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RAD-...-IFS ABB S900

PROFIBUS via Radioline with ABB S900 and Composer

Application note
107063_en_00

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1 Description

This document describes how to establish a wireless PROFIBUS connection via Trusted Wireless. In addition, it also describes how to install a point-to-point or a star connection.

You will need the following products:

Quantity	Order No.	Designation	Description
2	2901541	RAD-2400-IFS	2.4 GHz wireless module
1	2903447	RAD-CABLE-USB	USB cable for configuration and diagnostics
-	-	-	Various accessories such as antennas and adapter cables You can find the approved accessories for this wireless system at phoenixcontact.net/product/2901541
1	-	ABB AC 800M	ABB controller from the 800xA system, PROFIBUS master
1	-	ABB S900, CI920N	ABB I/O system, 46 inputs, 31 outputs, PROFIBUS slave
1	-	Melody Engineering Composer	Version 5.1, engineering software

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/product/2901541.

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2 Application example

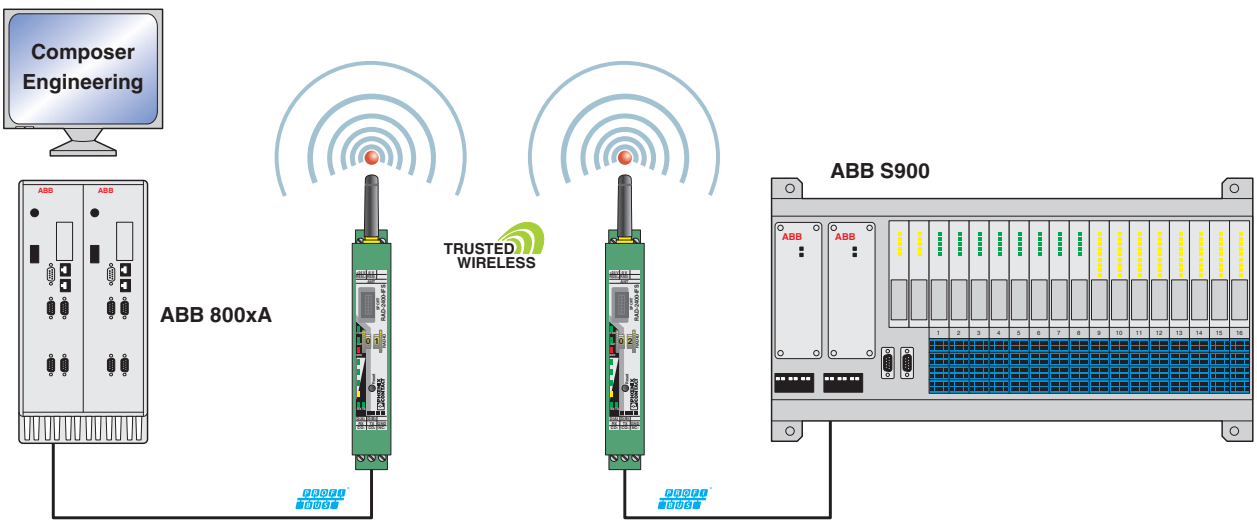

Figure 1 PROFIBUS via Radioline with ABB S900 and Composer

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3 System configuration

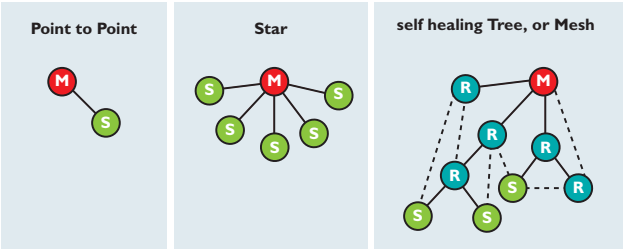

Figure 2 Point-to-point connection, star network, self-healing mesh network

M Master S Slave R Repeater

Point-to-point/star

A point-to-point/star network can only consist of one master and up to 249 slaves. This network structure is characterized by each slave that is directly connected to the master. In this structure, exchanging data is quick.

Line/mesh

A mesh network can only consist of one master and up to 249 repeaters/slaves. A mesh network features repeater functions which the wireless network can use to repair lost connections itself.

Within a very short period of time, the devices automatically establish an alternative connection path. The time depends on the data rate set for the wireless interface.

If you select the “line/mesh” network type, the delay time is increased. In this setting, every wireless module works as a repeater/slave. The delay time depends on the number of repeaters/slaves in the network and the data rate set for the wireless interface (125 kbps or 250 kbps).

The Radioline wireless module can perform the following functions in the wireless network:

Master: the master wireless module forms the central point in the network. It coordinates initialization and network-specific functions. Wireless connections cannot be established without the master. The master in a wireless network is usually located at a central point, e.g., in the control center. The PLC connected to the master is responsible for managing the transmission of serial data.

There may only be one master in the network. The master has the RAD ID = 01.

Slave: slaves are always an end point in the network and are not able to transmit data to other devices. You can connect the PLC slaves to a slave wireless module. In contrast to a master wireless module, a slave wireless module only has subordinate rights.

Repeater/slave: a repeater/slave can transmit data to other devices. As a result, you can establish line or mesh structures.

A repeater/slave wireless module fulfills two functions:

– Repeater: the device receives data and transmits it.
– Slave: the device sends data to its serial interface.

You can also connect a slave PLC to each repeater/slave wireless module.

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4 Configuring a PROFIBUS connection

PROFIBUS connections are only possible with the RAD-2400-IFS 2.4 GHz wireless module.

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/products.
- Install the software on your computer.

WARNING: Explosion hazard when used in potentially explosive areas

Do **not** use the USB cable in potentially explosive areas.

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

Configuring a point-to-point connection

- Start the PSI-CONF software.

Figure 1-1 PSI-CONF software

- In the “Wireless” folder, select the device.

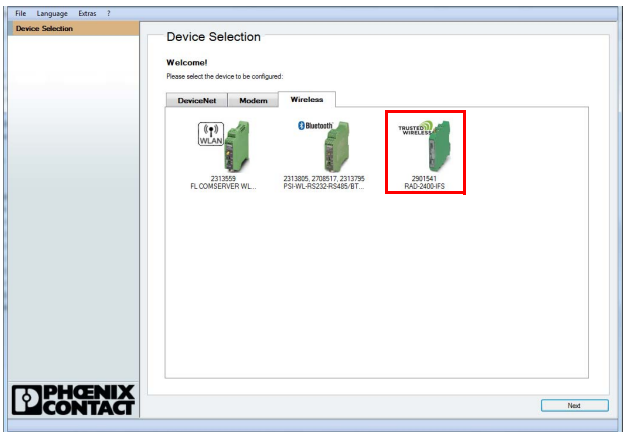

Figure 1-2 PSI-CONF software: Device Selection

- Select “Create new network project”.

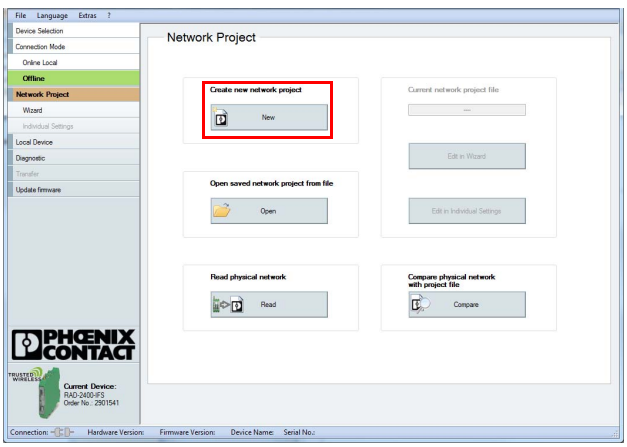

Figure 1-3 PSI-CONF software: Network Project

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

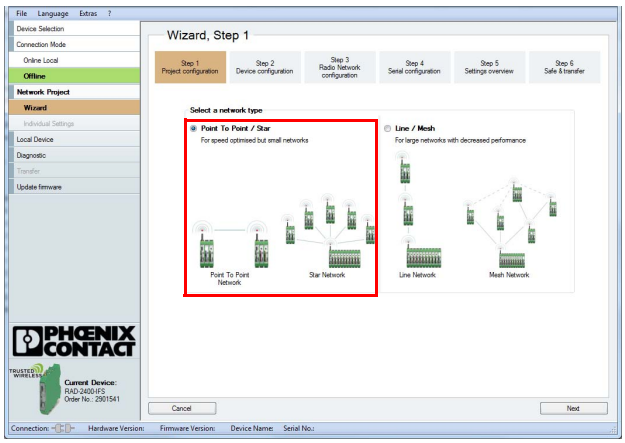

Figure 1-4 PSI-CONF software: Wizard, Step 1

If you select the “Line / Mesh” network type, every wireless module works as a repeater/slave. The result of this is an increased delay time. The delay time depends on the number of repeaters/slaves in the network and the data rate set for the wireless interface (125 kbps or 250 kbps).

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

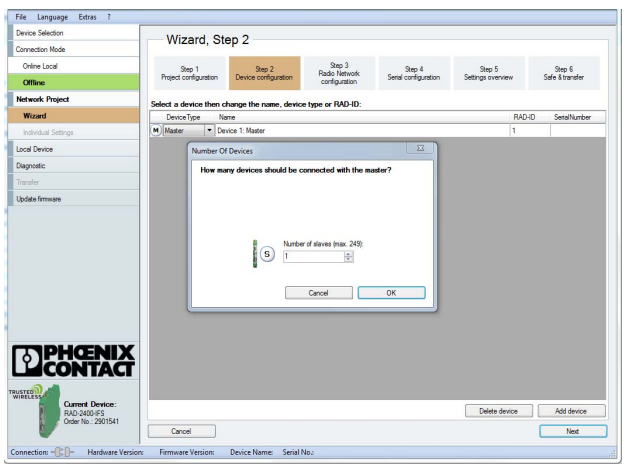

Figure 1-5 PSI-CONF software: Wizard, Step 2

- In step 3, select the “Serial data” network application. Configure the network settings:
  - RF band
  - Network ID
  - Optional: show or hide WLAN channels
- Depending on the distance between the wireless modules, you can set the required data rate under “Network speed/distance relation” (125 kbps or 250 kbps).

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

- Then confirm with “Next”.

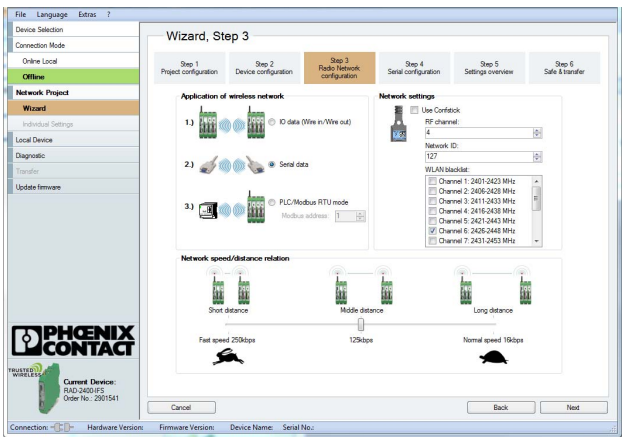

Figure 1-6 PSI-CONF software: Wizard, Step 3

Trusted Wireless 2.0 receiver sensitivities, 2.4 GHz:

Data transmission speed [kbps]	Typical receiver sensitivity [dBm]	Potential distance that can be covered with line of sight and a system reserve of 12 dB [m]
250	-93	1000
125	-96	2000

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- Select the PROFIBUS connection profile in step 4. Set the required data rate. Confirm with “Next”.

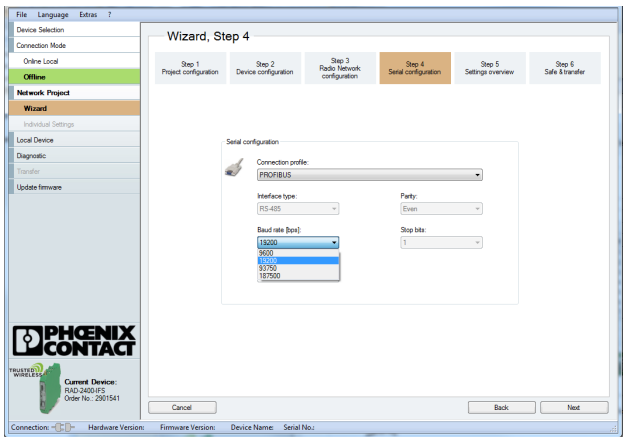

Figure 1-7 PSI-CONF software: Wizard, Step 4

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

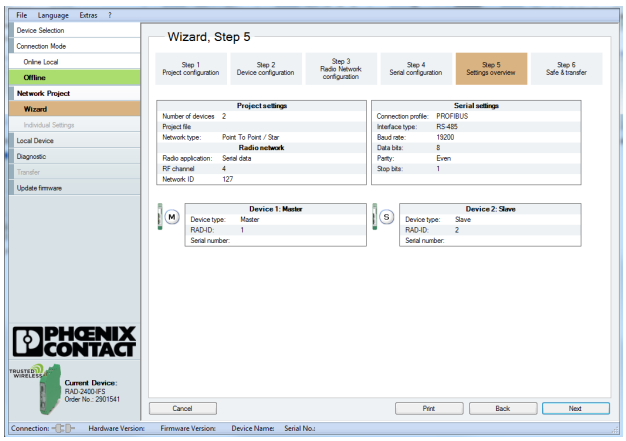

Figure 1-8 PSI-CONF software: Wizard, Step 5

- Save the project in step 6.

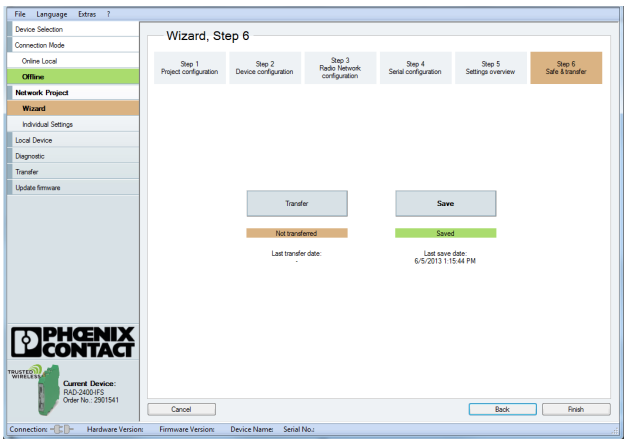

Figure 1-9 PSI-CONF software: Wizard, Step 6

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

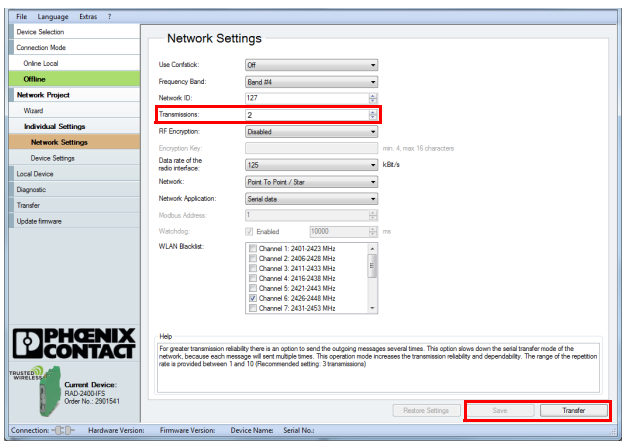

Figure 1-10 PSI-CONF software: Network Settings

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5 Adjusting PROFIBUS

5.1 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 located 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.

5.2 Configuring the PROFIBUS master

- Adjust the timing in the PROFIBUS master so that it corresponds to the signal runtime via the wireless path.

The adjustment is shown here for the following example:

– Melody Engineering Composer, Version 5.1 with

– ABB S900 (CI920N, 46 inputs, 31 outputs)

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 note the following:

– Cables

– Repeaters

– Fiber optics

– Other wireless components, etc.

The additional delay time may be increased in the event of a poor wireless connection, or the connection may be terminated completely. In the event of a poor connection, the wireless module does not discard PROFIBUS telegrams but repeatedly tries to send them. You can set the number of repetitions.

- For the wireless connection, consider the following PROFIBUS situations:
  - **In the PROFIBUS master: minimum delay time of 50 ms**
    Delta Slot Time 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. Possible telegram lengths:

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

When setting the maximum wait time for receipt (Slot Time), observe the following:

– Entry: Delta Slot Time + Slot Time > 13000 t_bit

– Entry: Retry Limit > 5

– Entry: Response monitoring time, depending on the application

– Baudrate: 93.75 kbps

The Delta Slot Time 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.

Example: with 93.75 kbps and a total time of 16383 (Delta Slot Time = 16000 + Slot Time = 383), the resulting wait for receipt time is 174 milliseconds. In this case, the value 13000 t_bit is the minimum delay time of the wireless module + reserve.

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5.3 Composer

- Start Composer.
- Switch to the “Bus Topology Structure” view.
- Select the required PNK and the corresponding PROFIBUS DP port.
- Right-click on the port to open the context menu.
- Select “Display DP-Configuration”.

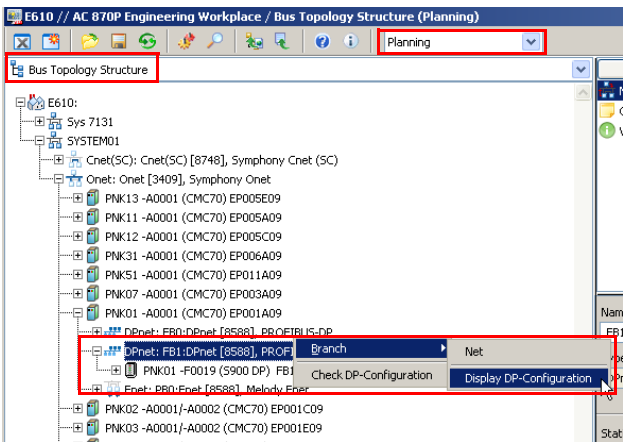

Figure 3 Composer: Display DP-Configuration

- Go to the “More FDL Parameters” tab.
- Set the “Retry Limit” to 5.

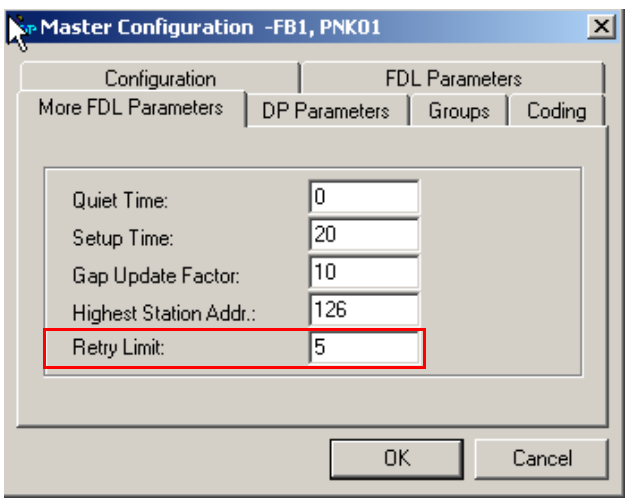

Figure 4 Composer: Retry Limit

- Go to the “FDL Parameters” tab.
- Set the baudrate to 93.75 kBaud.
- Set the Delta Slot Time to 16000.

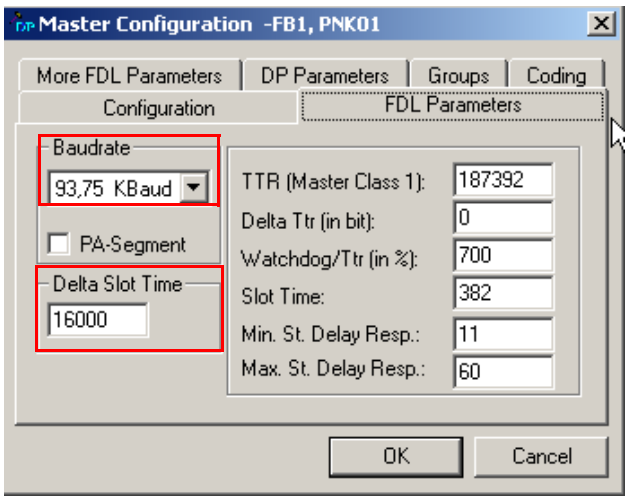

Figure 5 Composer: Baudrate and Delta Slot Time

- Go to the “DP Parameters” tab.
- Set the “Watchdog Timeout” to a value greater than 4000 ms.
- Confirm with “OK”.

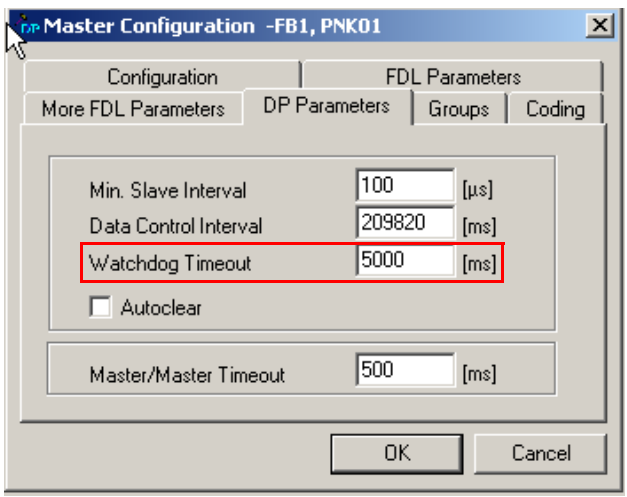

Figure 6 Composer: Watchdog Timeout

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Summary of the bus parameters

Delta Slot Time	16000
Slot Time	382
Retry Limit	≥5
Watchdog Timeout	>4000

These parameters have been determined with a wireless interface data rate of 125 kbps.

The value for the Slot Time and the telegram runtime of PROFIBUS depend on your application. To achieve the smallest possible telegram runtime, start with 13000 t_bit. If bus errors occur, increase the value.

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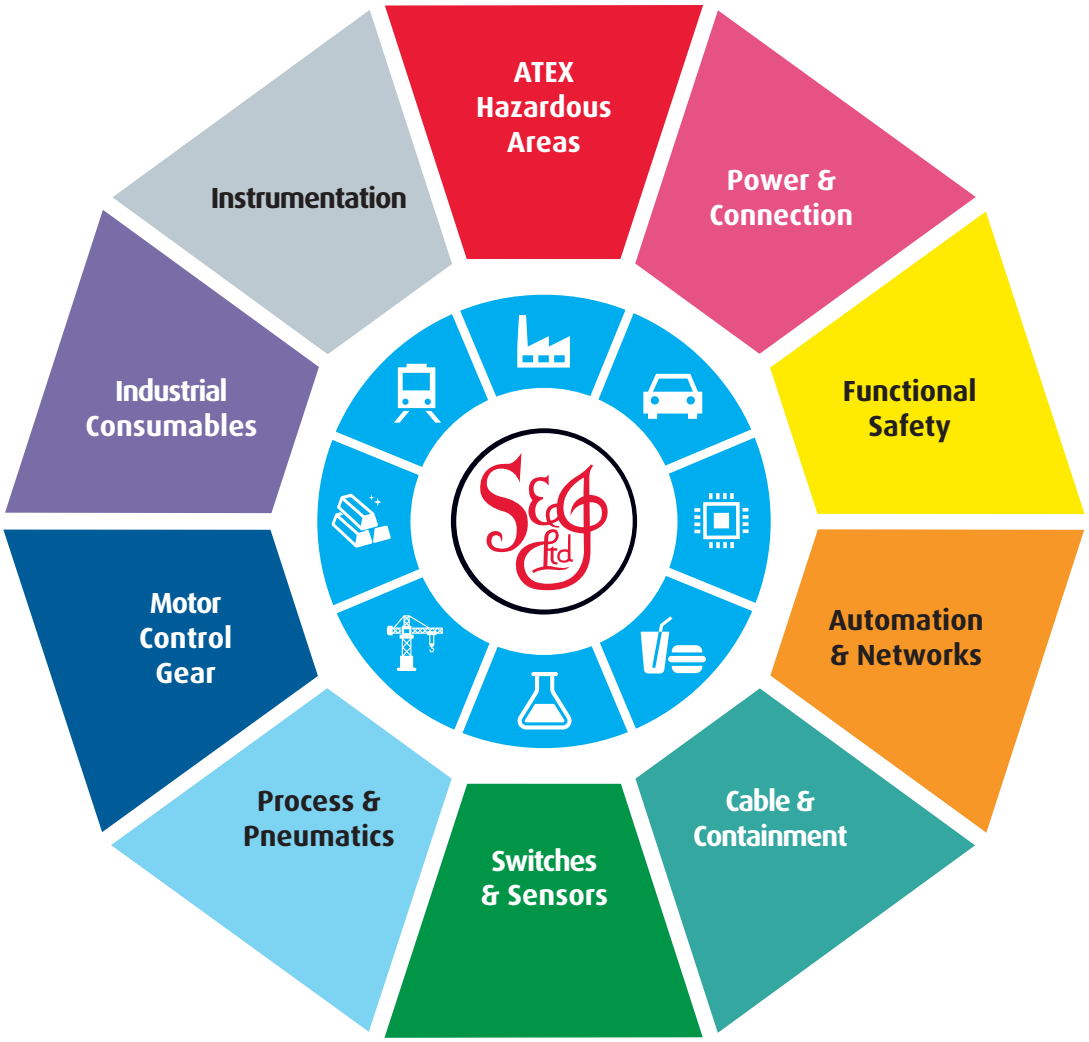

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