

FOUNDATION™ Fieldbus in Hazardous Areas



Physical Layer Concept

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FF Basic Information

Fieldbus control system (DCS)



FF Power Supply



31,25 Kbit/s
32 Address
12 dev. @ 1s scan

CONTROL ROOM

Trunk

FIELD

Field wiring hub
w. Short circuit protect.



Spur

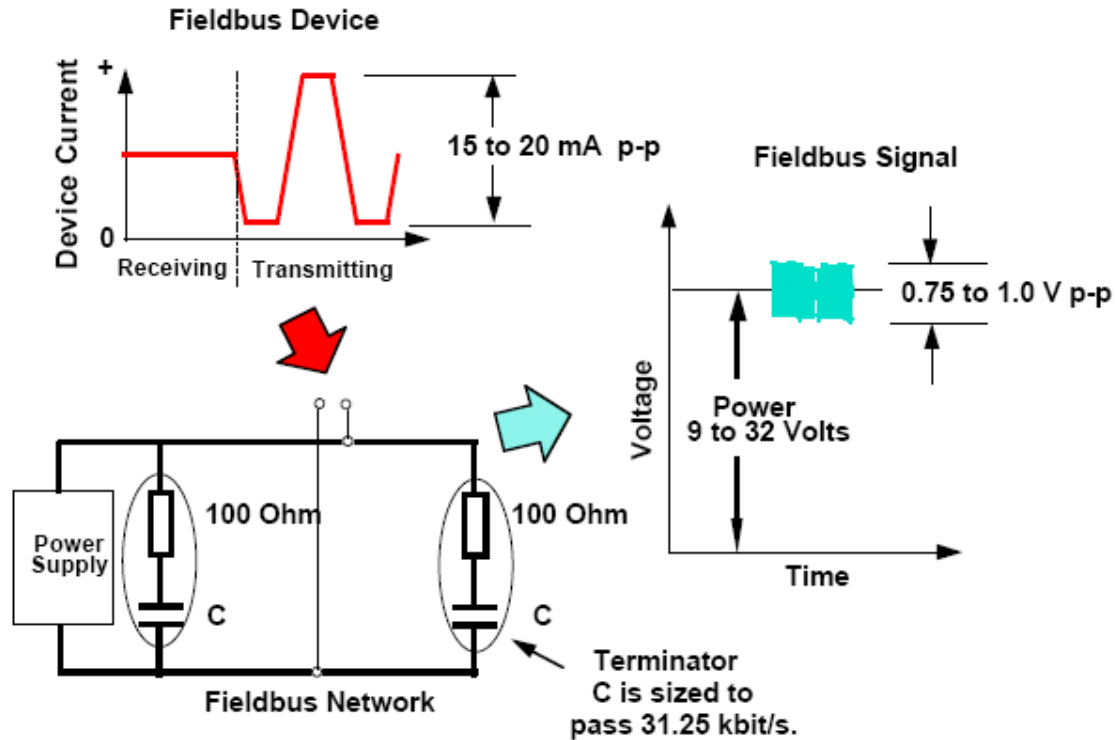


Min. 9V
Min. 10mA
Typical 12-16
devices.

Tx @ 14 mA
Pos @ 22mA

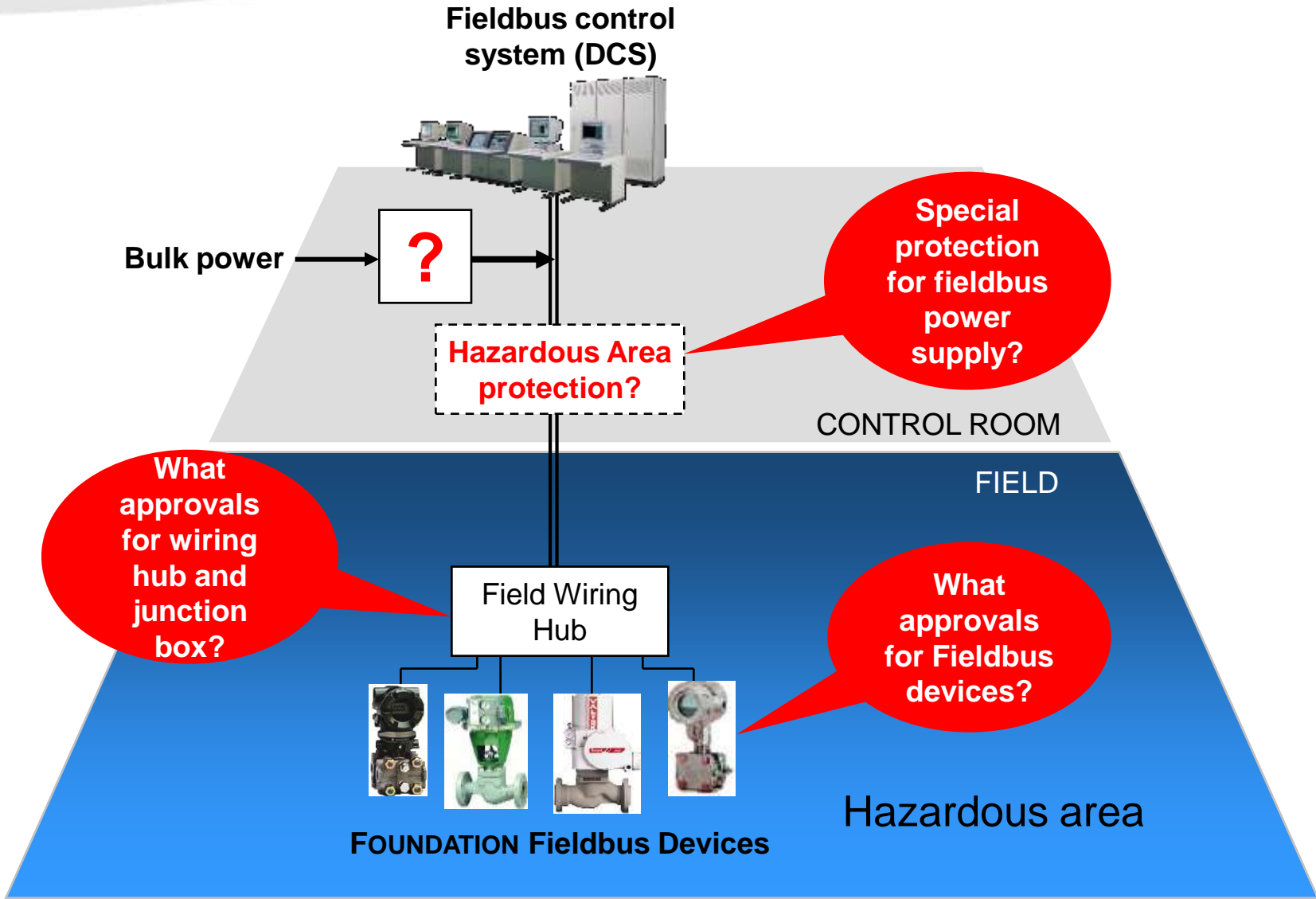
FF Basic Information

Signaling waveforms for the 31.25 kbit/s Fieldbus



Note: As an option, one of the terminators may be center-tapped and grounded to prevent voltage buildup on the fieldbus.

Fieldbus in hazardous areas



Methods of protection

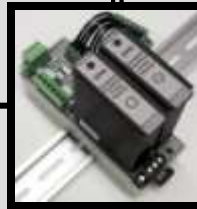
Method of protection	Zone 2	Zone 1
Ex d field devices and Ex e junction boxes	✓	✓
Ex i/Intrinsically Safe ENTITY or FISCO	✓	✓
Exe – Exi/Fieldbus Barrier	✓	✓
Ex nL / FNICO	✓	x
Ex nA, Non-Arcing	✓	x

Ex-d / Ex-e Fieldbus

Fieldbus control system (DCS)



Bulk power



Ordinary Safe Area Power Supply
Single or Redundant

CONTROL ROOM

FIELD

No live maintenance!

Ex-e
Field Wiring
Hub

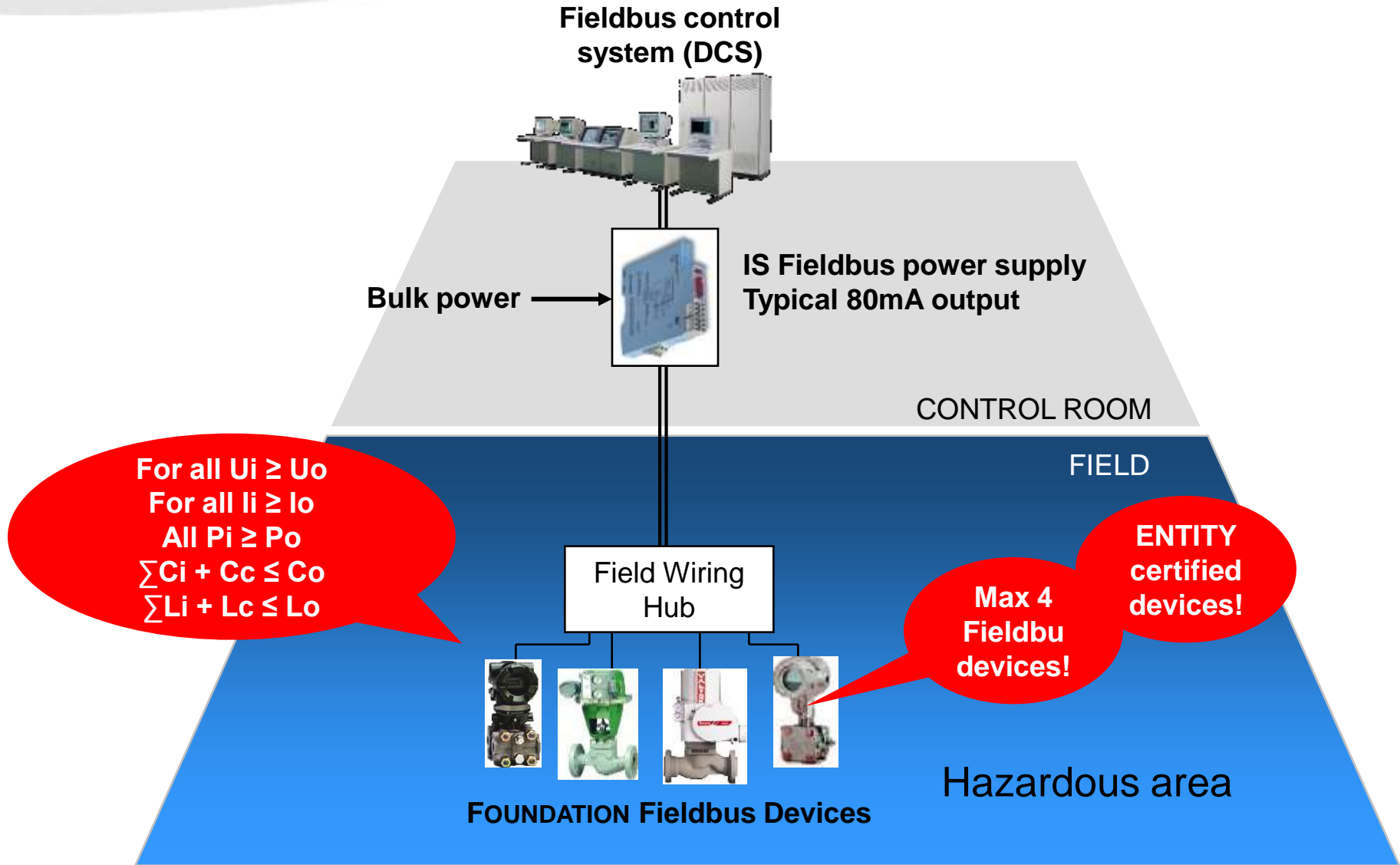
Ex-d / Ex-e
Instruments



FOUNDATION Fieldbus Devices

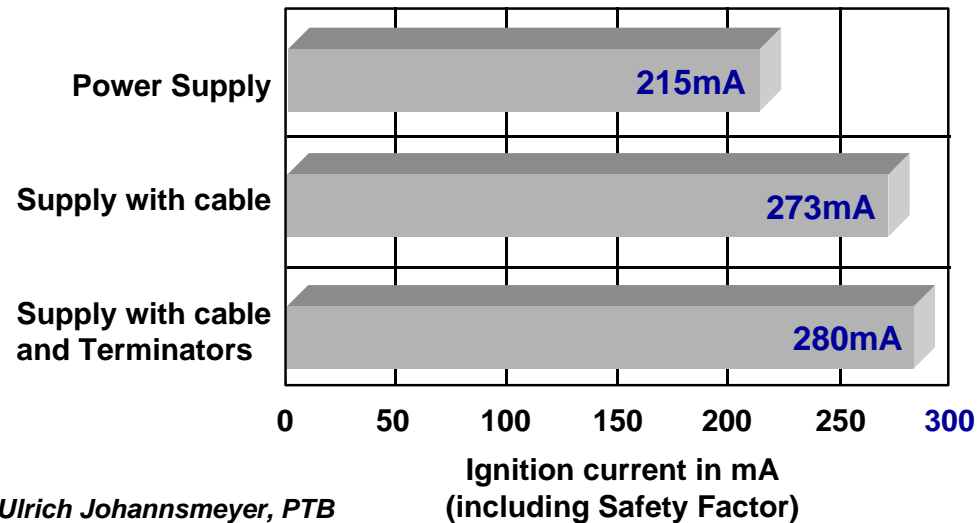
Hazardous area

'Entity' Intrinsically Safe Fieldbus



Introducing FISCO

- ❑ Fieldbus Intrinsically Safe Concept, IEC 60079-27
 - Provides **more current** to IS trunk than earlier 'Entity' model, and hence more field instruments
 - Proven by tests performed at PTB
 - Simplifies design and installation
 - Reduces documentation
 - First simplification of explosion protection techniques for many years!



Source: Dr. Ulrich Johannsmeyer, PTB

FISCO requirements

- ❑ All instruments FISCO certified
- ❑ Power Supply must be FISCO certified
- ❑ Field cables must conform to the following specification:
 - loop resistance must be between 15 and 150ohms/km
 - loop inductance must be between 0.4 and 1mH/km
 - loop capacitance must be between 45 and 200nF/km
 - maximum length of each spur cable is 60m in IIC and IIB
 - maximum length of each trunk cable is 1km in IIC or 5km in IIB
- ❑ *The limits are not restrictive*
 - typical Fieldbus cable has parameters of 50ohms/km, 0.8mH/km and 120nF/km

FISCO installation

Fieldbus control system (DCS)



24Vdc



FISCO power supply (IIB / IIC)

CONTROL ROOM

FIELD

Live Maintenance !

Intrinsically Safe Field wiring hub



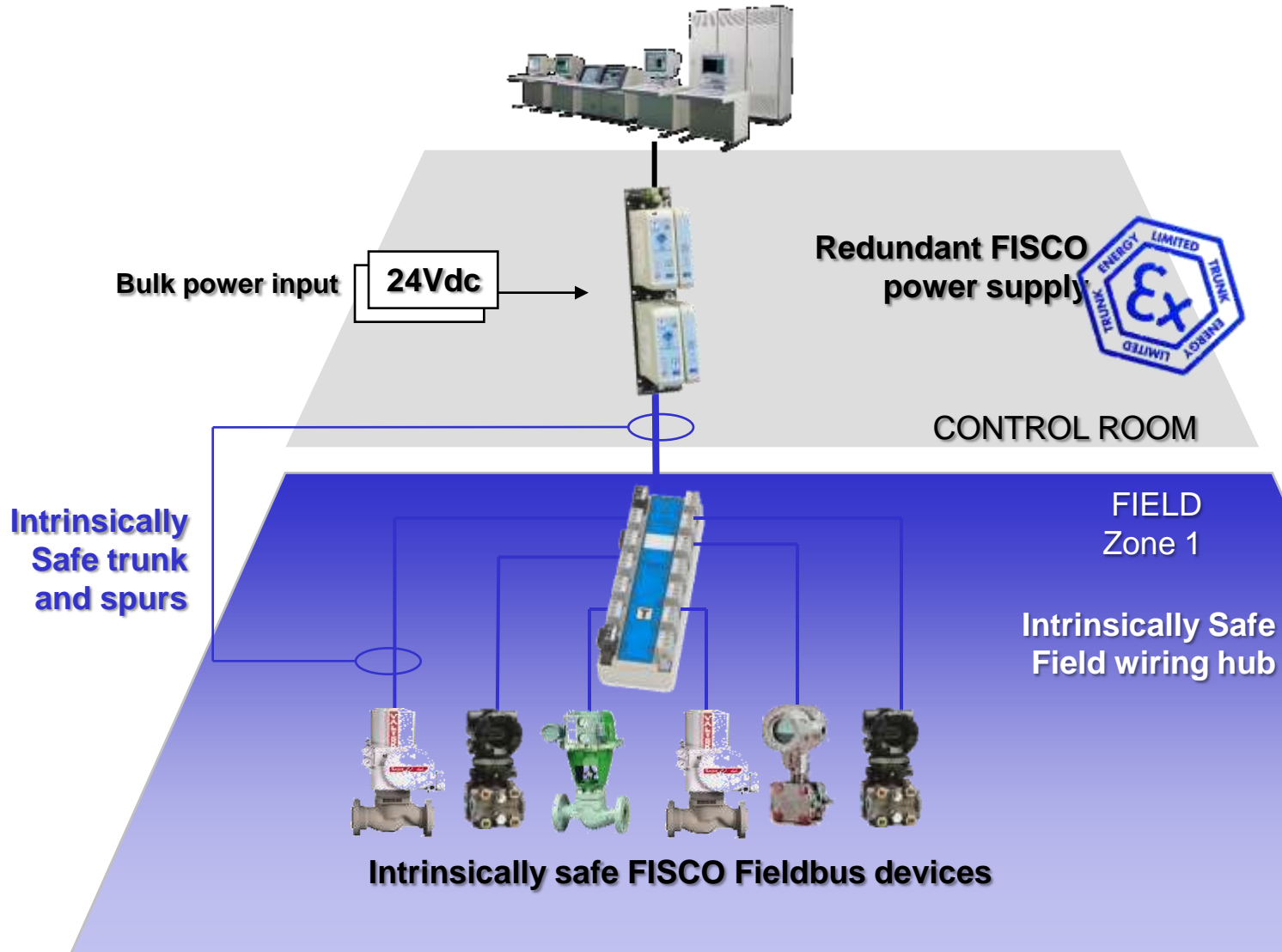
Intrinsically safe FISCO fieldbus devices

**Zone 1
Division 1**

Multiple hazardous area trunks



Redundant FISCO architecture



More field devices with FISCO



80mA available, typically
3 - 4 devices

Entity, IIC/IIB Gas Groups



120mA available, (140mA)
typically 6-8 devices

FISCO, IIC Gas Groups



265mA available,
(280 mA)
typically 14-16 devices

FISCO, IIB Gas Groups

Zone 1
Division 1

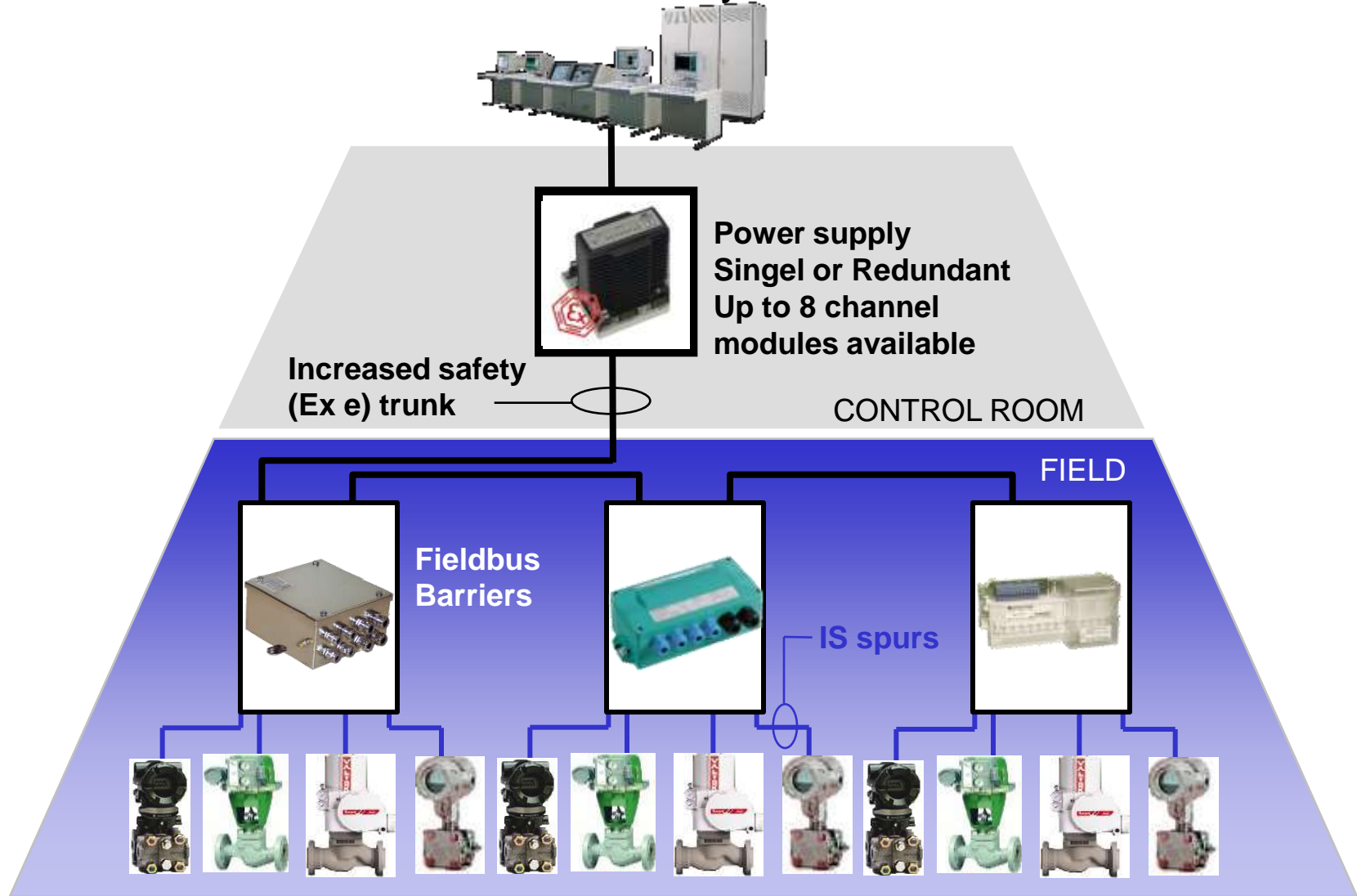
FB Fieldbus Barriers: Exe/Exi concept



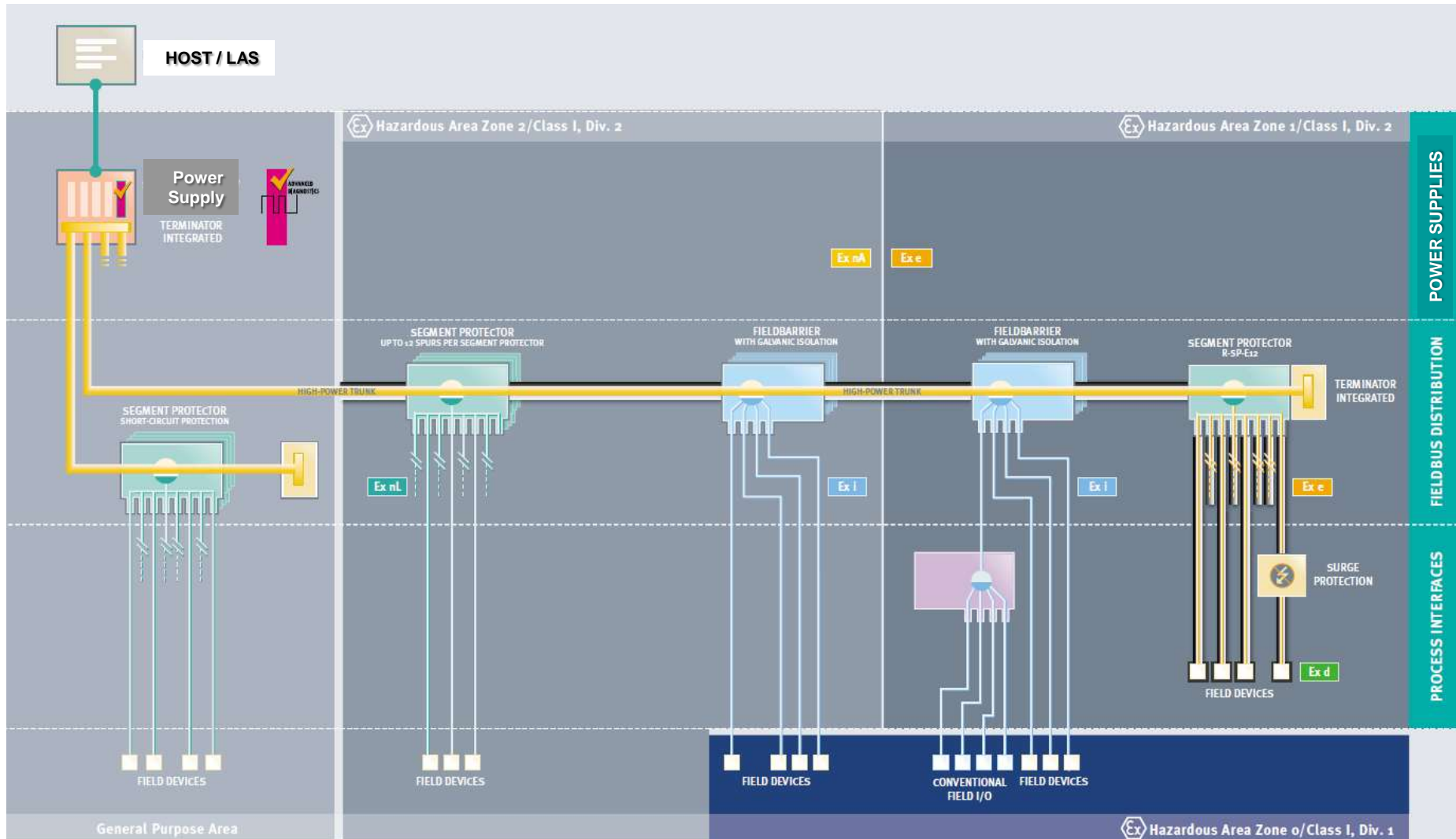
- ❑ Galvanic isolation and IS “barrier” in the field.
- ❑ Ex-e trunk with higher current available
- ❑ Zone-1 mountable fieldbus wiring hub for Intrinsically safe fieldbus devices
- ❑ Supports FISCO and ‘Entity’ field devices

Fieldbus Barrier

Fieldbus control system



Fieldbus Barrier across Zones



Comparision of Protection Techniques used in Hazardous Area

'Entity' IS vs. FISCO

	Entity IS	FISCO
Intrinsically safe trunk and spurs?	✓	✓
'Live-working' permitted in any part of field network?	✓	✓
Simple safety documentation?	x	✓
Eliminate cable parameter calculations?	x	✓
Gas Group IIB option?	x	✓
Max output current	80mA	265mA
Max spur length	120m	60m

FISCO vs. Fieldbus Barrier

	FISCO	Fieldbus Barrier
IS Spur? Live Maintenance?	✓	✓
IS Trunk? Live Maintenance?	✓	x
Simple documentation?	✓	✓
Redundant Power	✓	✓
Redundant Field Wiring Hub	x	x
Compatible with FISCO field devices?	✓	✓
Compatible with Entity field devices?	✓ Only with spur connector!	✓

Introducing FNICO

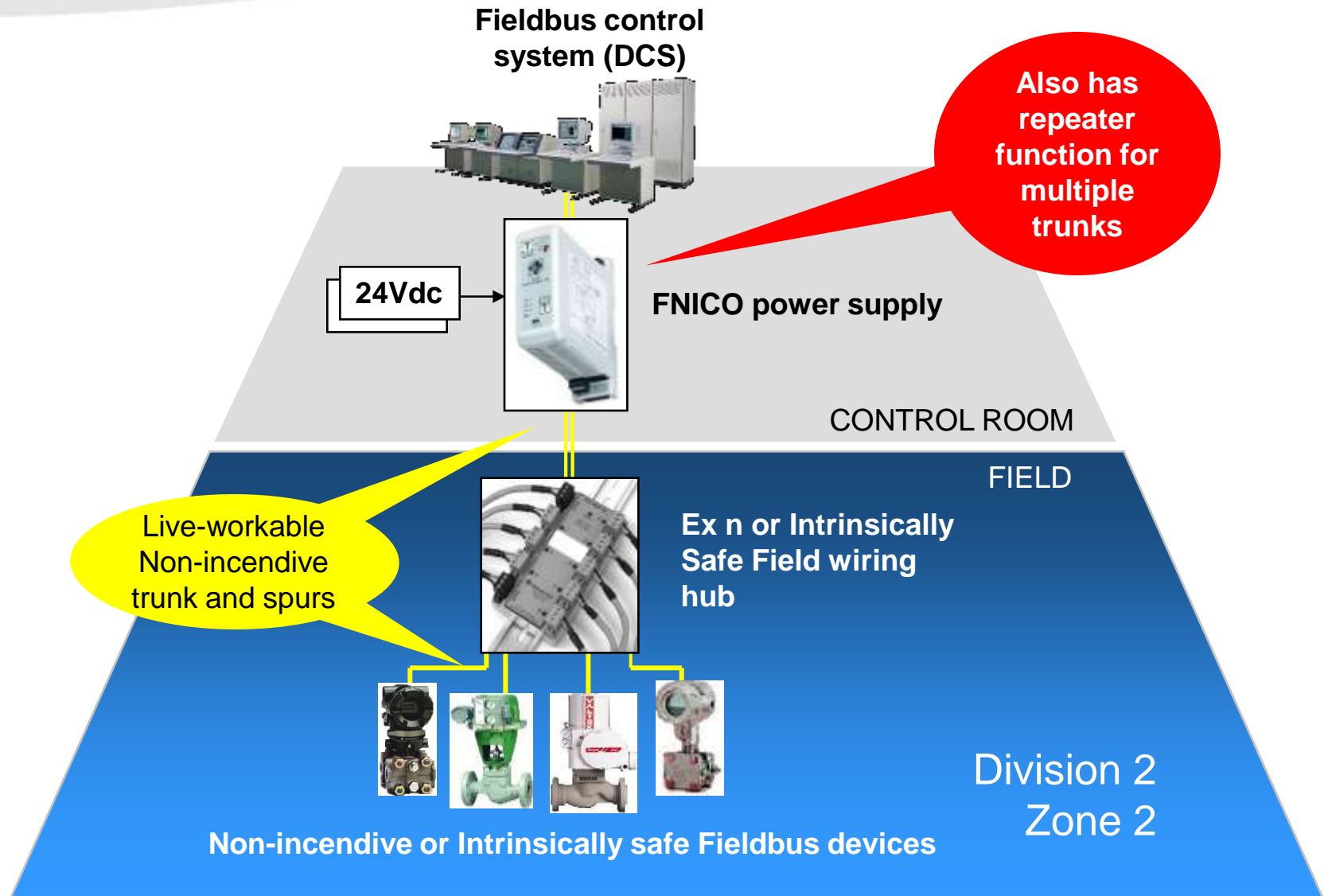
□ **Fieldbus Non-Incendive Concept**

- For fieldbus in Zone 2 and Division 2 hazardous areas
- Complete field network is Non-Incendive EEx nL
- Live-workable throughout without gas clearance, just like Intrinsic Safety
- Based on FISCO, the Fieldbus Intrinsically Safe Concept
- Easy to install, easy to document, easy to maintain.

Key benefits of FNICO

- ❑ Wide choice of suitable field devices:
 - IS 'Entity' certified
 - FISCO certified
 - Ex nL certified
- ❑ Relaxed installation rules
 - Don't need to comply with IS segregation rules
 - FNICO cables can share cable trunking with non-IS circuits
- ❑ More available current than FISCO in IIC/Group A:
 - FISCO: 120mA
 - FNICO: 180mA

Typical FNICO installation



How many field devices? FISCO / FNICO

Assumes 17mA per field device



80mA available, typically 3 - 4 devices

Entity, IIC/IIB Gas Groups

Zone 1/Division 1



120mA available, typically 6-8 devices

FISCO, IIC Gas Groups



265mA available, typically 14-16 devices

FISCO, IIB Gas Groups



320mA available, typically 18-20 devices

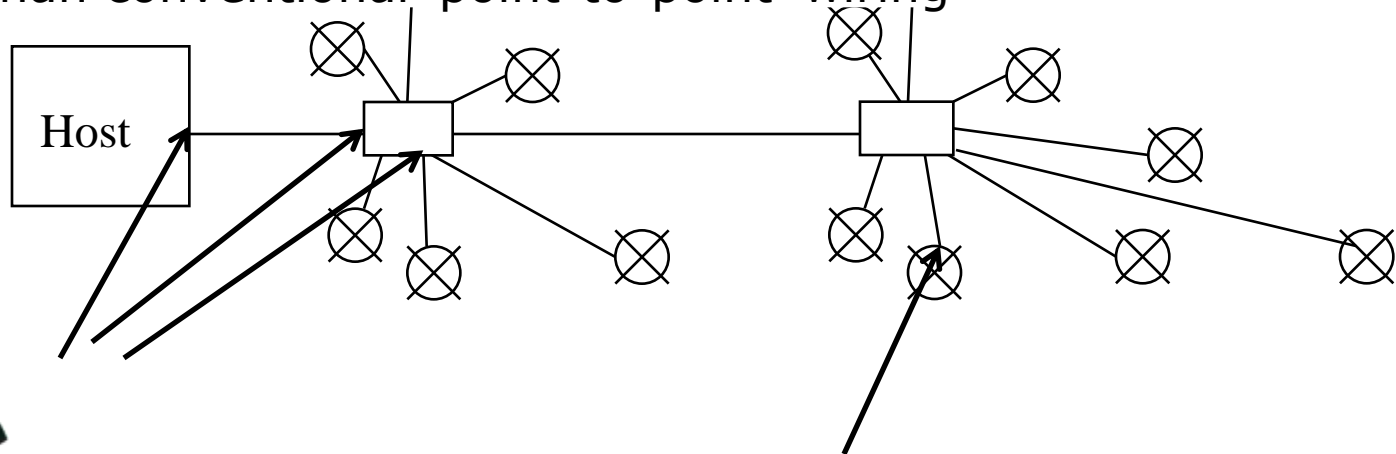
FNICO, IIB Gas Groups

Zone 2/Division 2

FF Installation Advices

Surge protection for fieldbus

Fieldbus installations are more vulnerable to surge damage than conventional 'point-to-point' wiring



DIN rail mount Fieldbus surge protector for the power supply, host and Fieldbus Barrier



Threaded entry Fieldbus surge protector for field instrument

- Recommended surge:
 - If >100m between devices
 - OR >10m vertically

Fieldbus Maintenance and Diagnosis

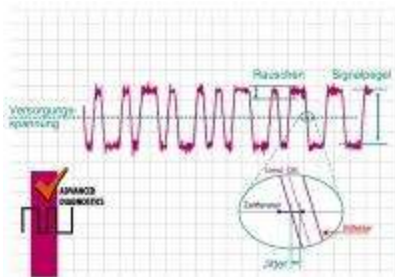


F809F



Diagnostic modules

Fieldbus testers



- Devices on net
- # transmissions
- # failed transmissions
- Retransmission rate
- Average noise in diff.bandwidth
- Peak noise in diff.bandwidth
- Voltage level of all devices
- Signal level of all devices
- Short Circuit of all dev.

How to connect Non FF Field Devices to FF?

Digital IO and Temperatur Mux



- 8 DI / 4 DO (low power)
- ATEX certified zone 1 & 2



- 8 ch Temp. Multiplexser
- RTD and THC

FF Remote IO



- Remote IO for Zone1
- IO modules for Exi and Exe

FF Displays

Field Mounting

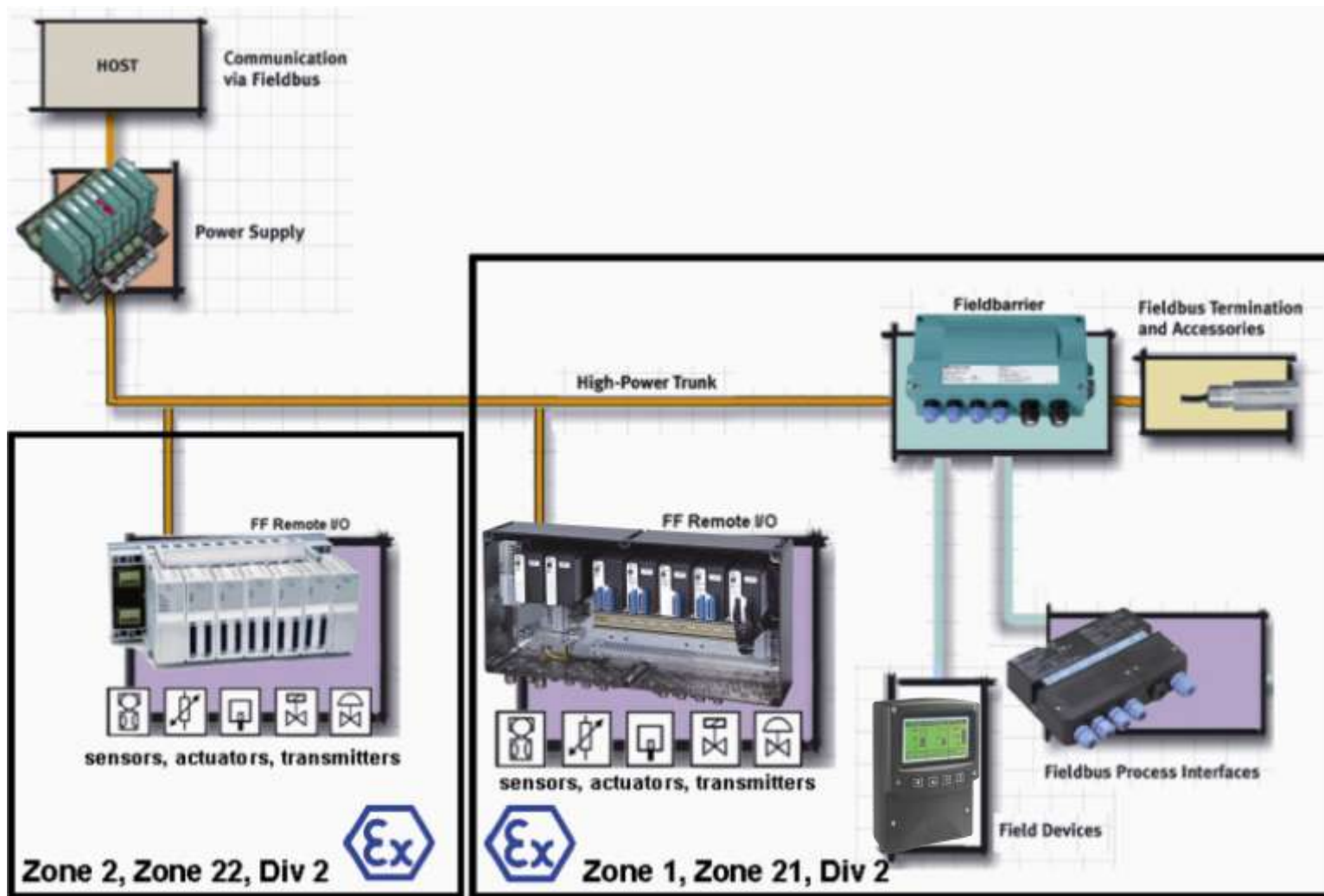


- 1 Address on the net
- FISCO compliant
- ATEX certified zone 1 & 2
- Non-Hazardous area

Panel Mounting

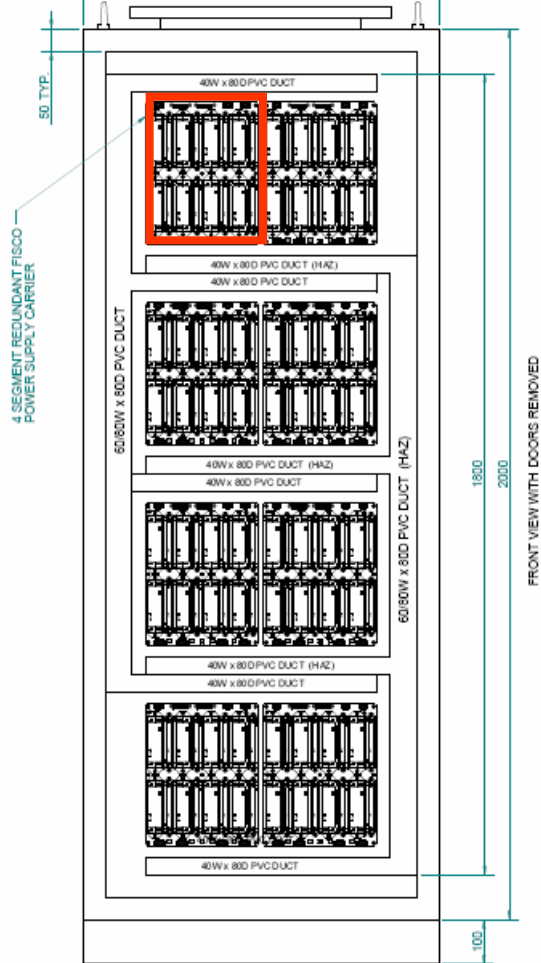


FF Structure Example

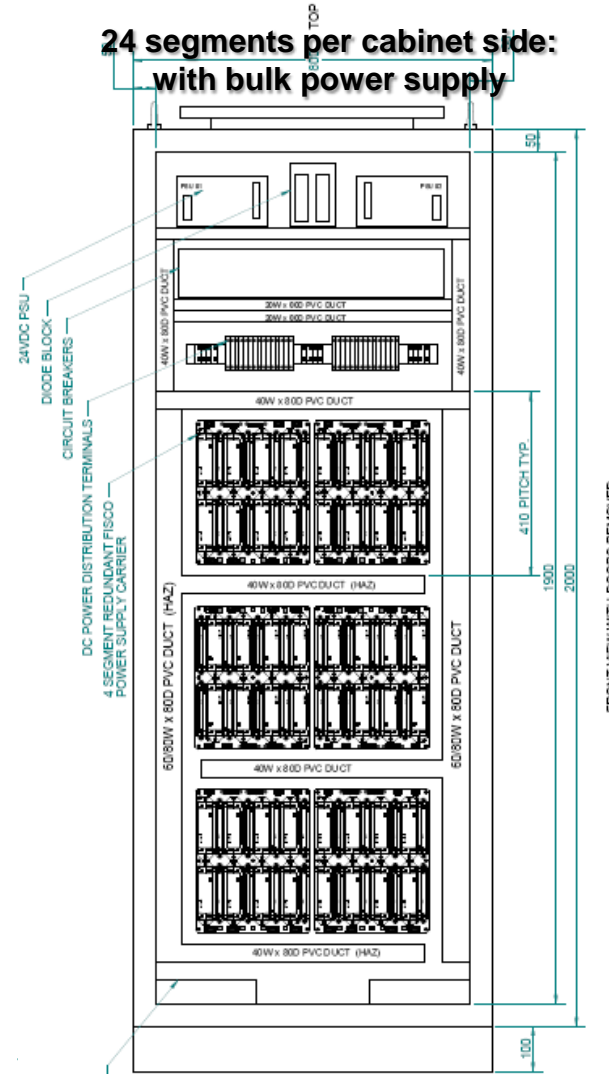


Typical Cabinet Layout

32 segments per cabinet side:



**24 segments per cabinet side:
with bulk power supply**



In summary...

- ❑ FISCO - IS solution for Zone 1
 - Intrinsically safe wiring: safe maintenance
 - New IEC standard (60079-27: 2005)
- ❑ Fieldbus Barrier - High power Trunk Zone 1
 - More field devices per segment in IIC gases
 - Compatible with FISCO and ENTITY
- ❑ FNICO delivers "*FISCO benefits*" in Zone 2
- ❑ Advanced Diagnosis available
- ❑ Many ways to include non-FF signals
- ❑ Don't forget surge protection!
- ❑ REMEMBER GROUNDING!

Thank you!



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