

TIA 1194

Surge Resistibility of Smart Grid Equipment Connected to either DC or 120/240 V Single Phase AC and Metallic Communication Lines

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2.1 Energy Management Controller

- *Definition:* A set of functions that manage energy consumption as an agent for the customer. Physically, these functions may be embedded in a **residential gateway**, in an appliance, or in a stand-alone device.

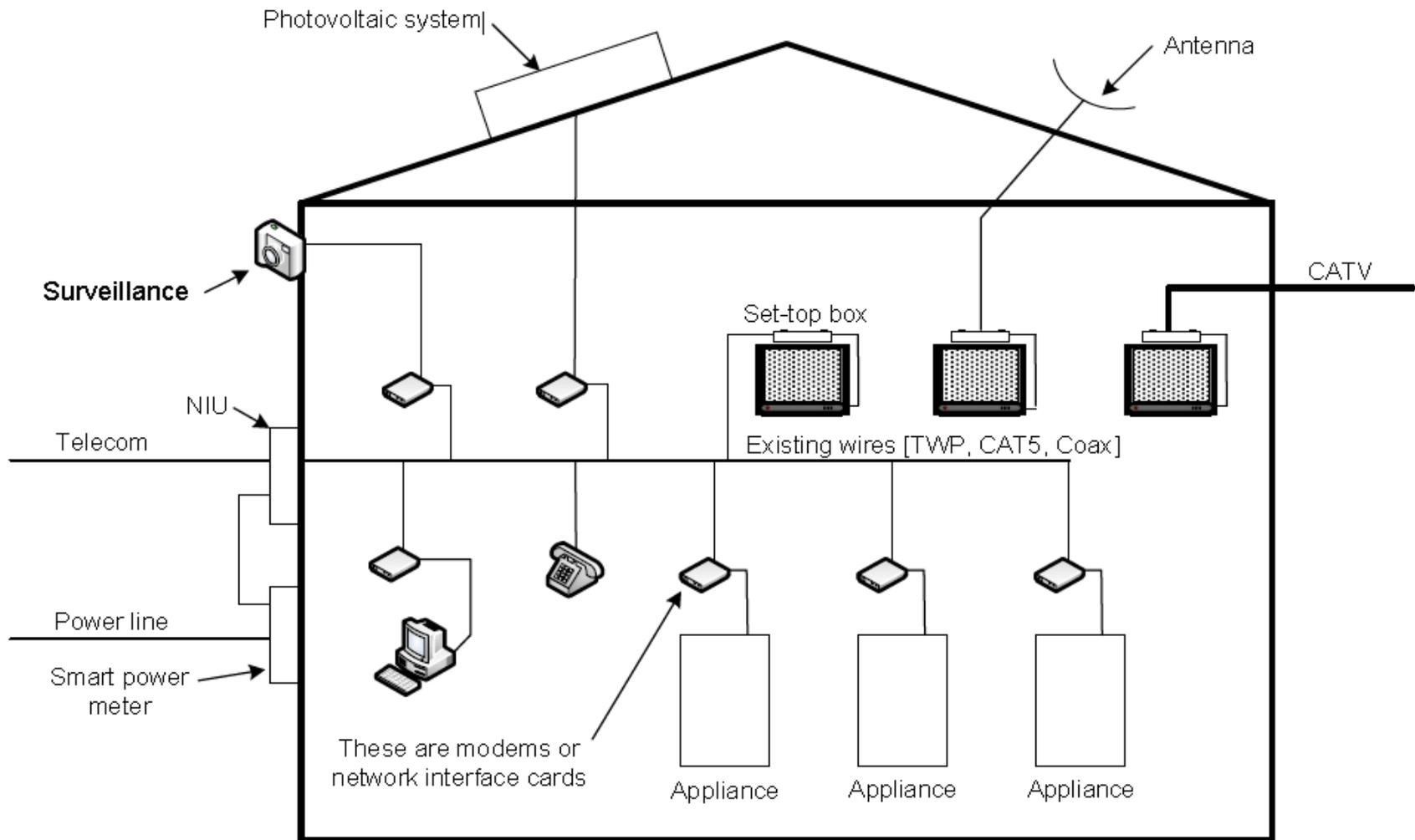
GridWise Architecture Council / NIST

Home-to-Grid Domain Expert Working Group - Requirements

2.3 Residential Gateway

- *Definition:* A communications function that interconnects two networks operating with different communications protocols.

A Possible Home Network



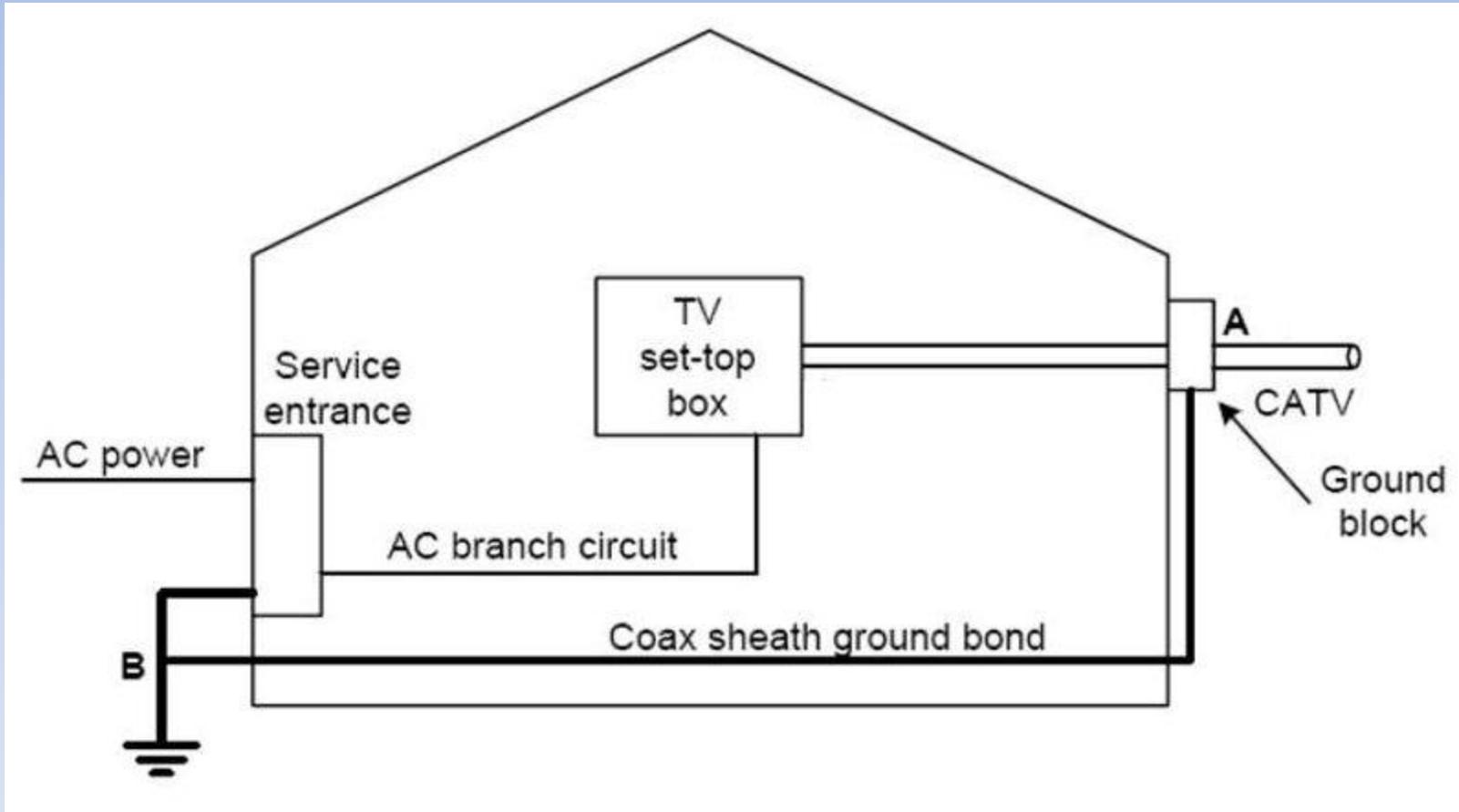
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- Premises equipment that is connected to:
 - one or more metallic conductive communication line(s)
 - a DC power source, or a 120/240 V single phase AC power service with the neutral grounded at the service entrance
- Test procedures
- Resistibility requirements
- Communications ports shall continue to demonstrate basic functionality

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- Examples of equipment with services having separate grounds:
 - smart grid power meter that is connected to the AC power at one side of a building and a communications service at the opposite side
 - roof-mounted photovoltaic system with a communications link to the smart grid

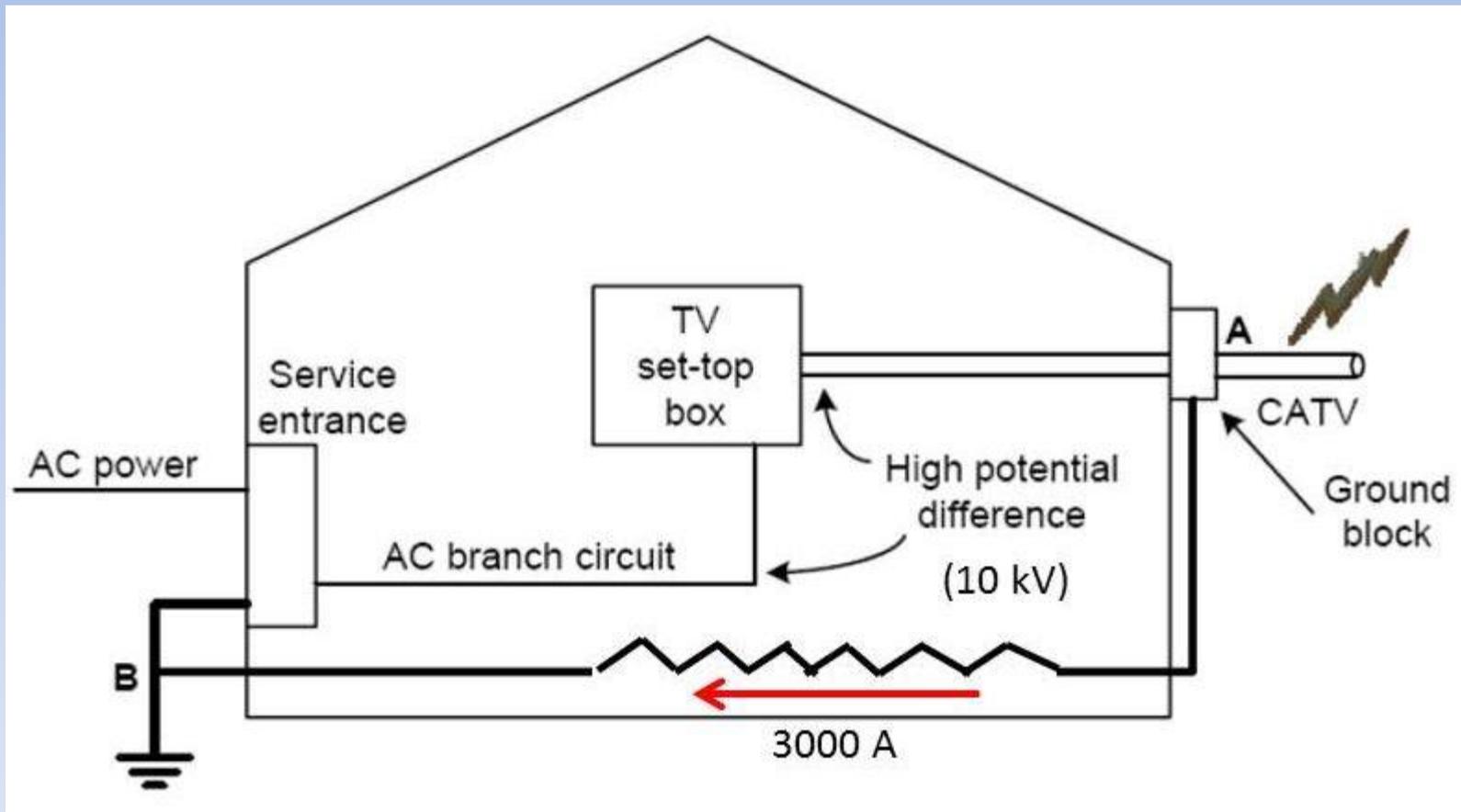
Equipment with 2 Ground Reference Points



Equipment with 2 Ground Reference Points

- The equipment is referenced on the AC side to point B
- The equipment is referenced on the signal side to point A
- A lightning strike can develop a large potential difference between point A and point B
- With a 3000 A surge and a 9 meter (~30 foot) long ground connection between A and B, the voltage developed in wire A–B is ~10,000 V

Equipment with 2 Ground Reference Points



This is enough voltage difference to flash over most ordinary insulating barriers in the equipment, with equipment damage likely to result.

6kV, 3kA Combination Wave

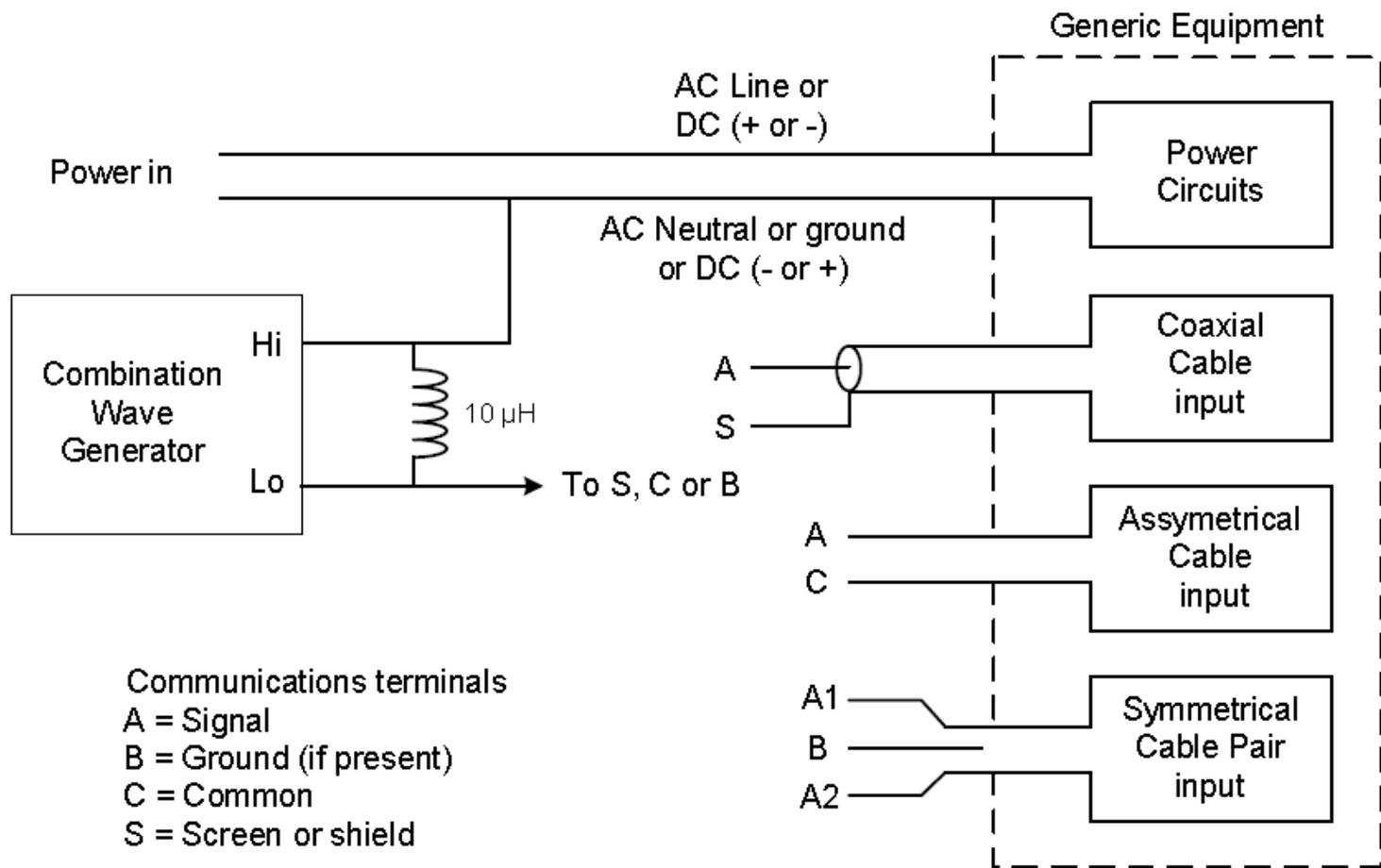


Figure 4. Generic equipment with AC or DC power and various communications inputs. Test set-up to verify a common service ground connection

6kV, 3kA Combination Wave

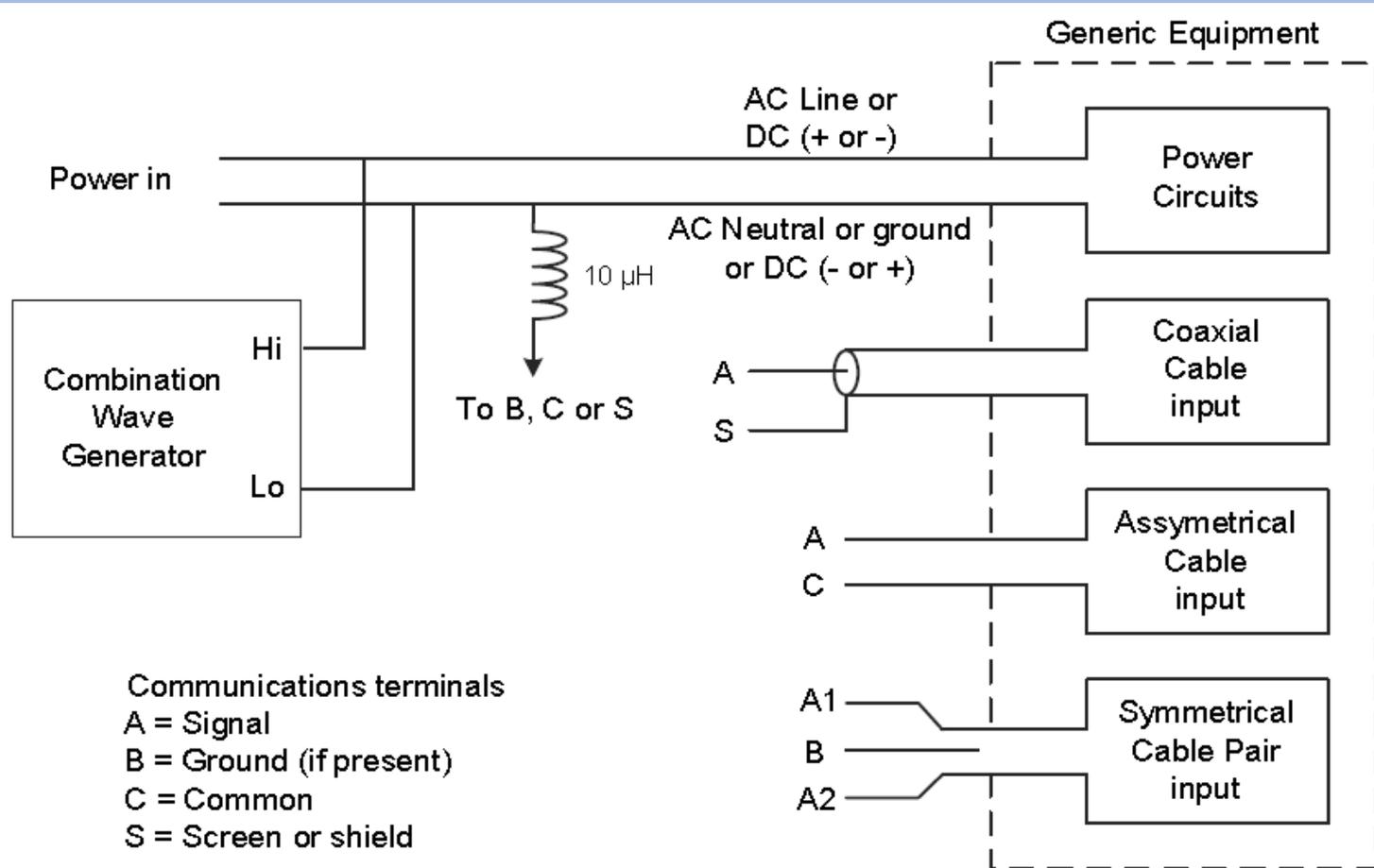


Figure 5. Generic equipment with AC or DC power and various communications inputs. Test set-up to verify robustness to a power port surge

6kV, 3kA Combination Wave

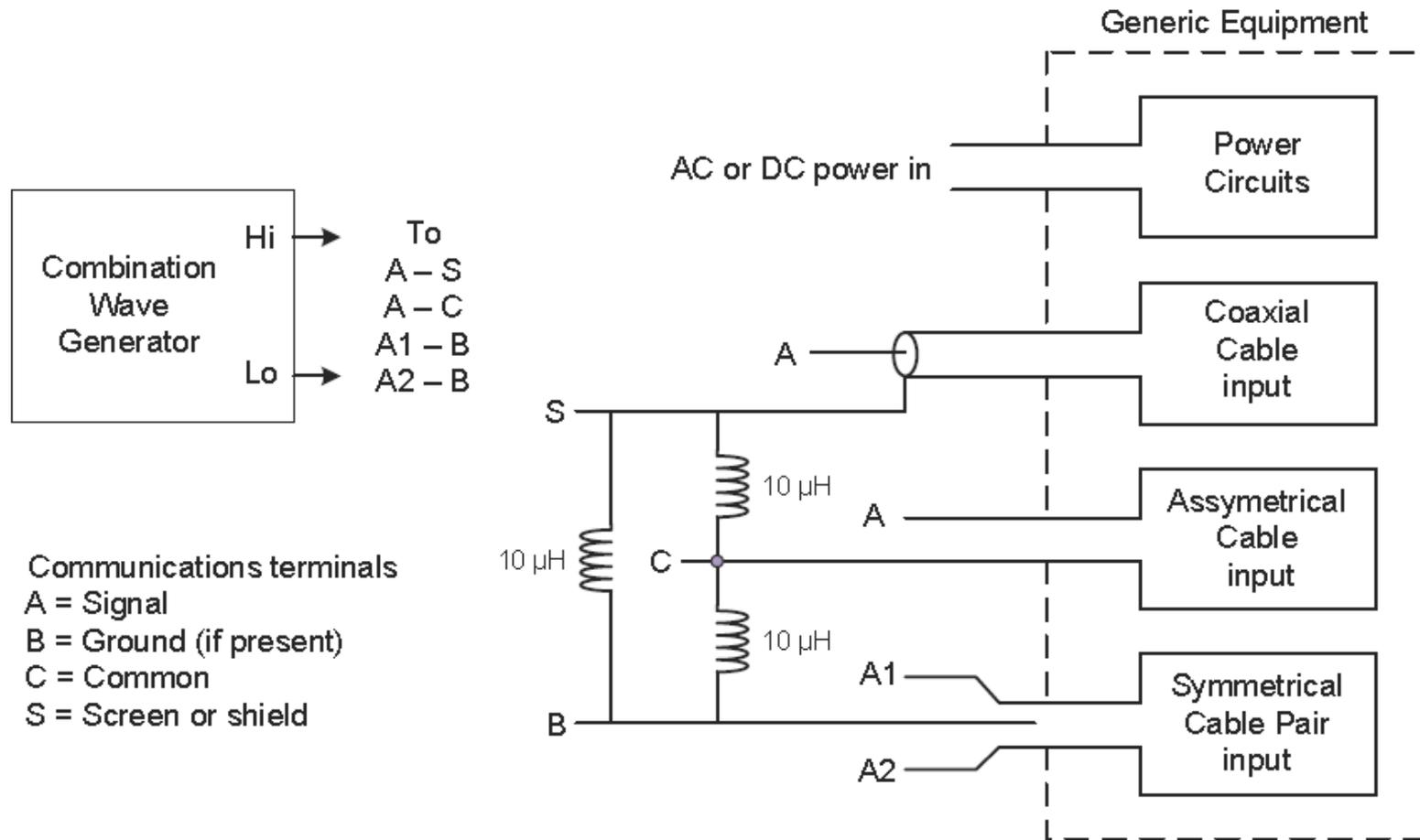
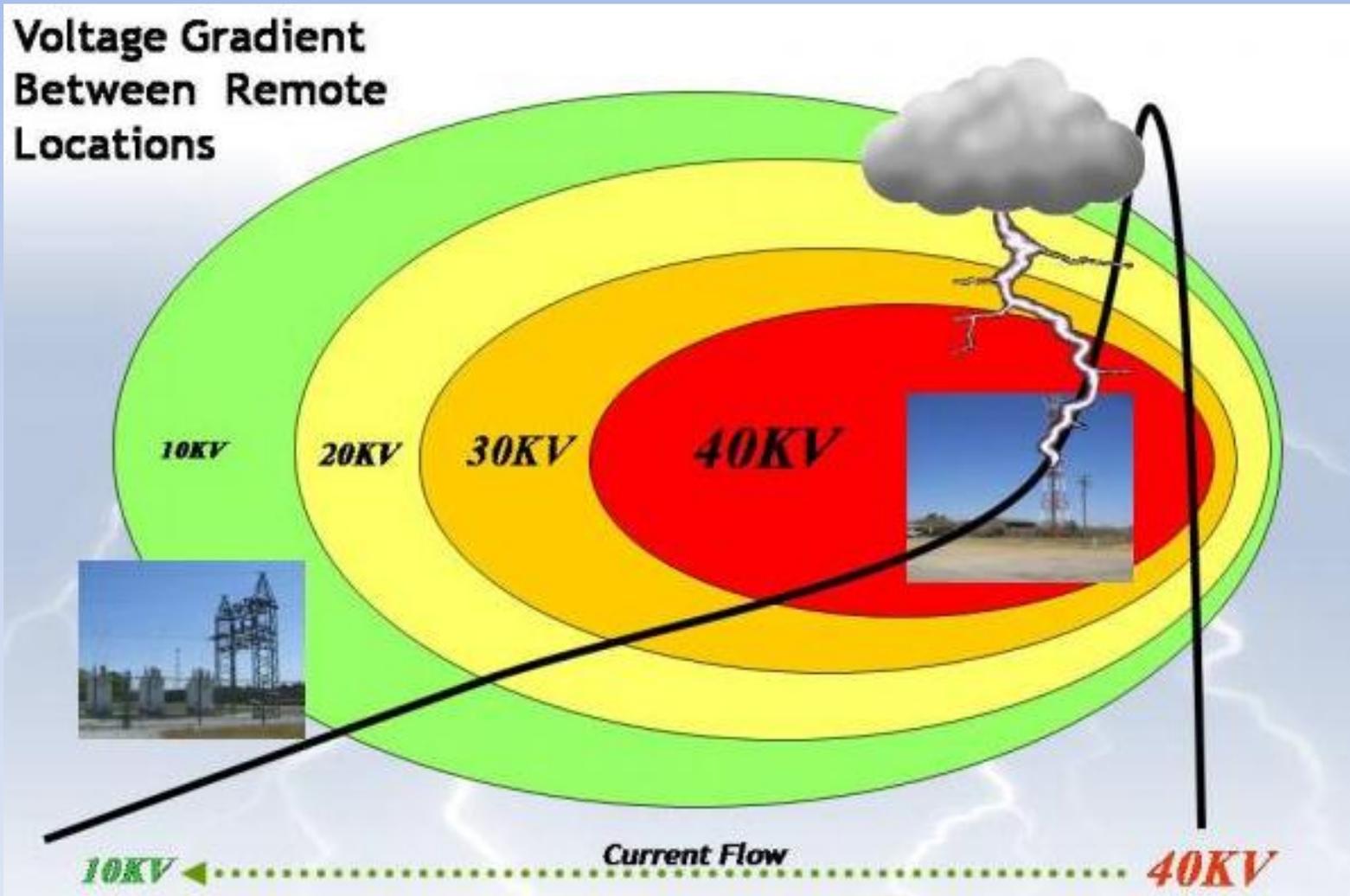


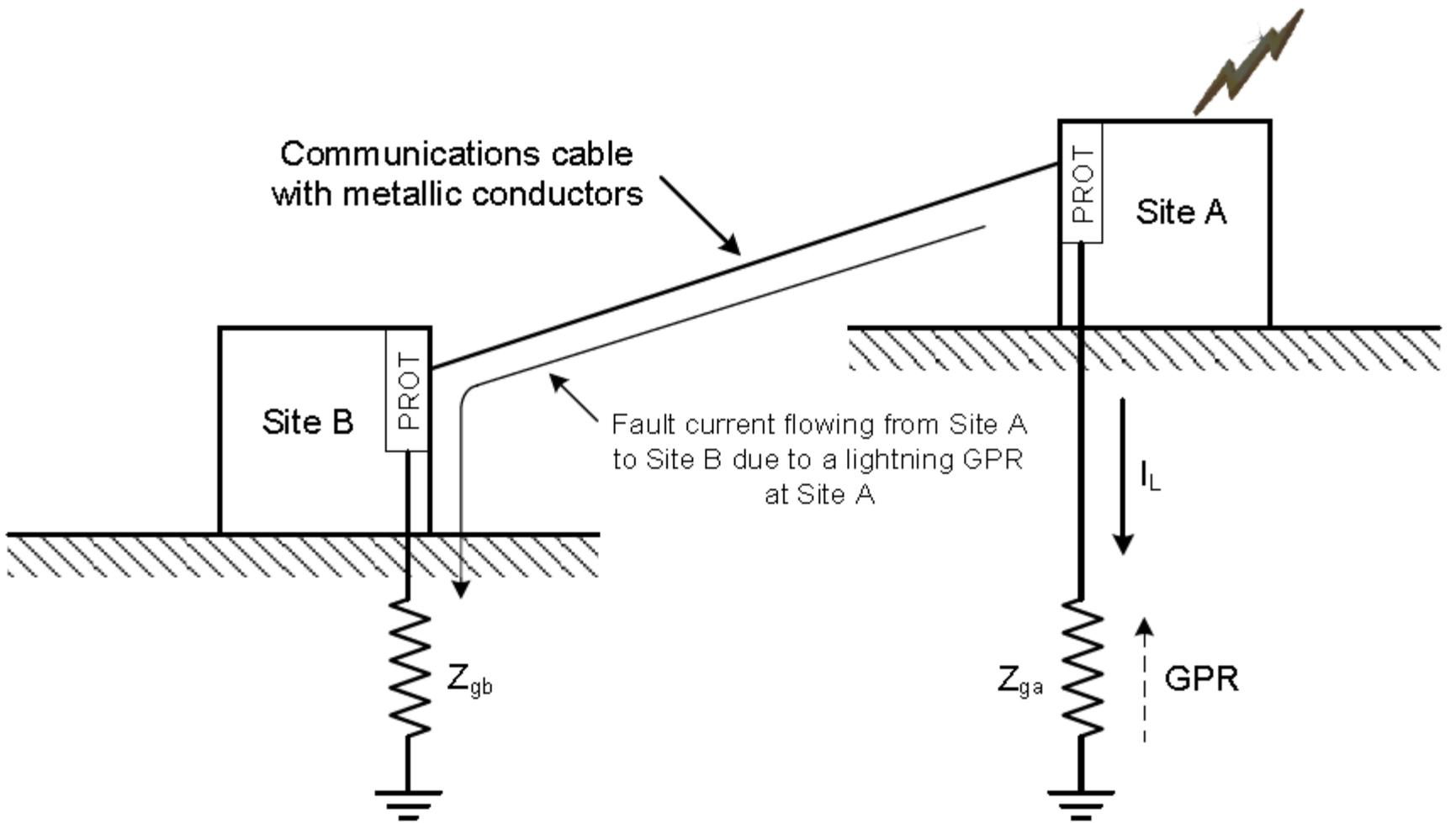
Figure 6. Generic equipment with AC or DC power and various communications inputs. Test set-up to verify robustness of one communications port to surges on another communications port

Ground Potential Rise (GPR)

Voltage Gradient
Between Remote
Locations



Signal Lines Grounded at Remote Site – Ground Potential Rise (GPR)



10/250, 4 kV, 500 A surge

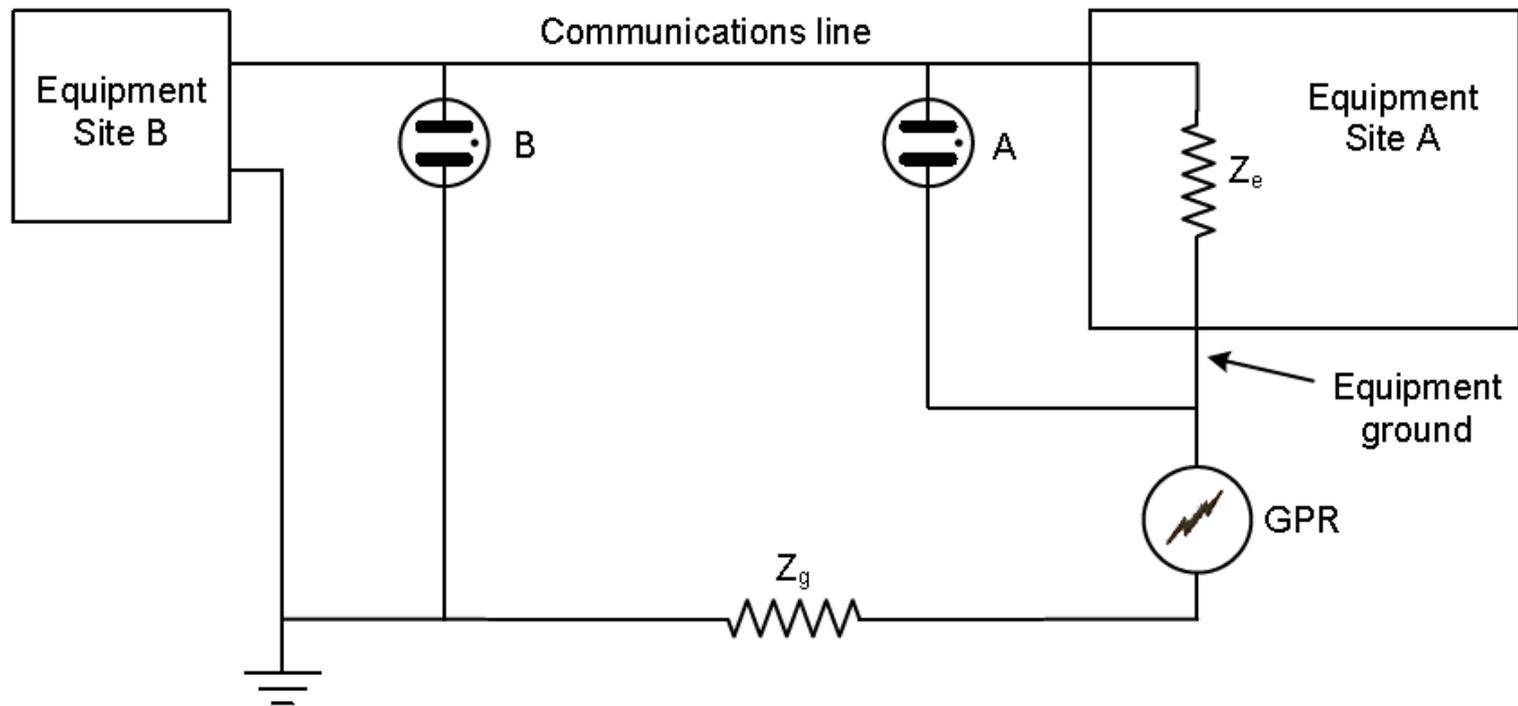


Figure 7. Effect of a lightning strike on equipment with a communications line connected to a remote ground



Questions ?