



TechnipFMC

# Profibus Dual Channel Case Study application “TankFarm to Process distribution”

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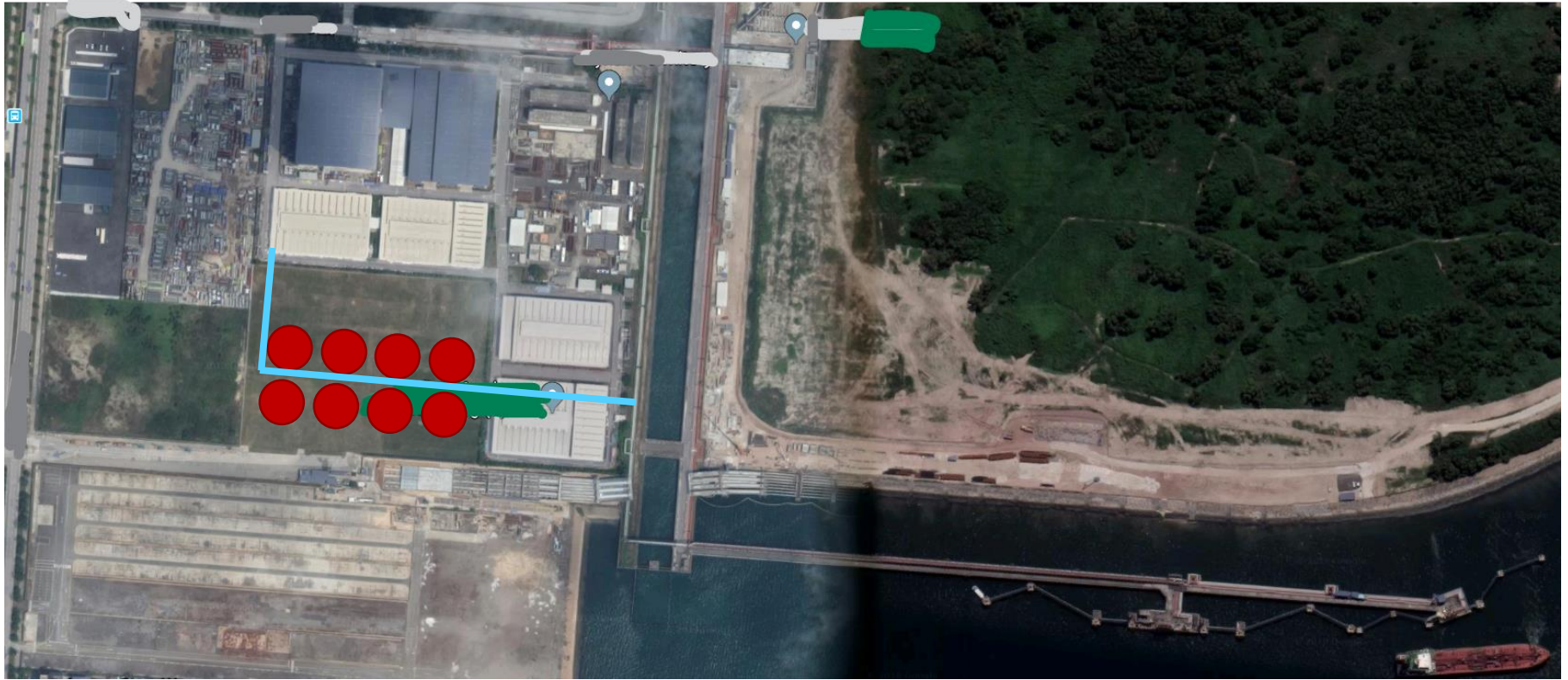
b) SR – SYSTEM REDUNDANCY

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# INTRODUCTION



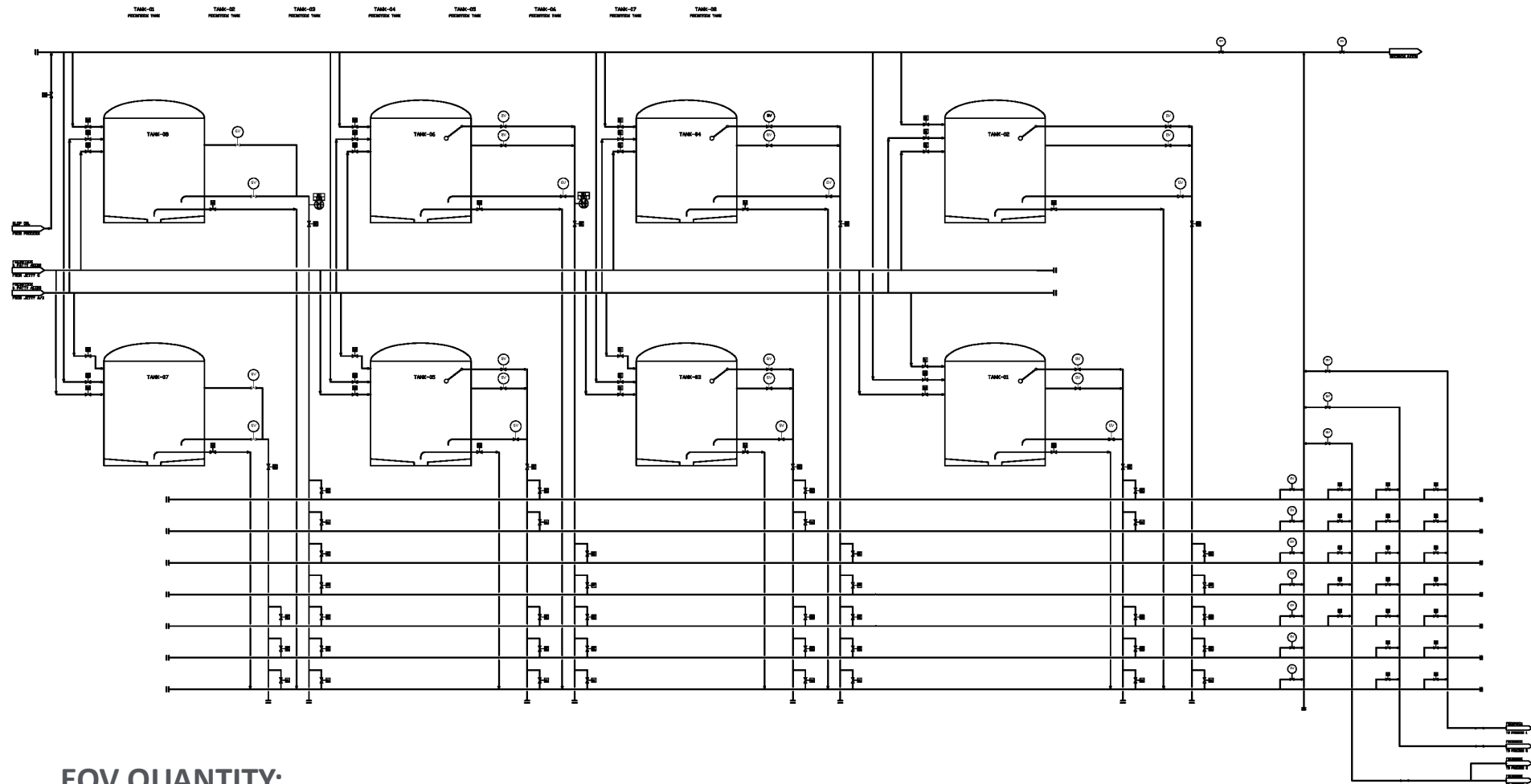
**TANK FARM:** Nr. 8 Tanks

**AREA:** 250x150 [m] – 37500 [m<sup>2</sup>]

**DISTANCE FROM CONTROL SYSTEM:** 200 TO 500 [m<sup>2</sup>] approx.

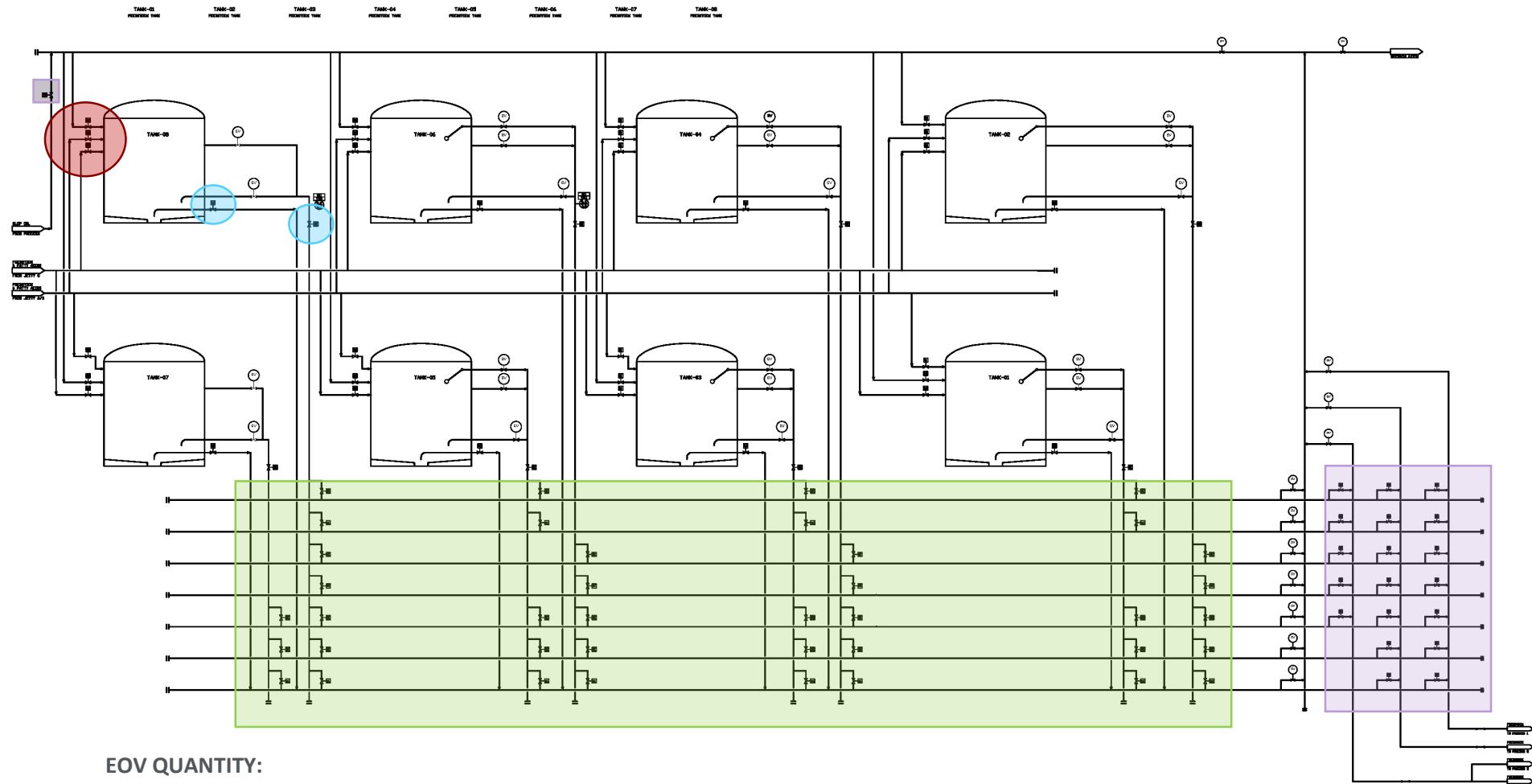
**QUANTITY:** 100 ELECTRICALLY OPERATED VALVES (EOVs)

# INTRODUCTION



EOV QUANTITY:

# INTRODUCTION



## EOV QUANTITY:

Nr 2 INLET from JETTY + N1 from RECIRCULATION for each TANK = 24 (+1 from PROCESS)

Nr 2 OUTLET to PROCESS for each TANK = 16

Nr 40 (approx. 5 per TANK) INLET to DISTRIBUTION

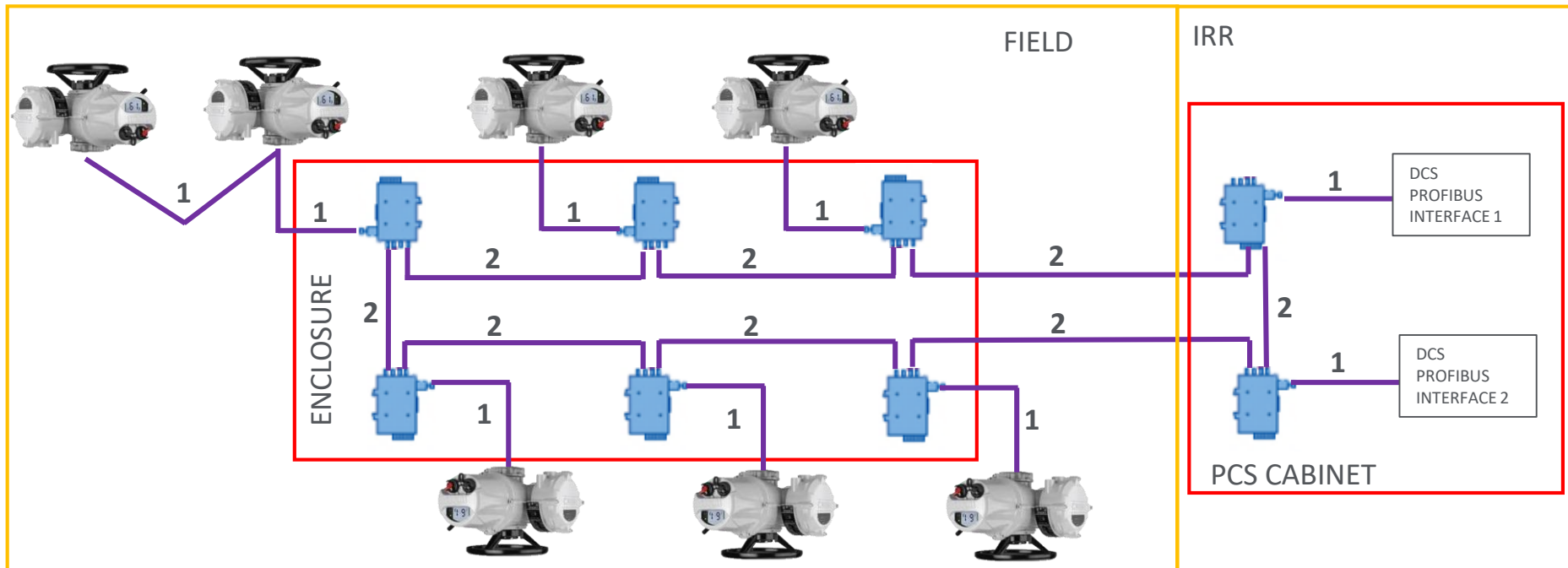
Nr 19 DISTRIBUTION to PROCESS

**TOTAL: 100 EOVs**

# EOV PROFIBUS-DP WITH SINGLE INTERFACE

**TARGET:** 100 EOVs to be connected to the PCS through PROFIBUS DP bus link.

For EOV with only one PROFIBUS interface board, the redundancy can be fulfilled through the following network topology: fiber optic ring using OLMs (Optical Link Module).



Configuration requirements:

- Power Supply for field distributed OLMs
- Junction box for OLMs enclosure
- OLMs' Fault signals cables/IOs/JBs to PCS
- Patch panels for splicing (to be evaluated)

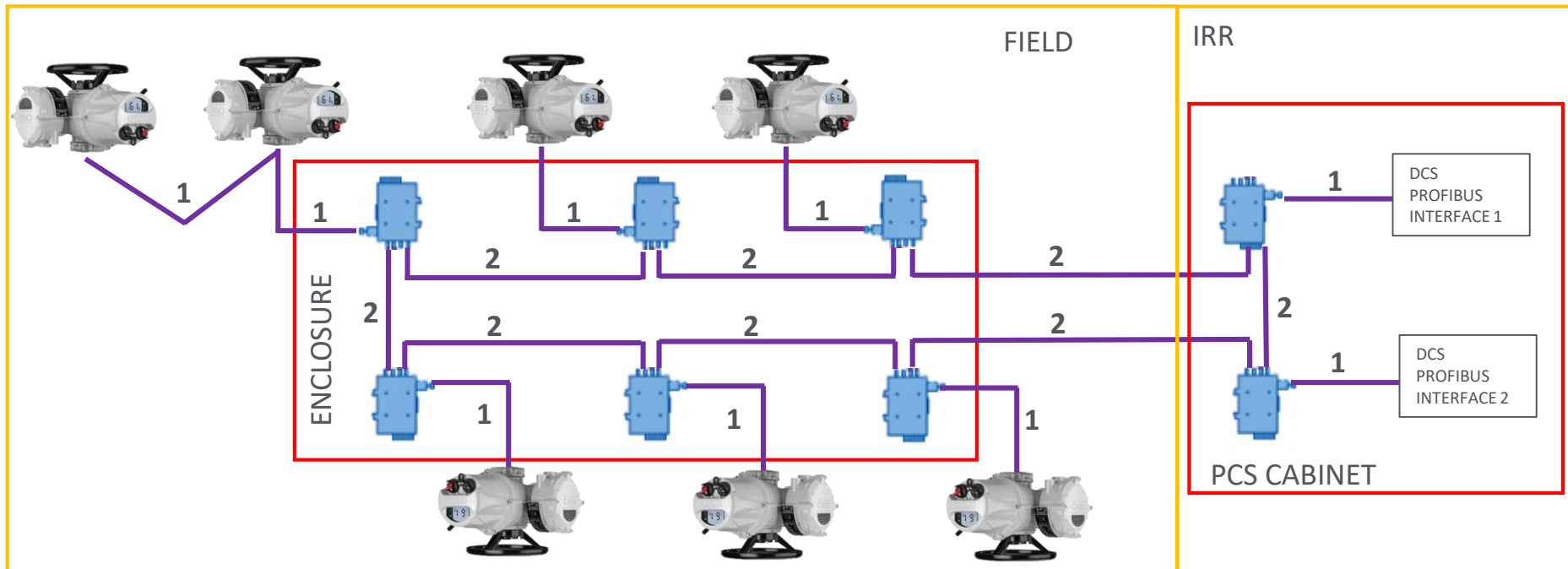
**CABLE LEGEND:**

- 1 – PROFIBUS CABLE
- 2 – FIBER-OPTIC CABLE

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**TARGET:** 100 EOVs to be connected to the PCS through PROFIBUS DP bus link.

For EOV with only one PROFIBUS interface board, the redundancy can be fulfilled through the following network topology: fiber optic ring using OLMs (Optical Link Module).



The fault of one OLM would cause the lost of one segment.  
Similarly, the control of each valve relies on the integrity of one non redundant segment.

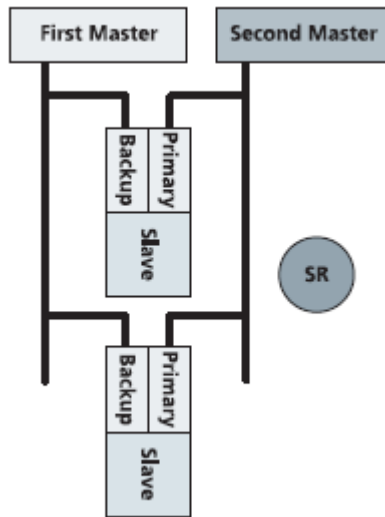
**CABLE LEGEND:**  
1 – PROFIBUS CABLE  
2 – FIBER-OPTIC CABLE

NOT ACCEPTABLE

# EOV PROFIBUS-DP WITH REDUNDANT INTERFACE

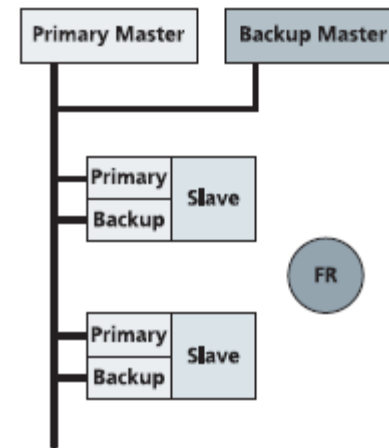
## Overview

### SR – SYSTEM REDUNDANCY



To be utilized for Simple Dual PLC

### FR – FLYING REDUNDANCY

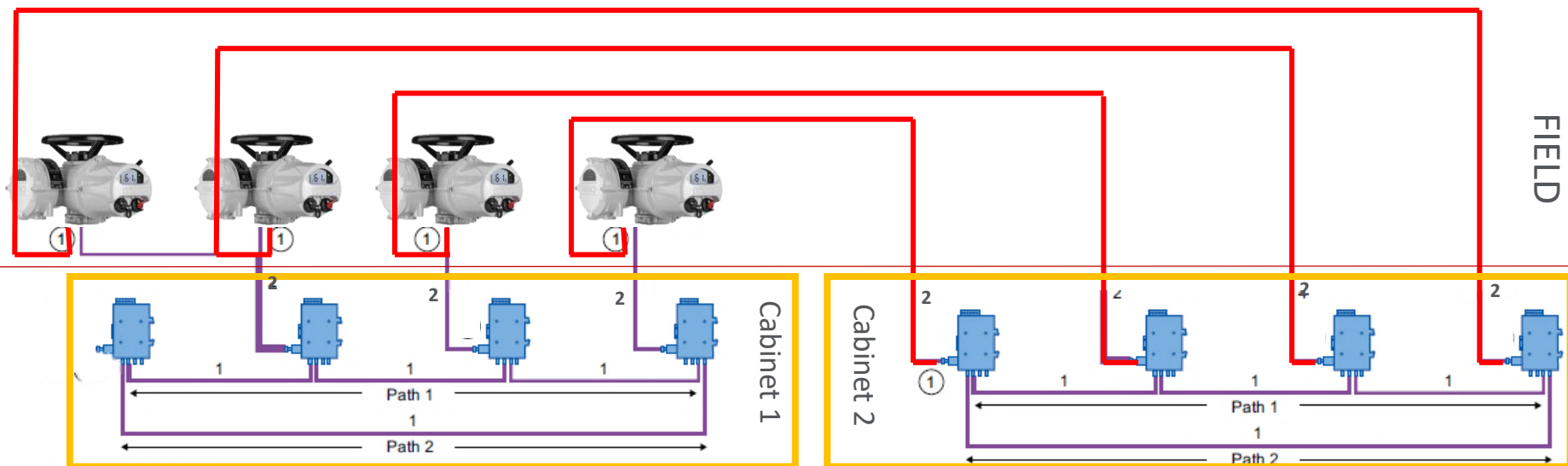
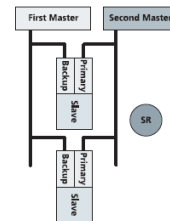


To be utilized for Integrated Redundant PLC

HOW WOULD THESE APPLY TO THE INTRODUCED  
TANKFARM SCENARIO?



# SR – SYSTEM REDUNDANCY

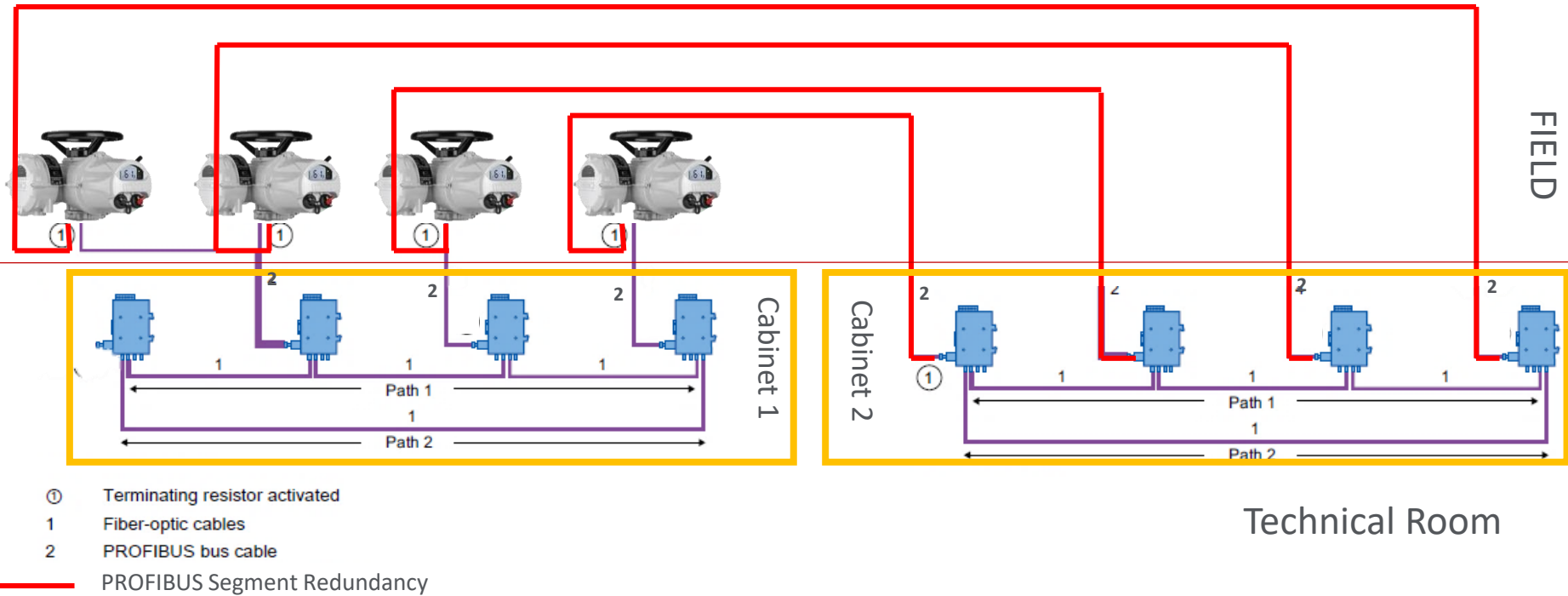
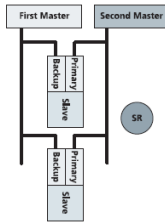


- ① Terminating resistor activated
  - 1 Fiber-optic cables
  - 2 PROFIBUS bus cable
- PROFIBUS Segment Redundancy

SA Technical Room

This configuration allows to fit all the OLMs in two Cabinets located in the Technical Room. The FO installation and ring is confined inside each cabinet but the redundancy is ensured by both OLM Rings and Profibus Segments Redundancy. Cabinet 1 and 2 can be physically separated. Cabinet 1 is connected to 100 EOVS primary PROFIBUS boards. Cabinet 2 is connected to 100 EOVS backup PROFIBUS boards.

# SR – SYSTEM REDUNDANCY

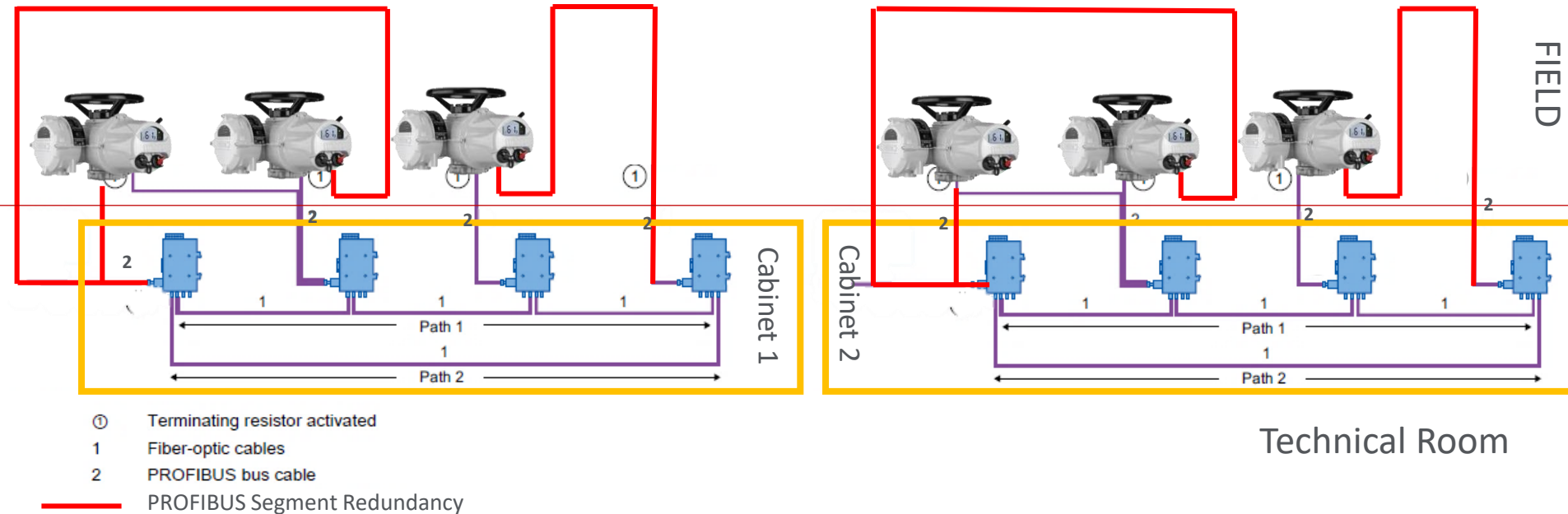
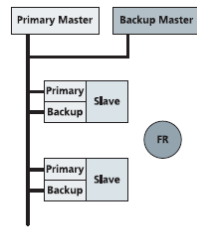


Technical Room

Each ring can contain maximum 9 OLMs and 126 devices. Each OLM can connect to 24 (max 32) devices. Each segment has to be connected to an active terminator in field. Power supply for field terminator shall be provided.

PROFIBUS redundancy shall be managed at system level for this topology?

# FR – FLYING REDUNDANCY



Technical Room

This configuration also allows to fit all the OLMs in two Cabinets located in the Technical Room. The FO installation and ring is confined inside each cabinet but the redundancy is ensured by both OLM Rings and Profibus Segments Redundancy. Cabinet 1 and 2 can be physically separated but in this case, each Cabinet contains both the segments connected to the primary and backup boards of the EOVS. Each Cabinet manages 50 EOVS in redundant configuration. Primary and Backup actuator profibus cards shall have different DP Addresses.

# TOPOLOGY STUDY PROS & CONS

## Pros

- Double redundancy (Redundant Profibus segment + OLM ring)
- OLMs are located in safe area inside PCS cabinet
- No need OLM enclosures, field networking and field power supply for OLM
- No need field wiring for OLMs fault signals. Furthermore IO channels for fault signals will be in DCS Vendor scope of supply (system diagnostic signals)
- Fiber Optic cables only inside the cabinets
- Cabinets can be physically separated increasing availability.

## Cons / Limitations

- Power supply in field shall be provided for segment terminators.
- Power supply cannot be taken from EOv to allow valve maintenance without switch-off the entire segment.
- Profibus maximum segment length is limited to the values given in the below table.

Data Rate (baud)	9600	19200	93.75k	187.5k	500k	1.5M
Maximum Segment Length	1 km	1 km	1 km	1 km	400 m	200 m
Maximum Highway Length	10 km	10 km	10 km	10 km	4 km	2 km
Max No. of actuators/segment	31	31	31	31	31	31

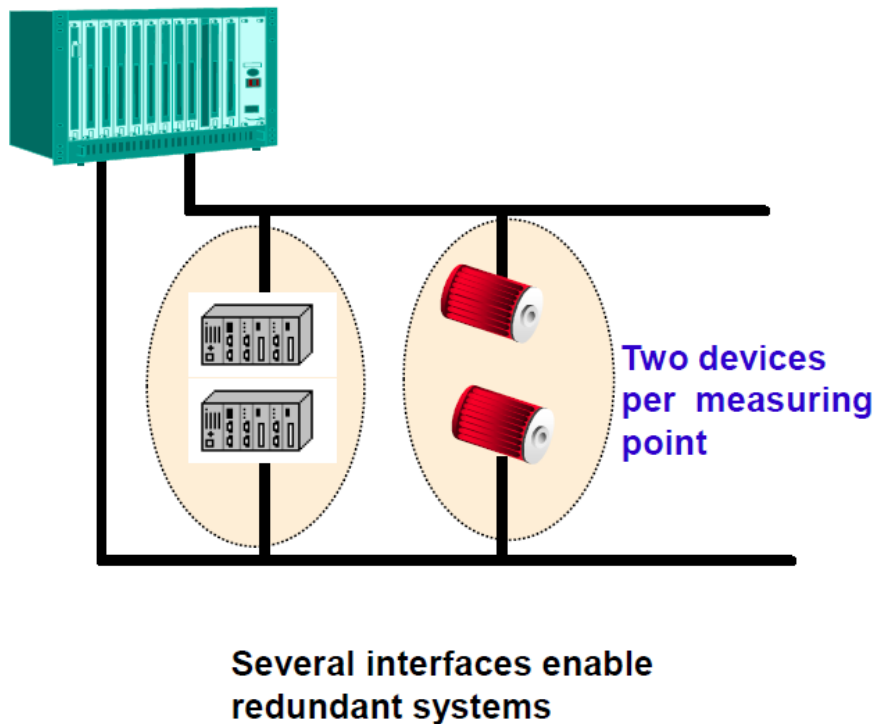
Limitations have been overcome by the available option of utilizing the EOv as active termination (EOv configuration) and the utilization of Disconnect Module

Flying Redundancy Topology has been selected due to PLC capabilities (Integrated Redundant)

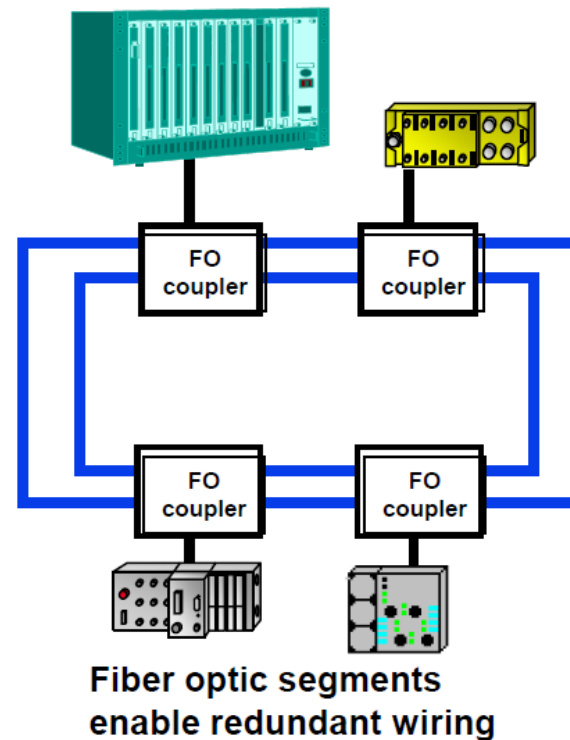
# REDUNDANCY CONSIDERATION

⇒ **Redundancy Improves System Reliability**

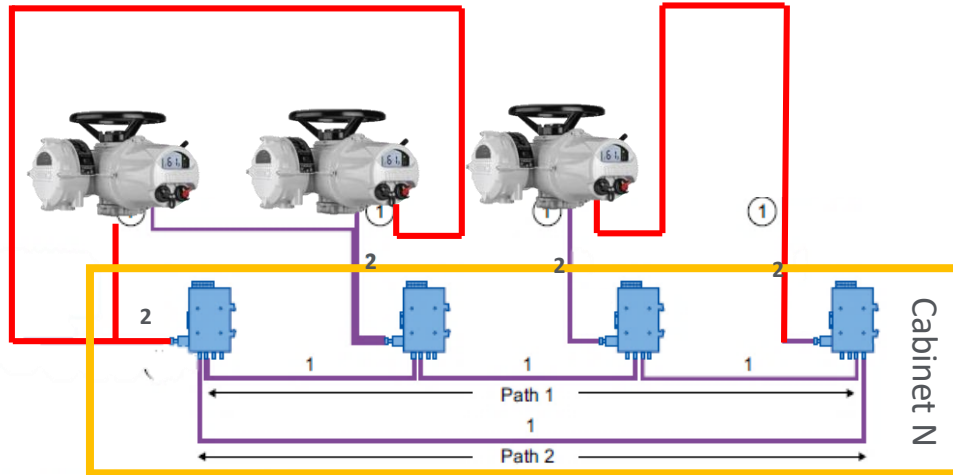
## System redundancy



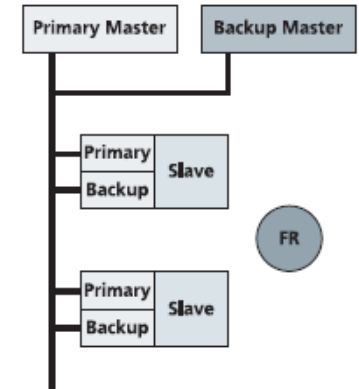
## Media redundancy



# REDUNDANCY CONSIDERATION

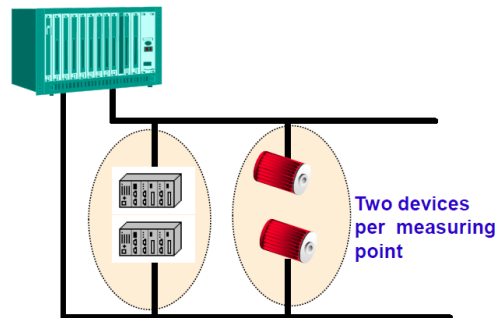


- ① Terminating resistor activated
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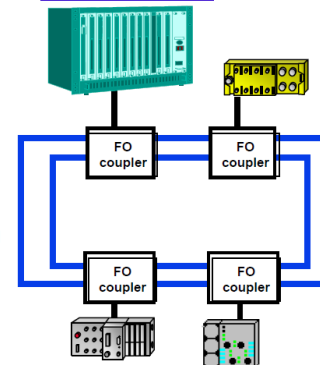
## ⇒ Redundancy Improves System Reliability

### System redundancy



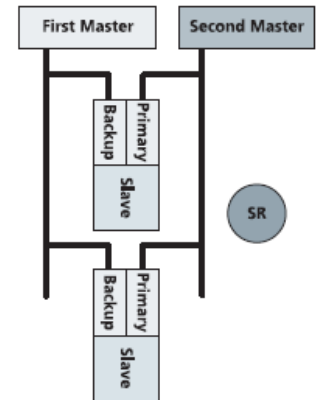
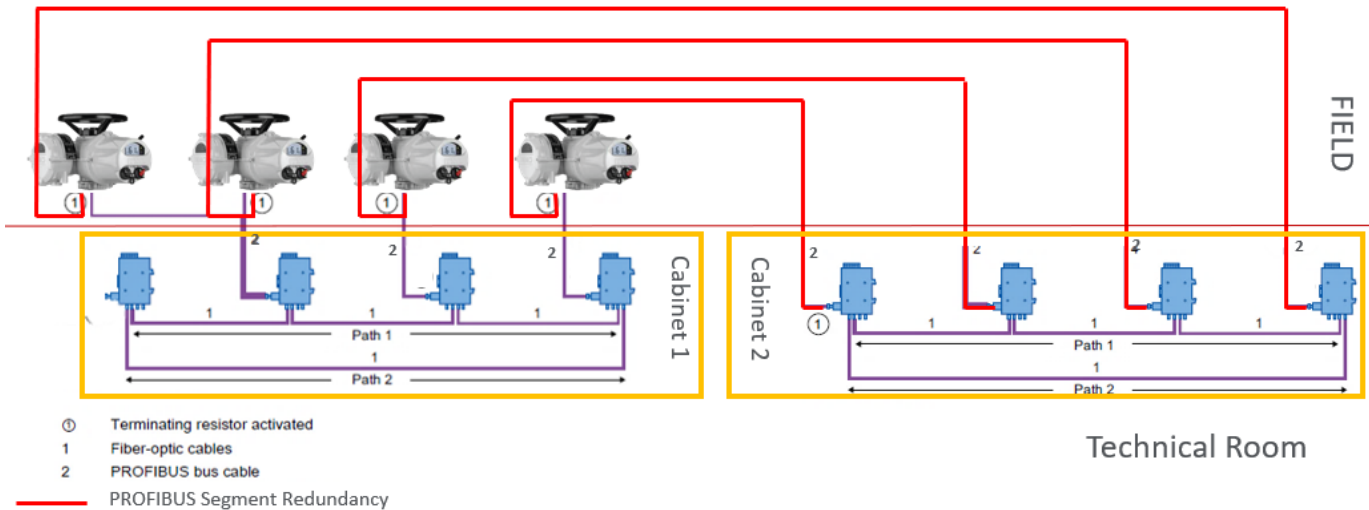
Several interfaces enable redundant systems

### Media redundancy



Fiber optic segments enable redundant wiring

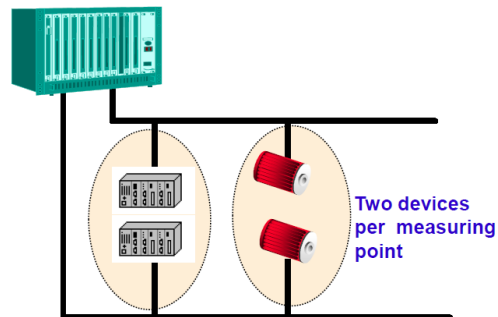
# REDUNDANCY CONSIDERATION



Technical Room

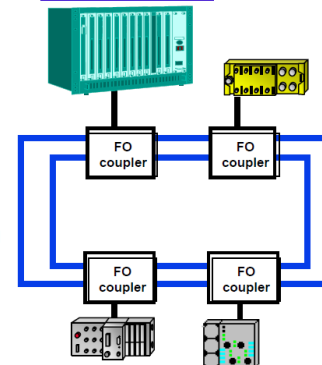
⇒ Redundancy Improves System Reliability

System redundancy



Several interfaces enable redundant systems

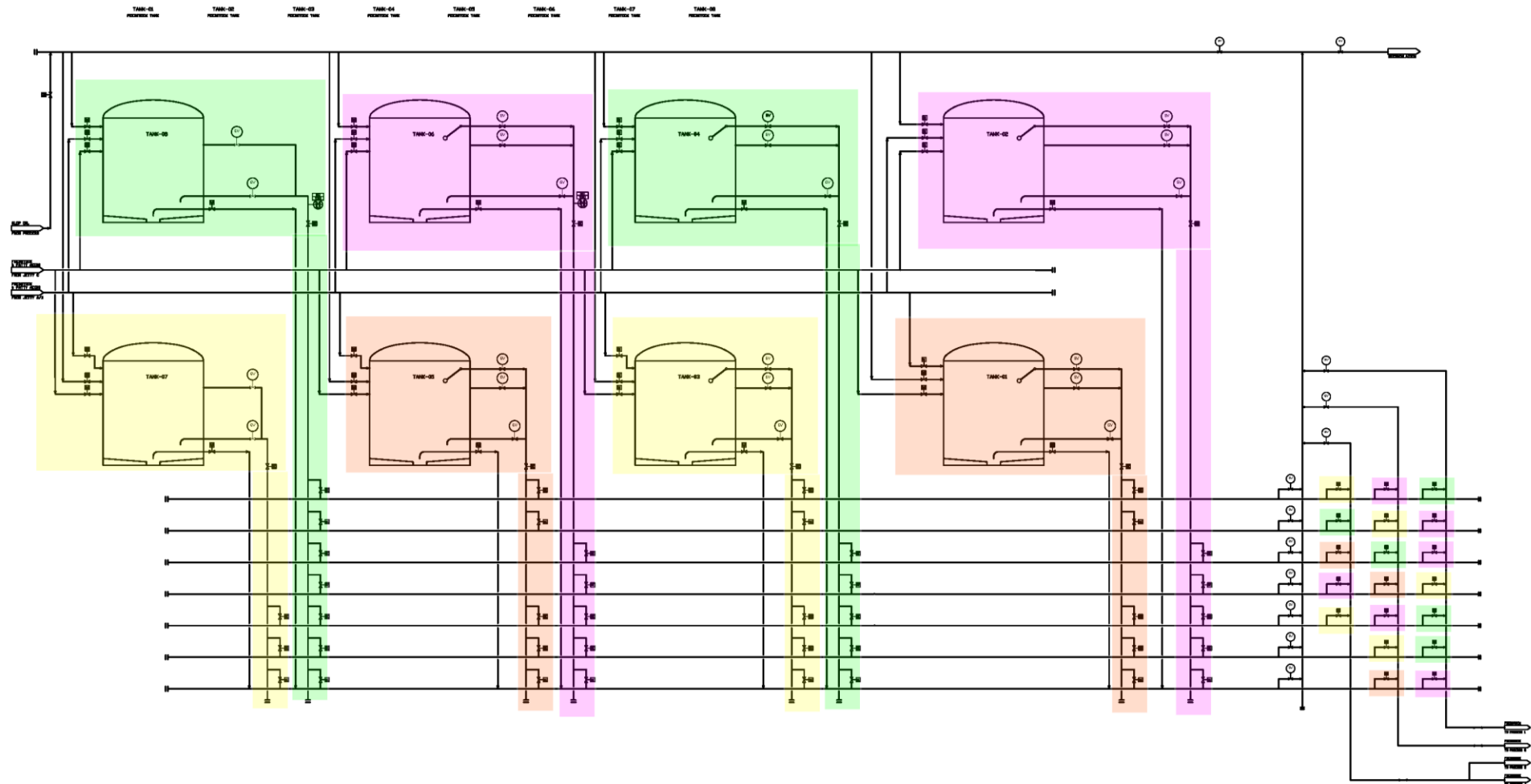
Media redundancy



Fiber optic segments enable redundant wiring

# FINAL TUNING

## RING ASSIGNMENT - SEGREGATION



RING 1 / RING 2 / RING 3 / RING 4



# CONCLUSIONI

The Case Study has been presented in terms of Process Requirements and Profibus Topologies

The selected architecture shall guaranty the communication redundancy

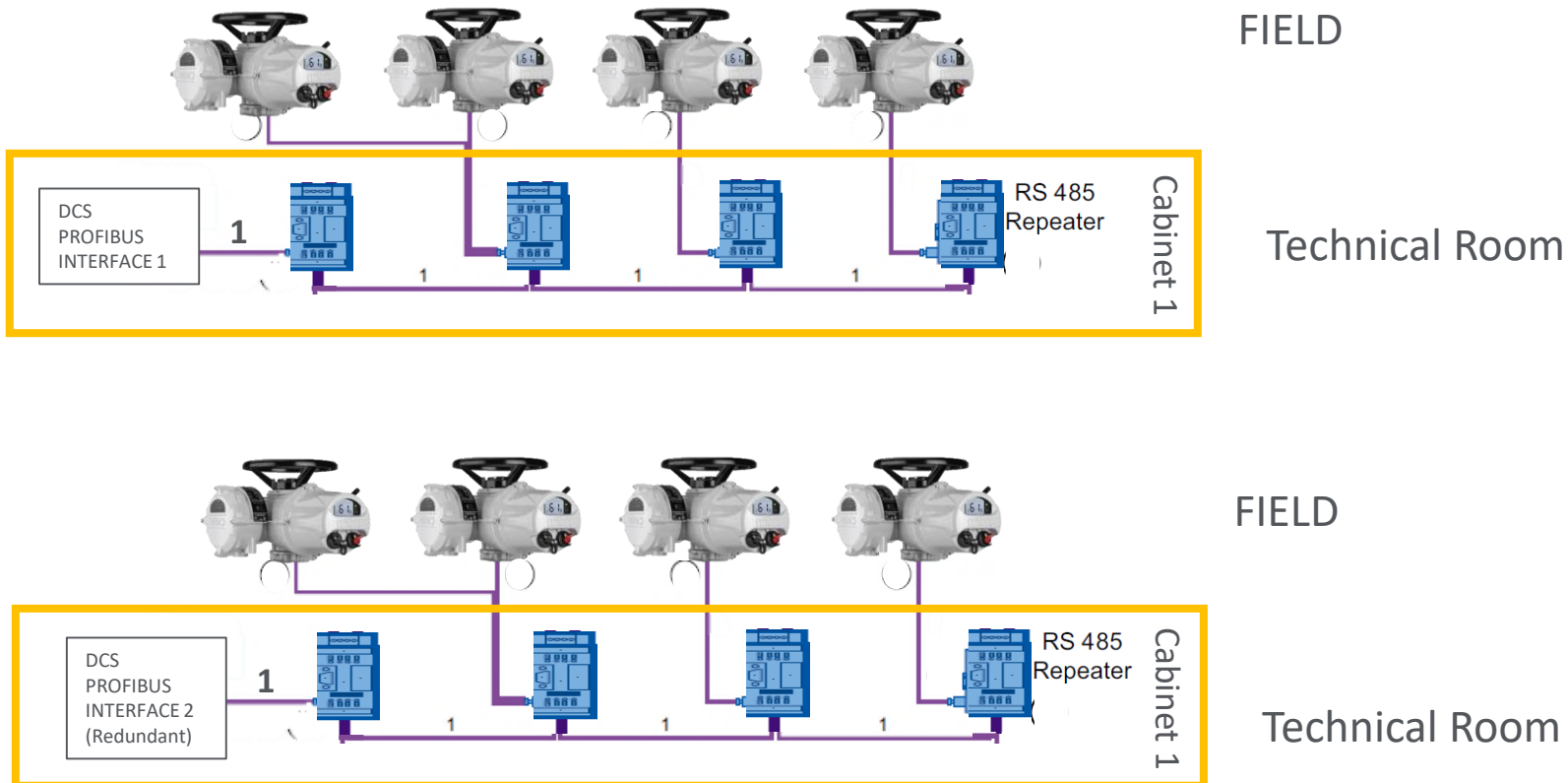
Failure scenarios addressed are:

- Profibus Master Failure
- OLM failure / Ring Break
- Segment break / Profibus Slave failure (Dual)
- Profibus Slave failure (Single)

Segregation has been foreseen in order to guarantee functionality in case of  
“Cabinet/Ring Failure”



This configuration also allows to fit all the RS-485 Repeaters in two Cabinets located in the Technical Room. No FO installation required.  
Cabinet 1 is connected to 100 EOV primary PROFIBUS boards. Cabinet 2 is connected to 100 EOV backup PROFIBUS boards. Thus redundancy requirement is addressed.



1 – PROFIBUS connection