Getting started with BACnet MSTP

Contents

Project history

Date	Author	Modification
29.10.09	TCS / hja	V1 Editing of documentation (version 1) and project for PG5 2.1.040

saia-burgess
Control Systems and Components

1 Introduction

This document is intended to offer an easy way to start using the Saia BACnet MSTP. With the appropriate PG5 project, it can serve as a guide to implementing communication with BACnet MSTP.
The information contained in this document has been extracted from the corresponding manuals and online helps and should make getting started easier for you. For further information, please consult the relevant documents (see section “References”).

2 Hardware and software requirements

Hardware
This project has been configured for the following hardware:

- PCD3.M5560; Hardware Version B; firmware 1.20.06 or higher
- One USB cable (max. 1.8m) for programming the PCD
- One Ethernet cable CAT 6
- PCD3.F215; Hardware Version E; firmware 1.02.09 or higher
- PCD7.R561; Hardware Version B; firmware 1.20.06 or higher
- PCD1.M2020; Hardware Version D1; firmware 1.20.06 or higher
- PCD2.F2150; Hardware Version D; firmware 1.02.09 or higher
- PCD7.R561; Hardware Version B; firmware 1.20.06 or higher

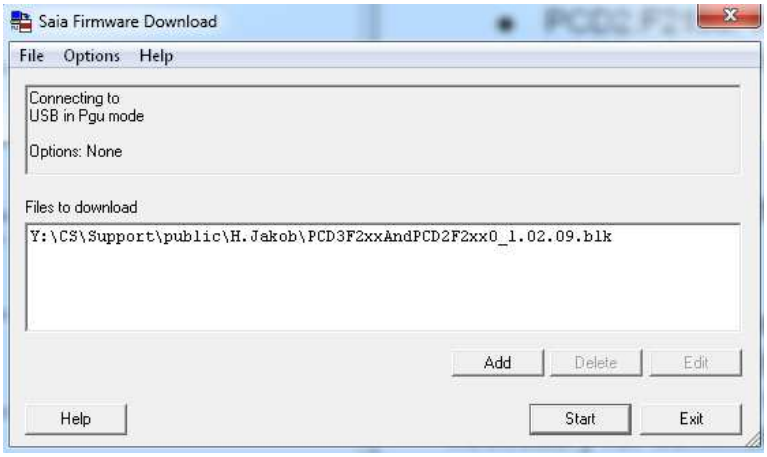
Software
To program the PCD the following software is needed, including a valid licence:

- PG5 2.1

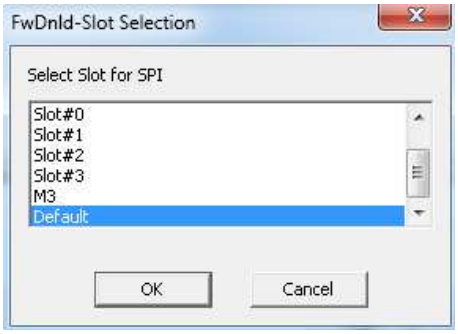
It is of course also possible to run this project with other hardware. Depending on the hardware, specific adjustments to the configuration will be required (hardware configuration in PG5, software settings in PG5. The appropriate Fupla settings will be necessary for communication between PCDs).

2.1 Firmware Download F215

The firmware in this example isn’t only a topic for the PCD and the BACnet stack, but also for the communication card F215 / F2150.The download is working in the same way like a firmware download for the PCD.

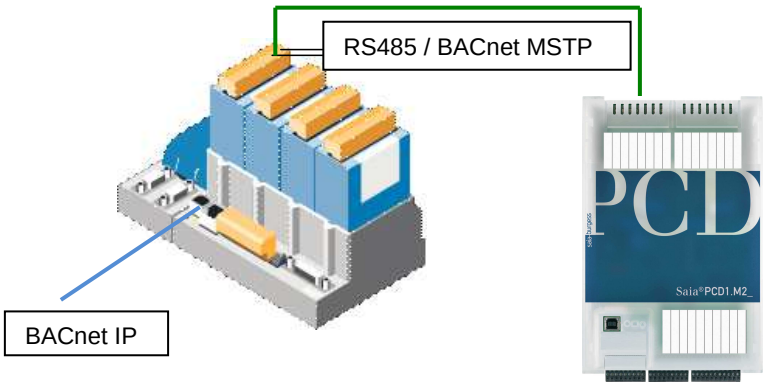


If your PCD has more then one communication card, always the first one gets this firmware. To change this behaviour, you have to change the slot in the Firmware Downloader. In the menu *Options / Select SPI Slot…* you can choose the target slot.



3 Description of project example

The project example consists of a PCD3.M5560 CPU. The communication Card F215 is plugged in Slot 0. The BACnet Stack PCD7.R561 is plugged to the M1 Slot. Furthermore there is a PCD1.M2020 with a plugged PCD7.R561 BACnet Stack and a PCD2.F2150 in Slot 0.
The PCD 3 is the Master in this example like a floorcontroller who controls a lot of roomcontrollers on one Floor. This controller is also the connection to an upper system over IP. The PCD 1 is a BACnet Slave Controller. Imaging that the PCD 1 is a substitute for a real BACnet MSTP Client like a roomcontroller.



3.1 The connections

The BACnet MSTP connection is build up with two wires connected to the connectors of the two cards. The used pins are 1 and 2, means Rx-Tx and \Rx-Tx.

RS485

0	PGND	Rx-Tx	1
2	/Rx-/Tx		3
4		PGND	5
6			7
8	(SGD)		9

In general, the requirements for standart RS485 connections are also valid for this communication.

3.2 The Hardware Configuration

Both Controllers are in the same Project as different Devices.

3.2.1 The Master, PCD3.M5560

Device

Type	Description
PCD3.M5560	CPU with 1024 KBytes RAM, 4 I/O slots (expandable), USB, Profi-S-Net, RS-232, Ethernet.

Memory Slots

Slot	Type	Description
M1	PCD7.R561	Flash memory module with BACnet firmware, 1 MByte for user program and 1 MByte for file system.
M2		

Monitoring

Section	Description
Monitoring	Monitoring and logging of meter data. Automatical scanning of S-Bus meters and gateways.

Onboard Communications

Type	Description
RS-485/S-Net	RS-485 port for Profi-S-Bus or general-purpose communications (D-Sub #2).
USB	Universal Serial Bus port, PGU or general-purpose.
RS-232/PGU	RS-232, PGU or general-purpose serial port (D-Sub #1).
RS-485	RS-485 port for general-purpose communications (Terminal block).
Ethernet	Ethernet port. IP Settings, DHCP.

Ethernet Protocols

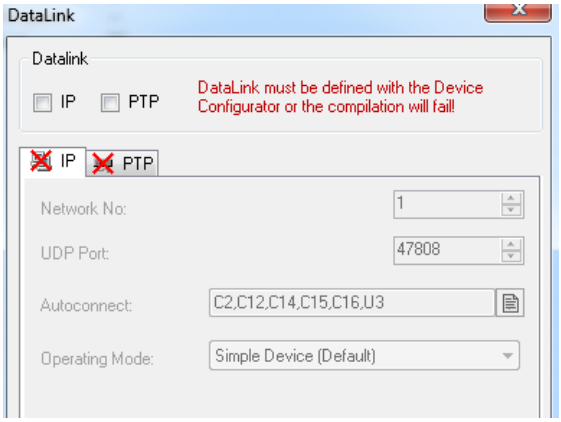
Section	Description
IP Transfer Protocols	FTP, HTTP Direct Protocols, ODM.
IP Protocols	DNS, SNTP, SNMP protocols.
HTTP Portal	HTTP Portal Communication For PCD Over Private Network.

Onboard I/O Slots

Slot	Type	Description
Slot 0	PCD3.F215	Serial interface RS-485, electrically isolated, for serial S-Bus or BACnet MSTP communication.
Slot 1		
Slot 2		
Slot 3		
+		

The BACnet Stack PCD7.R561 is added in the Memory Slot M1. In the properties it is possible already to enable the Network Configuration. In this case the data link settings of the BACnet configurator are disabled automatically.

BACnet Network Configuration	
Network Configuration Enabled	**Yes**
BACnet Memory Module Location	**M1**



Anyway, if there are Network Configurations in both tools, the one from the Device Configurator has the priority.

BACnet IP Configuration	
BACnet IP Enabled	Yes
Network Identifier	1
Communication Port	47808
Auto Connect Type	-
Device Operating Mode	Single Device

Furthermore, the BACnet IP Configurations are also in this Properties Window.
If we enable the BACnet IP Communication, also the Routing Function for MSTP is on.

The Network Number for IP must be the same for all BACnet IP devices within the entire network.
The BACnet UDP port is by default 47808 (BAC0 in hex). For normal BACnet networks without any Broadcast Management, means Single device, the additional settings are hidden.

In Slot 0, the PCD3.F215 is added. In the properties of this card, the BACnet MSTP Settings have to be done. To use MSTP, it must be enabled here. The Network Identifier must be the same for all BACnet MSTP devices within the entire network, but cannot be the same as for the IP Network.
The Baud Rate must fit to all MSTP modules connected to this interface.
Also the MSTP interface needs a unique station address. The highest MSTP address (Master Slave Token Passing) means that each device within a range of addresses can get a permission to send a certain number of packets until this “token” has to be hand over to next higher station address.
The Highest MSTP Address defines the maximum number of station address until the token passing starts again from 0.
Packets Per Token defines the number of telegram which can be send from this interface until the token has to be passed to the next device.
Together with the Baud Rate, these two parameters have the most impact on the communication cycle time!

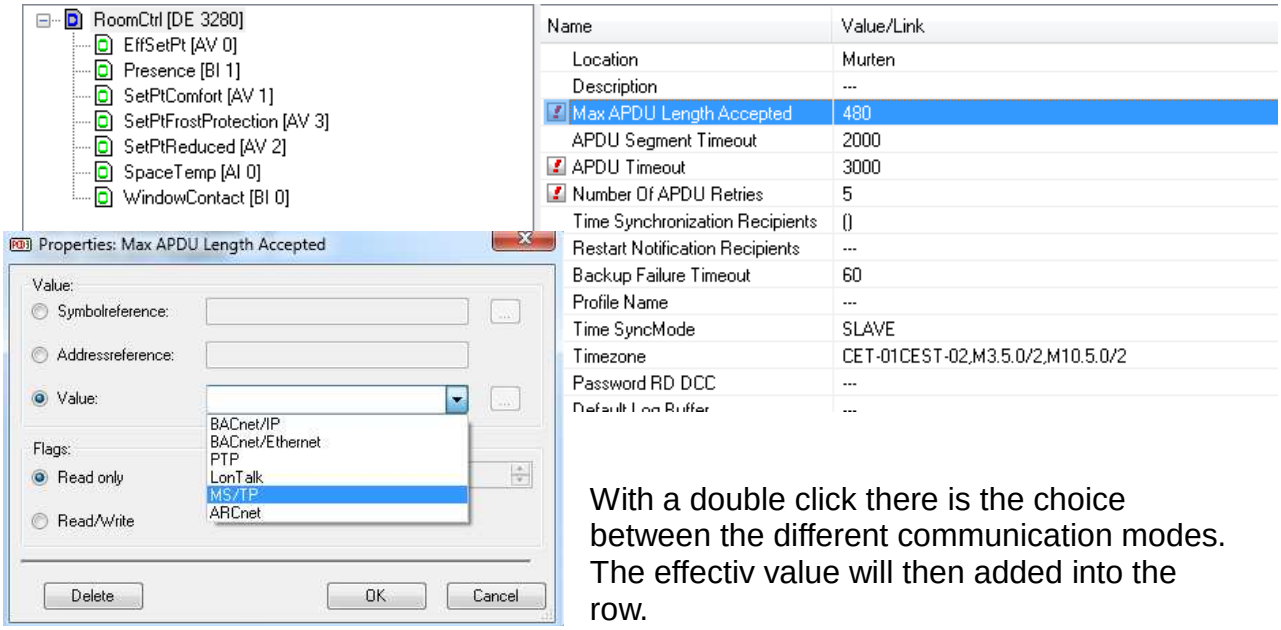
BACnet MSTP	
Port Number MSTP	100
MSTP Enabled	**Yes**
Network Identifier	**2**
Baud Rate MSTP	**57600 Baud**
MSTP Station Address	**1**
Highest MSTP Address	127
Packets Per Token	1
Auto Connect Type	-
Frame Abort Timeout	100
Reply Timeout	300
Usage Timeout	20

3.2.2 The Slave, PCD1.M2020

The configuration for the slave is almost the same. The only thing who is changing is the MSTP Station number, in this case it is 0.

BACnet MSTP	
Port Number MSTP	100
MSTP Enabled	**Yes**
Network Identifier	**2**
Baud Rate MSTP	**57600 Baud**
MSTP Station Address	0
Highest MSTP Address	127
Packets Per Token	1
Auto Connect Type	-
Frame Abort Timeout	100
Reply Timeout	300
Usage Timeout	20

Furthermore it is important, that the maximum APDU Length () for the slave is defined for MSTP. This is a value in the BACnet Configurator for the Slave Object.



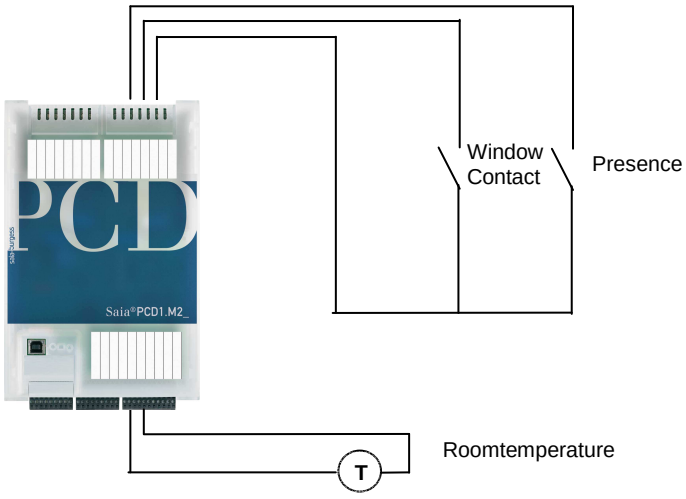
With a double click there is the choice between the different communication modes. The effectiv value will then added into the row.

The reduced APDU Length is only for the slave. The master is communicating with the default APDU Length. He is changing his behaviour depending on the APDU Lengths of the different slaves he is connected. It is also possible that this master is connected with BACnet/Ethernet in parallel to BACnet MSTP.

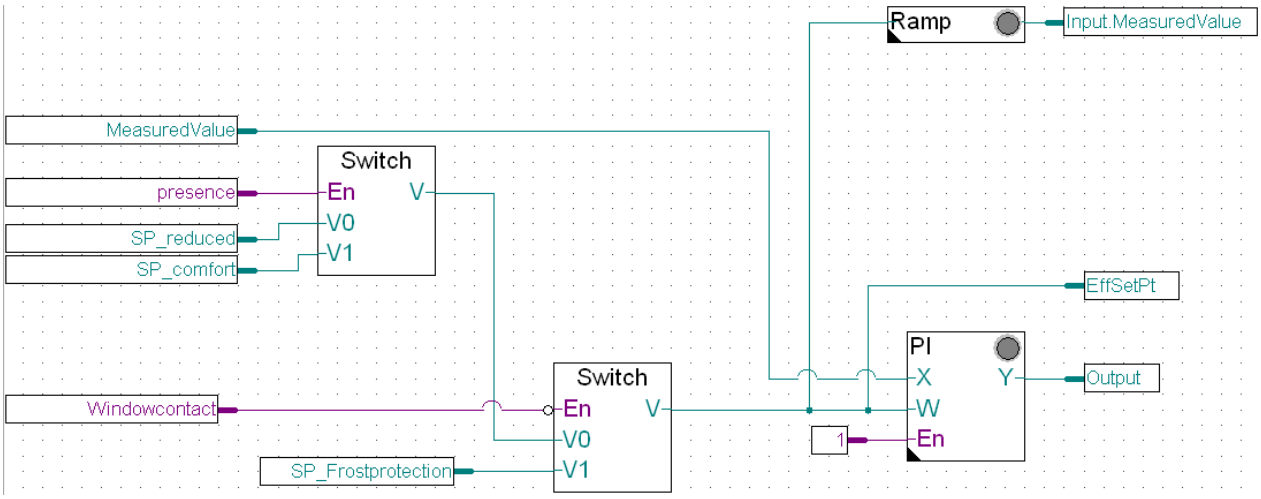
3.3 The Software

The Slave “plays” a roomcontroller in this example. That includes a short Fupla program and a BACnet File. In the Master, the Slave is known in the BACnet File as slave and the values are connected with some registers. The import from the slave into the master BACnet definition is done with importing the EDE file.

3.3.1 The Slave

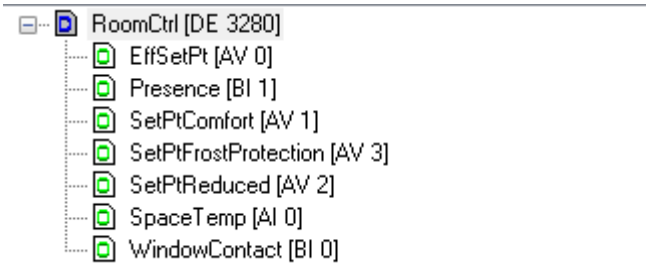


The Roomcontroller has three different modes. If the window is open, the frostprotection mode is switched on and the setpoint is 8 degrees. If the window is closed, but there is nobody in the room, the reduced mode is in charge and the setpoint is 18 degrees. With the occupancy signal, the comfort mode is switched on and the setpoint is 22 degrees.

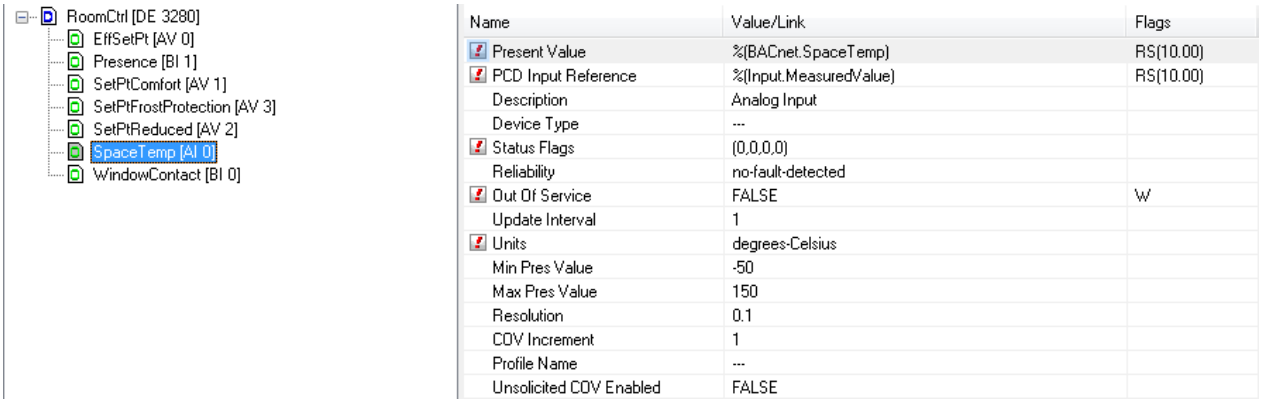


To simulate a changing manipulated value, the ramp Fbox is ramping this value.

In the BACnet bnt.File are seven BACnet Objects. For all the setpoints, there are Analog Value Objects. The measured value or Space Temperature is an Analog Input Object and the two digital signals are Binary Input Objects.

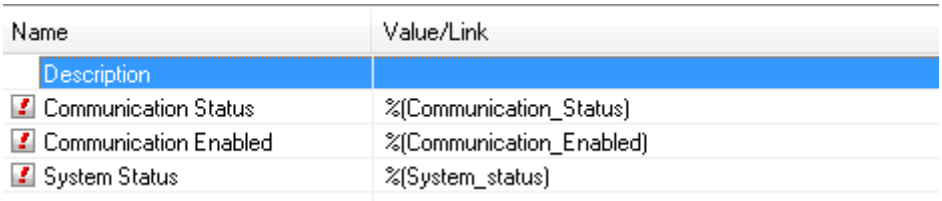


The space temperature has two connections to the symbols. The Space Temp, coming from the sensor is connected to the Present Value. The PCD Input Reference is connected to the measured value. If the sensor is not working any more or the reliability is not given anymore, it is possible to dispatch these two values with the Out of Service switch.



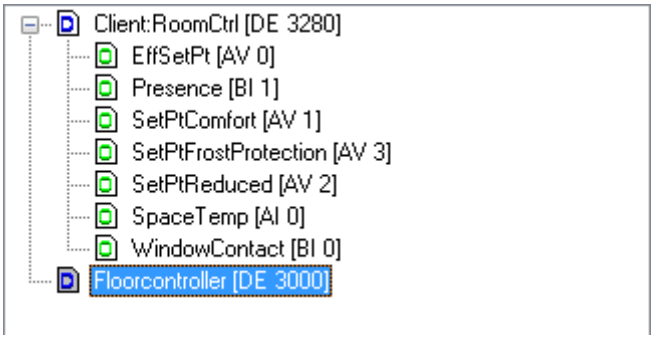
3.3.2 The Master

In the master program is only the HEAVAC initialisation Fbox. In addition to that, there are the two Status Signals from BACnet and the Communication Enabled Flag to Enable the Communication with the Slave. If this flag is mapped, it is necessary to switch on the communication with this flag. If it is not mapped, the communication is enabled anyway.



Of course there are the transmitted signals from the Slave in the Symbol Editor.

To get the BACnet Objects from the slave, the EDE. File is imported in the BACnet Configurator. You can see beside the Master Device floorcontroller 3000 the Client roomcontroller 3280 with his objects.



4 Preparation of the project example

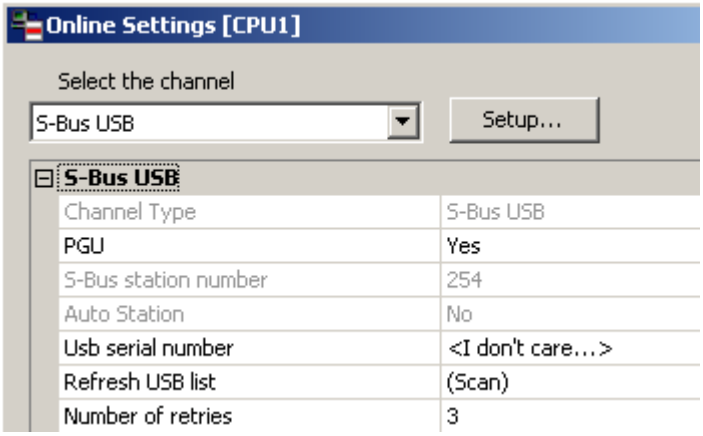
To import the project into the PG5, the “Restore” function from the “Project” menu in the PG5 Project Manager may be used.

4.1 PCD configuration

Three steps are necessary to prepare the PCD:

Establish online connection to PCD
Before a connection can be established, the PG5 must “know” which medium/cable is to be used for accessing the PCD. This is defined in the “Online settings” of the PG5 Project Tree:

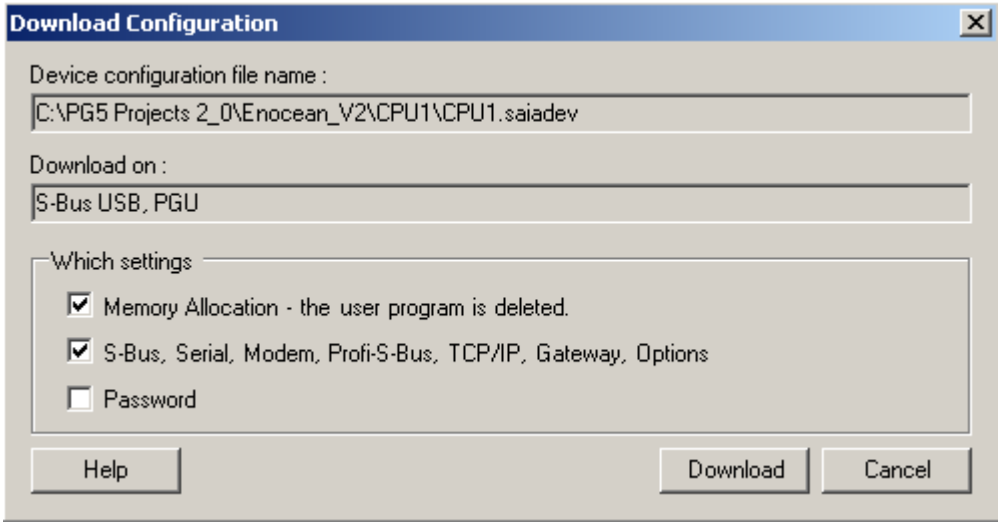
The channel to select here is “S-Bus USB”. The PGU option should be enabled.



Once these settings are complete, the “Online Configurator” can be used to check whether communication is working.

Hardware configuration
The “Device Configurator” is used to configure such settings as the IP address, memory settings and enabling the PCD’s “Run/Stop” switches. The PCD’s “Device Configurator” is to be found in the PG5 Project Tree, directly beneath “Online Settings”.

To download the configuration to the controller, just click on the “Download Configuration” in the “Device Configurator” window.
When asked what should be downloaded onto the controller, the “Memory Allocation” option must also be checked for the first download to configure memory correctly.



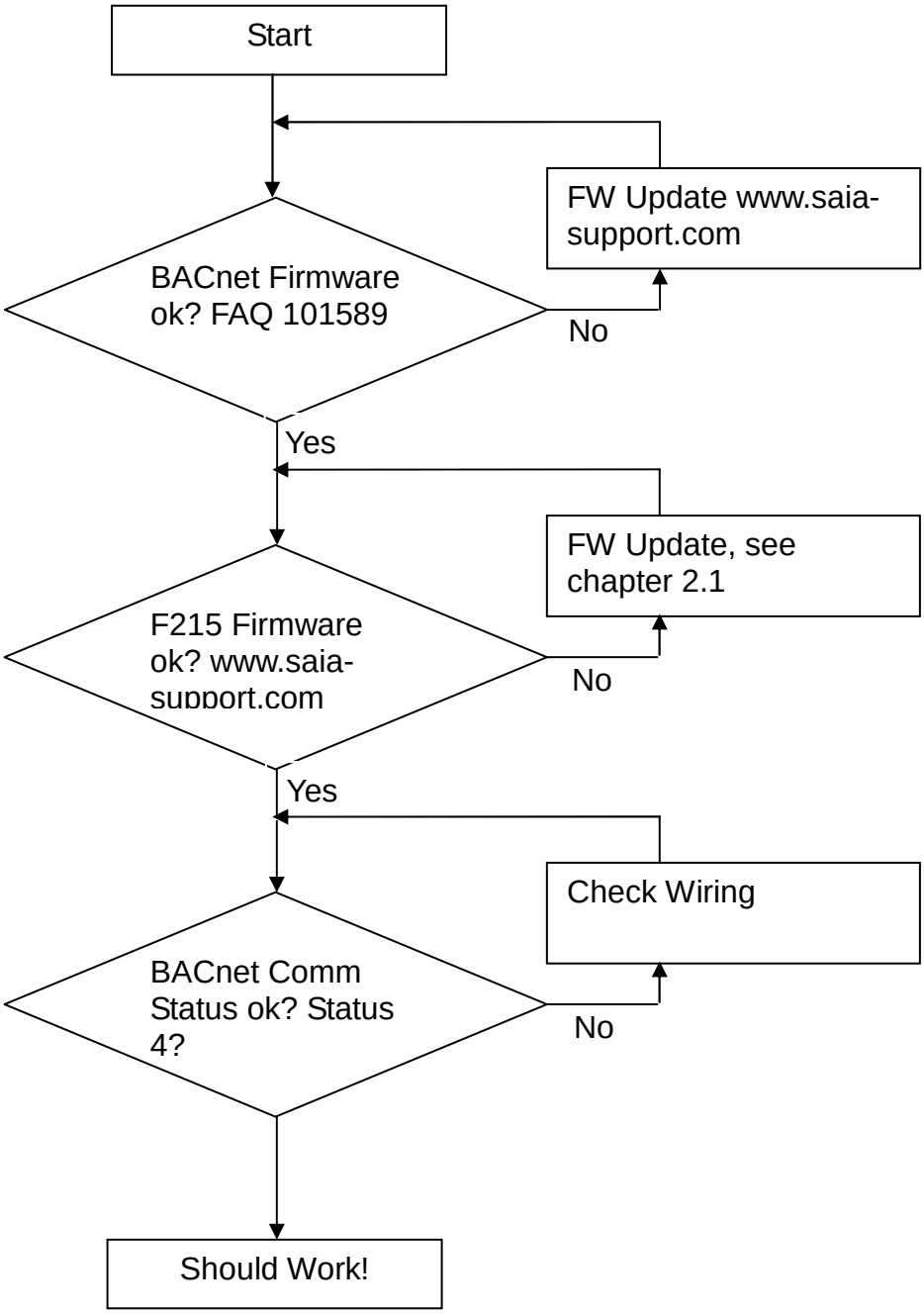
If the exact PCD type is not known, or if the existing hardware configuration must not be changed, it is also possible to use the “Upload” button in the “Device Configurator”. This will transfer the current PCD configuration to the PG5 project.

The hardware settings must be adjusted accordingly on any PCDs that will be used.

Hardware configuration

The example has been designed so that there is one Device for the roomcontroller PCD1.M2020 and the second one for the floorcontroller PCD3.M5560.

5 Commissioning



6 Useful links to BACnet knowledge

Several links can help you to find general knowledge of BACnet. The first link brings you to the BACnet interest groupe Europe, an interesting homepage, in german and english available.
http://www.big-eu.org
Of course, there is also the link to the official BACnet page from the ashrae (American Society of Heating, Refrigerating and Air-Conditioning Engineers)
www.ashrae.org
One more link to the ashrae page brings you directly to the BACnet standard 2010, which costs 170$
http://www.techstreet.com/ashrae/standards/ashrae/135_2010?product_id=1778347

7 References

Topic	Document	No.
Misc.	Saia® FAQ Manager http://faq.sbc-support.ch/	-