



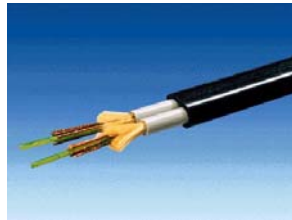
# Bus Physics & Wiring

❑ PROFIBUS wiring/installation can be done with:

✓ Copper



✓ Fiber optic



✓ Infrared & RF components





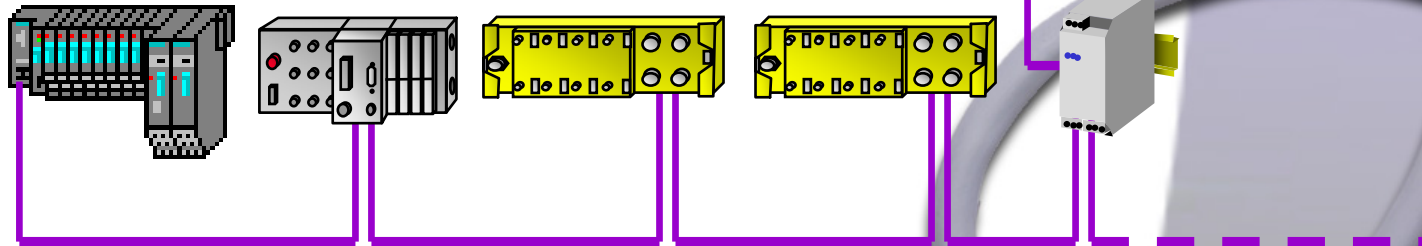
# Bus Physics & Wiring



❑ PROFIBUS is based on RS485...

Network consists of RS485 segments

Proper installation required



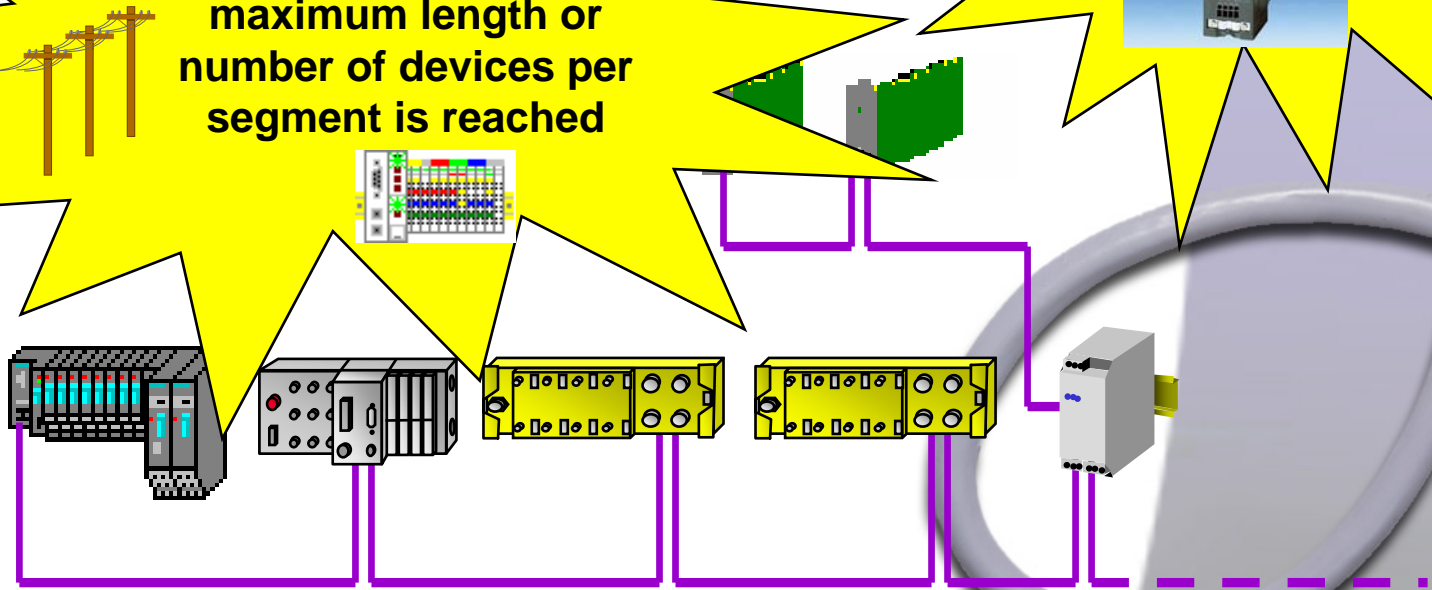
# Bus Physics & Wiring



## PROFIBUS Segments

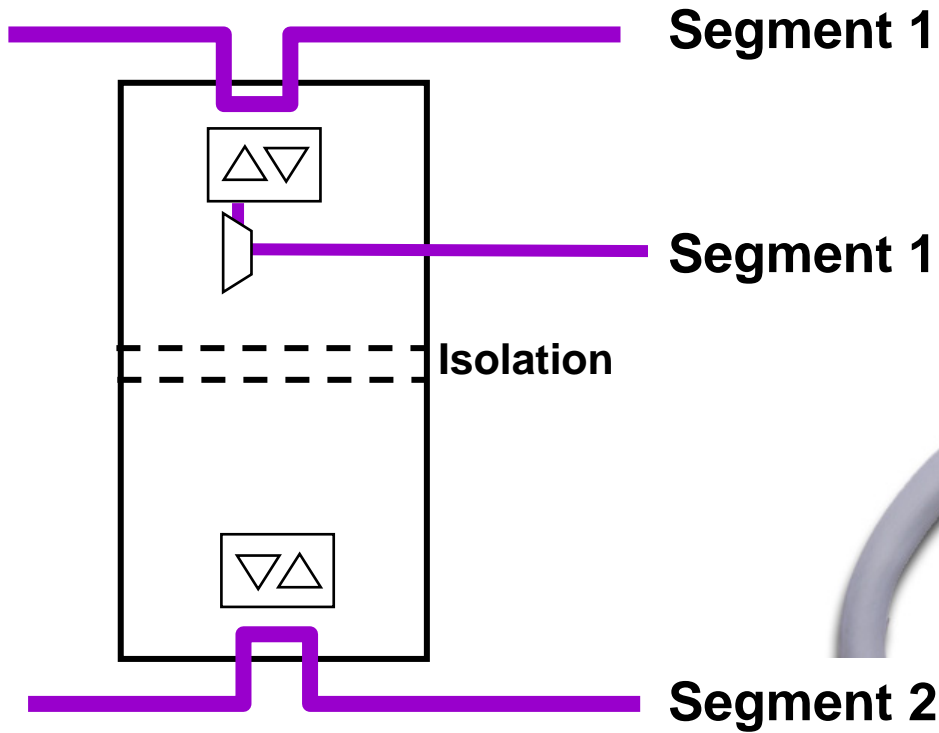
New segment when maximum length or number of devices per segment is reached

Connected via repeaters



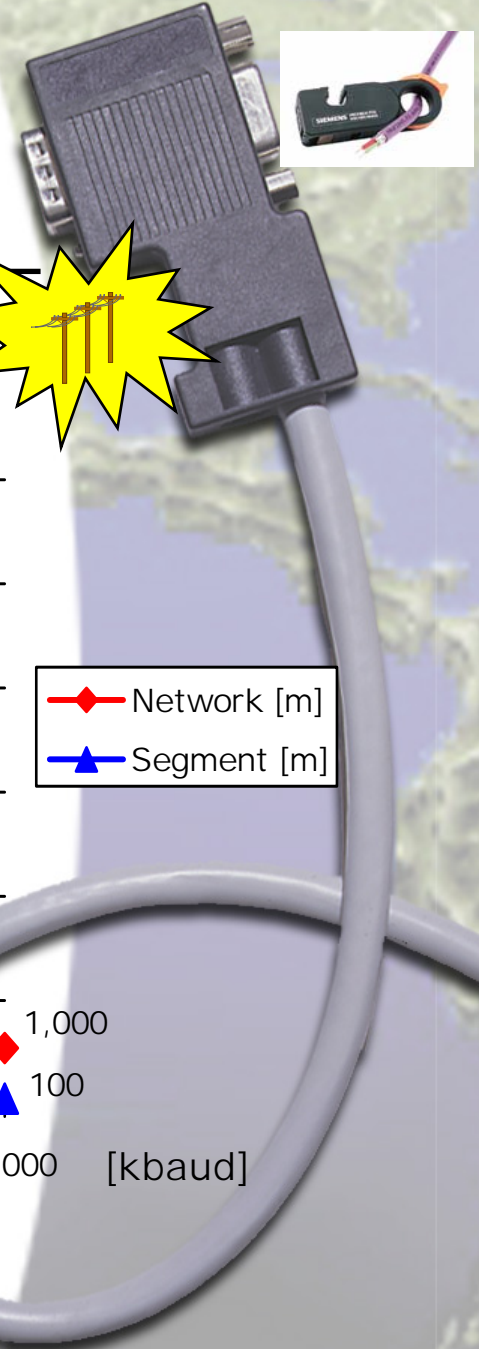
# Bus Physics & Wiring

## PROFIBUS Segments - Repeater

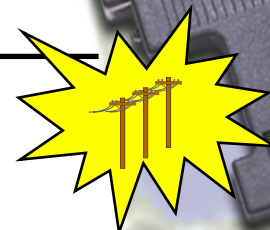




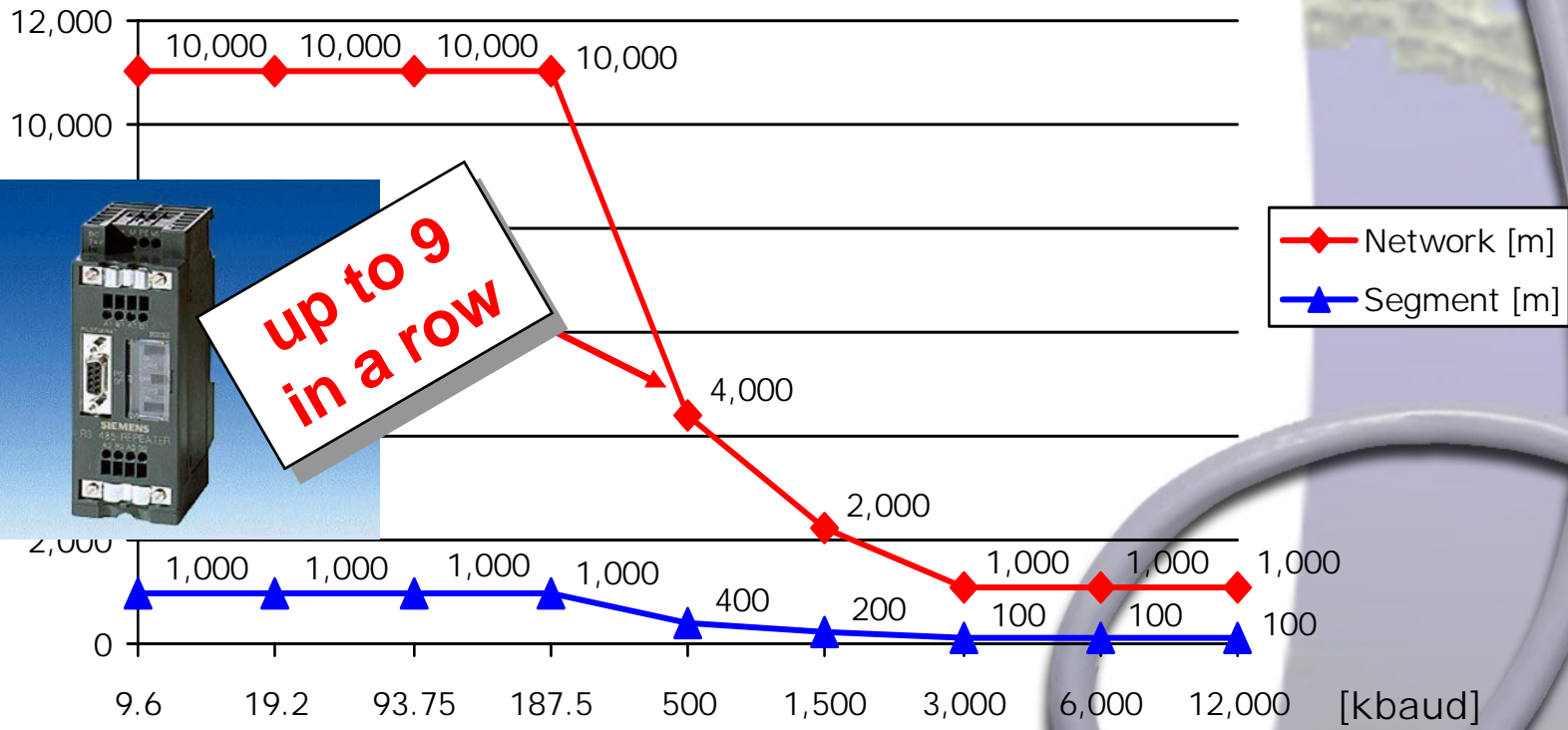
# Bus Physics & Wiring



## PROFIBUS - Segment & Network Length

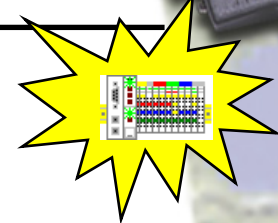


**up to 9  
in a row**





# Bus Physics & Wiring



## PROFIBUS Segments - Nodes/Devices

- ✓ Up to 126 addressable nodes per network
- ✓ Up to 32 devices per segment

## What counts as “device”?



**PROFIBUS  
Nodes (e.g. I/O)**



**Optical Link  
Modules  
(OLMs)**



**Repeater**

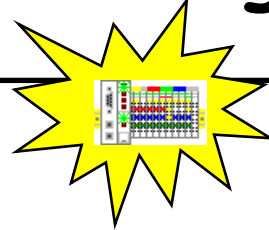
**! No PROFIBUS Address !**



# Bus Physics & Wiring

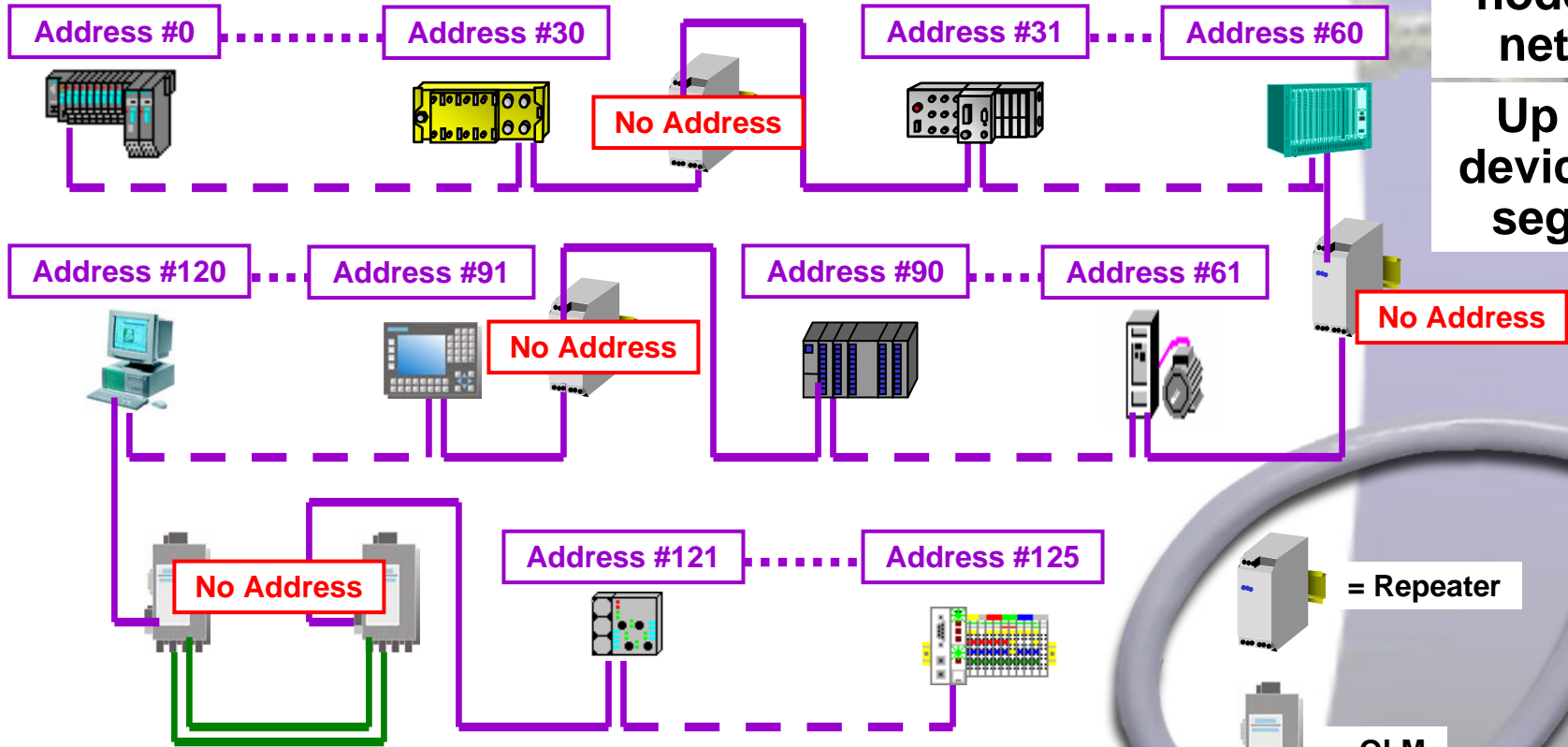


## PROFIBUS Segments - Example



Up to 126  
addressable  
nodes per  
network

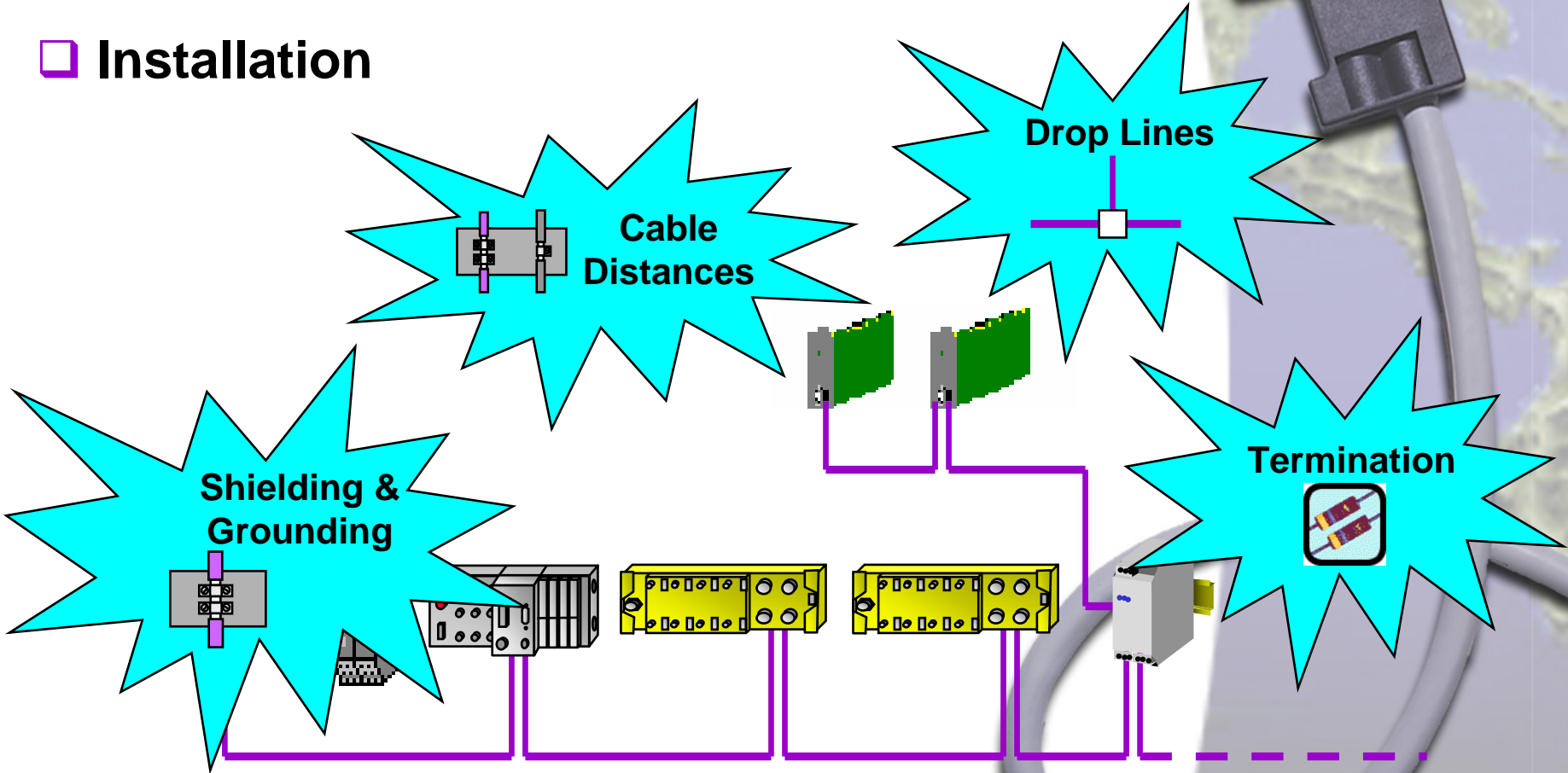
Up to 32  
devices per  
segment



# Bus Physics & Wiring



## Installation



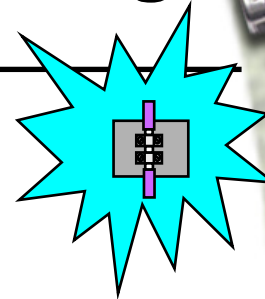




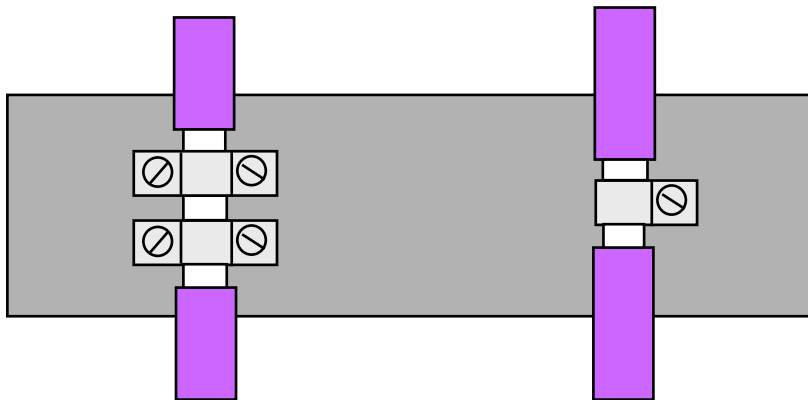
# Bus Physics & Wiring



## ❑ Installation - Shielding & Grounding



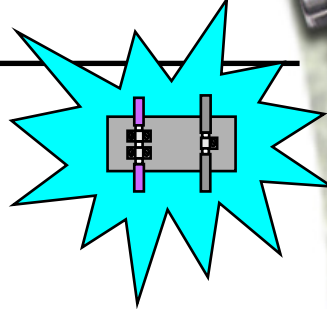
- ✓ Improves EMC behavior
- ✓ Provides a low impedance (short) return path for noise and current
- ✓ Reduces the emission from the bus



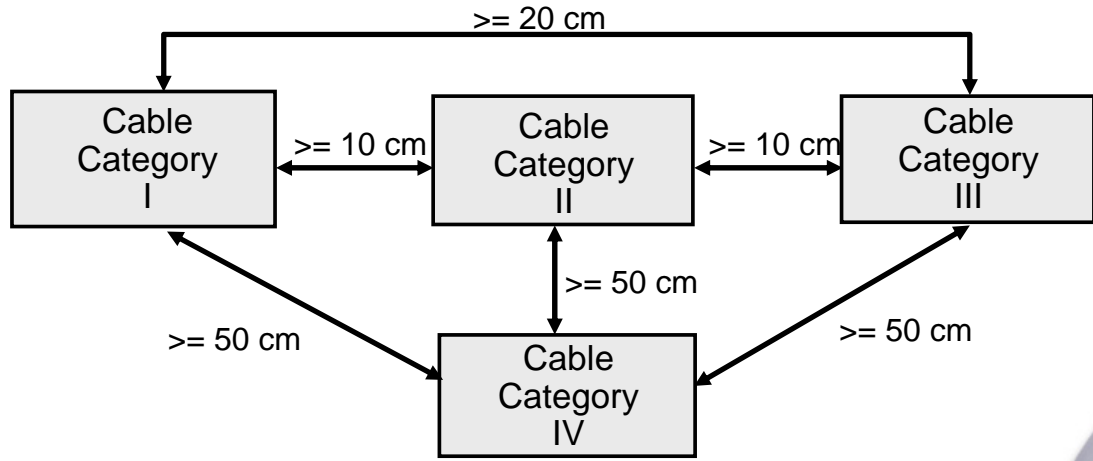
!!!  
Shield is not always connected to protective GND within the devices; therefore, make sure the cable shield will be connected to GND before it enters or leaves the cabinet  
!!!



# Bus Physics & Wiring

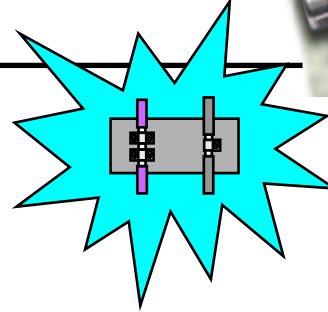
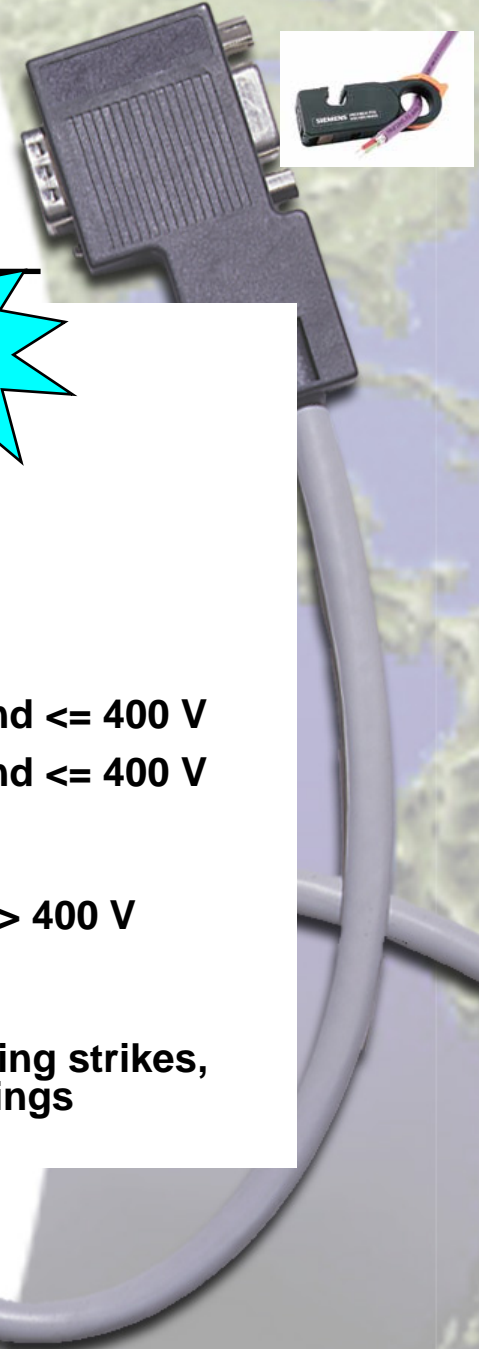


## Installation - Cable Distances





# Bus Physics & Wiring



## ❑ Installation - Cable... (continued)

### ✓ Category I:

- LAN cables (e.g. Ethernet)
- Other communication cables

### ✓ Category II:

- Shielded and unshielded cables for DC voltages  $> 60V$  and  $\leq 400 V$
- Shielded and unshielded cables for AC voltages  $> 25V$  and  $\leq 400 V$

### ✓ Category III:

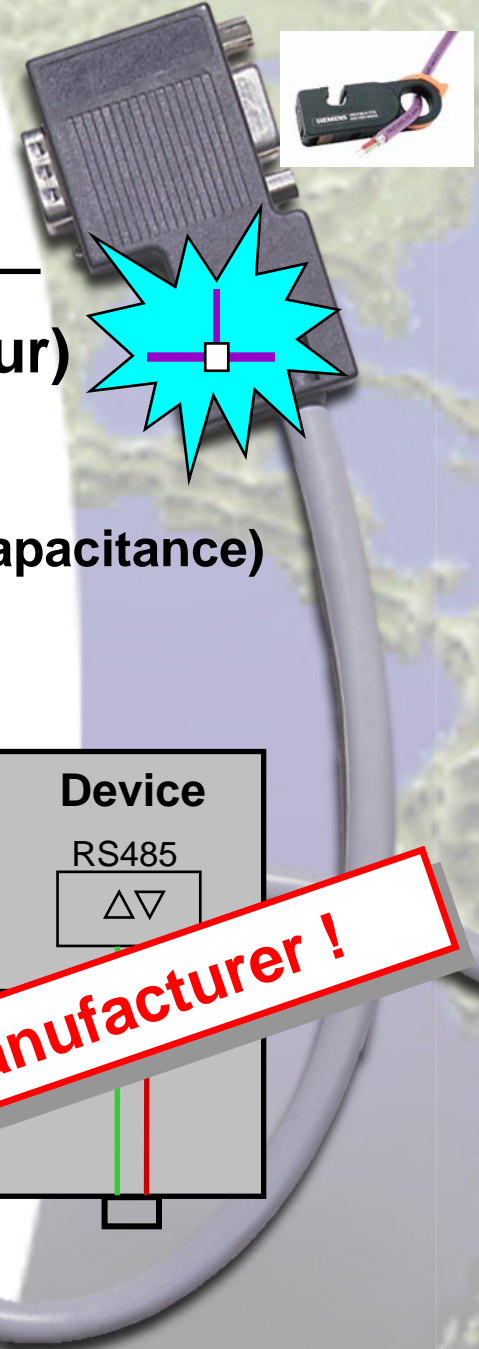
- Shielded and unshielded cables for DC and AC voltages  $> 400 V$

### ✓ Category IV:

- Signal cables of categories I - III at risk from direct lightning strikes, e.g., connections between components in different buildings

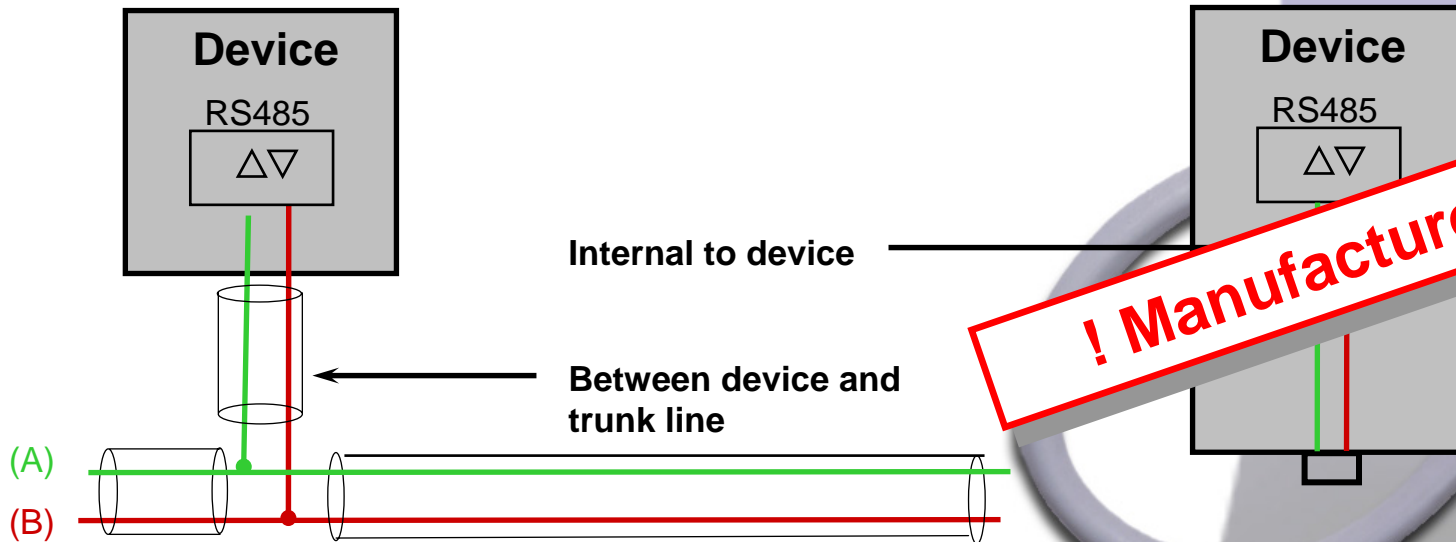


# Bus Physics & Wiring



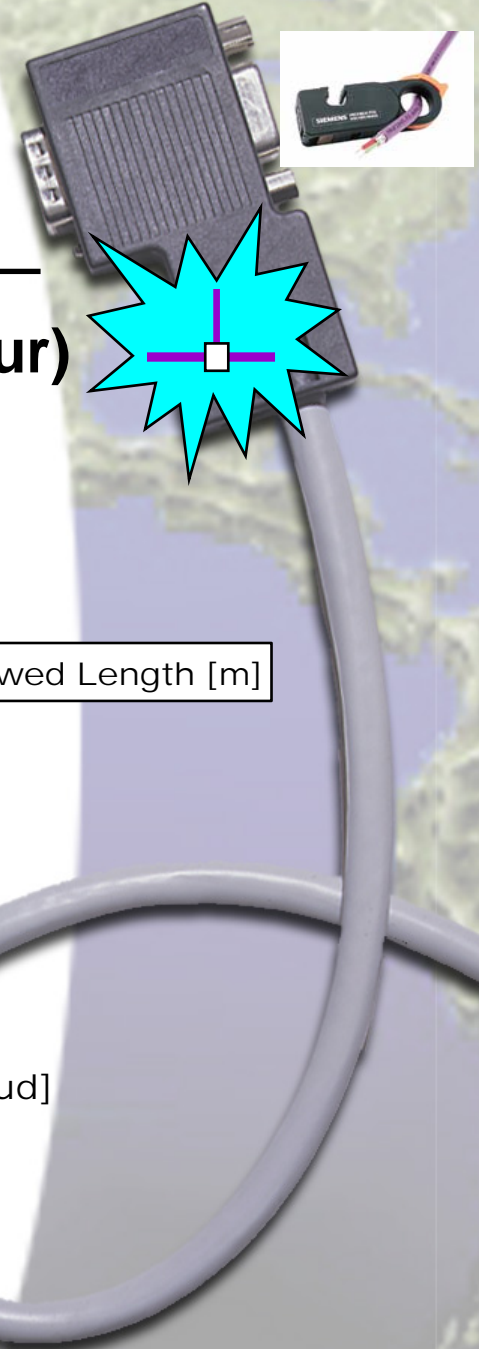
## ❑ Installation - T-Connections (Drop/Stub/Spur)

- ✓ Every branch or drop directly from the cable
- ✓ Stubs to devices cause reflections (additional capacitance)
- ✓ Repeaters are not spur-lines

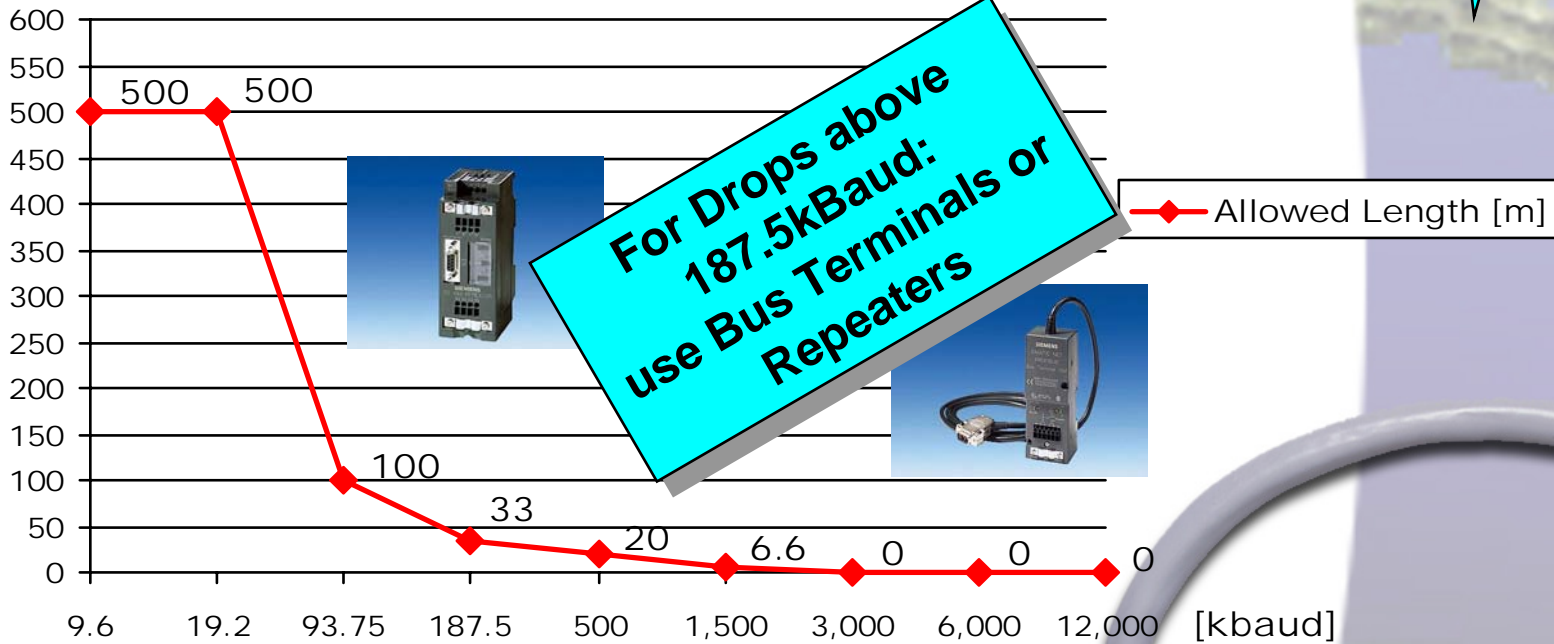




# Bus Physics & Wiring



## Installation - T-Connections (Drop/Stub/Spur)

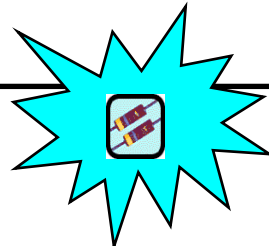


**For Drops above 187.5kbaud: use Bus Terminals or Repeaters**

**Although stub lines can theoretically be tolerated at the lower baud rates, the recommendation is to avoid the use of stub lines altogether.**

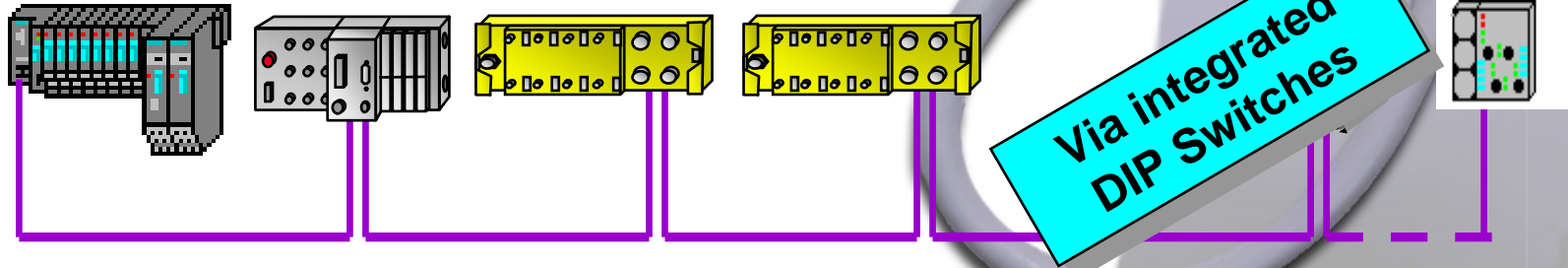
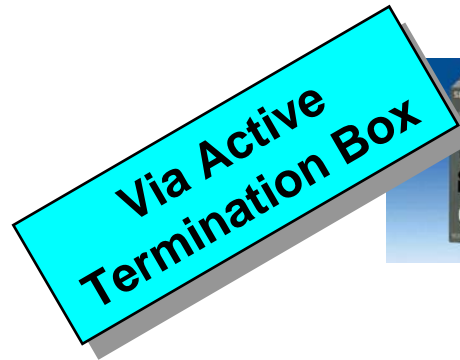
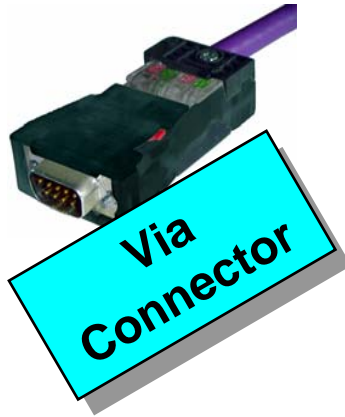


# Bus Physics & Wiring



## ❑ Installation - Termination

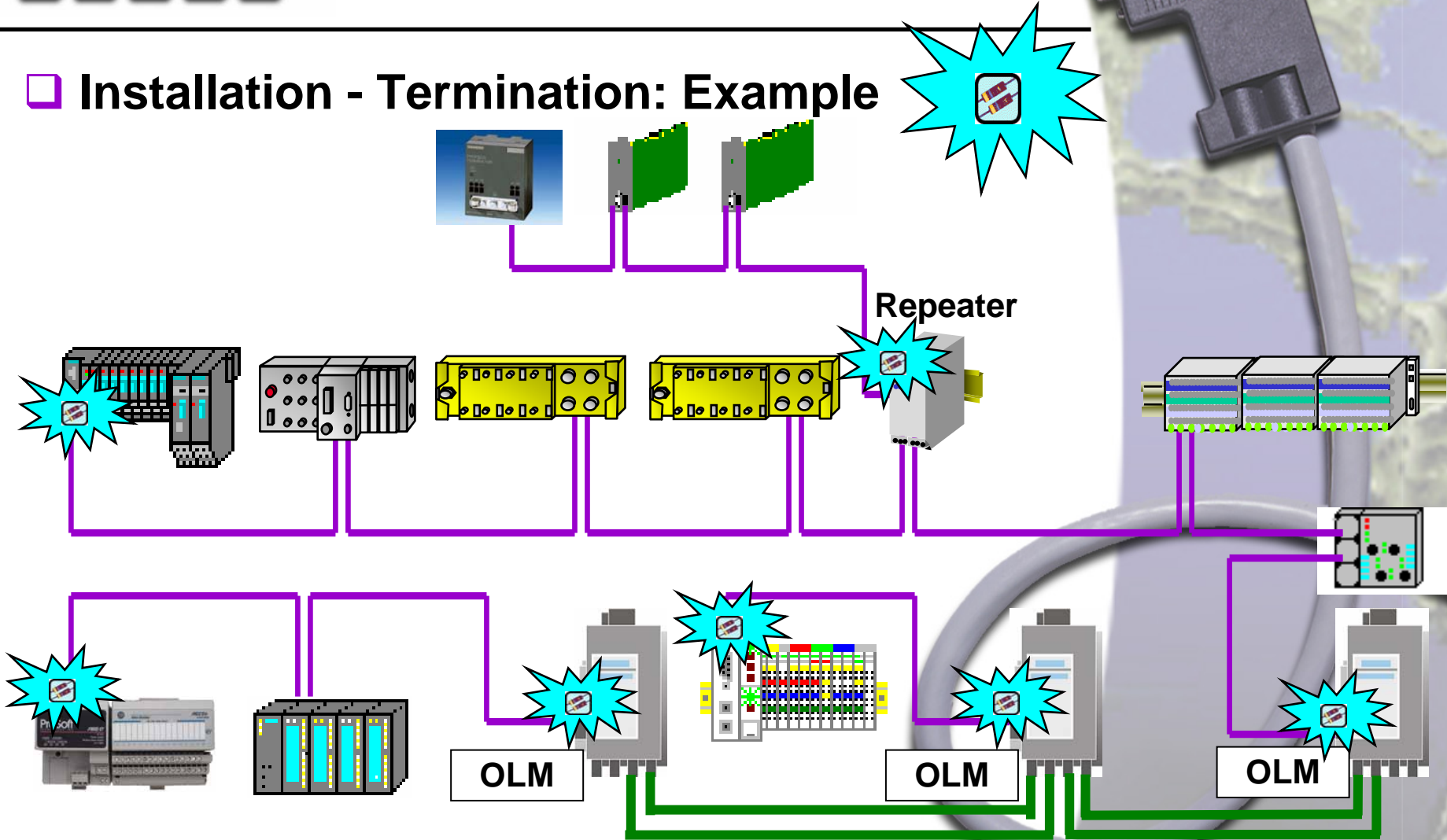
- ✓ Termination for each segment at BOTH ends
- ✓ Termination works **ONLY** when supplied with power





# Bus Physics & Wiring

## Installation - Termination: Example





# Bus Physics & Wiring

❑ Wiring - Easy, when you use the right tools...





# Bus Physics & Wiring



## ❑ Wiring - Easy, when you use the right tools...



1. How to hold the insulation stripper in your **right hand**.



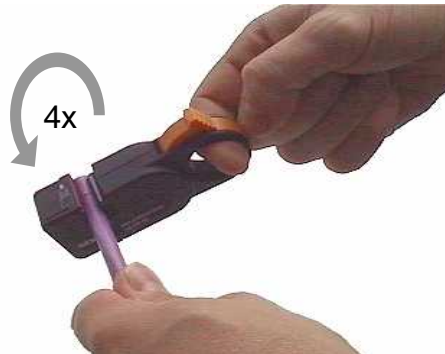
2. Match up the cable end with the template so that your left index finger is against the end surface of the tool.



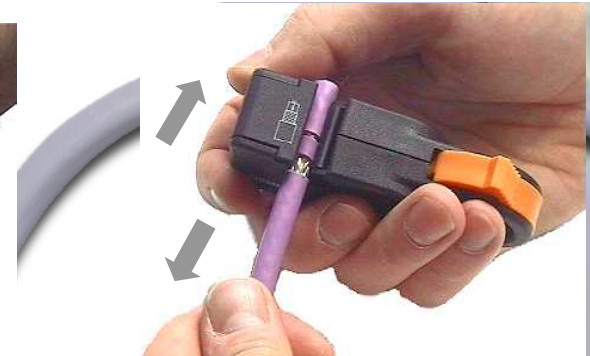
3. Insert the end of the cable into the stripper using your left index finger as a limit stop to ensure the correct length is inserted.



4. Clamp the cable firmly in the stripper.



5. Rotate the stripper around the cable 4 times in the direction of the arrow.



6. With the clamp still closed, pull the stripper off the end of the cable.

# Bus Physics & Wiring



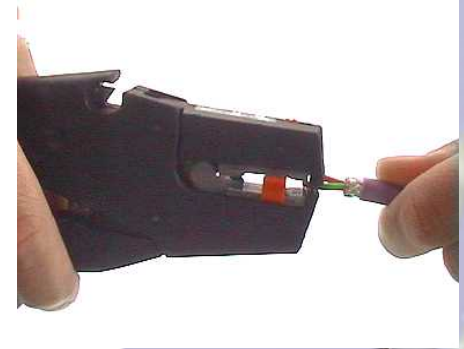
## ❑ Wiring - Easy, when you use the right tools...



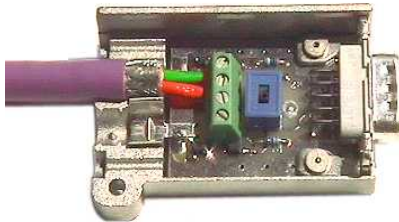
7. The removed insulation remains in the stripper. After releasing the clamp, the remnants can be removed.





8. Pull the protective foil off the cores.



9. After removing the insulation from the cores, the cable can be fitted into the PB connector.



 green wire A  
 red wire B



# Bus Physics & Wiring



## Copper is not the End of the Road...

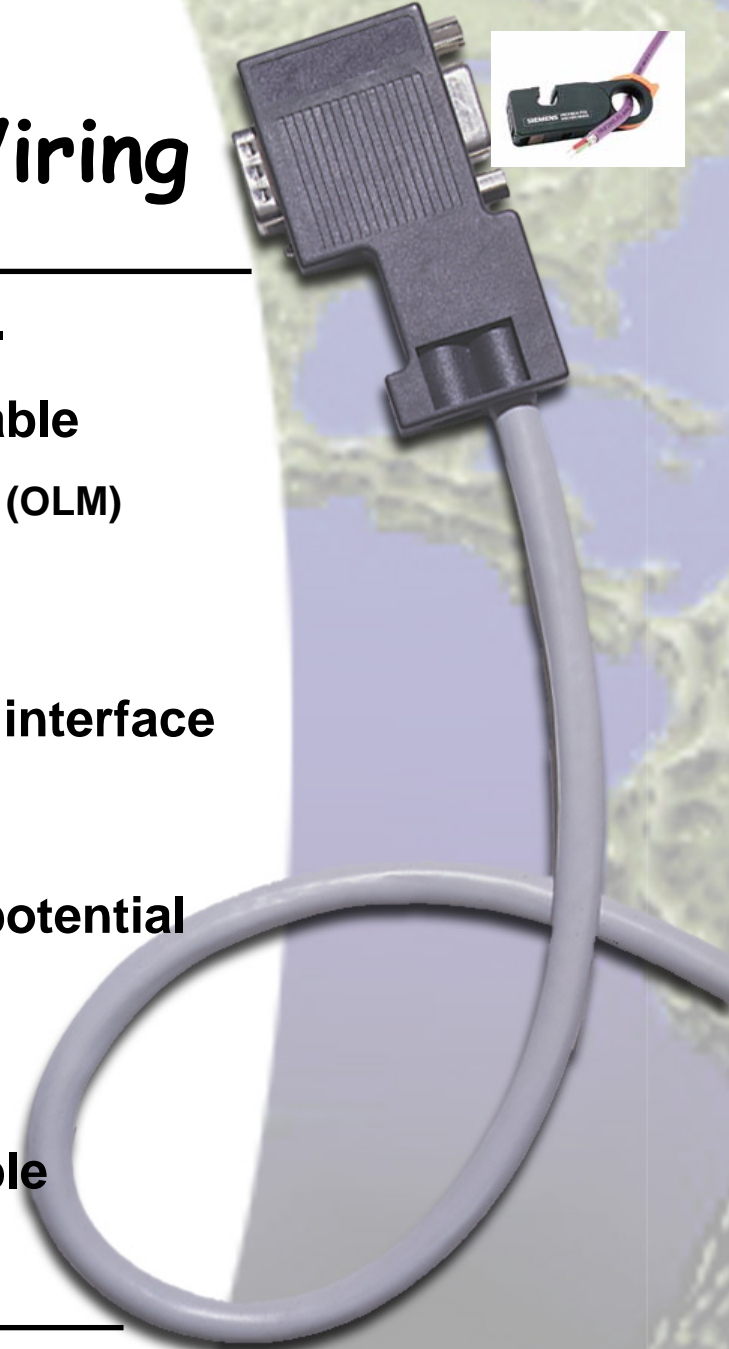
### ✓ Plastic, PCF and glass fiber optic available

- × Plastic - 50m between 2 Optical Link Modules (OLM)
- × PCF - 300m between 2 OLMs
- × Glass - up to 15km between 2 OLMs

### ✓ Connections via modules or integrated interface

## When is Fiber Optic the Choice?

- ✓ Noise immunity & independence from potential differences
- ✓ Cover longer distances
- ✓ Line, ring and star configuration possible
- ✓ Media redundancy



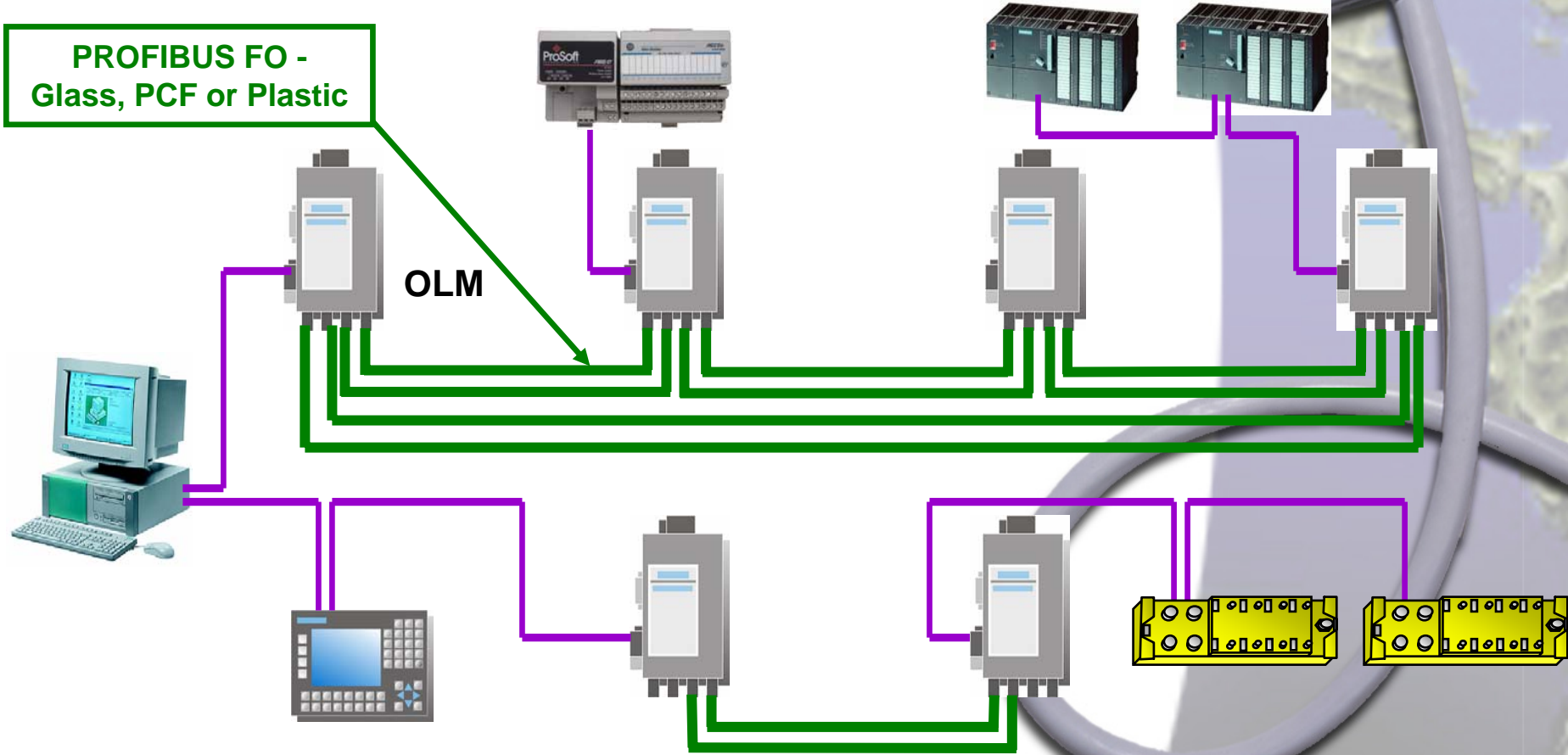


# Bus Physics & Wiring



## ❑ Fiber Optic - Optical Link Modules (OLM)

PROFIBUS FO -  
Glass, PCF or Plastic

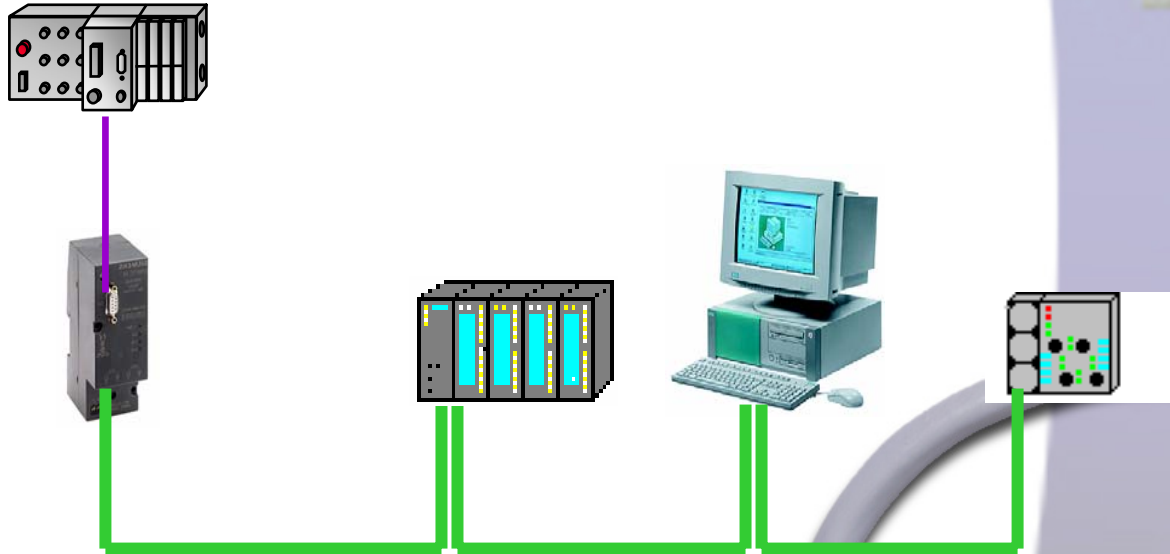




# Bus Physics & Wiring



## ❑ Fiber Optic - Integrated FO Interface



= Optical Bus Terminal (OBT)

PROFIBUS FO -  
PCF or Plastic



# Bus Physics & Wiring

## More Options... Infrared Components

- Wireless linking of devices (up to 15m)
- Communication with moving devices
- Communication with changing devices
- Noise immune
- Ground independent



## More Options... RF Technology

- <http://www.micro-control.no>  Micro-control as
- <http://www.akerstroms.no> 