



ASM Process Automation Saudi Arabia

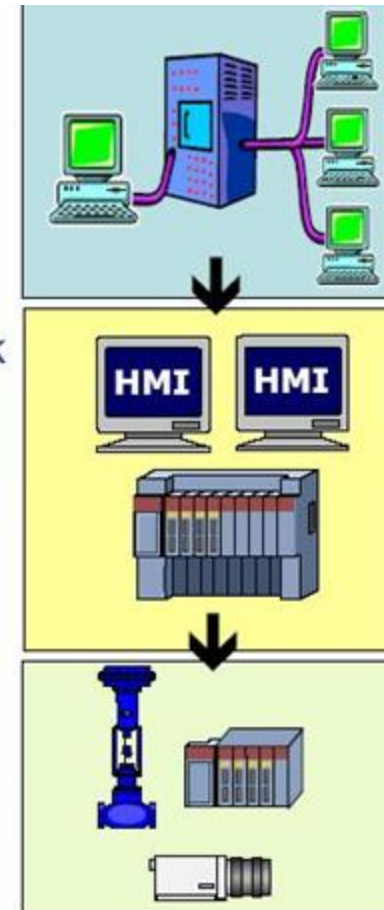


**PROFI
NET**

PROFINET DIAGNOSTICS

Ethernet Today .. Diagnostic Today

- With the advances to Ethernet, it has now moved down the Hierarchy from just PC's / HMI's into the field devices on the plant floor.
- Now, we need a way to diagnose the network if there are any issues. And we can since we have connection to both the office and Industrial network!
- Most Industrial Ethernet manufacturers already build these diagnostic capabilities into their products.

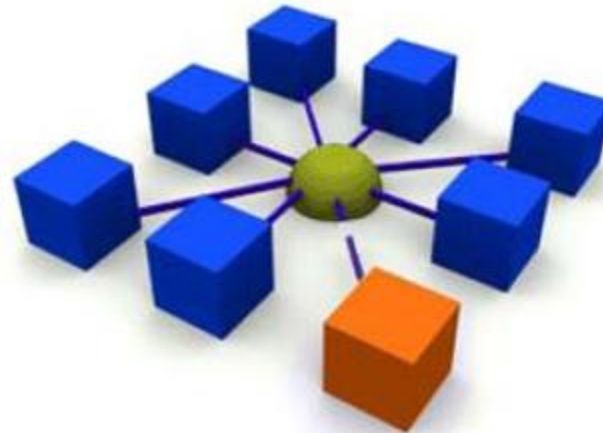


What can go wrong on the networks?

A list of problems you might encounter on an Ethernet (or other) network.

Physical Network problems

- Wire break / Damaged cable or connector
 - Damaged cable / connector can cause reflections
- Improper Wiring
- Network components or devices faulty
- Frame oversize / undersize
- EMI / Noise



What can go wrong on the networks?

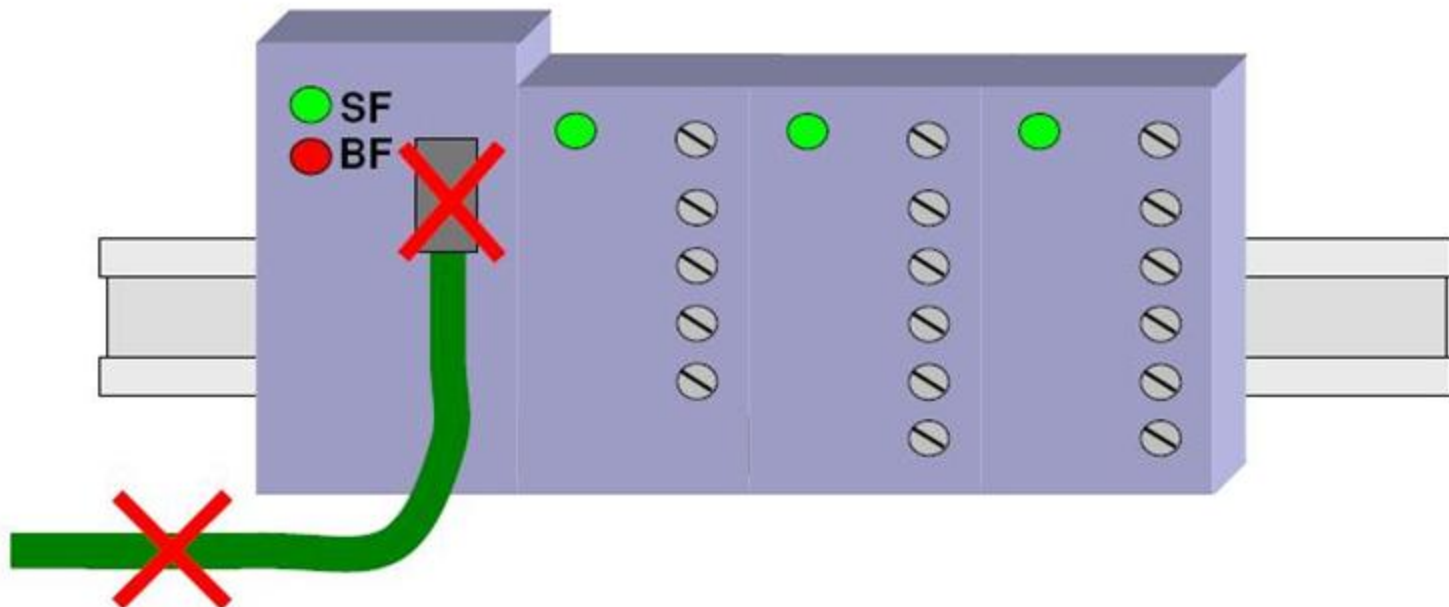
User and software related problems

- Address not set
- Incorrect addresses set
- Duplicate addresses set
- Network or device overload from traffic on device / switch
- Port not open
 - Application not running
- Resource is not available or running
 - Ex: Application is stopped
 - Device powered down



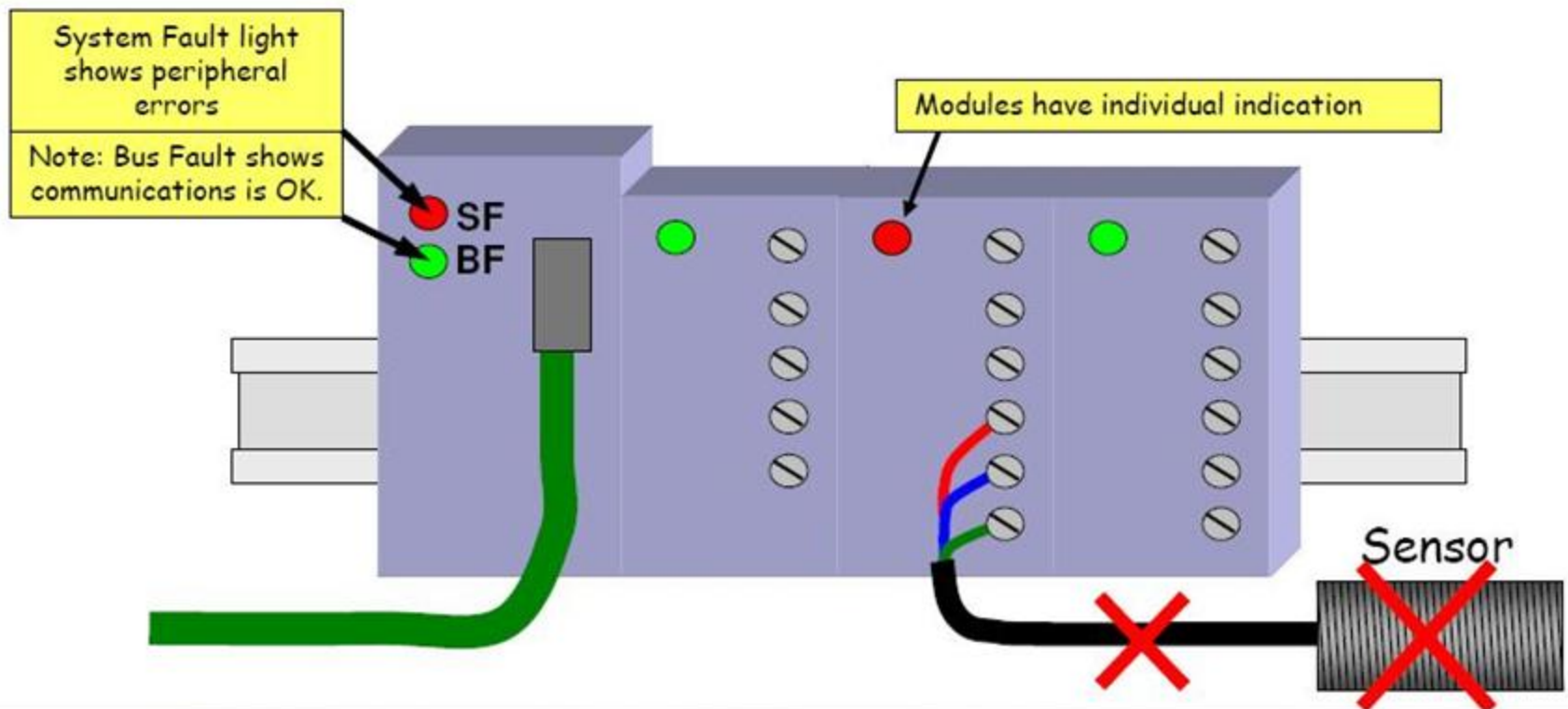
Communication Faults

- Mainly caused by poor network wiring or layout or cable/connector deterioration.
- Can be permanent or intermittent.



Peripheral Faults

- Caused by sensor/actuator failure or wiring faults.



What Diagnostic capabilities are available?

Protocols or ways we can use to find the problem:

- **Link light (lights on Switch)**
 - Do I have an Electrical connection?
- **Ping (IP test)**
 - Is the device there and active?
- **WBM – Web Based Management**
- **Cable Testers**
- **Ethernet Sniffers**
- **PROFINET Tools**
- **Port Mirroring**



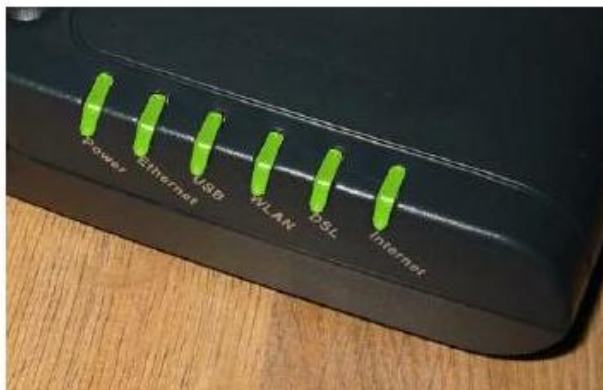
Link Light

Use link lights to determine if you have a good electrical connection.

Simple way to see if physical connection is available

Some devices also have a light for duplex (10 / 100) setting

NOTE: The link light can't tell you if there is an EMI problem. Or if there is an internal fault of the device.



Packet Internet Gopher (PING)

Ping is the minimal test of network connectivity

Basically sends an “Are you there?” message to another host and waits for a response

Type: *ping <ip_address>* in the command prompt

Ping sends a message using the ICMP Echo Request and the recipient host responds with Echo Reply

Ping determines if the pinging and pinged devices are on the network

NOTE:

- Only checks up to the internet layer of OSI model



Web Based Management

A web based management device supports diagnostics from a web interface.

A standard internet browser can read out information from a device locally or at a remote site.

Diagnostics and information about the current status of the device can be viewed.



Port Mirroring

- **Port Mirroring** is used on a switch to send a copy of network packets seen on one switch port (or an entire VLAN) to a network monitoring connection on another switch port.
- Defining a mirror port duplicates all traffic on the mirror.
 - √ incoming and outgoing traffic
- Useful for monitoring the switch traffic on a certain port, the monitor port **for diagnostic reasons**.
 - √ e.g. with Ethereal / Wireshark analyser
- **Available in managed switches or as a dedicated device.**



Cable Testers

- There are many different cable test tools available for checking Ethernet cables.



Cable Testers

A cable tester is a simple tool for checking proper wiring and shield.

Check to make sure the tester you use has a remote and shield test possible.

Physical layer test device



Cable Testers

- Connect the test plug at one end and the tester at the other end.
- Detect many wiring faults:
 - √ Wire break
 - √ Short circuit
 - √ Swapped wires



Good Wiring



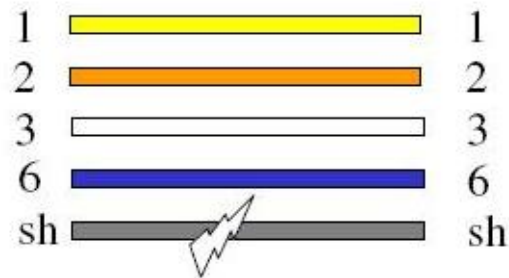
Select this Mode

Shield present

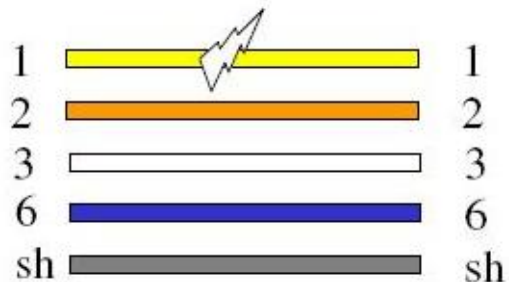
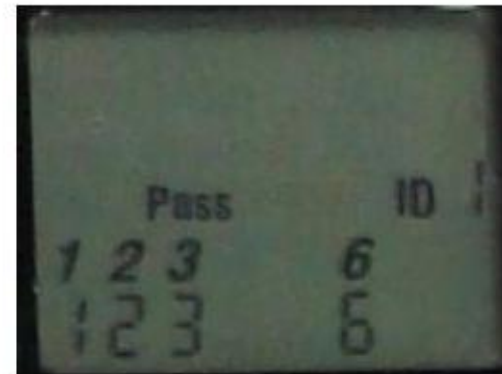
Upper line: Connector at the tester

Lower line: Connector at the plug

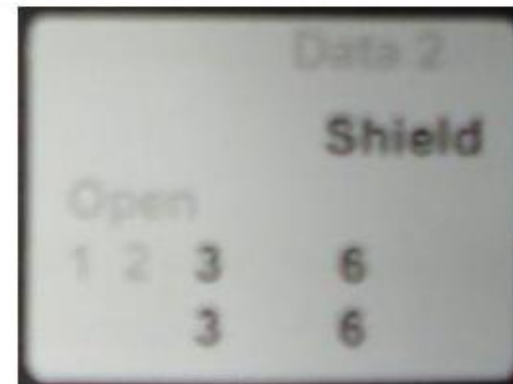
Wiring Faults



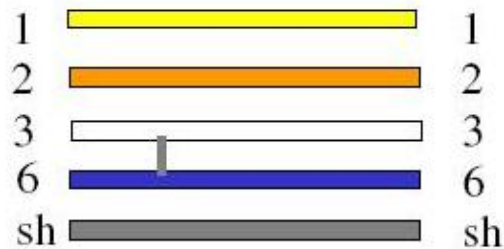
No shield or
Shield broken



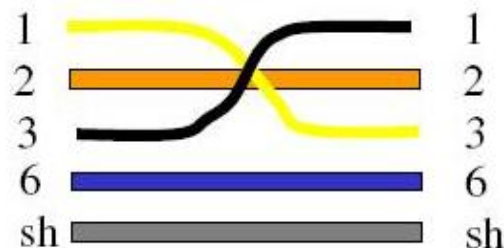
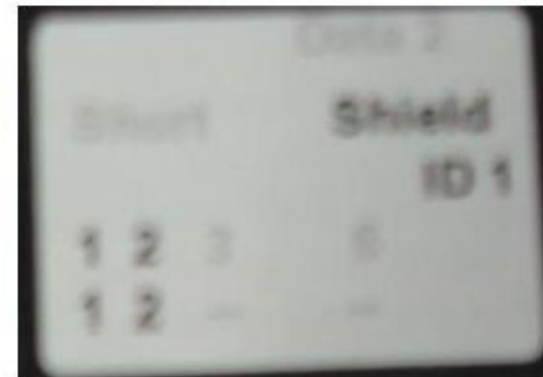
Wire break and
Effected pins



Wiring Faults



Short circuit,
Second
line indicated
as --



Yellow and White
swapped



Ethernet Sniffers / Wireshark

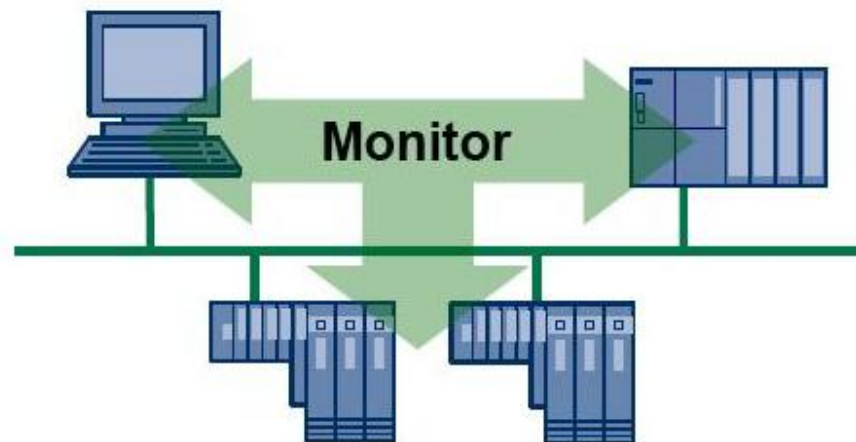
An Ethernet Sniffer lets you Monitor, decode and analyze Ethernet traffic

Wireshark is available for free on the Internet at

www.wireshark.org

Many Ethernet protocols supported

- PROFINET IO since version 0.10.8
- PROFINET CBA since version 0.10.9



Ethernet Sniffers / Wireshark / NETILITIES

- Free tool, Wireshark.
- The alarms are captured.

USB2.0 to Gigabit Ethernet Adapter (Microsoft's Packet Scheduler) : Capturing - Wireshark

File Edit View Go Capture Analyze Statistics Help

Filter: Expression... Clear Apply

No. -	Time	Source	Destination	Protocol	Info
232	18.350774	wagoKont_01:50:89	SiemensA_89:5e:35	PNIO	RTC1, ID:0xc000, Len:
233	18.430231	SiemensA_89:5e:35	Siemens_6c:02:90	PNIO	RTC1, ID:0xc000, Len:
234	18.431144	SiemensA_89:5e:35	wagoKont_01:50:92	PNIO	RTC1, ID:0xc010, Len:
235	18.432140	SiemensA_89:5e:35	wagoKont_01:50:89	PNIO	RTC1, ID:0xc010, Len:
236	18.622398	Siemens_6c:02:90	SiemensA_89:5e:35	PNIO-AL	Alarm Low, Src: 0x0,
237	18.623020	SiemensA_89:5e:35	Siemens_6c:02:90	PNIO-AL	Alarm Low, Src: 0x3,
238	18.626222	SiemensA_89:5e:35	Siemens_6c:02:90	PNIO-AL	Alarm Low, Src: 0x3,
239	18.626763	Siemens_6c:02:90	SiemensA_89:5e:35	PNIO-AL	Alarm Low, Src: 0x0,
240	18.689043	Siemens_6c:02:90	SiemensA_89:5e:35	PNIO	RTC1, ID:0xc001, Len:
241	18.747602	wagoKont_01:50:92	SiemensA_89:5e:35	PNIO	RTC1, ID:0xc002, Len:
242	18.862765	wagoKont_01:50:89	SiemensA_89:5e:35	PNIO	RTC1, ID:0xc000, Len:
243	18.942035	SiemensA_89:5e:35	Siemens_6c:02:90	PNIO	RTC1, ID:0xc000, Len:
244	18.943010	SiemensA_89:5e:35	wagoKont_01:50:92	PNIO	RTC1, ID:0xc010, Len:
245	18.944050	SiemensA_89:5e:35	wagoKont_01:50:89	PNIO	RTC1, ID:0xc010, Len:

PROFINET Tools – Application Level

When using PROFINET protocol for your Industrial needs note that there are extensive application diagnostics available as part of the protocol.

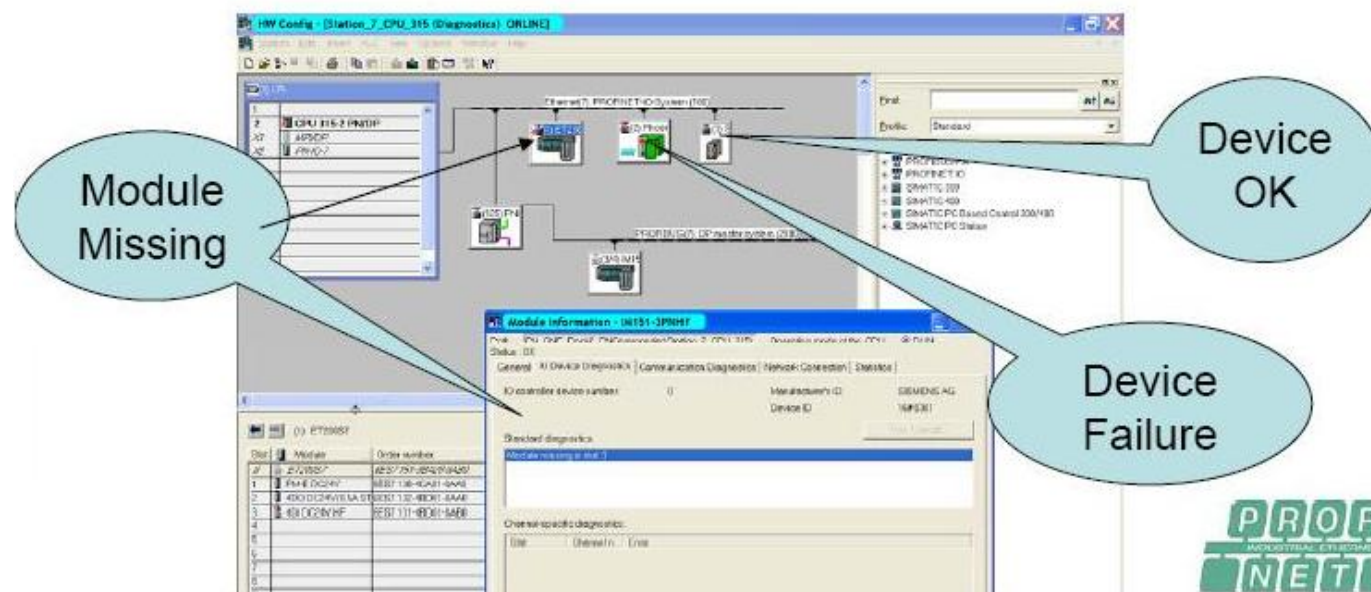
Just to name a few, some of these diagnostics are:

- **Browse function – see all devices on network**
- **Diagnostic Overview – quick scan for problems in the network**
- **Topology Editor – View the existing topology and compare against current one**



PROFINET Application Diagnostic

- **PROFINET** has extensive application based diagnostics for troubleshooting a system.
- By simply going online with your controller, you get a readout of the current status of devices and modules.
- **PROFINET Alarms** can also be captured by your PLC / PC application and monitored from HMI systems.
- Detailed diagnostics can be retrieved from the faulty device



How to deal with Noise? / EMI

Since Ethernet is a point to point system, 'lines', individual runs, or network sections can be affected by EMI.

So, when installing the system

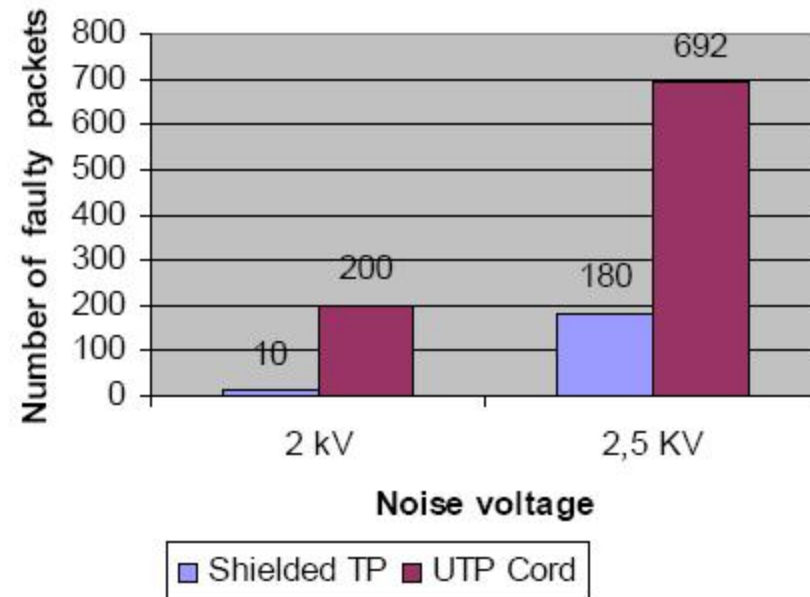
- UTP = unshielded = watch out!
- Shielded cable = better protection
- Fiber = No noise / EMI
- EMI disturbances can be found by using managed switches which support SNMP.
 - Ex: faulty packets start increasing
- O-Scope can be also used on lines in the event noise can't be easily identified. Tools are already available for this
 - Requires specialized tools and training



Shielded vs. Unshielded Cables

Reference measurement

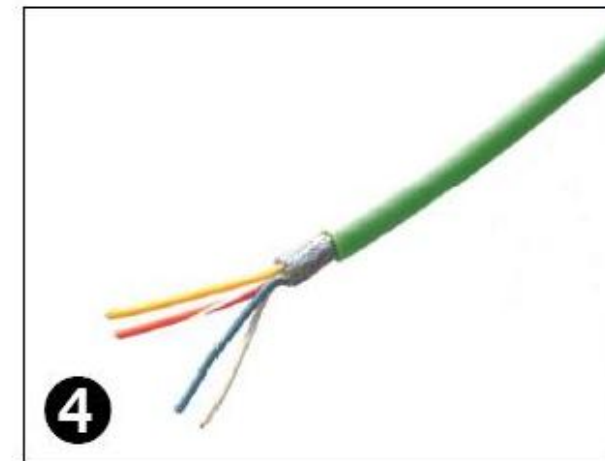
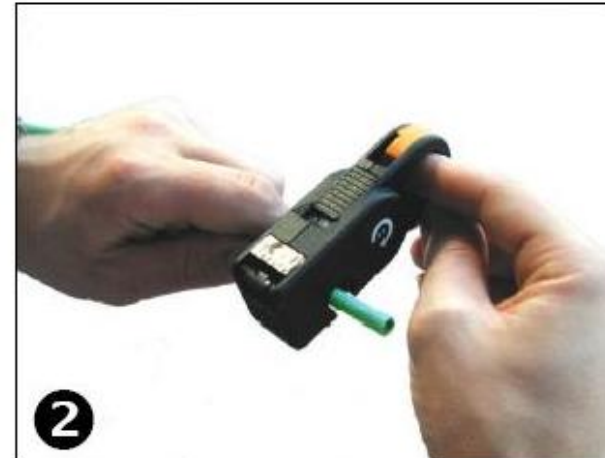
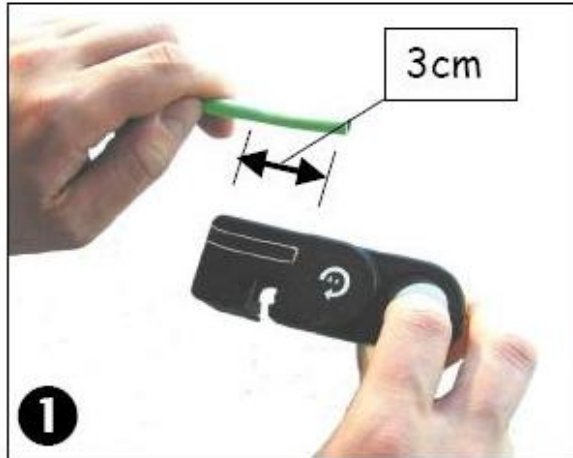
- Shielded Twisted Pair (STP) vs. Unshielded Twisted Pair (UTP)
- Data transfer rate : 100 Mbit/s
- Bus load 81%
- Packet length : 346 bytes
- Duration: 30 s



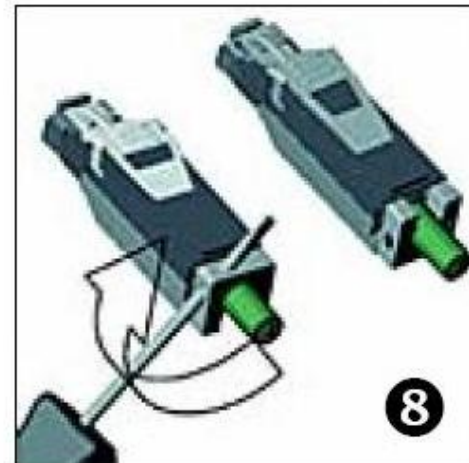
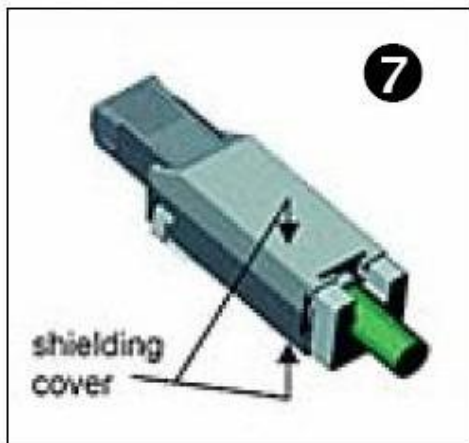
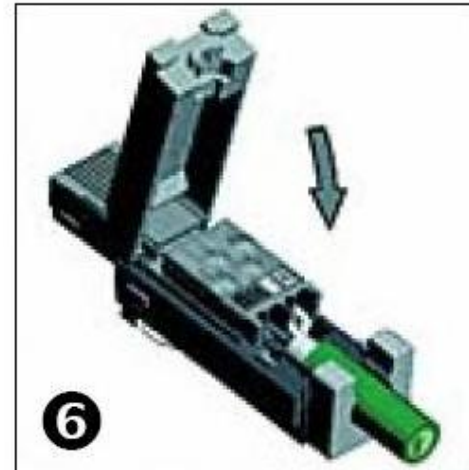
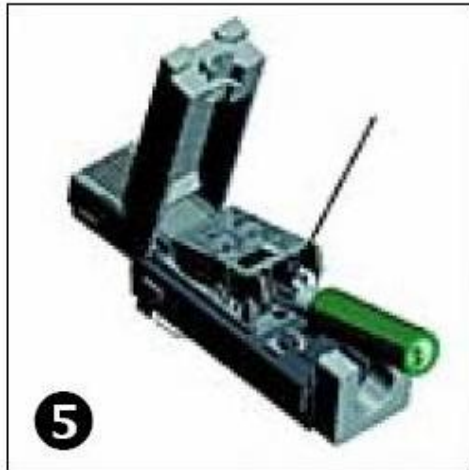
Result

- An UTP cable is totally unsuitable for noisy environment
- Even noise voltages of 1 kV can lead to a breakdown in communication

Stripping Tools



Insulation Displacement Connectors



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