



# Application Manual

 **Cumulocity**  
Cloud Fieldbus

# PSsystec SMARTbox Modbus Agent User's Guide

## Overview

Smartbox Modbus, based on the Telit Chipset HE910, is a ready to use solution for connecting Modbus devices to the Cumulocity "Cloud Fieldbus". It provides a Modbus RTU Master Communication on RS485 for connecting up to 20 devices with max. 1000 datapoints. Easy configure the SetUp of building automation fielddevices like pumps, e-meters, Airhandling units in the Cumulocity Cloud Fieldbus – the Smartbox Modbus will take care of it!...by automatically picking up the coils and registers and sending alarms, measurements and status back to Cumulocity. Using the Smartrest protocol the terminal comes up with a low traffic solution for decentralized applications.

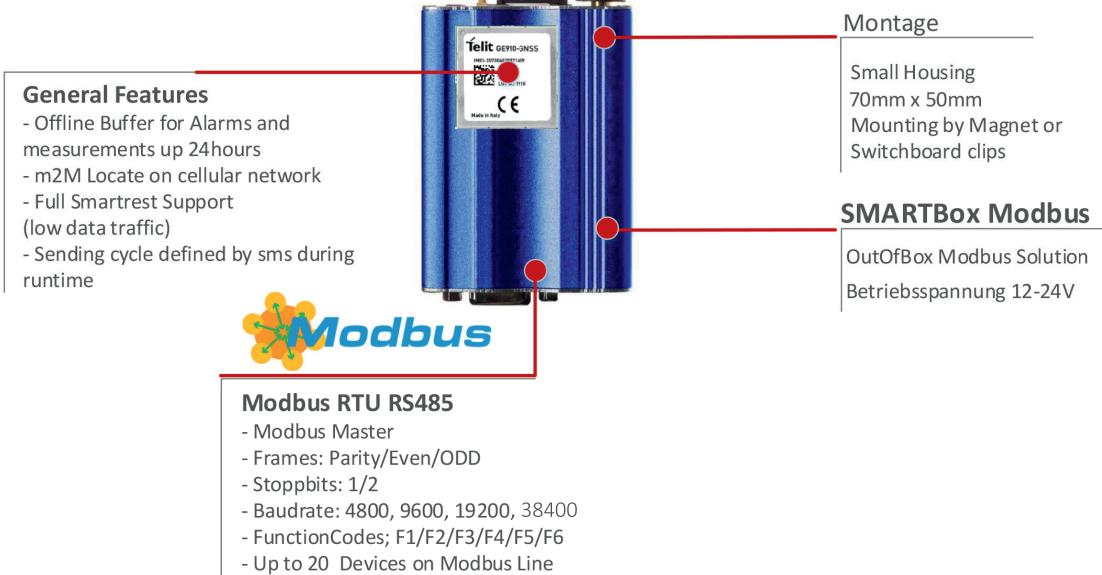
PSsystec GmbH is specialized in building automation. With SMARTbox Modbus we developed a slim line M2M device, fully integrated in the HVAC market.

### SMARTBox Modbus

Tested on modbus building automation devices



Developed for **Cloud Fieldbus**  
- Flexible Device database  
- Alarming  
- Events  
- Measurements  
- Value/Operations  
- SetUp Modbus MasterCommunication  
- Remote restart



# Wire your Modbus RTU RS485 Network

Combined RS232/RS485 Interface. After StartUp ( $\approx$  60sec) the RS232 is switched to RS485 Mode, half duplex. Table of DB9 pins:



Pin DB9	RS232	Full Name	RS485 - Modbus
Pin 3	TD	Transmit Data	
Pin 2	RD	Receive Data	
Pin 7	RTS	Request To Send	
Pin 8	CTS	Clear To Send	
Pin 6	DSR	Data Set Ready	DATA+
Pin 5	SG	Signal Ground	GND
Pin 1	CD	Carrier Detect	
Pin 4	DTR	Data Terminal Ready	
Pin 9	RI	Ring Indicator	DATA-

For this an adapter cable is provided for the RS485 Line



# Configure the terminal

By default the terminal supports Cloud Fieldbus from cumulocity. To do so, you need to:

- Subscribe your account to the Cloud Fieldbus app by contacting [support@pssystec-gmbh.de](mailto:support@pssystec-gmbh.de) or [support@cumulocity.com](mailto:support@cumulocity.com)
- To configure your APN put your SIM CARD to the Smartbox. After this, power On the Smartbox Modbus , wait > 10 seconds – and send an SMS to the phone number, given by the provider from your SIM CARD.

Change APN	Send SMS with APN, > 10s after Power on GPRS=public4.m2minternet.com
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From this point, the Smartbox stores your set APN.

# Connecting the terminal

After setting APN, register your SMARTbox Modbus to Cumulocity: Type the IMEI of the terminal in the registration tab of Cloud Fieldbus and press register. The IMEI is printed on the back side of the terminal as shown in the screenshot below.

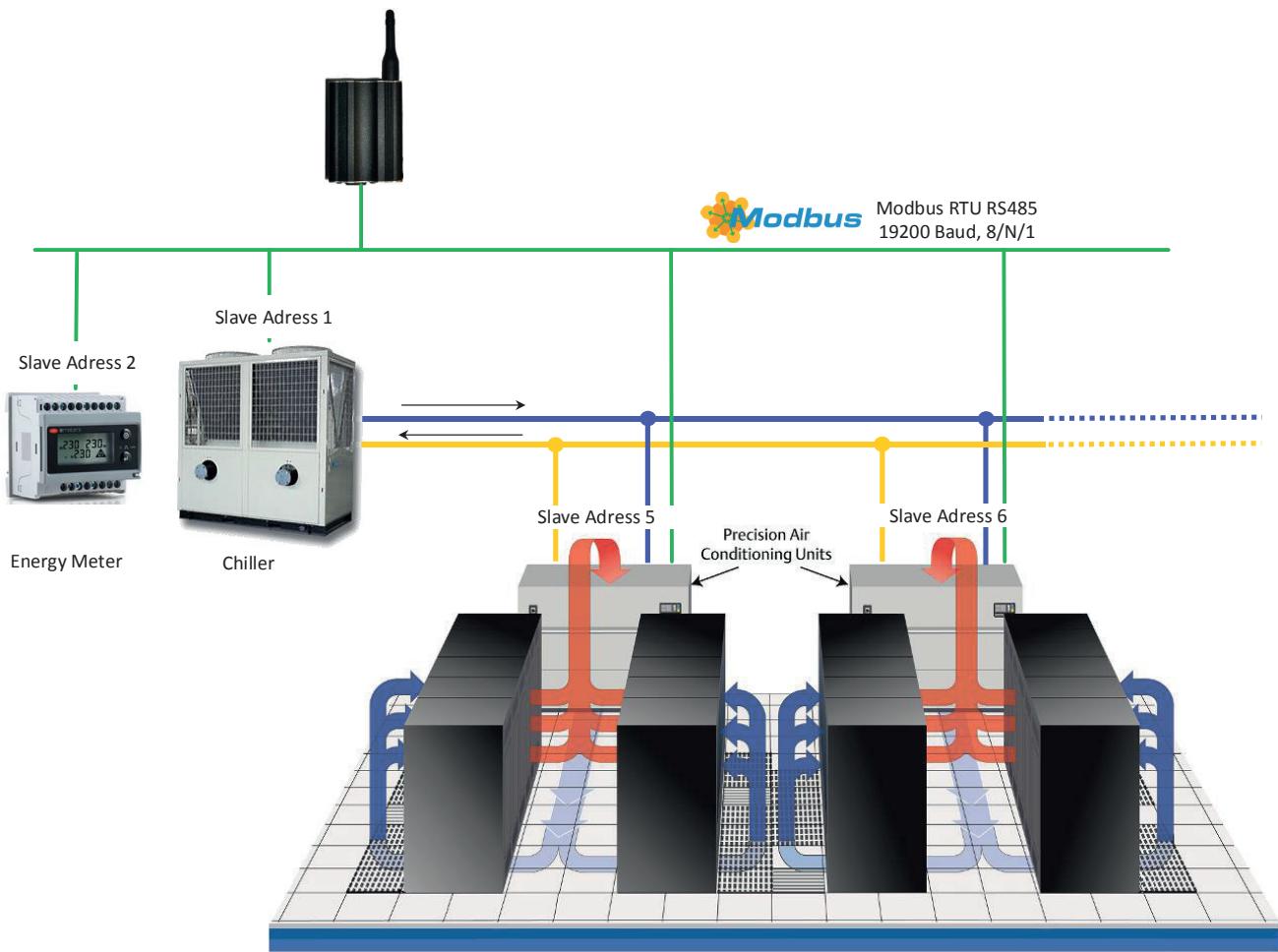


After clicking the „accept“ button, navigate to „All devices“, the terminal should appear after  $\approx$  30 seconds after registration.

The screenshot shows the Cumulocity web interface. The left sidebar has a dark theme with white text and icons. The "Alle Geräte" option under "GERÄTE" is selected and highlighted with a green arrow. The main area displays a table of devices. One row for a terminal with IMEI 351579058095389 is highlighted with a green box. The table columns include the device icon, the device name, and a small orange circle with a number indicating the count of events or notifications.

After this step, configure your Modbus Network in Cumulocity.

Lets make an example: Assume you have a data center application: A chiller provides constant cold water of 7°C at the outlet. For each Serverrack line, a precision airconditioner is installed which maintain the racktemperature to 20°C by blowing cool Air through the floor grid to the racks. The warm air at the outlet of each rack will be again cooled down by a heat exchanger, installed in the air conditioning units, feeded from cool water coming from the chiller. Your company servicing the cooling system for your customer.



To connect this datacenter application to Cumulocity follow these steps:

1. The Smartbox Modbus, acts as a Modbus Master. Connect all slaves together in one line and put different Slave addresses in the fielddevices, as well as a common Baudrate and Communication frame (e.g. 8/N/1). Normally all fielddevices provides such setting at a local display.
2. For each different Fielddevice (Chiller, AirConditioning units, Energy meter) create the Device database in Cloud Fieldbus in Cumulocity (see the Appendix “Create” Device Database).
3. SetUp in Modbus configuration Tab
  - A) Set Field Communication Parameter
  - B) Set Communication parameter between Smartbox and Server. Note Events, Alarms, Values (See device database) are transmitted to server if the read out value from Modbus is changed. So only the transmittate for measurements is defined.
  - C) BuildUp the network by adding slave devices defined in the device database. In Cumulocity, each Fielddevice come up with a single childdevice. So in this cases we would have 3 childdevices. After adding the slave devices, the terminal will discover all childdevices and its Modbus items and begin feeding the platform with measurements, alarms, events, values. Note: Without a setup network, the terminal will not send any data.

Note: In Device database you define for each datapoint, if it is a measurement, alarm, event, R/W value or R value.

**A**

ModbusBaudrate Select  
3200  
9600  
19200  
38400\* (coming soon)

Modbus Communication Frame:  
Databits: 8 or 7  
Parity: None, Even, Odd  
Stopbits: 1 or 2

**B**

**SERIELLE KOMMUNIKATION**

- BAUDRATE: 19200
- DATENBITS: 8
- PARITÄT: N
- STOP-BITS: 1

**MODBUS-KOMMUNIKATION**

- ÜBERTRAGUNGSRATE: 20 Sekunden
- POLLING-INTERVALL: Not used but set 1 or any value
- PROTOKOLL: RTU

Transmissionrate Terminal to Cumulocity Cloud  
Measurements: define the cycle time here  
Events: if value read out changes  
Alarms: if value read out changes  
Value: if value read out changes

Pressing this button will save the values on the terminal, you can do this during runtime

**C**

Add a slave device

Name	Gerätetyp	Adresse	Slave address
EnergyMeter	Powergen	2	
AirConditioning	Datenlogger	5	
Chiller	tec301	1	

The default name of the terminal is the IMEI. Click on the terminal to view the detailed information. You can change the terminal's name on the „Info“ tab, which also displays basic information such as serial number of the router and SIM card data. After changing the name, remember to click „save changes“ button at the bottom of the „Info“ page. All data coming from the fielddevices are available under the section childdevices.

**FIELDBUS3**

**GERÄTEREGISTRIERUNG**

- Alle Geräte
- Karte
- Service
- ÜBERSICHTEN
- Alarme
- Kommandos
- Ereignisse
- DEVICE TYPES
- Device Database
- GRUPPEN
- Top-level Gruppen
- TestGruppe
- VERWALTUNG
- Firmware-Ablage
- Software-Ablage
- Konfigurationsablage

**TERMINAL 351579058095272**

**INFO**

VERBINDUNGSÜBERWACHUNG

- Verbunden
- LETZTE KOMMUNIKATION vor einer Minute
- ERWARTETES SENDEINTERVALL: 11 Minuten

Wartungsmodus einschalten

**HARDWARE**

- MODELL:
- SERIENNUMMER:
- VERSION:

**MOBILNETZ**

- MSISDN:
- IMSI:
- IMEI: 351579058095272
- NETZBETREIBER: 8910390000008904351
- NETZTECHNOLOGIE:
- SIGNALSTÄRKE:
- SIGNALQUALITÄT:
- RSCP:

# Manage the Application

1. Manage: In order to monitor the Measurements, events, alarms from the fielddevices, go to the child device tab. Inside each childdevice tab all relevant data are available according to the specific device and the set configuration in the device database. Refer to <http://cumulocity.com/guides/cloud-fieldbus/#manage>

The screenshot shows the Cumulocity FIELDBUS3 application interface. On the left, there is a navigation sidebar with the following menu items:

- Startseite
- GERÄTE
- Geräteregistrierung
- Alle Geräte** (highlighted in blue)
- Karte
- Service
- ÜBERSICHTEN
- Alarne
- Kommandos
- Ereignisse
- DEVICE TYPES
- Device Database
- GRUPPEN
- Top-level Gruppen

In the center, the device details for "KLIMA" are displayed, including the terminal ID "Terminal 351579058095272". Below this, there is a "FIELDBUS-WIDGET" section with the following configuration:

SOLLWERTE	
SOLLWERT	24 <input type="button" value="Setzen"/>
VENTILATORDRE...	hoch2
BETRIEBSART	Kuehlen
LAMELLEN	Schwenken
EIN/AUS	<input type="button" value="Aus"/>

2. Sending Alarm, Events, Measurements, Values: The Send cycle is as follows:

Send cycle	Values (Readstatus)	On Change	Add Fieldbus-widget
	Values (Updatestatus)	On Change	Add Fieldbus-widget
	Alarms	On Change	Found in Alarntab Childevice
	Events	On Change	Found in Events Childevice
	Measurements	Defined in Modbus tab	Found in Measurements Childevice
	Signal strength	Is sent every 10 Min as an measurement	Found in Measurements

3. Monitor the success of operations: All operations send from server to the samrtbox can be monitored if they are successful processed. Operations are e.g. Changing the transmit rate, changing Modbus communication frame, adding new slave devices, remote restart, changing values on the Modbus (Updatestatus)

The screenshot shows the Cumulocity Device Control interface for terminal 351579058095264. The left sidebar has a 'GERÄTE' section with 'Alle Geräte' selected. The main area displays a log of events:

Kategorie	Inhalt	Datum
Unerledigt	Serielle Kommunikation ändern	08. September 2016 17:03
Wird ausgeführt	Modbus-Konfiguration ändern	08. September 2016 17:03
Erfolgreich	Modbus-Konfiguration ändern	08. September 2016 01:10
Fehlgeschlagen	Serielle Kommunikation ändern	08. September 2016 01:10
Alle	Added new child device to Terminal 351579058095264 (213774)	08. September 2016 01:08

4. Restart the terminal: The terminal can be restarted either by power On/off or Remote Restart by Cumulocity Device Control, on terminal level
5. Location: The terminal features cell Location. The location is evaluated after startup and is available in Location tab on terminal level.

The screenshot shows the Cumulocity interface for 'WEIDNER HOLDING GMBH & CO.KG'. The left sidebar has a 'STANDORT' section with 'Standort' selected. The main area shows a map of Augsburg with various location markers and road networks.

6. Signal strength: The signal strength of the terminal is sent each 10minutes and is displayed as a measurement on terminal level.

The screenshot shows the Cumulocity interface for 'WEIDNER HOLDING GMBH & CO.KG'. The left sidebar has a 'MESSWERTE' section with 'Messwerte' selected. The main area displays a line graph titled 'SIGNAL STRENGTH' showing signal strength in dBm over time.

7. Indication and Software Version: Go to Indication and Software tab to identify the terminals IMEI and Version and FW installed.

The screenshot shows the 'FIRMWARE' section of the software. It includes a table with columns 'Name' and 'Version'. One entry is listed: Name 'appZone' and Version '0.9.5'.

The screenshot shows the 'Software' section of the software. It includes a table with columns 'Typ' and 'Id'. One entry is listed: Typ 'c8y\_IMEI' and Id '351579058094739'.

8. Real time Clock: The terminal has an Real Time clock installed. Each time a measurement, event or alarm is sent to Cumulocity, the time is retrieved from the internal real time clock. The terminal is updated the internal Realtime clock from a time server at startup. This means, you don't need to use a SIM Card with the NITZ feature.
9. Buffering data: In case of bad connection, measurements, events, alarms are permanently stored in an internal buffer. About 24h can be stored in case of bad communication. Getting online again, the terminal sends the data to Cumulocity.

## Appendix: “Create Device database”

1. Select the tab Device database and add device type

The screenshot shows the 'DEVICE DATABASE' section of the software. It lists several device types: ModDevtest, Bigdevice3, Bigdevice1, BigDeviceModbus, Powergen, Datenlogger, tec301, Bigdevice, and Bigdevice2. There are also buttons for '+ Add device type' and 'Neu laden'.

General: The SmartboxModbus supports following Function Codes:

- FC1 Read Coils (Address Cumulocity == AddressDevice +1)
- FC2 Read Input Status (Address Cumulocity == AddressDevice +10001)
- FC3 Read Register (Address Cumulocity == AddressDevice +1)
- FC4 Read Input Register (Address Cumulocity == AddressDevice +10001)
- FC5 Write Coils (Address Cumulocity == AddressDevice +1)
- FC6 Write Register (Address Cumulocity == AddressDevice +1)

Taking the Modbus Datapoint list from your device you want to connect to the smartbox, you can now define all registers and coils in the Device database by adding register or adding coils. Note: The limitation is 100 datapoints if you have 10 slave devices or 1000 datapoints if you have only 1 device you want to connect.

## 2. Add Register

NEW REGISTER		
<b>NAME</b>	<b>DISPLAY CATEGORY</b>	
Tset	Setpoint	
<b>NUMBER</b>	<b>START BIT</b>	<b>NUMBER OF BITS</b>
234	0	16
<b>MULTIPLIER</b>	<b>DIVISOR</b>	<b>DECIMAL PLACES</b>
1	1	2
<b>UNIT</b>	<b>MINIMUM</b>	<b>MAXIMUM</b>
°C		
<b>OPTIONS</b>	Needed to limit the user input values (Fieldbus Widget)	
<input checked="" type="checkbox"/> Signed		
<input checked="" type="checkbox"/> Enumeration type		
<b>ENUMERATION VALUES</b>	<b>Read/Write</b> Value without Timestamp, (Display in FieldbusWidget)	
0	On	Remove value
1	Off	Remove value
<b>+ Add value</b>		
<b>FUNCTIONALITIES</b>	<b>Alarm</b> with Timestamp, (Display in Alarms of Childdevice)	
<input checked="" type="checkbox"/> Show status (read-only access)	0 = no Alarm, 1 = Alarm	
<input checked="" type="checkbox"/> Update status (read/write access)	Note: This Alarm can <b>only be publised</b> from the device to CC. it must be acknowledged in CC. The device send no „clear“ to the Alarm in CC, even if the alarm is not present anymore on the device	
<input type="checkbox"/> Send measurement		
<input type="checkbox"/> Raise alarm		
<input type="checkbox"/> Send event		
<b>MEASUREMENT TYPE</b>	<b>MEASUREMENT SERIES</b>	<b>Defining Measurements:</b>
		Series: Name of Measured Value e.g. same as under „Name“ (Display in Tab Measurements)
<b>ALARM TYPE</b>	<b>ALARM TEXT</b>	Type: Possibility to group measurements. But you can take any name e.g. same as „Name“
<b>ALARM SEVERITY</b>		<b>Defining Alarms:</b>
		Alarm Type: Possibility to group. But you can take any name e.g. same as „Name“
<b>EVENT TYPE</b>	<b>EVENT TEXT</b>	Alarm Text: Displayed text in Alarm tab folder
		Alarm Severity: Displayed Severity in Alarm tab folder
<b>Defining Events:</b>		
Event Type: Possibility to group, But you can take any name e.g. same as „Name“		
Event Text: Displayed text in Event tab folder		

### 3. Add Coil

**NEW COIL**

Name of datapoint displayed in CC Datapoint Tab (used in Fieldbus Widget)	<b>NAME</b> MotorStatus	<b>DISPLAY CATEGORY</b> Statusinformation DisplayCategory, Displayed in FieldbusWidget
Address of Coil in the Slave (+1 or +10001, according to FC1 or FC2)	<b>NUMBER</b> 2	
Readout the Value without Timestamp, (Display in FieldbusWidget)	<b>FUNCTIONALITIES</b>	
	<input checked="" type="checkbox"/> Show status [read-only access]	Read/Write Value without Timestamp, (Display in FieldbusWidget)
	<input checked="" type="checkbox"/> Update status [read/write access]	Alarm with Timestamp, (Display in Alarms of Childdevice) 0 = no Alarm, 1 = Alarm Note: This Alarm can <b>only be published</b> from the device to CC. it must be acknowledged in CC. The device send no „clear“ to the Alarm in CC, even if the alarm is not present anymore on the device
	<input checked="" type="checkbox"/> Raise alarm	
	<input checked="" type="checkbox"/> Send event	
<b>Event</b> with Timestamp, (Display the Measured Value in Events of Childdevice)	<b>TEXT TO SHOW IF COIL IS ZERO</b> Off	<b>TEXT TO SHOW IF COIL IS ONE</b> On
Definition of enum Values (used in Fieldbus Widget)	<b>ALARM TYPE</b>	<b>ALARM TEXT</b>
<b>Defining Events:</b> Event Type: Possibility to group, But you can take any name e.g. same as „Name“ Event Text: Displayed text in Event tab folder	<b>ALARM SEVERITY</b>	Defining Alarms: Alarm Type: Possibility to group, But you can take any name e.g. same as „Name“ Alarm Text: Displayed text in Alarm tab folder Alarm Severity: Displayed Severity in Alarm tab folder
	<b>EVENT TYPE</b>	<b>EVENT TEXT</b>
	<b>OK</b> <b>CLOSE</b>	



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