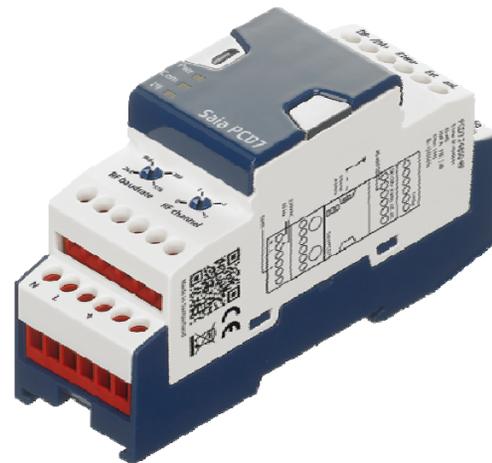




# RF-Modem PCD7.T4850-RF

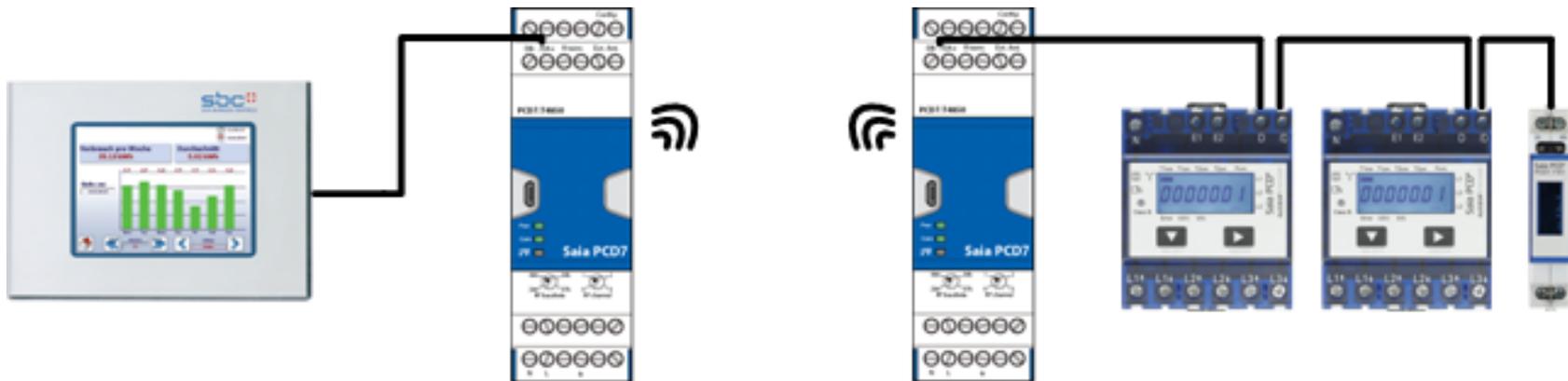
P. Hurni | 14.01.2016



**sbc**   
SAIA BURGESS CONTROLS

# PCD7.T4850-RF / General information

- The RF-modem transmits the data from the integrated RS-485 interface for Modbus and S-Bus protocol
- Internal antenna, no additional HW needed
- Connection of an external antenna to increase the communication distance.
- The device works on the 869MHz frequency band, which is free for use in whole European-Union incl. Norway and Switzerland
- Typically for cable replacement projects



# General functionalities

**R term:**

ON/OFF for the end of line resistor

**Config:**

Configuration mode

**DB- /DA+:**

RS-485 interface

**Ext. Ant.:**

ON/OFF external antenna

**Connection external Antenna**

**Status LED:**

- PWR
- Com
- 

**Radio channel:**

- 0: 869.475 MHz
- 1: 869.525 MHz
- 2: 869.575 MHz
- 3: 869.600 MHz

**Radio baud rate:**

- 2400 bps
- 9600 bps
- 38000 bps
- 57600 bps

**Power supply:**

230VAC ( $\pm 20\%$ ), 50Hz



# Status LED



Status LED

## Status LED:

- **PWR:**  
Activated if the external power supply is turned on and the RF-Modem has done the startup sequence.
- **Com:**  
Shows the communication activity (radio and wired)
- **RF:**
  - Off: No or very poor RF connectivity
  - Blinking: Average radio connectivity
  - On: Good radio connectivity

# Radio transmission speed



Radio baud rate

## Radio transmission speed

Four transmission speeds are available on the RF-modem

- 2400 baud
- 9600 baud
- 38400 baud
- 57600 baud

**The radio transmission speed has a direct influence on the communication distance!**

Transmission speed (baud)	Internal antenna (100mW)	External antenna (100mW)
2400	1000m	6000m
9600	900m	5000m
38400	700m	4000m
57600	600m	3000m

All values are LOS (line of sight), direct communication distance without any obstacles

# Radio channel

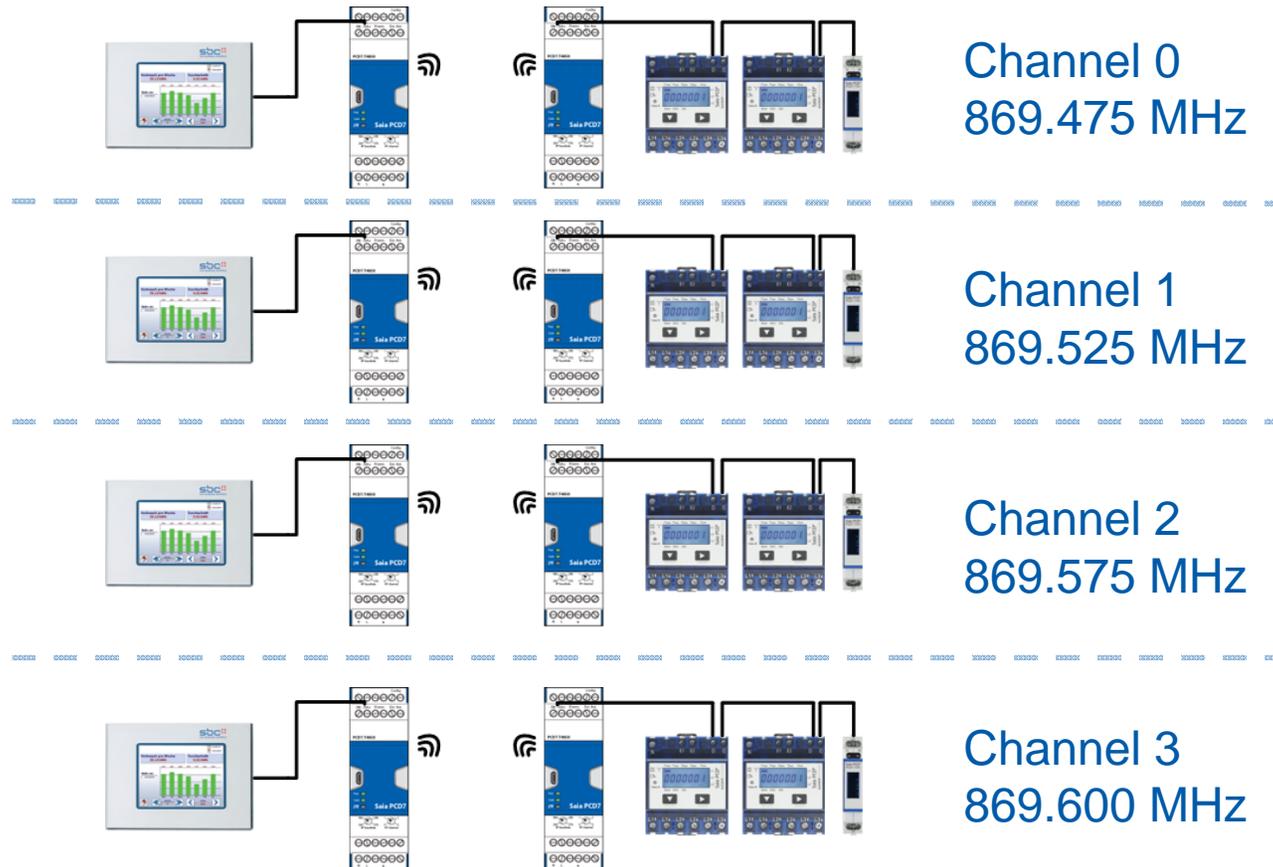
## Radio channels

Allows to have 4 different installations in one network



### Radio channel:

- 0: 869.475 MHz
- 1: 869.525 MHz
- 2: 869.575 MHz
- 3: 869.600 MHz



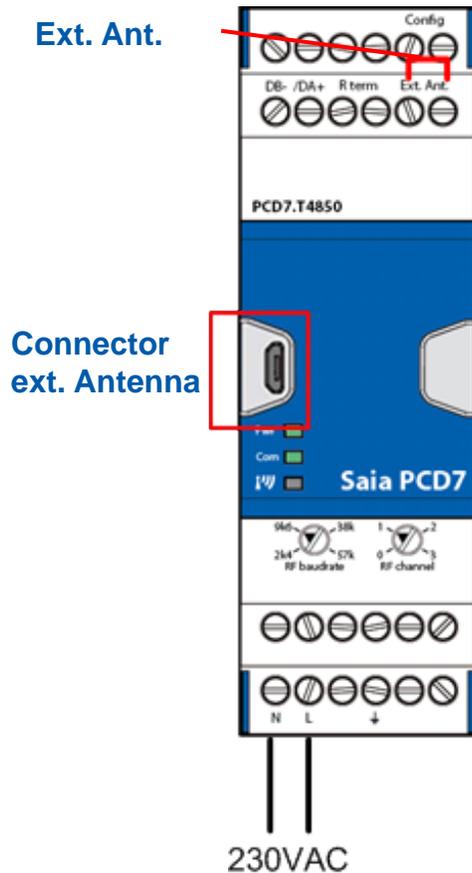
Channel 0  
869.475 MHz

Channel 1  
869.525 MHz

Channel 2  
869.575 MHz

Channel 3  
869.600 MHz

# Radio settings / internal external antenna



## Internal antenna:

- For the use of the internal antenna, no manipulation on the device is necessary
- Distances from around 1000m, line of sight (free field), 2k4baud, are maximal reachable

## External antenna:

- To use the external antenna, a short-circuit bridge on the connector “Ext.Ant.” must be made. (e.g. a copper wire)
- To connect the external antenna to the RF-modem, the adapter uUSB-SMA must be used.
- Use the PCD7.K840 antenna or each other SMA-antenna which is useable for 869MHz
- Distances from around 6000m, line of sight (free field), 2k4baud, are maximal reachable



The uUSB connector is only for the external RF-antenna.  
No other function is available.

# Radio settings / internal external antenna

---



External Antenna PCD7.K840 is available from stock in Murten.



Adapter to connect an external antenna with SMA connector to the micro USB on the housing. This allows to increase the wireless communication distance. This adapter is delivered with the RF-modem. SKU for this adapter is 32300899-001.



RF-modem with the adapter and the external antenna PCD7.K840

# Wired RS-485 settings

DB- /DA+:  
RS-485  
interface



- The RF-Modem has an integrated RS-485 Interface
- Connector: DB- /DA+
- Baud rate: 2k4, 4k8, 9k6, 19k2, 38k4, 57k6, 115k2bps
- Parities: 8E1, 8O1, 8N1, 8N2

Auto detection of Baudrate / parities at power up

- Protocol: Modbus, S-Bus
- Protocol buffer: max. 300 Bytes
  
- Timeout table: see next page



The limitation of the 10% transmission time is prescribed in the standard ERC 70-03. The reason is that no device has to block permanently a frequency band more than 10 percent. This limitation must be driven by the master device, which is connected over RS-485 to the RF-modem.

# Wired RS-485 settings

To prevent retries, we recommend to use the following timeout settings:

For 32 registers (All values in milliseconds)								
		RS-485 baud rates [bps]						
		2400	4800	9600	19200	38400	57600	115200
RF baud rates [bps]	2400	3300	2600	2350	2250	2200	2150	2150
	9600	1750	1100	850	700	650	650	600
	38400	1350	650	450	300	250	250	200
	57600	1300	650	400	250	200	200	150

For 64 registers (All values in milliseconds)								
		RS-485 baud rates [bps]						
		2400	4800	9600	19200	38400	57600	115200
RF baud rates [bps]	2400	6550	5200	4700	4500	4350	4300	4300
	9600	3500	2150	1650	1400	1300	1250	1200
	38400	2700	1300	850	600	500	450	400
	57600	2600	1250	750	500	400	350	300



A free timeout calculator is available on the support side.  
<https://www.sbc-support.com/en/product-index/pcd7/txxx-rs485-components/>

# RS-485 settings / end resistor RS-485 line

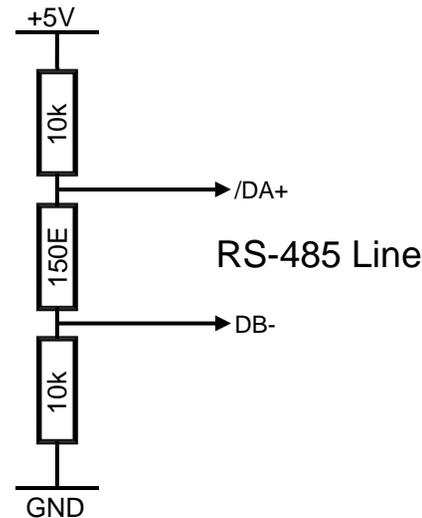
R term:  
End of line resistor



## Activation of the RS-485 end resistor:

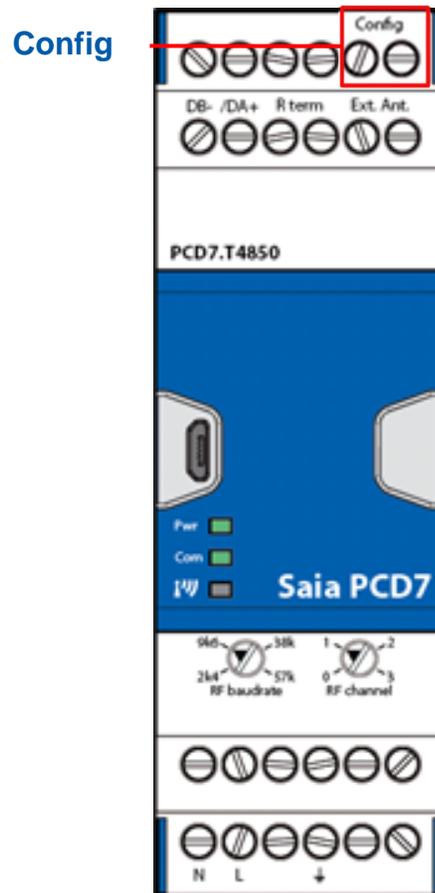
- To activate the end of line resistor, a short-circuit bridge on the connector “R term” must be made. (e.g. a copper wire)
- After the activation, the RS-485 line is completed at this point.
- The bus termination is polarized. (5V/0V)

Schematic of the termination resistor



We always recommend to use a end of line termination to avoid problems on the bus communication.

# Configuration settings



## Configuration mode:

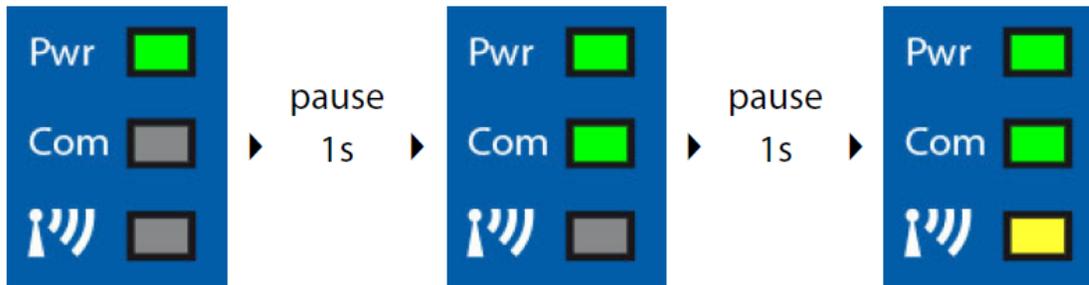
- To enter the configuration mode, a short-circuit bridge on the connector “Config” must be made. (e.g. a copper wire).
- If you entered to the configuration mode, the RF-communication is disabled and the wired baud rate is set to 9600bps, 8N1. The device is waiting for the AT commands. (F-Box, or direct commands over RS-485)
- Removing the short-circuit bridge reinitialize the device, initiate auto bauding and reactivate automatically the RF communication.

## AT commands:

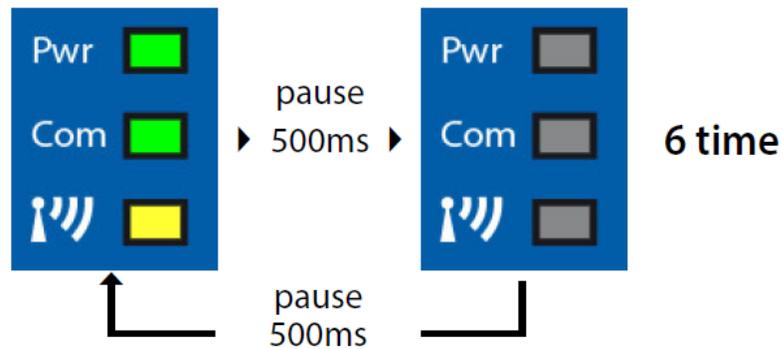
- All commands must be in ASCII format
- Each command/answer must always finished with CR(0x0D) and LF (0x0A)
- After a successful command the device will return a “O” (0x4F)
- If there was a problem with the command, the device will return “E” (0x45)

# LED Sequences of the RF-modem

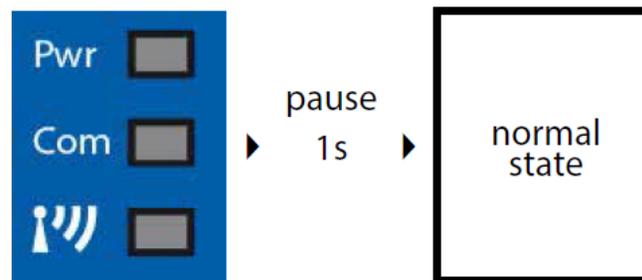
Put in the config mode (if you connect to the config pads)



After a wrong configuration (if the user remove the config-bridge)



After a correct configuration (if user remove the config-bridge)



# Configuration settings

Config



## AT commands table:

- **ATS231** = Configuration of the radio power
- **ATS253** = number of the radio network
- **ATSRST** = Reset of the radio modem
- **ATREAD** = Read of the configuration
- **ATSTAT** = General device information
- **ATRFST** = Signal strength of the RF signal

# Configuration of the radio power (ATS231)

Config



## ATS231 = x; (x could be 0...6)

- 0 = 20 dBm ~ 100mW
- 1 = 18 dBm ~ 65mW
- 2 = 16 dBm ~ 40mW (out of factory)
- 3 = 13 dBm ~ 20mW
- 4 = 10 dBm ~ 10mW
- 5 = 07 dBm ~ 5mW
- 6 = 03 dBm ~ 2mW

## Channels/baud rate vs. max radio power

Channel number	Baud rate RF			
	2k4	9k6	38k4	57k6
0	20 dBm 100 mW	16 dBm 40 mW	16 dBm 40 mW	16 dBm 40 mW
1	20 dBm 100 mW	20 dBm 100 mW	20 dBm 100 mW	20 dBm 100 mW
2	20 dBm 100 mW	16 dBm 40 mW	16 dBm 40 mW	16 dBm 40 mW
3	20 dBm 100 mW	16 dBm 40 mW	16 dBm 40 mW	x*



\* If the channel 3 and the baud rate 57k6 are selected, the modem will automatically switch to channel 2 (869.575 MHz).

# Number of the radio network (ATS253)

Config



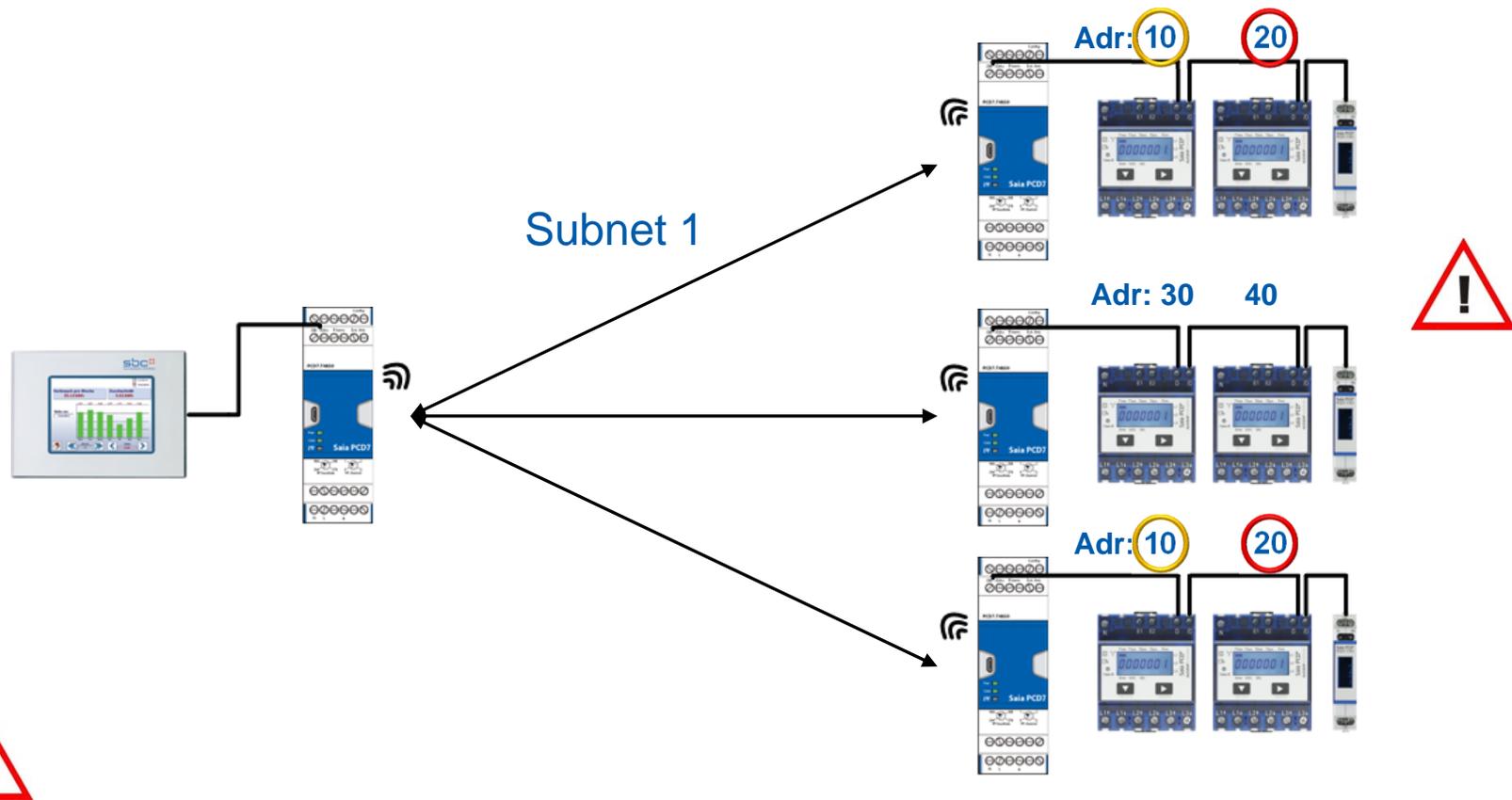
**ATS253 = x; (x could be 1...250 / 255)**

- 1 = Subnet Nr.1 (Standard from factory)
- 2...250 = Number of the subnet in addressing mode
- 255 = Broadcast, all subnets are addressed

# Network structure

## Transparent transmission:

- ATS253 = 1 (standard from factory)
- The communication is sent to all slave devices in the subnet
- The addressing is made only by the S-Bus address in the slave devices

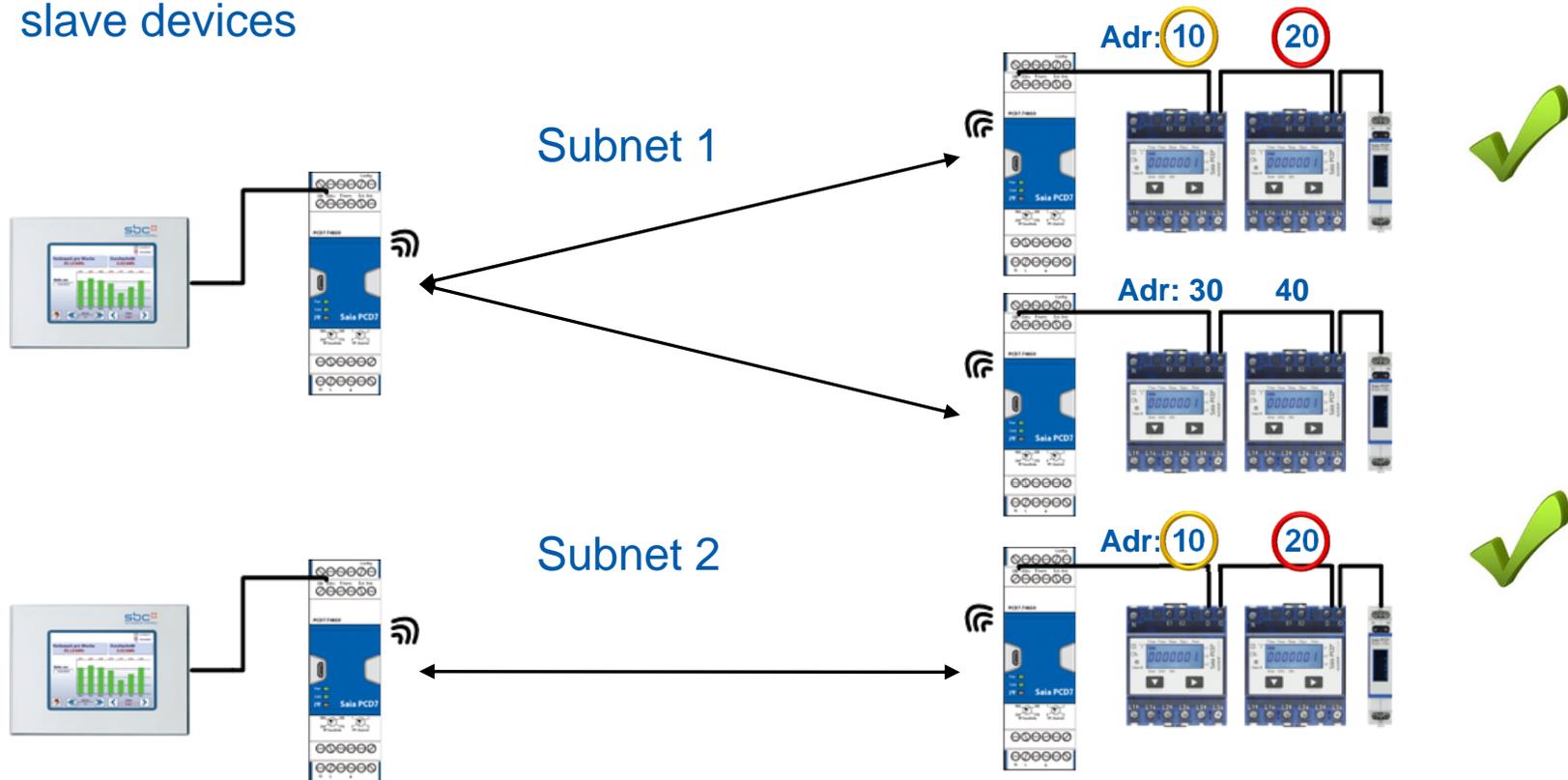


**Twice the same addresses in a subnet gives communication problems**

# Network structure

## Sub-network transmission:

- ATS253 = 1...250, number of subnet
- The communication is sent to all slave devices in the same subnet
- The addressing is made by the subnet number and the S-Bus address in the slave devices

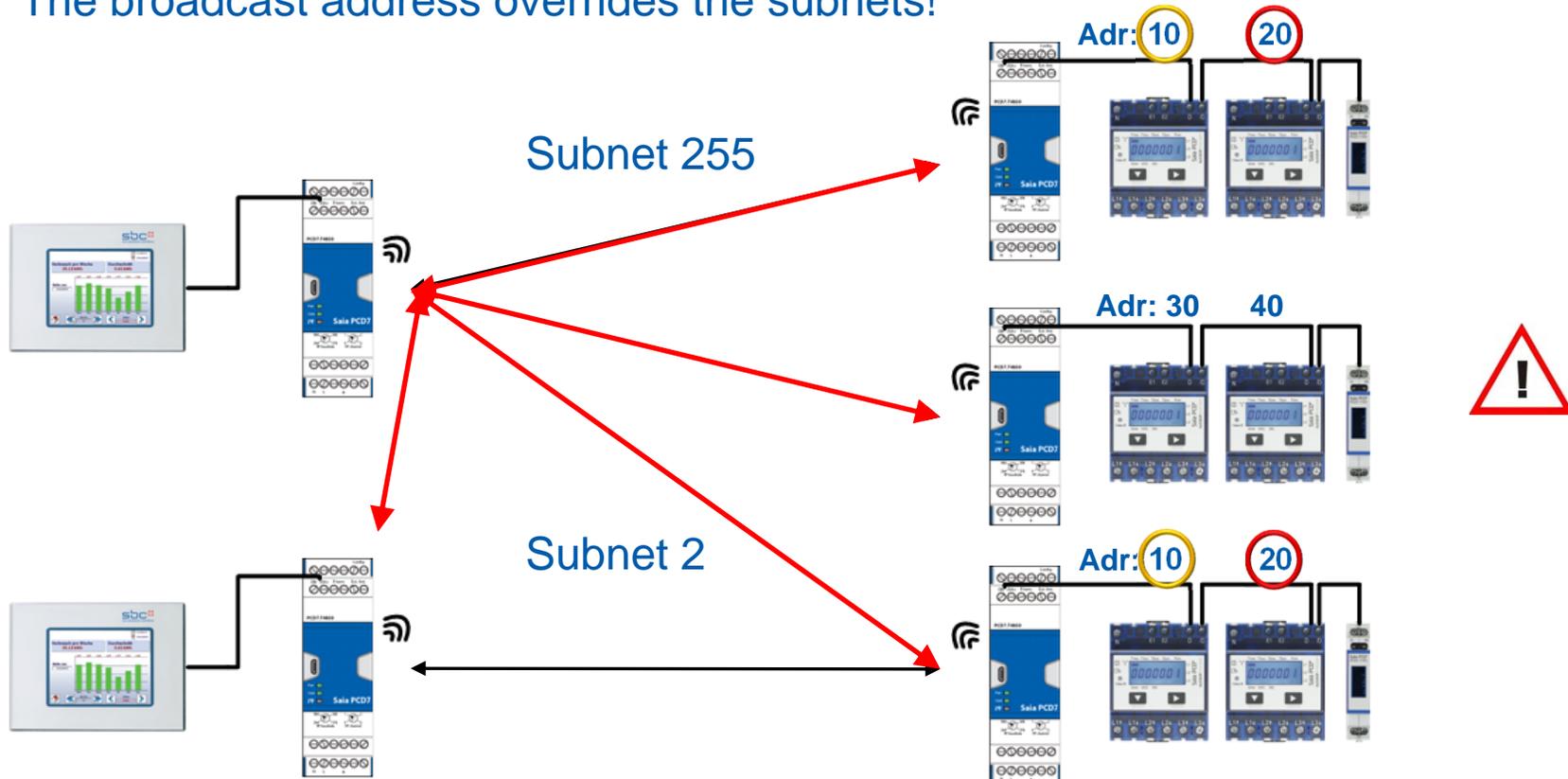


**Twice the same addresses in different subnets is no problem!**

# Network structure

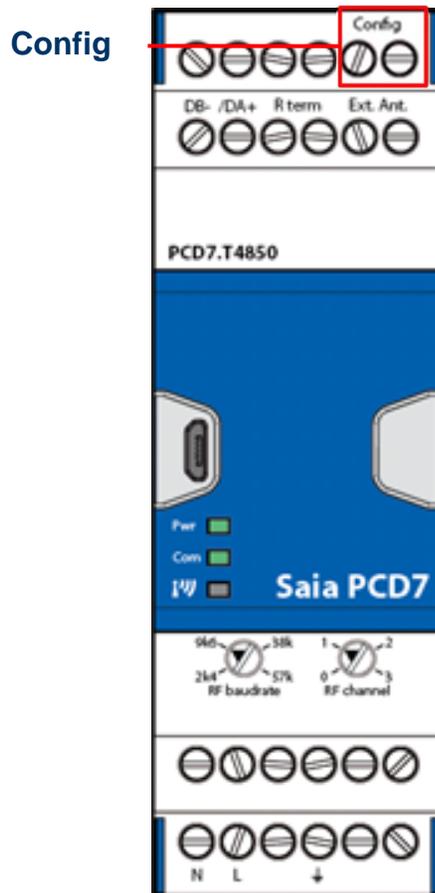
## Sub-network transmission:

- ATS253 = 255, broadcast to all subnets
- The communication is sent to all slave devices in all subnets
- The addressing is made only by the S-Bus address of the slave devices
- The broadcast address overrides the subnets!



**The Subnet 255 should be used only with care!**

# Reset of the radio modem (ATSRST)



## ATSRST;

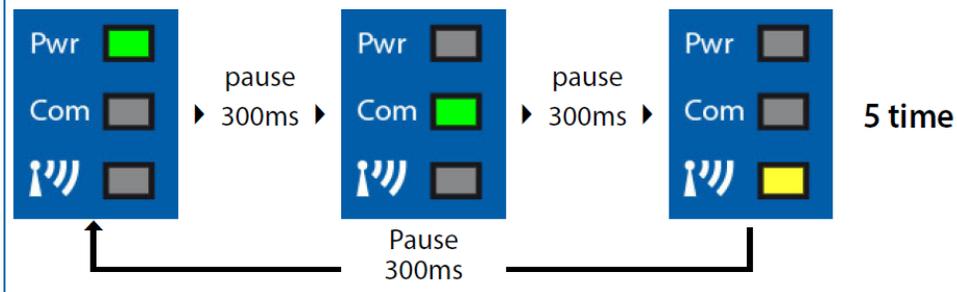
This command makes a factory default of the device. The re-initialization of the RF-Modem takes around 10seconds.

After the factory reset of the RF-Modem the following parameters are set:

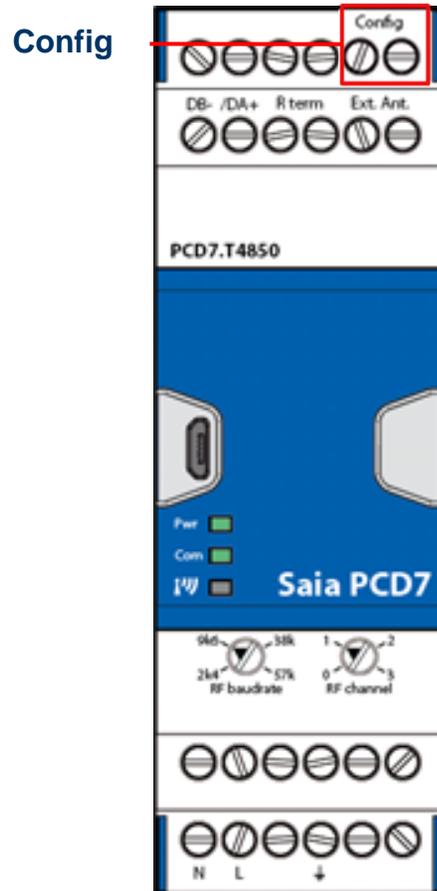
- RF-power: 16dBm (40mW)
- Subnet RF: 1
- Autobaud is initiated on the wired RS-485 interface

### LED Sequences of the RF-modem

After a RESET



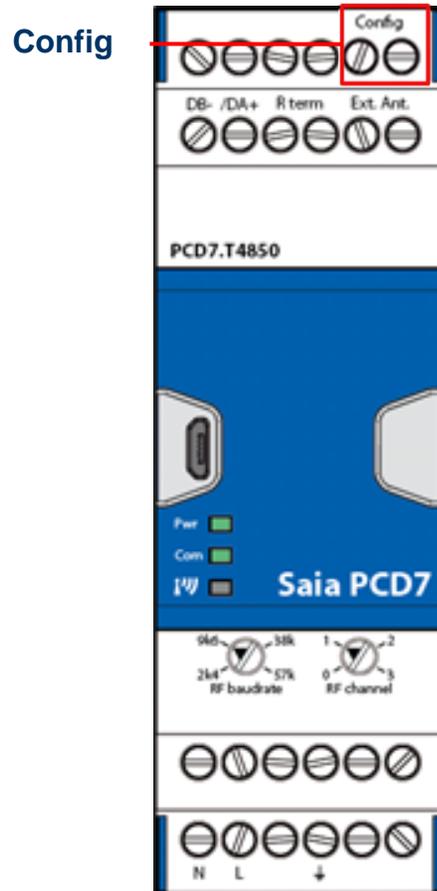
# Read of the configuration (ATREAD)



**ATREAD; The following registers are transmitted in one frame from the device:**

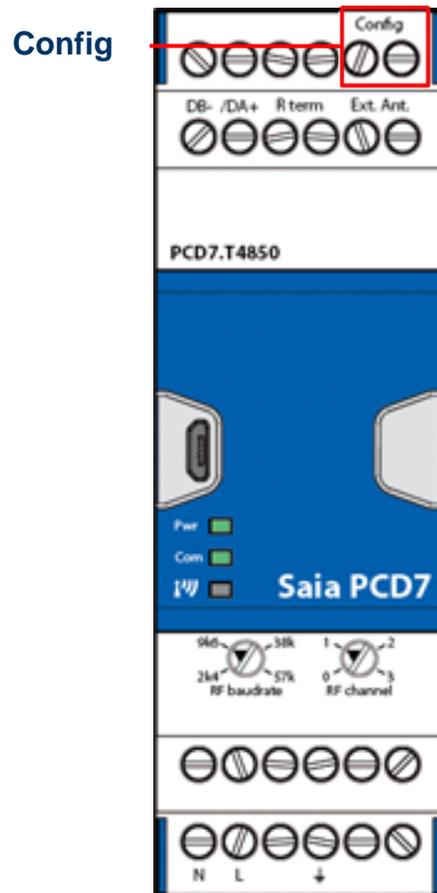
- **ATSMOD=x;** (Mode of the radio modem)  
0 = modem mode
- **ATSTER=x;** (RS-485 end of line resistor)  
0 = disabled  
1 = enabled
- **ATSANT=x;** (active antenna)  
0 = internal antenna  
1 = external antenna
- **ATSBPS=x;** (transmission speed over radio)  
0 = 2400 bps  
1 = 9600 bps  
2 = 38'400 bps  
3 = 57'600 bps

# Read of the configuration (ATREAD)



- $ATS\_CH=x$ ; (active radio channel frequency)
  - 0 = 869.475 MHz
  - 1 = 869.525 MHz
  - 2 = 869.575 MHz
  - 3 = 869.600 MHz
- $ATS231=x$ ; (configuration of the radio power)
  - 0 = 20 dBm ~ 100mW
  - 1 = 18 dBm ~ 65mW
  - 2 = 16 dBm ~ 40mW
  - 3 = 13 dBm ~ 20mW
  - 4 = 10 dBm ~ 10mW
  - 5 = 07 dBm ~ 5mW
  - 6 = 03 dBm ~ 2mW
- $ATS253=x$ ; (number of the radio network)
  - 1 = Standard from factory
  - 1...250 = number of the subnet
  - 255 = Broadcast, all subnets are addressed

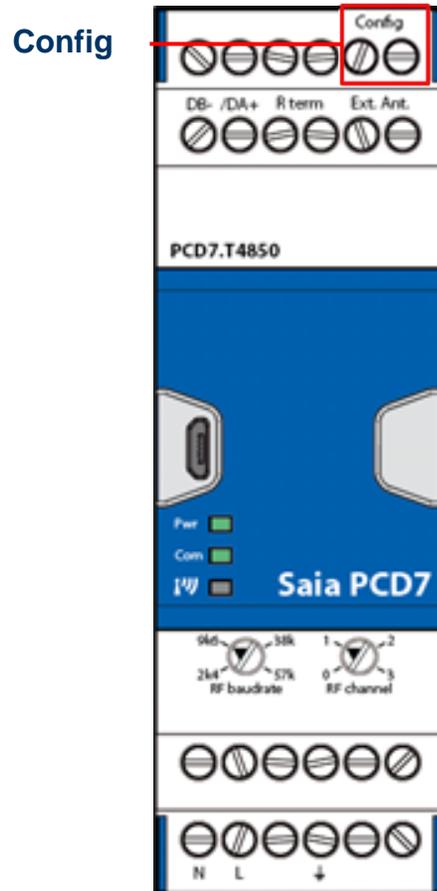
# Read of the configuration (ATSTAT)



**ATSTAT; The following registers are transmitted in one frame from the device:**

- **ATS400=x**  
ASN number (PCD7.T4850)
- **ATS401=x**  
FW version (e.g. 1.00.00)
- **ATS500=x**  
HW version (e.g. 'A')
- **ATS501=x**  
Date of production year/cw (2014/35)
- **ATS502=x**  
Serial number 3 bytes + 1 byte CRC

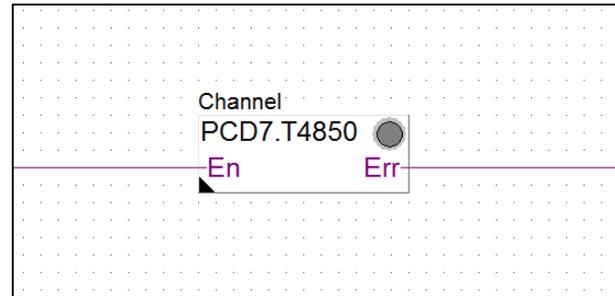
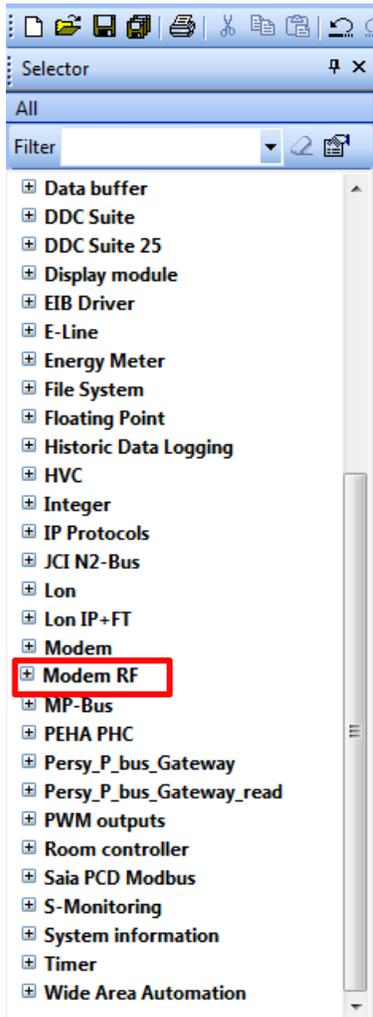
# Radio signal strength (ATRFST)



**ATRFST; gives the signal strength of the RF connection**

- 0...-7.9      good signal level
- -8.0...-11.9      sufficient signal level
- -12...-25.5      poor signal level

# F-Box



## Fupla F-Box:

- All parameters can be set with the F-Box and PG5
- This allows a fast implementation of the device
- The newest version is available through the update manager of PG5

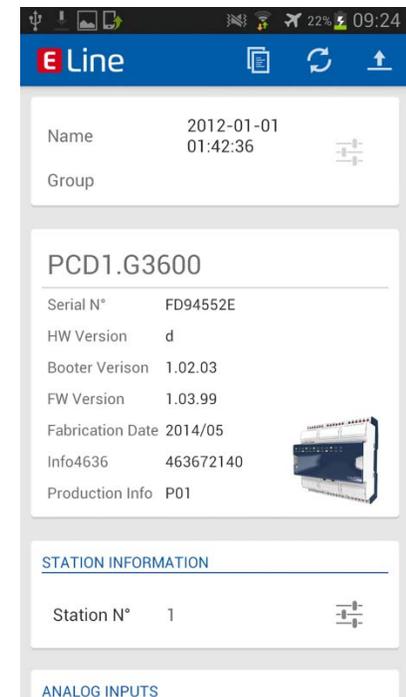
# NFC application for Android smartphones

## Near Field Communication application:

- The RF-modem is capable to be addressed with the SBC NFC application.
- This function can be used to read out the status of the device and to configure the module.



To read / configure with the NFC app the Advanced Mode is not necessary; the bridge between the terminals «Config» is not necessary.



The application is available for Android smartphones over Google Play store.

# Normative / Legal / Documentaion

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## Normative aspects:

The RF modem respects the following normative directives:

- ERC 70-03
- ETSI EN 300 220-1
- ETSI EN 300 220-2

## Certifications:

- With the “CE” declaration, the devices can be used in all EU-countries, including Switzerland and Norway.
- Other certification for Russia, USA, China, etc. could be made in future.

## Security:

- The communication over RF is not encoded. The customer must be careful which data is sent over the RF-modem.

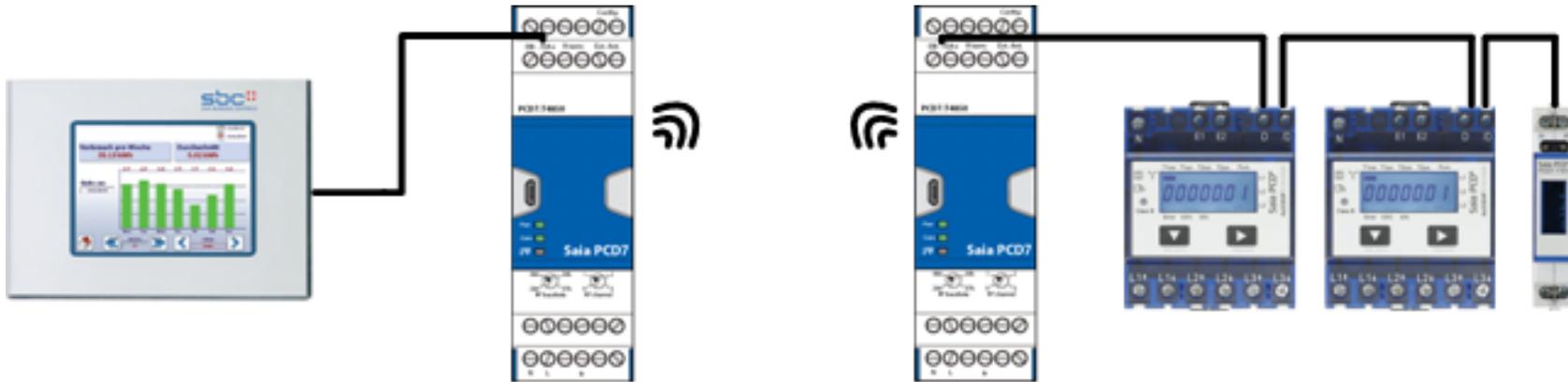
## Protocols:

- The RF-modem is tested / approved with the following RS-485 based protocols:
  - S-Bus
  - Modbus RTU

## Documentation:

- Support Site: <https://www.sbc-support.com/en/product-index/pcd7/txxx-rs485-components/>

# Out of the box functionality



**The RF-modems are delivered from factory with the following configuration:**

- Subnet 1, modem mode
- Internal antenna
- 40mW output power
- Disabled end of line resistor
- Frequency channel 1 (869.475MHz)
- 57.6kbaud RF-Transmission speed
- Auto baud of the RS-485 interface Baudrate

→ **Ready to use, without additional configuration**

→ **Enlarge the system offering of S-Monitoring**

# Do you have questions?

If you have any problem, please ask our regional support team.



Country	Support request	Phone
Germany	<a href="mailto:support.de@saia-pcd.com">support.de@saia-pcd.com</a>	+49 6102 2025 400
France	<a href="mailto:support.fr@saia-pcd.com">support.fr@saia-pcd.com</a>	+33 1 39 96 49 59
Switzerland	<a href="mailto:support.ch@saia-pcd.com">support.ch@saia-pcd.com</a>	+41 26 580 31 00
Netherland	<a href="mailto:support.bnl@saia-pcd.com">support.bnl@saia-pcd.com</a>	+31 182 54 31 54
Belgium	<a href="mailto:support.bnl@saia-pcd.com">support.bnl@saia-pcd.com</a>	+31 182 54 31 54
Italy	<a href="mailto:support.it@saia-pcd.com">support.it@saia-pcd.com</a>	+39 039 216 52 28
Austria	<a href="mailto:support.at@saia-pcd.com">support.at@saia-pcd.com</a>	+43 2752 516 84 0