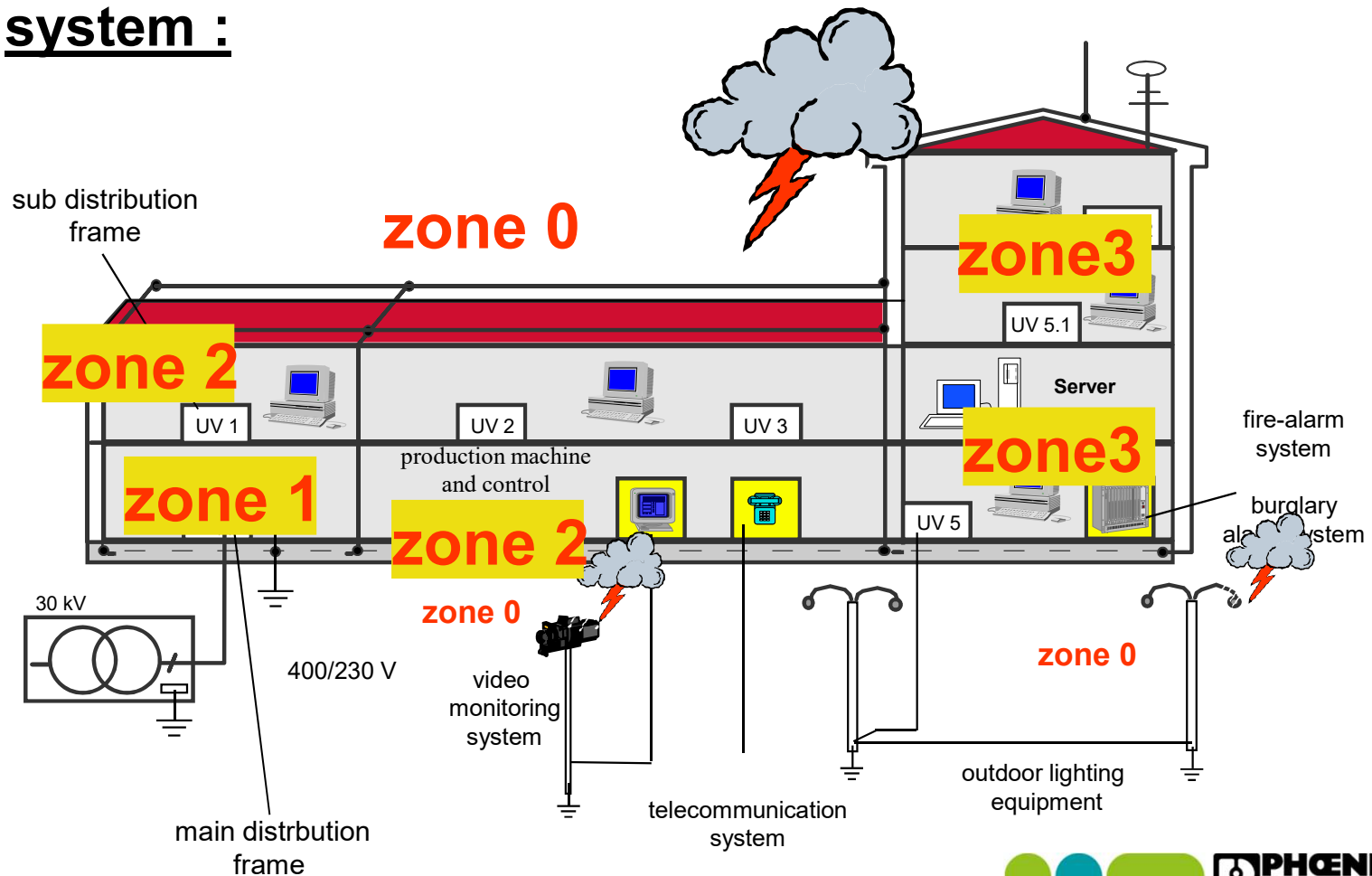
5. Conclusion



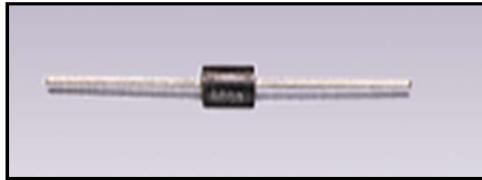
# Example Of Protection Zones In A Process Plant



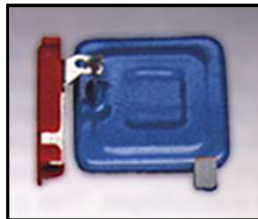
# Lightning Zone - Building with lightning protection system :



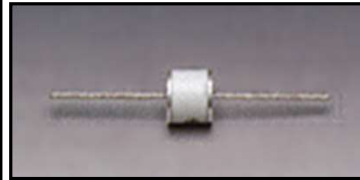
# Technologies for Surge Protection Devices



Silicon Avalanche Diode (SAD)



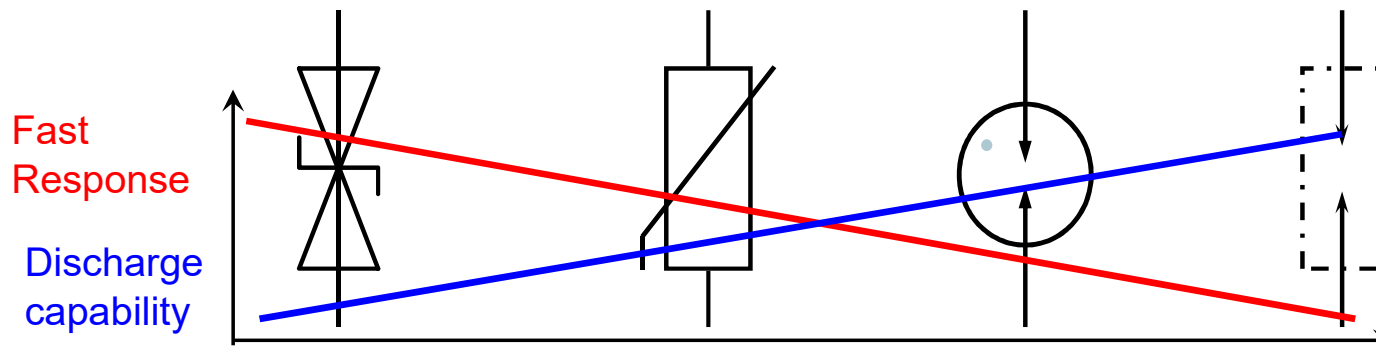
Metal Oxide Varistor (MOV)



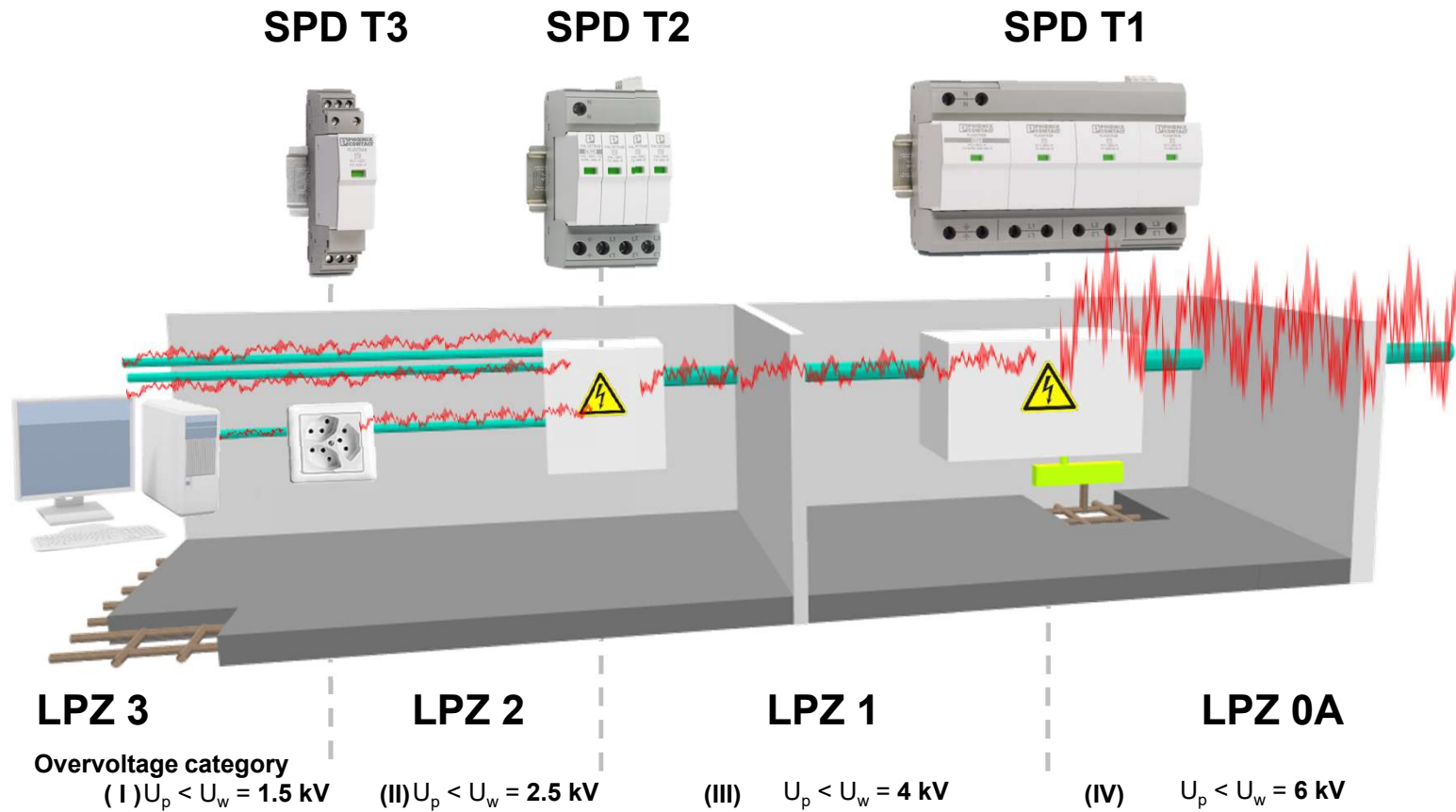
Gas Discharge Tube (GDT)



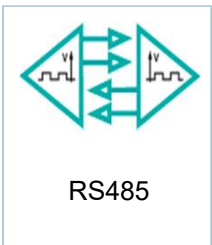
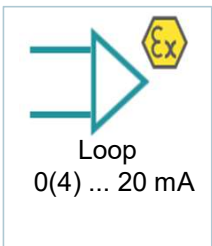
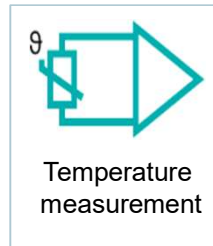
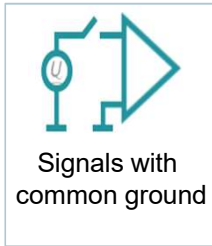
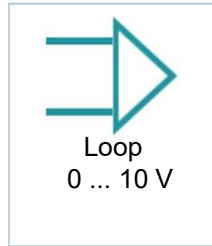
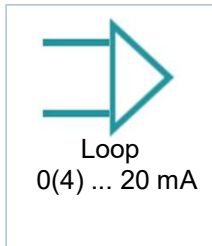
Spark Gap



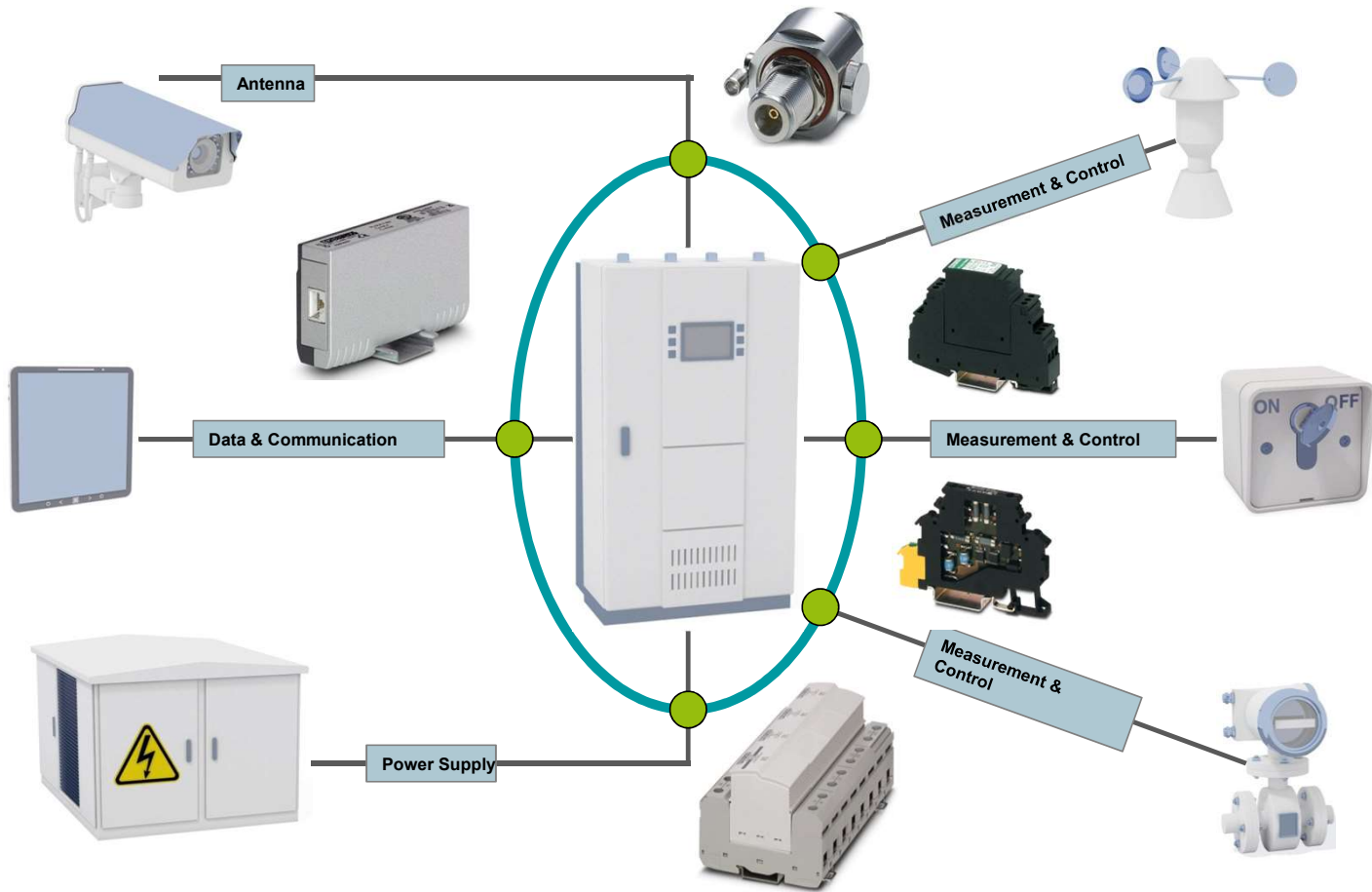
# AC Power Line Surge Protection Devices As per IEC 61643-11



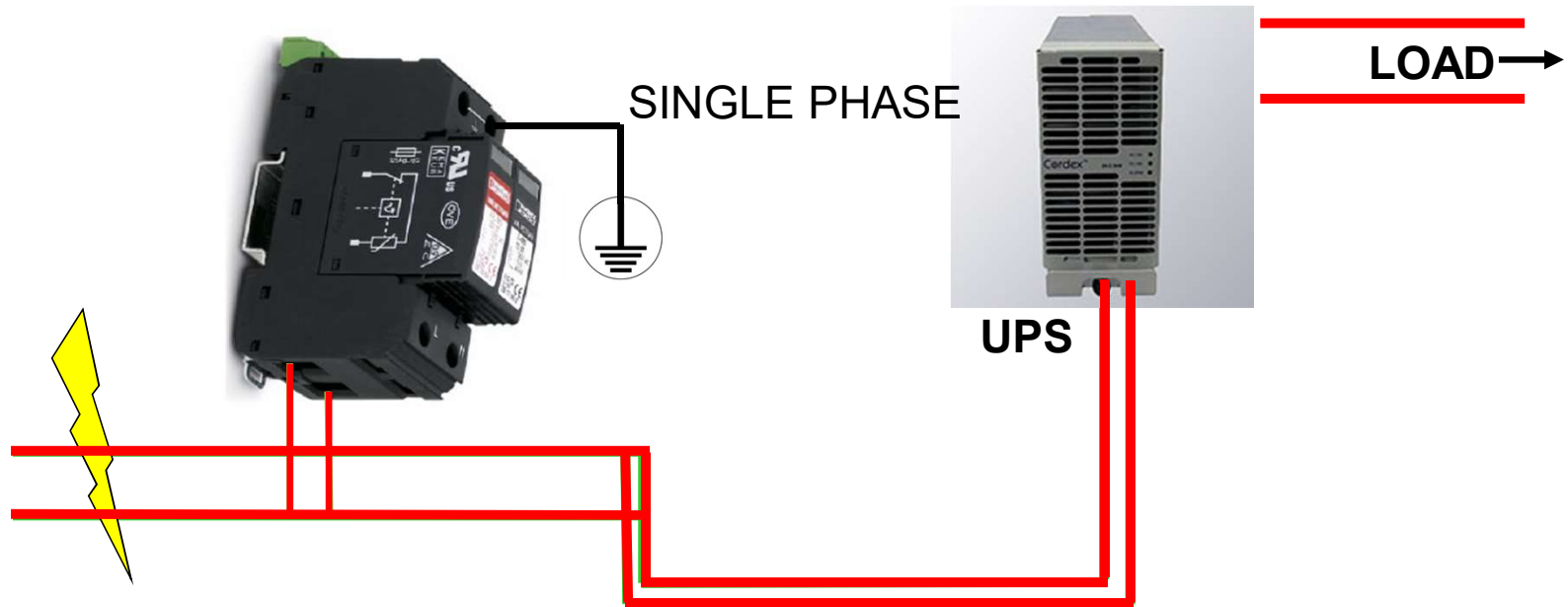
# Signal & Communication Line Surge Protection Devices As Per IEC 61643-21



# Effective Protection



# UPS Protection ... Normal Operation



**UPS will not protect load against surges**

**Surge will pass through the UPS to Load and can Damage Terminal Equipment**

# Protection for Transmitter

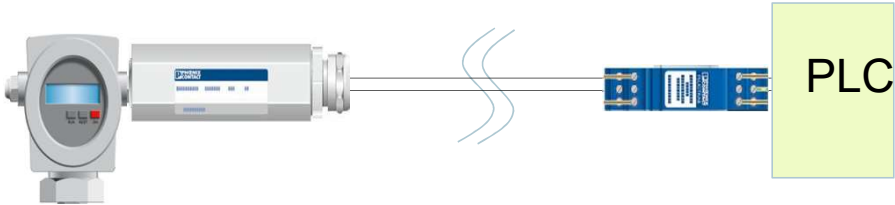
Liquid Level Measurement



Control Center



Example 4...20 mA loop

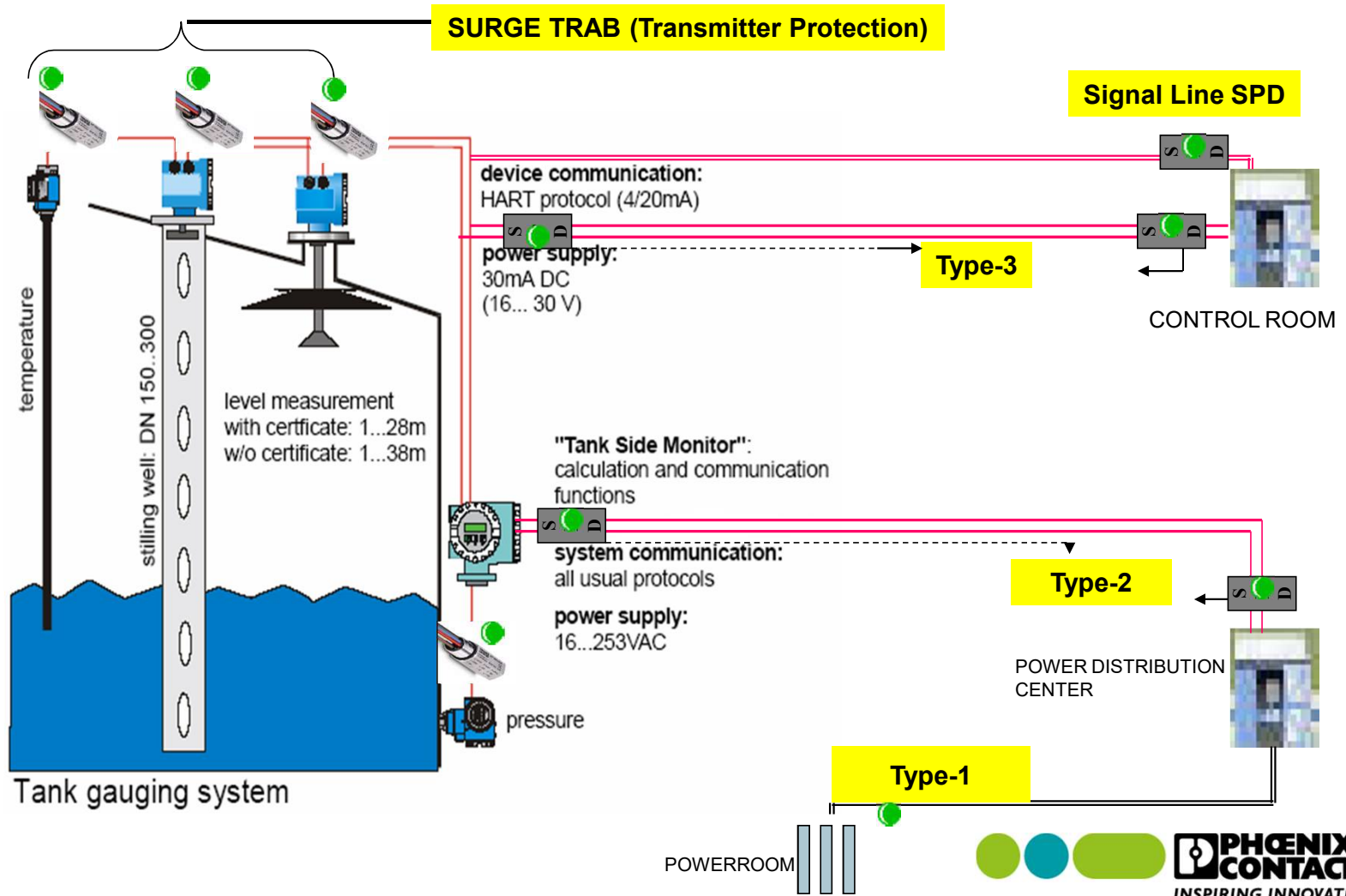


Surge Protection Device In The Field

Surge Protection Device In The Cabinet (Controller Room)

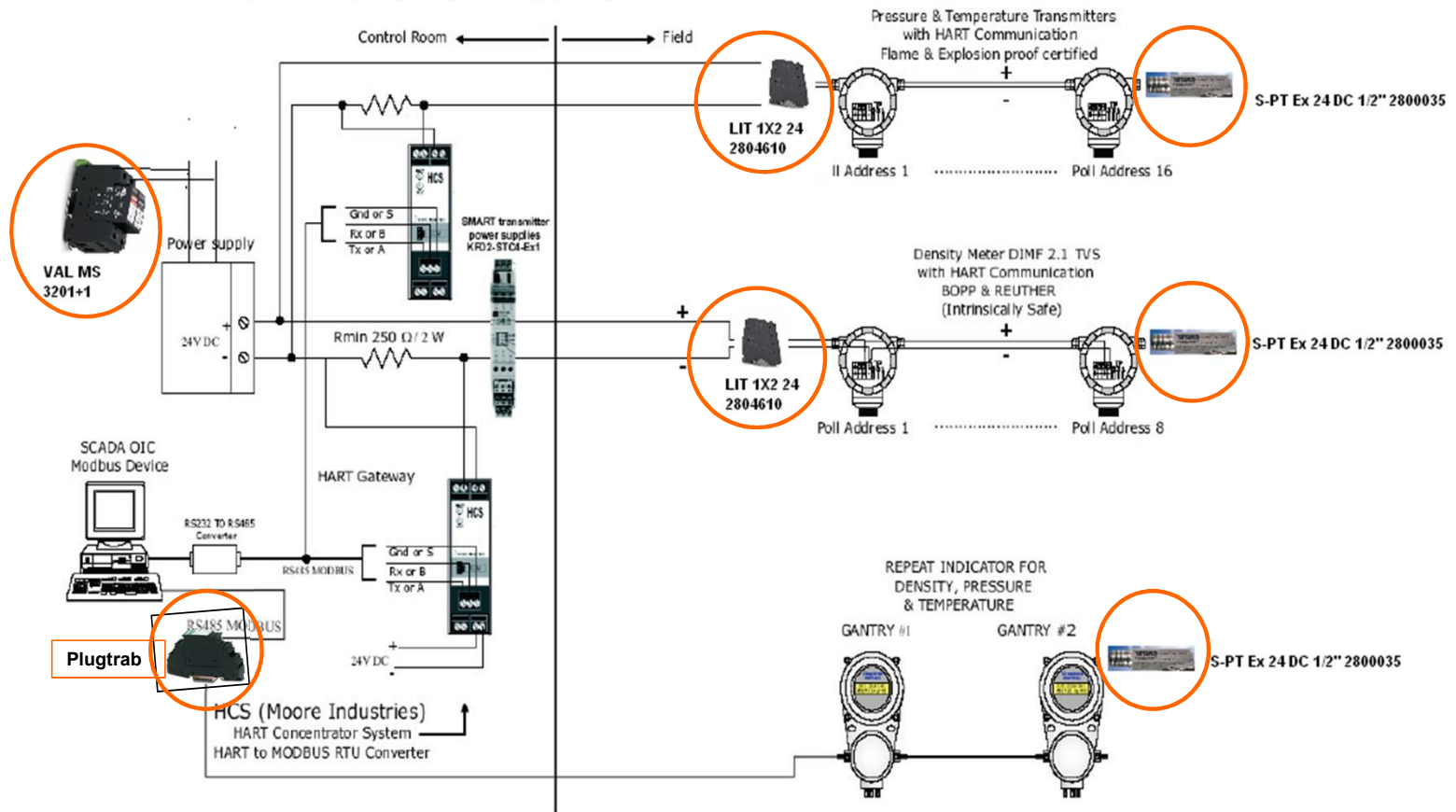


# Tank Gauge Protection



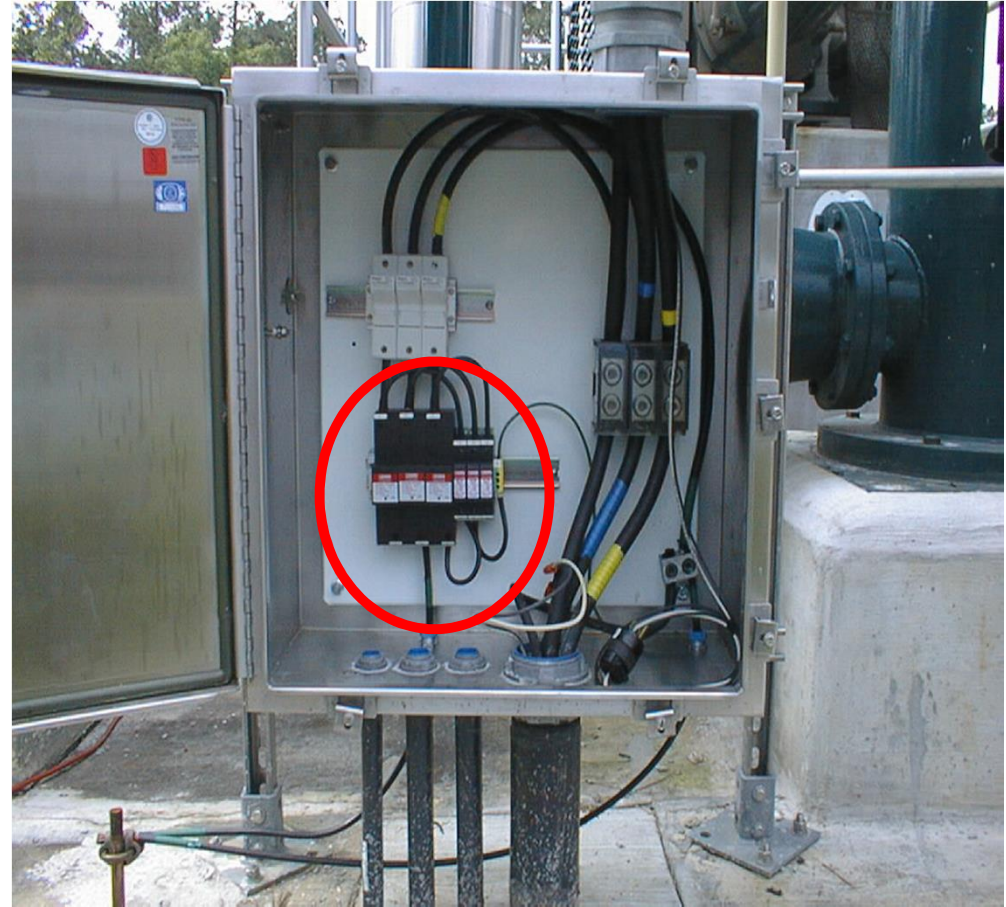
# Terminal Automation

HART to Modbus Gateway Connection Diagram (Multi-drop mode)



TERMINAL AUTOMATION

# Lightning and Surge Protection at Pumping Station



# EX Approval according ATEX and IECEx

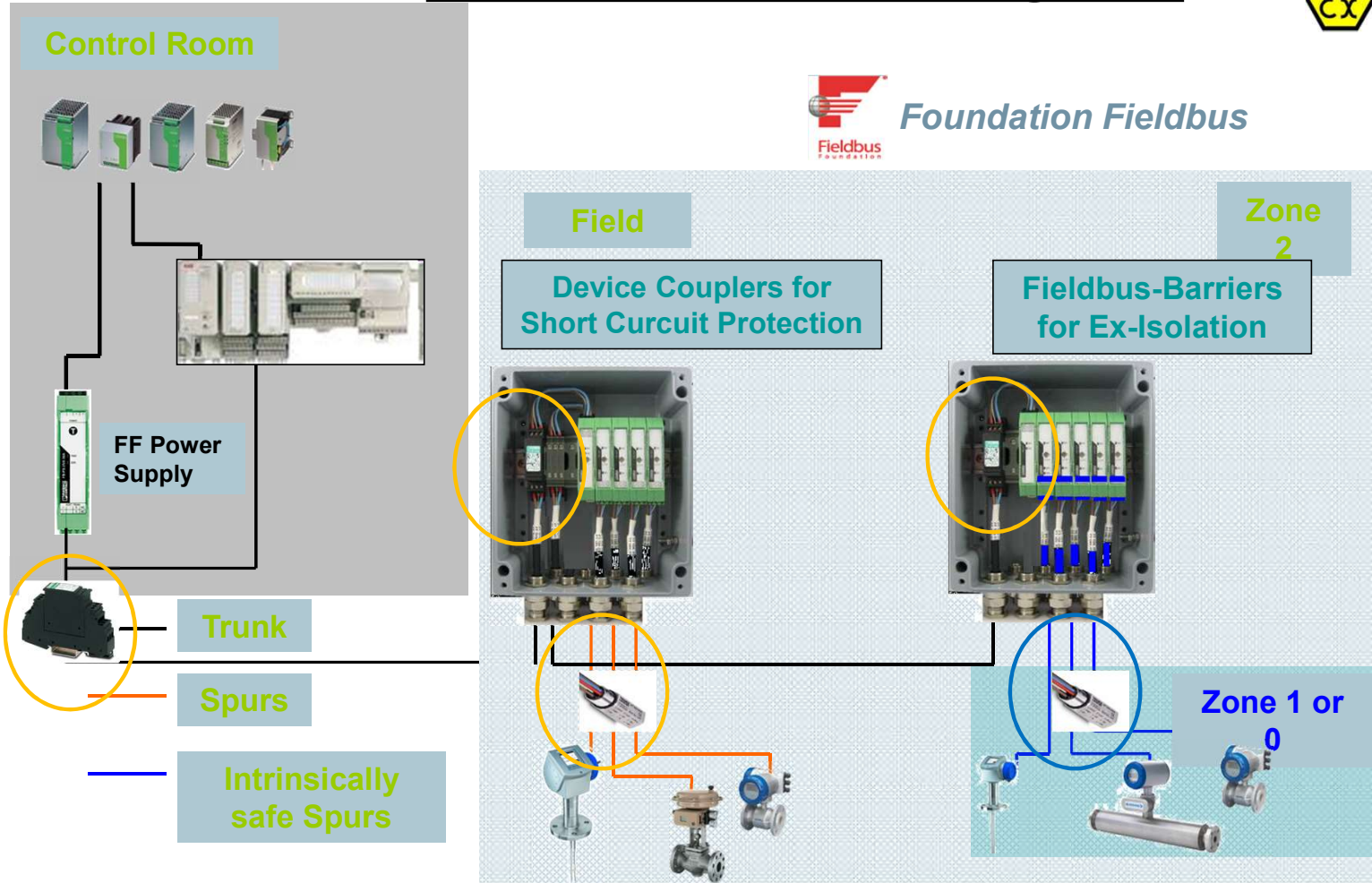


II 2(1) G EX ia [ia GA] IIC T4/T6 Gb

II (1)D [Ex ia Da] IIIC

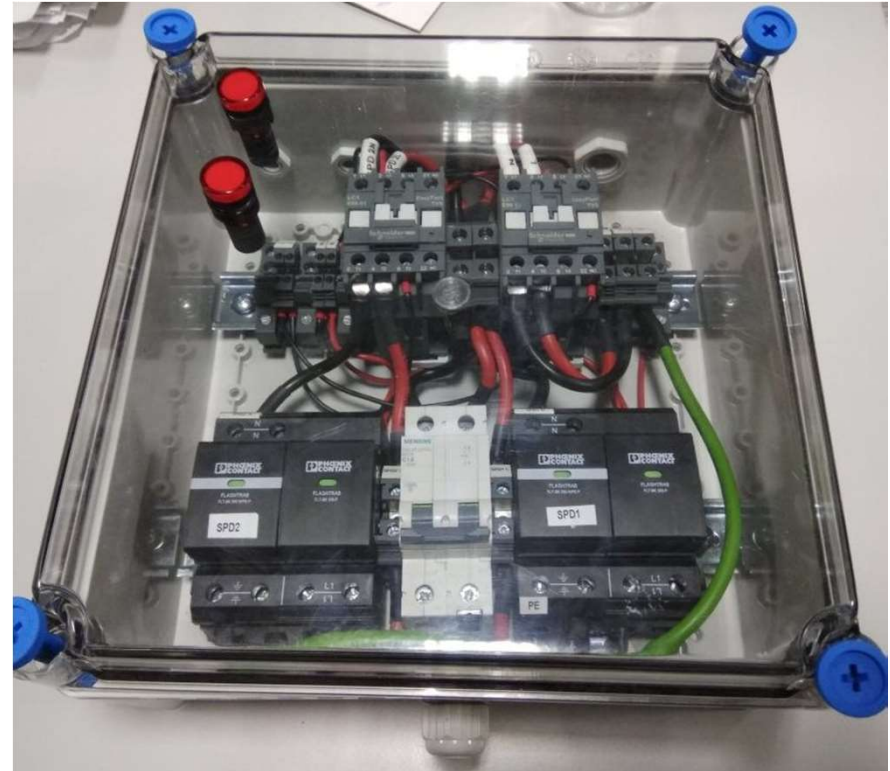
- For intrinsically safe signals
- Signals can lead into EX Zone 0
- Installation of SPD in EX Zone 1,2 or non EX Area

# Setup of a Fieldbus Segment



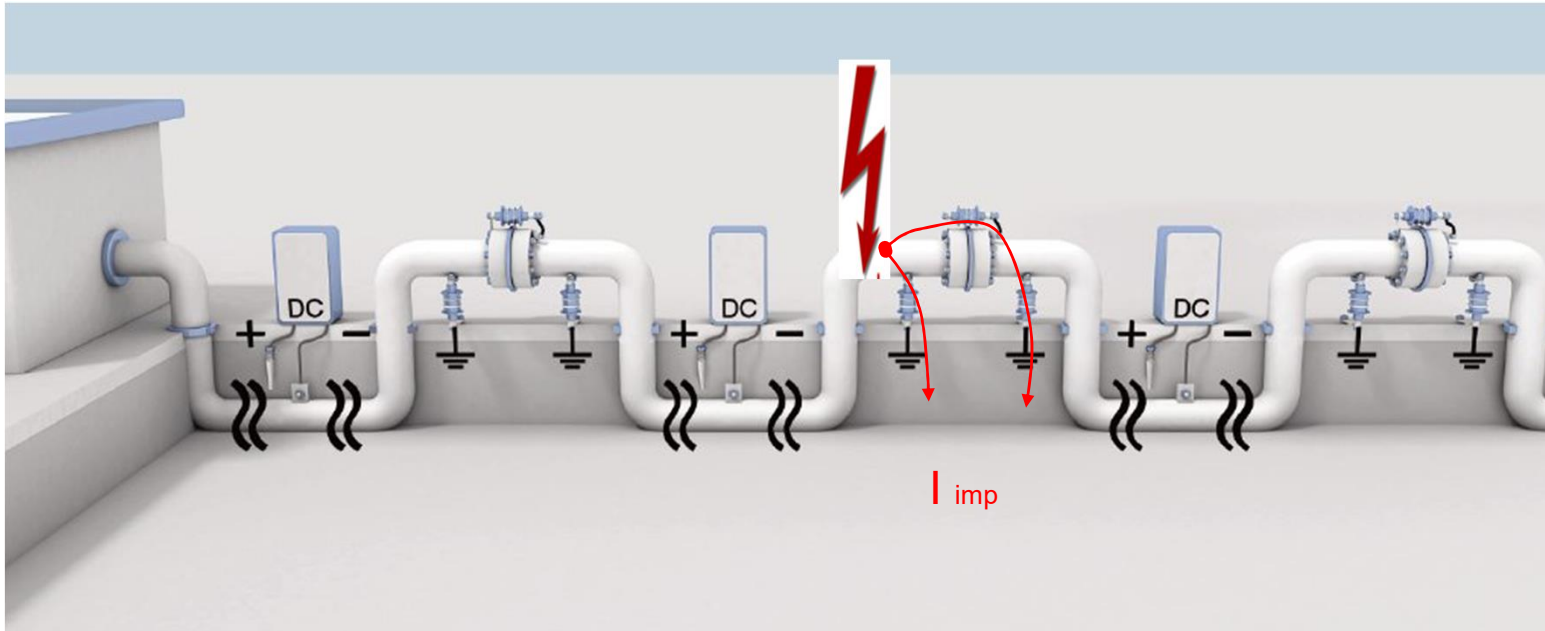
## Solution for Retail Automation

- **Solution for Retail Automation**
- **Redundant Solution for High System Availability**
- **Possibility of Remote Monitoring**



# Pipeline Protection

## Lightning Strike



Isolating spark gap

Flange Is Protected

# Indirect Bonding To Protect Isolated Pipeline Flanges

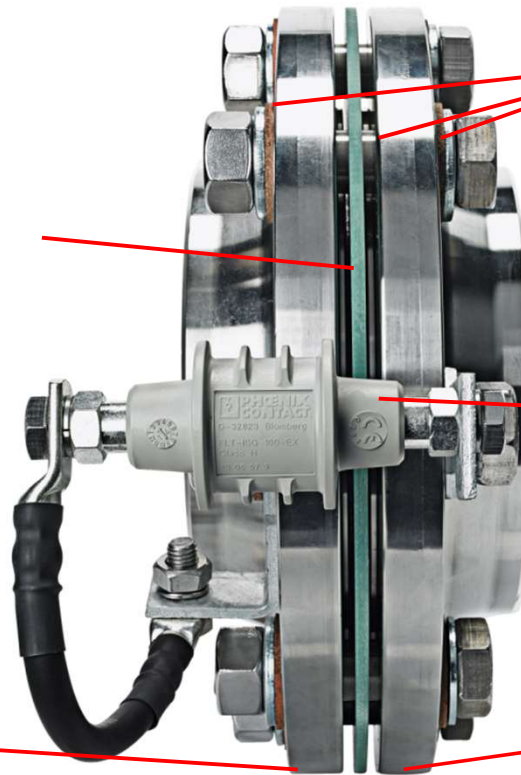
Isolation Between The  
Parts Of The Flange

Isolation For The Screws

Isolating Spark Gap

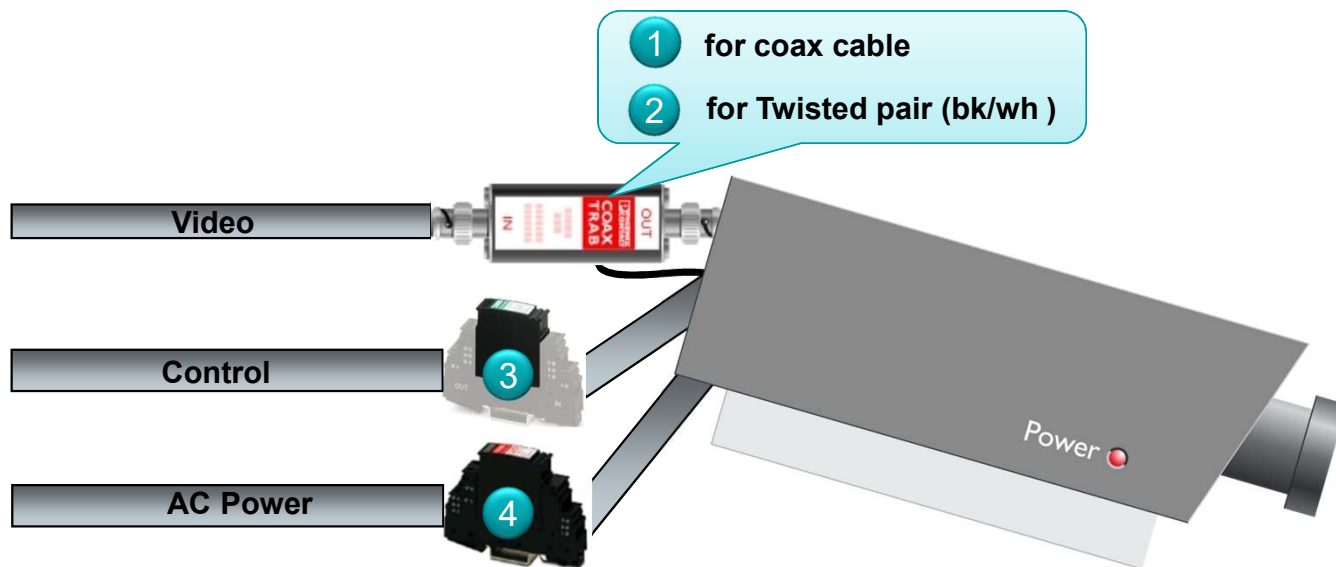
Part Of Flange 1

Part Of Flange 2





# Overvoltage Protection For Analog CCTV



1

**C-UFB-5DC/E**



2

**PT 3PB-ST  
& PT 1X2+F-BE**



3

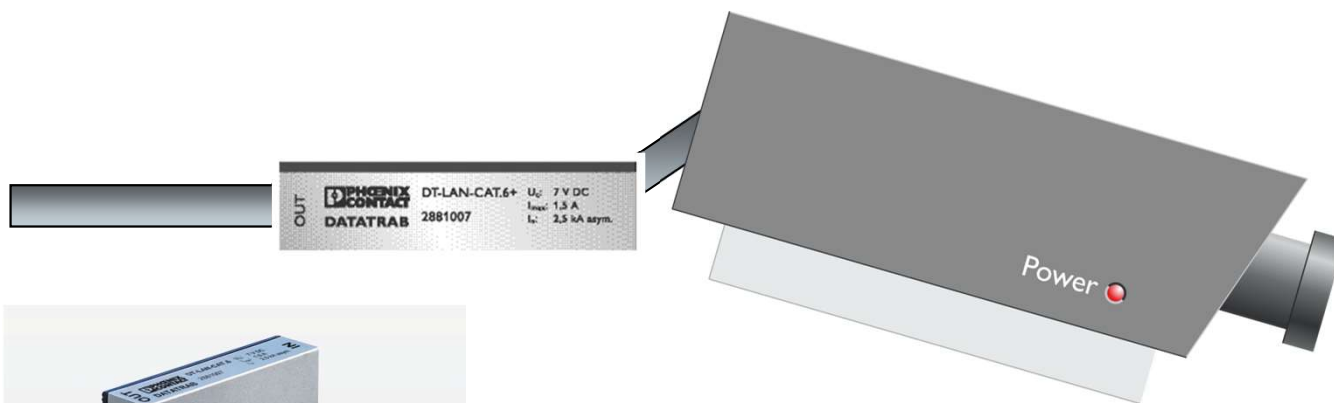
**PT 5-HF-12DC-ST  
& PT 2X2-BE**



4

**PT 2-PE/S 230AC**

# Surge protection for Digital / POE based CCTV



**SPD for Ethernet  
Protection for POE  
Camera**

# TRABTECH

## Conclusion

- Less Downtime & less stress
- Better life & equipment performance
- Lower operation & maintenance costs

## Global Trend for Surge Protection in Process Industry

Thank you