# RAD-2400-IFS PROFIBUS


## PROFIBUS connections with Radioline wireless modules

Application note
107765_en_01



## 1 Description

This application note describes how to establish PROFIBUS connections with the Radioline wireless modules.
PROFIBUS connections are only possible with 2.4 GHz wireless modules:

| Order No. | Designation | Description | |
|---|---|---|---|
| 2901541 | RAD-2400-IFS | For worldwide use | with RS-232, RS-485 2-wire interface, expandable with I/O extension modules, with screw connection, antenna connection: RSMA (female), including DIN rail connector, without antenna |
| 2904909 | RAD-2400-IFS-JP | For operation in Japan | |

**WARNING:**
This application note does **not** replace the device-specific documents.
Please follow the safety notes in the associated package slips and data sheets.

Make sure you always use the latest documentation.
It can be downloaded at phoenixcontact.net/products.

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## 2 Table of contents



## 3 PROFIBUS application examples

System limitations:

- A PROFIBUS network must only have one PROFIBUS master at the maximum.
- No other PROFIBUS devices must be connected to the local PROFIBUS master.
- Deactivate the “Test, commissioning, routing” function when using a PROFIBUS CPU as a slave. If this function is activated, the interface becomes an active PROFIBUS device. Multi-master systems are not permitted.
- Observe the following for multi-drop connections: the transmission time increases with the number of wireless devices. Reduce the PROFIBUS data rate, if necessary.

The SIMATIC® PCS 7 process control system and the PCS 7 controllers are very time-critical. They are therefore not suitable for wireless connections.

### 3.1 Point-to-point connection

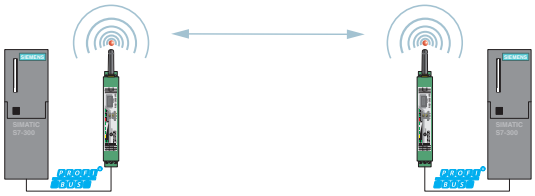

Figure 1 Point-to-point connection with PROFIBUS

### 3.2 Star structure

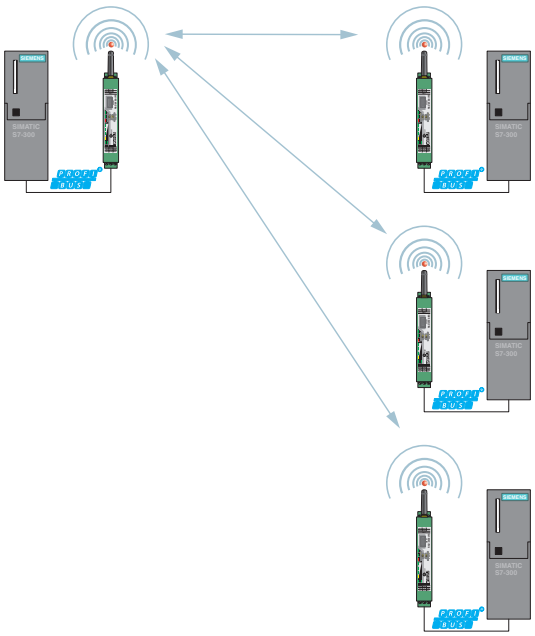

Figure 2 Star structure with PROFIBUS, up to 10 slaves

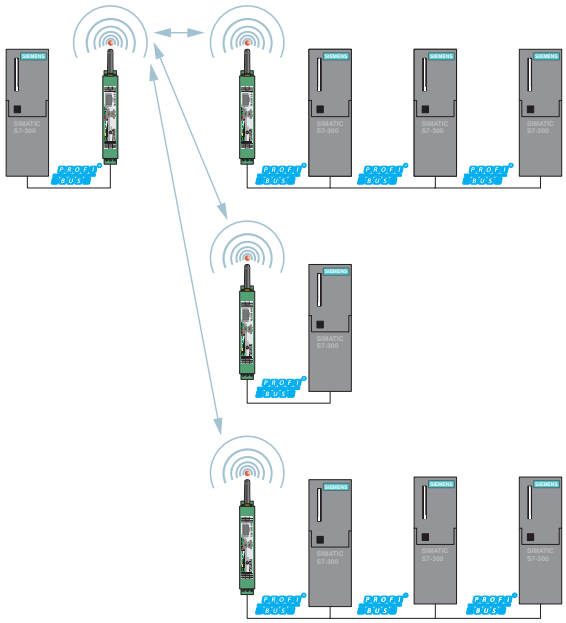

Figure 3 Star structure with several wired PROFIBUS slaves downstream of the wireless path

# 4 Configuration

In order to configure a point-to-point or star connection for PROFIBUS transmission, proceed as follows:

- Download the latest PSI-CONF software from the Internet at phoenixcontact.net/product/2901541.
- Install the software on your computer.

**WARNING: Explosion hazard when used in potentially explosive areas**

The USB cable must **not** be used in potentially explosive areas.

- To connect the wireless module to the PC, use the RAD-CABLE-USB cable (Order No. 2903447).
- Start the PSI-CONF software.


Figure 1-1 PSI-CONF software

- Select the device from the “Wireless” tab.

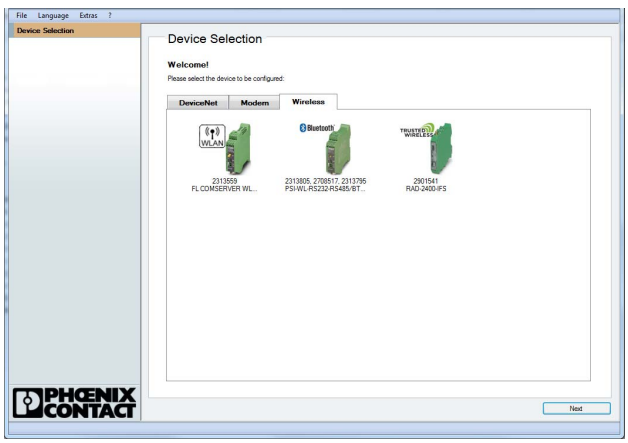


Figure 1-2 PSI-CONF software: “Device selection”

- Select “Create new network project”.

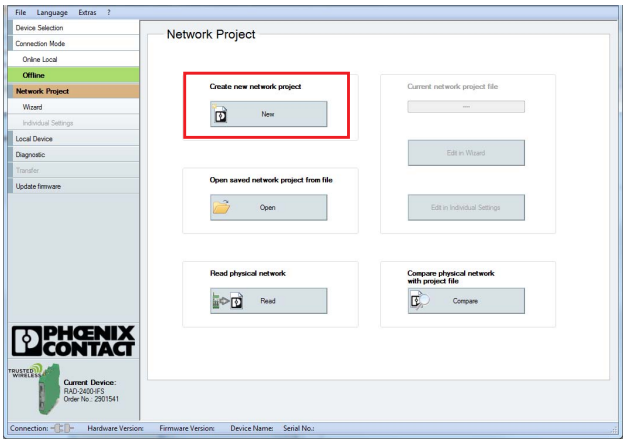


Figure 1-3 PSI-CONF software: “Network Project”

- In step 1 of the wizard, select “Point to Point / Star”. Confirm with “Next”.

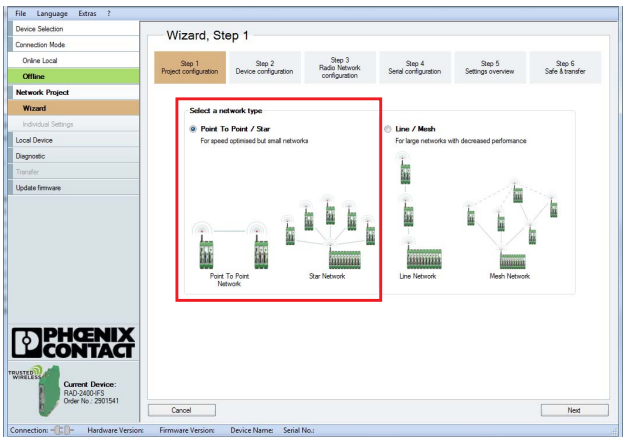


Figure 1-4 PSI-CONF software: “Wizard, Step 1”

- Follow the software wizard. Specify the number of network devices. Confirm with “OK” and “Next”.

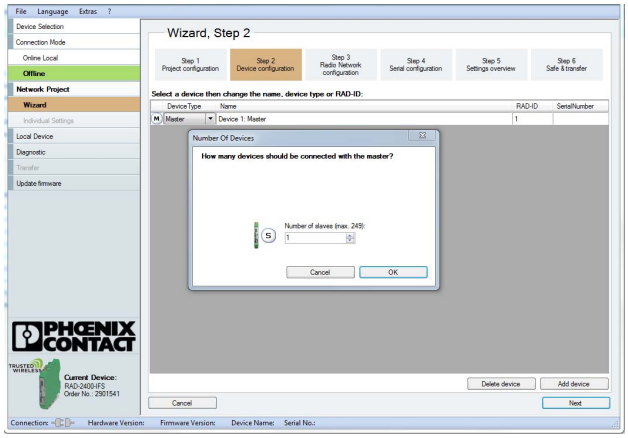


Figure 1-5 PSI-CONF software: “Wizard, Step 2”

- In step 3, select the “Serial data” network application. Configure the network settings:
  - RF band
  - Network ID
  - Optional: show/hide WLAN channels
- Depending on the distance between the wireless modules, you can set the desired data rate under “Network speed/distance relation”.

| Data transmission rate [kbps] | Typical receiver sensitivity [dBm] | EIRP (max. radiated power) [dBm] | Potential distance with line of sight and 12 dB system reserve [m] |
|---|---|---|---|
| 250 | -93 | 20 (Europe: 19) | 1000 |
| 125 | -96 | 20 (Europe: 18) | 3000 (Europe: 2000) |
| 16 | -106 | 20 (Europe: 11) | 5000 (Europe: 3000) |

- Then confirm with “Next”.

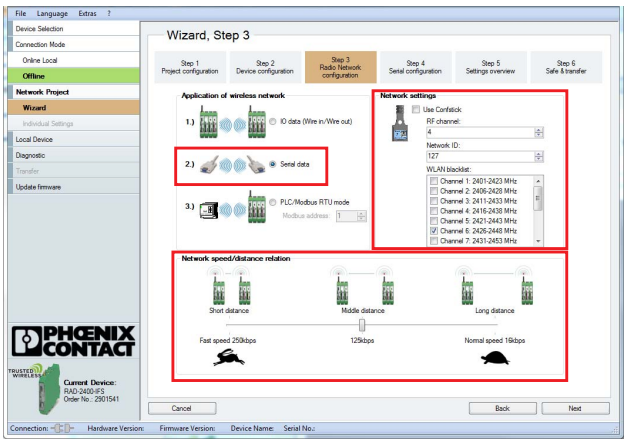


Figure 1-6 PSI-CONF software: “Wizard, Step 3”

- Select the PROFIBUS connection profile in step 4.
- Set the same serial PROFIBUS data rate as the one set in the PROFIBUS master. Depending on the distance to be covered, you may need to reduce the serial data rate (wireless interface 125 kbps or 250 kbps).
- Confirm with “Next”.

Due to the increased delay time, PROFIBUS transmission with 16 kbps is **not** possible.

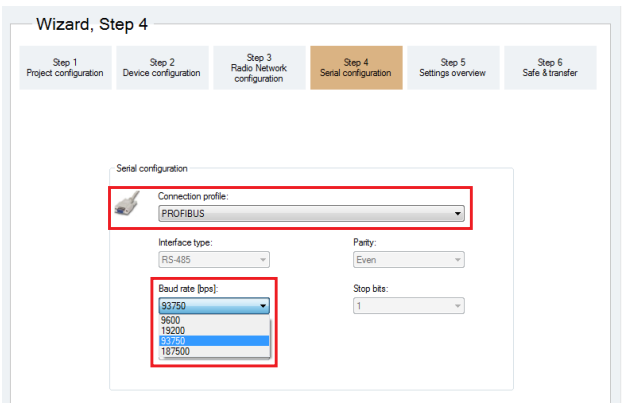


Figure 1-7 PSI-CONF software: “Wizard, Step 4”

- In step 5, you will see an overview of the settings that have already been made. Check these settings and confirm with “Next”.

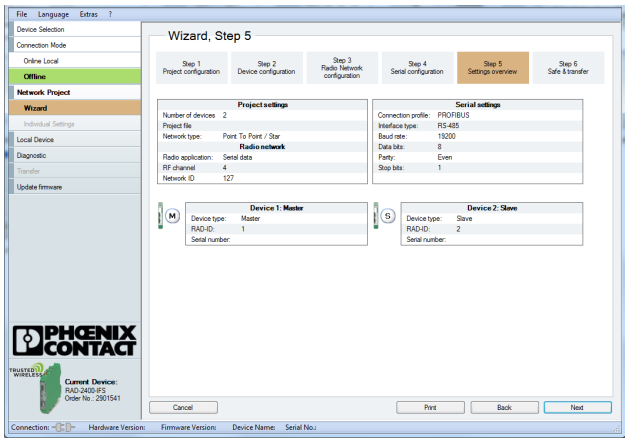


Figure 1-8 PSI-CONF software: “Wizard, Step 5”

- Save the project in step 6.

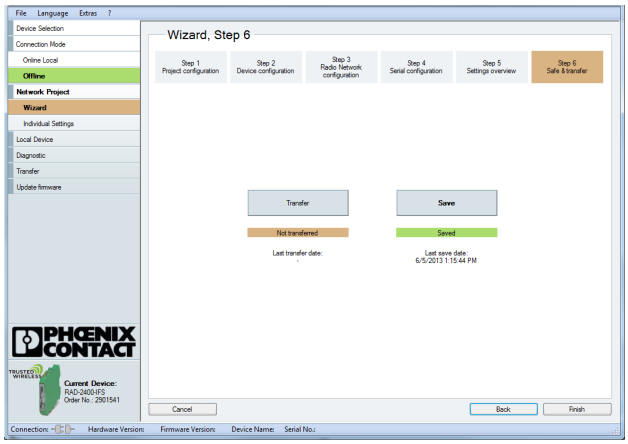


Figure 1-9 PSI-CONF software: “Wizard, Step 6”

- Open “Individual Settings” and set “Transmissions” to 2. Save the settings again. Click on “Transfer” to transfer the settings to the devices.

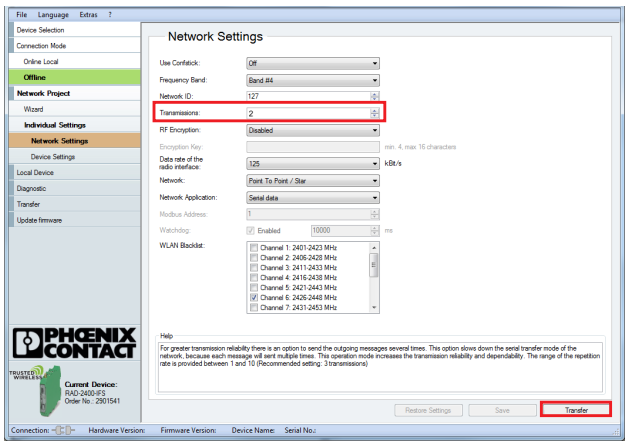


Figure 1-10 PSI-CONF software: “Network Settings”

## 4.1 Connecting the PROFIBUS cable

- Connect the PROFIBUS cable to both wireless modules:
  - Negative data conductor (green) to terminal block D(A) 4.1
  - Positive data conductor (red) to terminal block D(B) 4.2
- Activate bus termination if the wireless module is used at the start or the end of the electrical PROFIBUS segment. To do this, set DIP switches 1 and 2 to ON. The DIP switches are located on the side of the wireless module.

### 4.2 Configuring the PROFIBUS master

- Adjust the timing in the PROFIBUS master to the signal runtime via the wireless path.

This setting is shown here using the SIMATIC® Manager, Version 5.x, as an example.

The wireless module does not support the SIMATIC® PCS 7 process control system.

The wireless modules do not modify the PROFIBUS telegram (transparent transmission, tunneling). They only modify the PROFIBUS cycle time. In the case of an optimum wireless connection, the wireless modules will cause a delay time of approximately 50 ms, unidirectionally approximately 25 ms.

If the wireless component is connected in series with other components that also cause a delay time, the delay times must be added together. Please also take into account:

– Long cables
– Repeaters
– Fiber optics
– Other wireless components

The additional delay time may be increased in the event of a poor wireless connection. The connection may be terminated completely. In the event of a poor connection, the wireless module would not discard PROFIBUS telegrams but repeatedly try to send them.

- For the wireless connection, consider the following PROFIBUS situations:
  – **In the PROFIBUS master - minimum delay time of 50 ms**
    Tslot_Init parameter (maximum wait time for receipt)
  – **In the PROFIBUS master - short interruption of the wireless connection**
    Retry-Limit parameter (maximum number of connection retries)
  – **In the PROFIBUS slave - permanent interruption of the wireless connection**
    Response monitoring time (watchdog) parameter
  – The telegram length depends on the data transmission speed:

| | | PROFIBUS [kbps] | | | |
|---|---|---|---|---|---|
| | | **9.6** | **19.2** | **93.75** | **187.5** |
| **Wireless [kbps]** | **250** | 255 | 255 | 220 | 110 |
| | **125** | 255 | 255 | 110 | 0 |

  – 1 analog value = 1 word = 2 bytes
    ⇒ OTA125k@PB93.75k = 110 bytes = 55 analog values
  – 1 digital value = 1 bit = 8 values per byte
    ⇒ OTA125k@PB93.75k = 110 bytes = 880 digital values
- You have two options for setting the Tslot_Init parameter (maximum wait time for receipt):
  – **Automatically:** Enter the number of repeaters and the cable length under “Options, Cables”.
  – **Manually:** Directly enter the bus parameters under “User-defined, Bus Parameters”. In this case, deactivate the automatic calculation, otherwise the sum of automatic and manual entry will be used.

We recommend that you use manual entry:

– Entry: Tslot_Init >13000 t_Bit
– Entry: retry limit >3
– Recalculate
– Entry: response monitoring time, depending on the application

Under certain circumstances, the Tslot_Init value may need to be larger than 13000 t_bit. This may be the case, for example, if there is a poor wireless connection or if the components are connected in series. The value of 50 ms will increase by factor x.

The Tslot_Init parameter is expressed in t_bit. The maximum value for a Siemens S7 PLC is 16383 t_bit (S5: 9999 t_bit). The maximum wait time for receipt is therefore 93.75 kbps = 174 ms. In this case, the value 13000 t_bit is the minimum delay time of the wireless module + reserve.

- Start SIMATIC® Manager. Open your user project. Select “Options, Configure Network” from the pull-down menu.

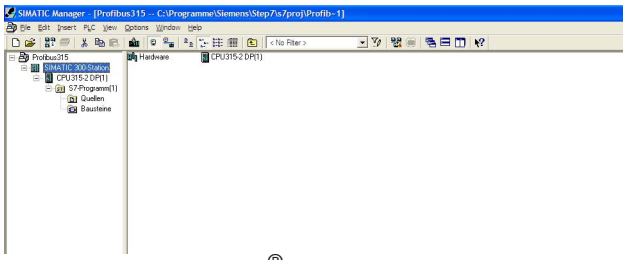

Figure 1-11 SIMATIC® Manager

- In the “NetPro” window, right-click the PROFIBUS line. Then select “Object Properties” from the context menu.

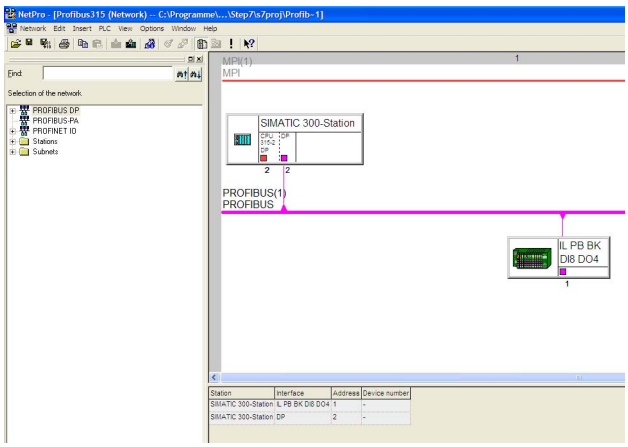


Figure 1-12 “NetPro” window

- In the “Network Settings” tab, select a transmission rate of 93.75 kbps.
- Click on “Options”.

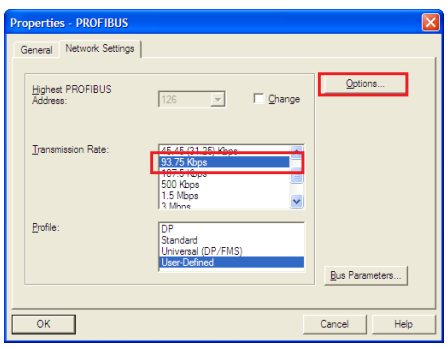


Figure 1-13 “Network Settings” tab, transmission rate

- In the “Cables” tab, deactivate the “Take into account the following cable configuration” check box. Confirm with “OK”.

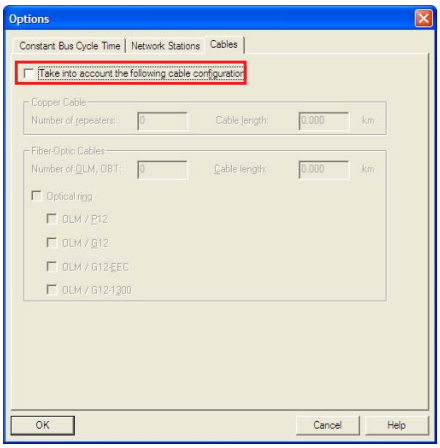


Figure 1-14 “Cables” tab

- In the “Network Settings” tab, select the “User-Defined” profile and the “Bus Parameters” option.

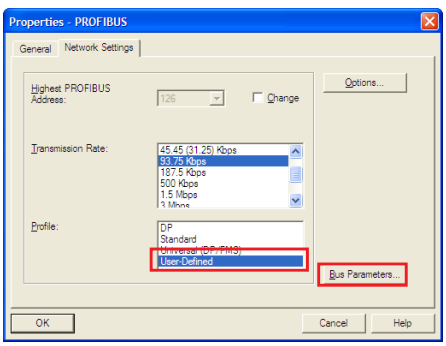


Figure 1-15 “Network Settings” tab, profile

- The most recently valid bus parameters are shown in the “Bus Parameters” tab. Enter the following values:

The value for the Tslot time and the telegram runtime of PROFIBUS depend on your application. Start with 13000 t_bit in order to achieve the smallest possible telegram runtime. Increase the value if bus errors occur.

| | |
|---|---|
| Tslot_Init | 13000 t_Bit ... 16383 t_Bit |
| Max. Tsdr | 60 |
| Min. Tsdr | 11 |
| Tset | 1 |
| Tqui | 0 |
| Gap Factor | 10 |
| Retry limit | 5 |

- Confirm the entry with “Recalculate”.

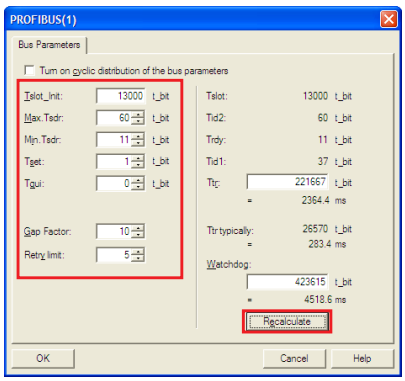


Figure 1-16 “Bus Parameters” tab

- Calculating the bus parameters also modifies the response monitoring (watchdog) value. Enter 93750 t_bit here to achieve a response monitoring (watchdog) time of 1 second for the PROFIBUS slave. Confirm with “OK”.

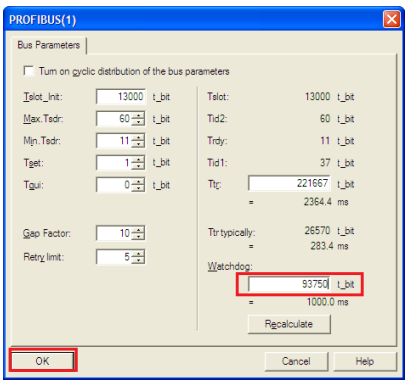


Figure 1-17 “Bus Parameters” tab, response monitoring

- Go back to the “NetPro” view. Save and compile the changes.
- Transfer all settings to the PROFIBUS master.
- Test the accessibility of the PROFIBUS devices via the wireless path.

### 4.3 PROFIBUS controller in DP slave mode

You can change the operating mode of the PROFIBUS controller under “Properties - DP”. The DP controller can be operated as a master or slave.

To ensure error-free operation, the “Test, commissioning, routing” check box must **not** be enabled. If this option is activated, the interface becomes an active PROFIBUS device and takes part in the token rotation of PROFIBUS.

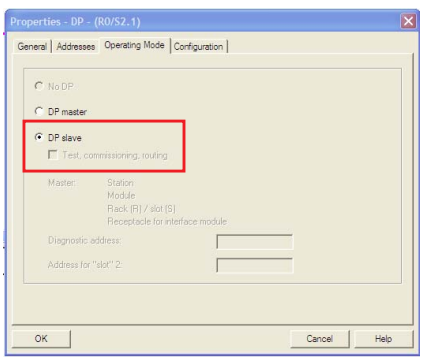


Figure 4 “Properties - DP” tab

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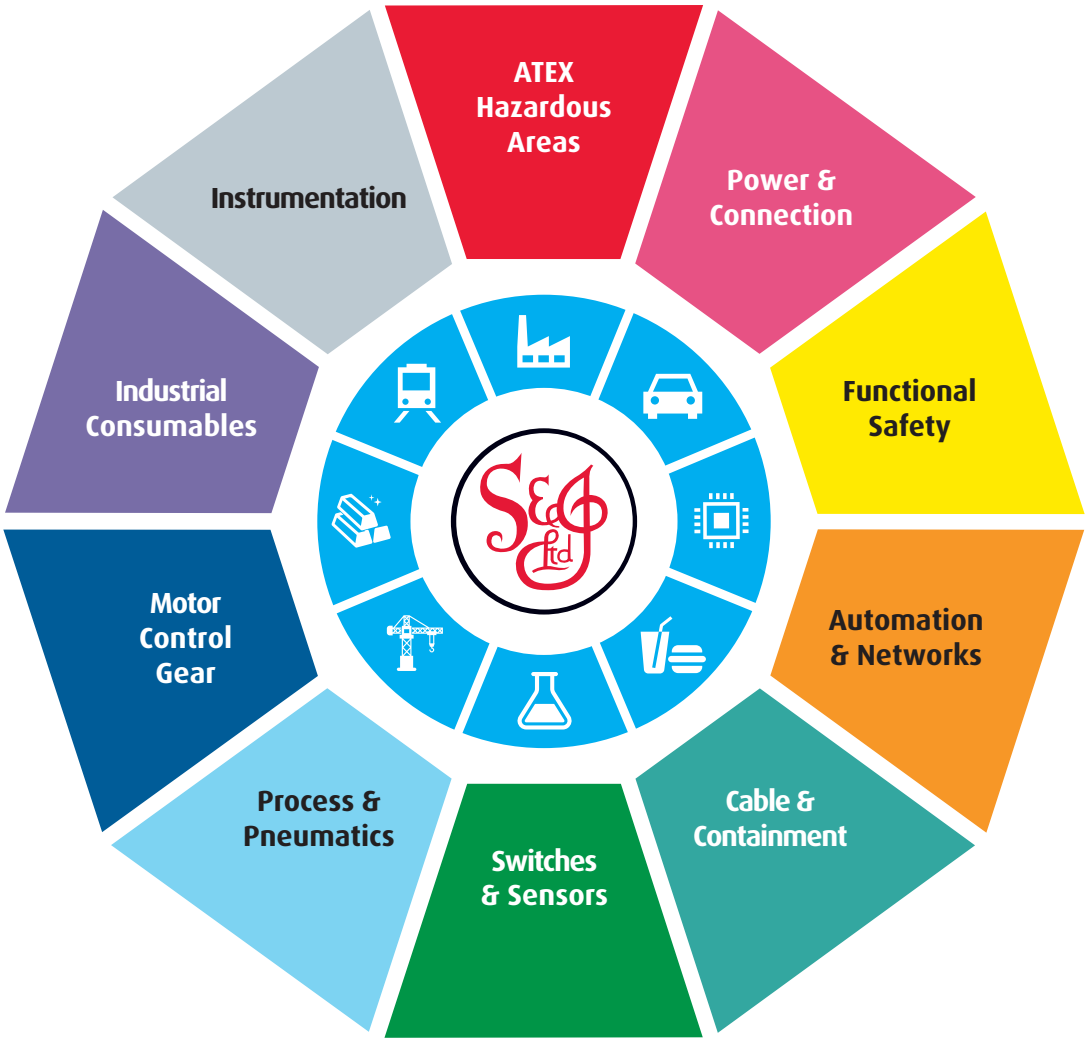


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