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# Simplify your life with fieldbus in Zone 2

## How to apply up-to-date intrinsic safety Ex ic

**In Zone 2 hazardous areas, energy limiting ignition protection type Ex nL (non-incentive) has been available to fieldbus users for years paving the way for instrumentation in an increasing number of installations. Compared to protection type Ex i (intrinsic safety), Ex nL has contradictory requirements that have lead to ambiguity regarding correct dimension and construction of electrical circuits rather than the expected savings in installation and maintenance cost. The new directive:Ex ic intrinsic safety is replacing Ex nL as of 2011. This article explores the improvements that can be realized by combining this new standard with FOUNDATION fieldbus H1 and PROFIBUS PA.**

### Protecting your investment

Ignition protection type Ex ic (IEC 60079-11:2007) is intrinsic safety. It is very similar to and replaces protection type non-incentive Ex nL (IEC 60079-15), which becomes obsolete in 2011. Plants put in operation using Ex nL may continue to conform to the standards to which they have been designed. This includes minor updates and modifications, for which Ex ic-rated equipment can be used as one-to-one replacement parts, even though Ex nL will cease to exist. For new plants and major upgrades the new standard Ex ic is to be used.

### On intrinsic safety (Ex ic) with fieldbus

With Ex ic for Zone 2, installations are required to conform to the demands of intrinsic safety similar to the existing requirements already known from protection methods for Zone 0 and 1. They are:

- Separation of intrinsically safe and other circuits by a tight string length of 50 mm
- Ex ic circuits require either marking or a light blue cable

- Validation of intrinsic safety Ex ic either through Entity or FISCO

Validation according to Entity requires a comparison of safe voltage ($U_O$), current ($I_O$) and power levels ($P_O$) of the power supply with respective input voltages for the instruments as well as calculating and observing limits for inductance and capacitance. FISCO, the winner in simplifying validation of explosion protection, removes the need for any numeric comparison or calculation. With FISCO Ex ic (IEC 60079-27), the limits for safe current, voltage, and power are set and adhered to by all certified components such as fieldbus power supplies and instruments.

*Fig. 1*

For the user, FISCO prescribes limits in cable types and lengths (up to 1000 m) and specifies that only one power supply is permitted per segment. Validation of intrinsic safety with FISCO is simple: It only requires proper documentation of certification of power supply, cables, and instruments used.

Fundamentally, the way fieldbus segments are designed remains the same. A topology with one trunk line and connection points to the trunk line for one device each – spurs – is easy to plan, install, and maintain. All existing topologies continue to be valid.

*Fig. 2*

A simple spreadsheet can document the relationship between DCS (host interface), power supply, Segment Protector, and instrument including installation point. The spreadsheet eliminates the need for wiring diagrams, as the connection points are identical regardless of the instrument's function – a reduction in planning effort in cost. The same spreadsheet is easily marked-up with equipment changes that occur during commissioning or plant operation. And it holds the documentation for explosion protection, too.

**Fieldbus infrastructure – always with short-circuit protection**

Most specifications for the fieldbus infrastructure today demand short-circuit protection at each spur in order to protect the trunk and remainder of the segment from unwanted faults e.g. caused by live work on devices. Thus, fieldbus couplers with short-circuit protection, often referred to as Segment Protectors (SP), are typically used. This results in significantly higher availability of the fieldbus infrastructure.

**Simple yet elegant product design for ease of use in Zone 2**

The same Segment Protectors also provide Ex ic ignition protection with typically high safe values. Particularly $U_O$ is set higher for validation according to Entity where many field

instruments allow high safe input voltages ($U_I$). The Segment Protector limits the current at each spur output to a safe value of $I_O$ = 70 mA, low enough for practically all devices available today.

For a lower required safe voltage $U_O$ at the spur connection e.g., in a FISCO installation, the voltage is limited elsewhere: in the fieldbus power supply, as it already provides voltage control. So the simple and reliable way to put FISCO Ex ic into practice is to use a power supply with an upgraded electric design to comply with demands for Ex ic. In combination, the power supply and the Segment Protector realize intrinsic safety FISCO or Entity Ex ic at the spur with levels of selectable safe voltages.

This design is known as the High-Power Trunk concept, already an industry standard for any hazardous area. Since the trunk's power is unlimited with regards to ignition protection, live work at the trunk is permitted only with gas clearance. However, hot work on instruments is permitted anytime. Not only cost-effective, this design makes best use of the segment by allowing a higher load current on the trunk. More devices can be connected in comparison to energy limitation at the power supply. The higher the voltage level the longer the cable runs.

**EPC and plant owner are well-prepared to meet the latest requirements with FieldConnex**

The innovators at Pepperl+Fuchs, who are always actively involved in IEC committees and fieldbus governing organizations such as the Fieldbus FOUNDATON or PROFIBUS International, anticipated the technical changes and started re-engineering FieldConnex system components for fieldbus infrastructure early on. Only minor updates were necessary to qualify isolation levels of the FieldConnex Power Hub and R2 Segment Protector for Ex ic as described above.

MBHD-FB1-4R is the up-to-date FieldConnex High-density Power Hub. Individual plug-in power modules in redundant configuration supply to up to four segments. The High-density Power Hub provides a beefed up 500 mA of current per segment, increased voltage isolation, and now allows a free choice of galvanically isolated power modules. Output voltages from 31 V down to 17 V ($U_O$ for FISCO Ex ic) allow the right fit in conjunction with the right FieldConnex fieldbus coupler for any hazardous area. The High-density Power Hub is certified for installation in Zone 2/Div. 2.

*Fig. 3*

R2-SP-N* marks the FieldConnex Segment Protector family fitted for Ex nL and Ex ic. The * identifies the choice from four to twelve spur outputs. It is updated with a protection wall for a tight string length of 50 mm between the trunk and spur lines. Short-circuit protection at each

spur ensures fieldbus availability keeping the fieldbus in operation while work is performed on field instruments.

*Fig. 4*

**Other Consequences for Users?**

Validation now follows the already known concepts for intrinsic safety according to Entity or FISCO. Fieldbus planners who separate non-incendive (Ex nL) circuits from power circuits are well prepared. Intrinsic safety Ex ic for Zone 2 and FieldConnex enable live work on devices while the plant is in operation – all without the requirement of a hot work permit.

Ex ic brings intrinsic safety to Zone 2. With its requirements adapted to the risk of explosion protection, it reduces costs and removes ambiguity. Working with fieldbus instrumentation should be as easy as always. With Ex ic it is.


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| Key words: | FieldConnex, Fieldbus infrastructure, FOUNDATION Fieldbus H1,PROFIBUS PA, Ex ic, intrinsic safety, Ex nL, energy limitation, power supply, Power Hub, Segment Protector, fieldbus coupler, hazardous area, Zone 2 |



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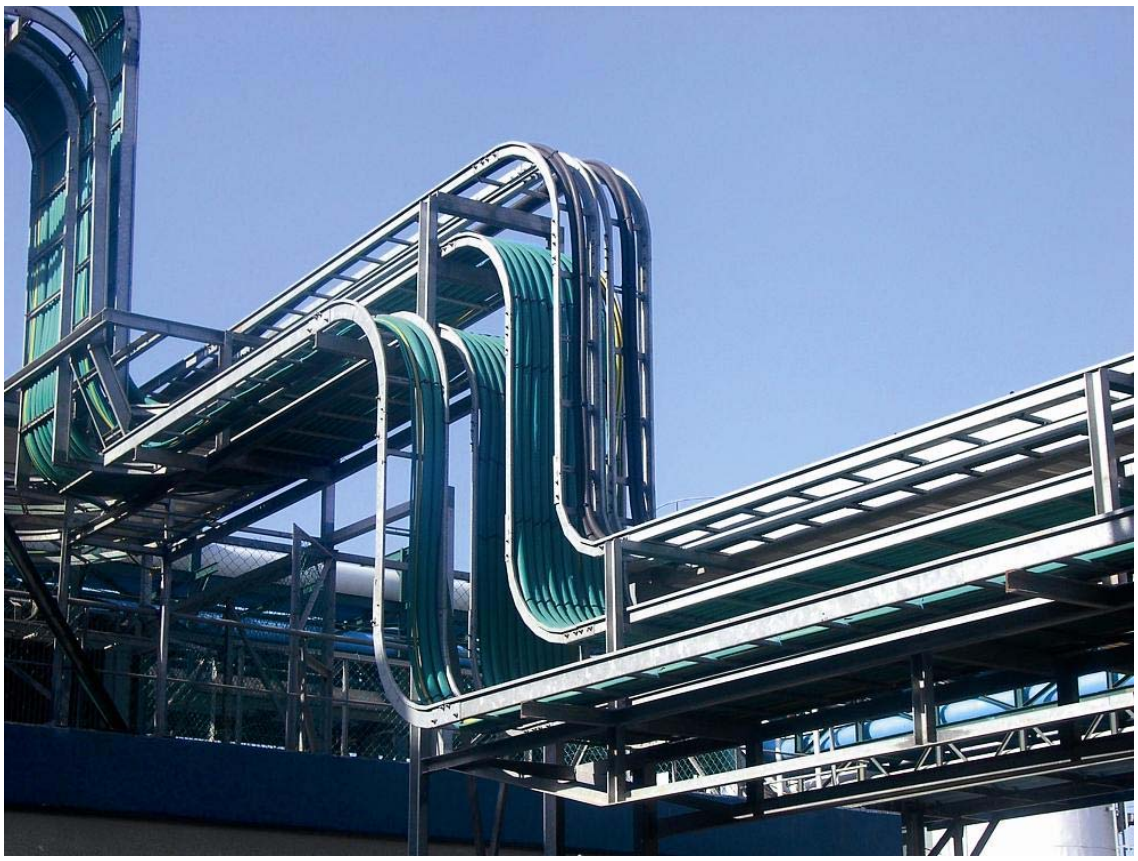

Eye catcher

| Calculations for validating intrinsic safety with Entity | |
|---|---|
| **Entity Limit Value Comparison** | **Prescribed Limit Values for FISCO** |
| $I_o \leq I_i$ | $I_o \leq 380\ mA \leq I_i$ |
| $U_o \leq U_i$ | $U_o \leq 17.5\ W \leq U_i$ |
| $P_o \leq P_i$ | $P_o \leq 5.32\ W \leq P_i$ |
| $L_0 \geq L_{cable} + \Sigma L_i$ | Entity only. |
| $C_0 \geq C_{cable} + \Sigma C_i$ | |
| Indices:<br>'O': Output value e.g. power supply<br>'I' = Input value e.g. field instrument | |

Fig. 1: Intrinsically safe ignition protection Ex ic: FISCO with fixed limit values eliminates calculations entirely. Entity's higher voltage levels allows for longer cable distances.

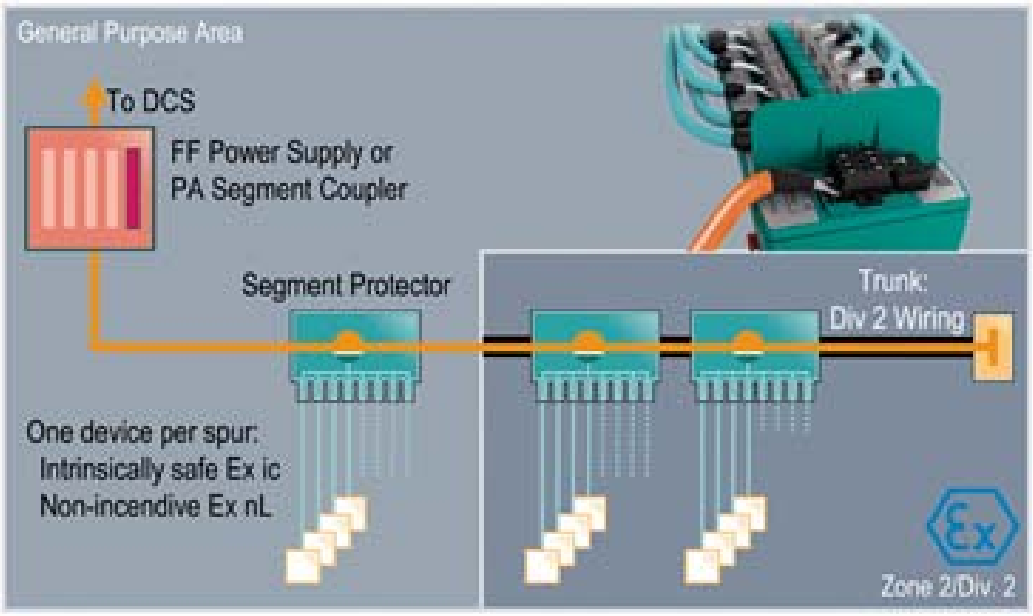


Fig. 2: Trunk-and-Spur topology is clear, easy to implement and maintain. High-Power on the trunk allows for longest cable runs and high device count. Ex ic at the spur is achieved with the proper selection of power supplies and segment protectors.

Fig. 3: FieldConnex High-density Power Hub meeting isolation levels of Ex ic ignition protection.

Fig. 4: FieldConnex R2 Segment Protector with short-circuit protection per spur-output and easy handling.