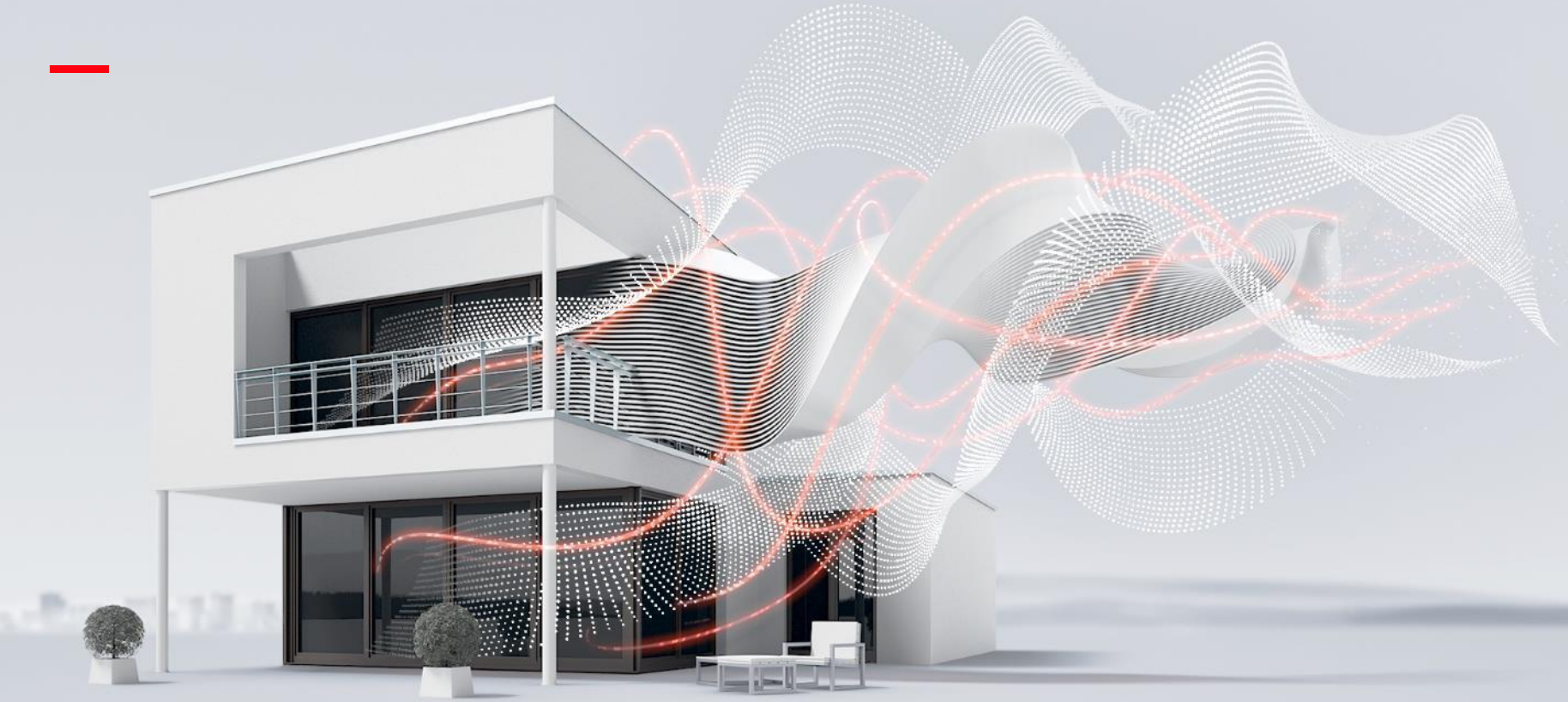


HEIDELBERG, MAY 2022

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session – Building Academy Smart Buildings

Thorsten Reibel & Juergen Schilder

© Copyright 2022 ABB. All rights reserved. Document ID.: … Rev.: …

ClimaECO – Application Controller AC/S – Functions & Sol.

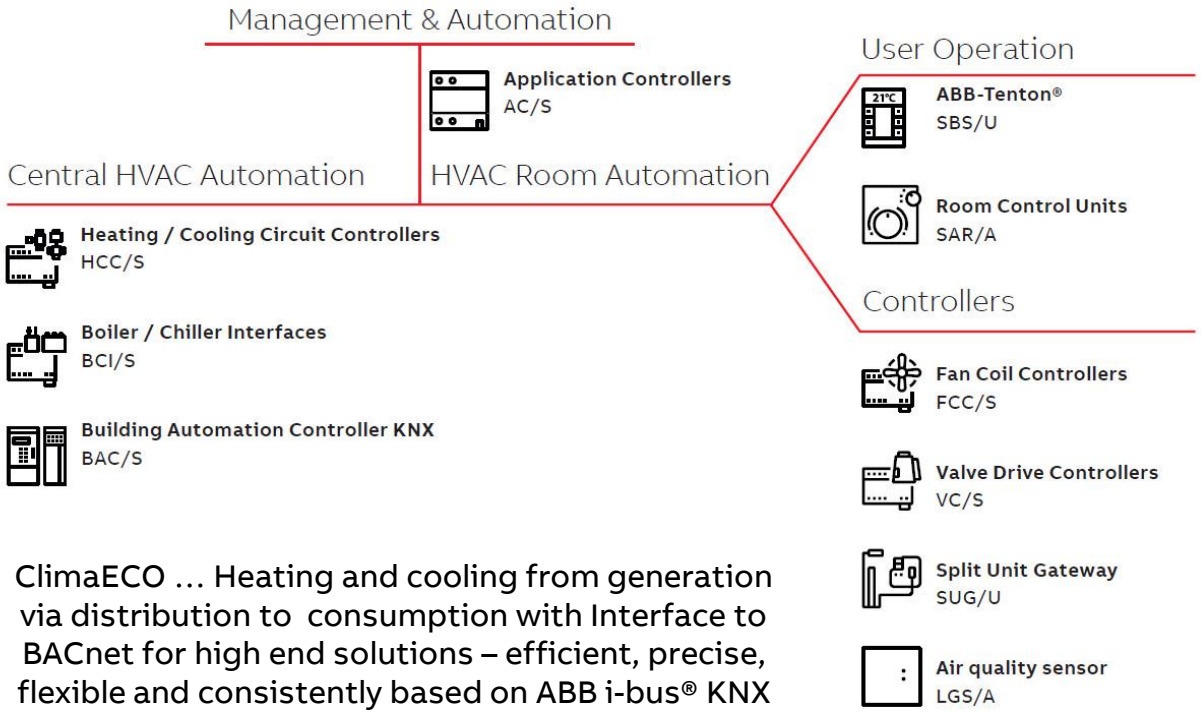
Introduction

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

ClimaECO – Intelligent HVAC solutions with ABB i-bus® KNX

- ClimaECO is the holistic heating, ventilation and air-conditioning (HVAC) automation solution based on ABB i-bus® KNX
- A solution that seamlessly integrates room automation, distribution, central HVAC functions, management and automation into one system – a significant step towards increasing energy efficiency and reducing operational costs
- ABB's ClimaECO portfolio includes
  - ClimaECO® Sensors SBx/U and Room Control Units SAx/A
  - Valve Drive Controllers VC/S
  - Fan Coil Controller FCC/S
  - Heating/ Cooling Circuit Controllers HCC/S
  - Boiler/ Chiller Interface BCI/S
  - Application Controllers AC/S with Interface to BACnet
  - Building Automation Controller KNX BAC/S
- Slides & videos of Webinars, Learning Sessions → T&Q Database



ClimaECO … Heating and cooling from generation via distribution to consumption with Interface to BACnet for high end solutions – efficient, precise, flexible and consistently based on ABB i-bus® KNX

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Overview ABB i-bus® KNX HVAC Range

Room Temperature Sensor (Slave) ...

RTC with CO_2/Humidity Sensor

Fan Coil Controller

Valve Drive Controller

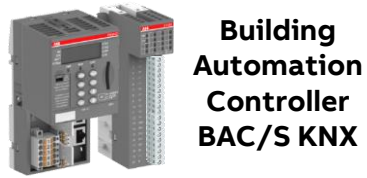
Split Unit Gateway

Electronic Switch Actuator

Valve Drive Actuator

Blower Actuator

Electromotor Valve Drive



Building Automation Controller BAC/S KNX

Application Controller

Boiler/Chiller Interface

Presence Detector

Air Quality Sensor

Analogue Input

Room Master

Heating/Cooling Controller

Room Controller

Electrothermal Valve Drive

Heating Cooling Circuit Controller

©ABB

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Overview ABB i-bus® KNX HVAC Range

Room Temperature Sensor (Slave) ...

RTC with CO_2/Humidity Sensor

Fan Coil Controller

Valve Drive Controller

Electronic Switch Actuator

Valve Drive Actuator

Blower Actuator

Split Unit Gateway

Electromotor Valve Drive

Building Automation Controller BAC/S KNX

Application Controller

Boiler/Chiller Interface

Presence Detector

Air Quality Sensor

Analogue Input

Room Master

Heating/Cooling Controller

Room Controller

Electrothermal Valve Drive

Heating Cooling Circuit Controller

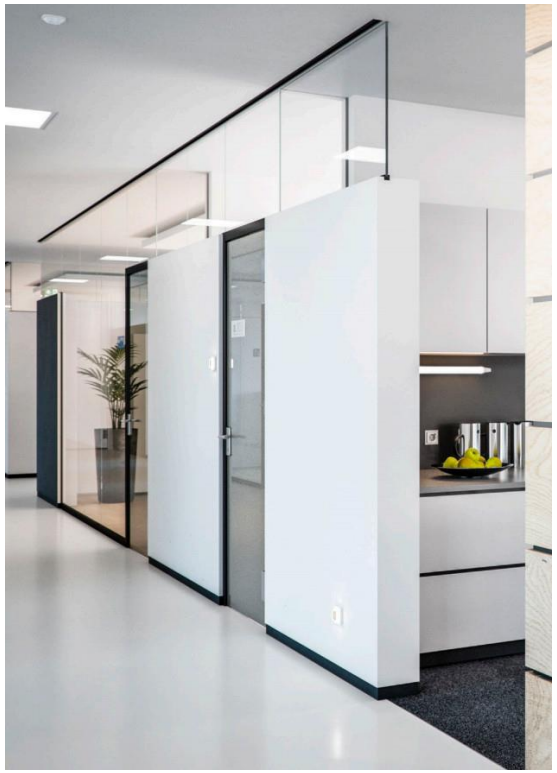
ClimaECO – Application Controller AC/S – Functions & Sol.

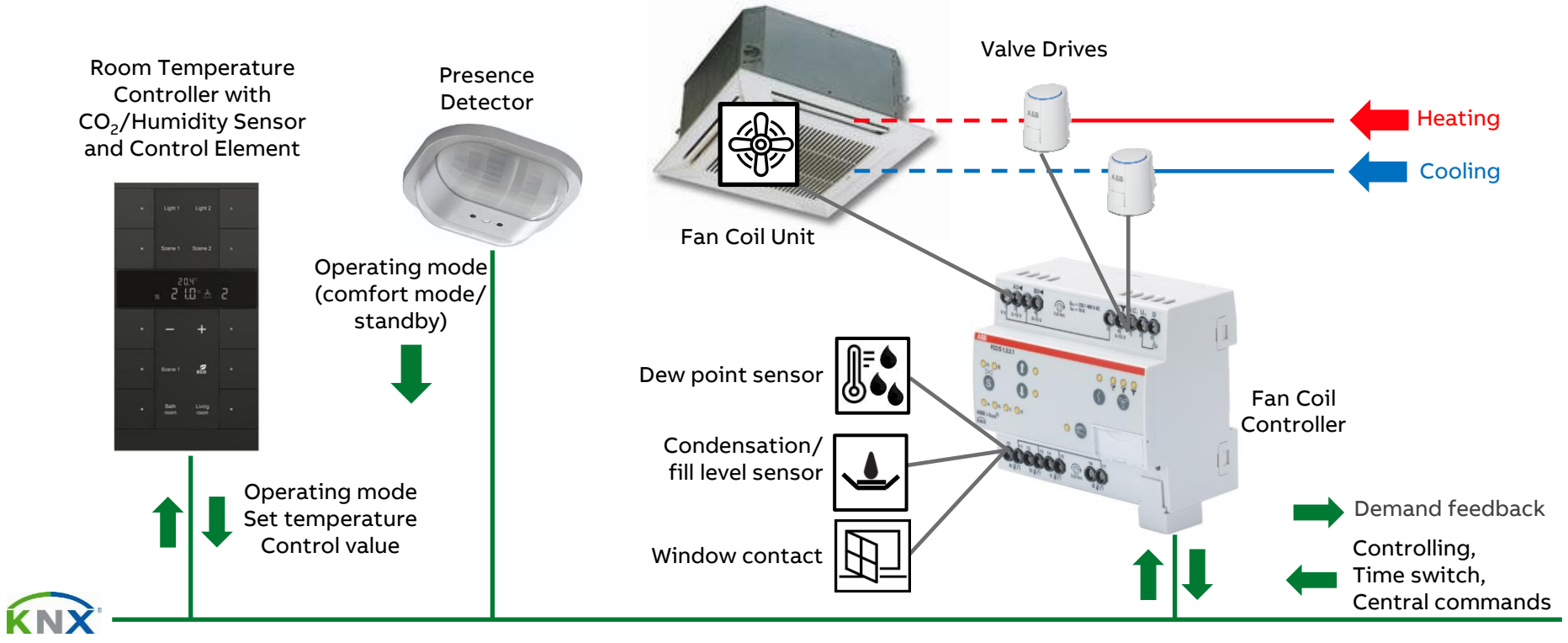
Overview Application Controller AC/S

ClimaECO – Application Controller AC/S – Functions & Solutions

ClimaECO: ABB i-bus® KNX and HVAC

Room automation solutions: Heating/cooling/ventilation on the room level





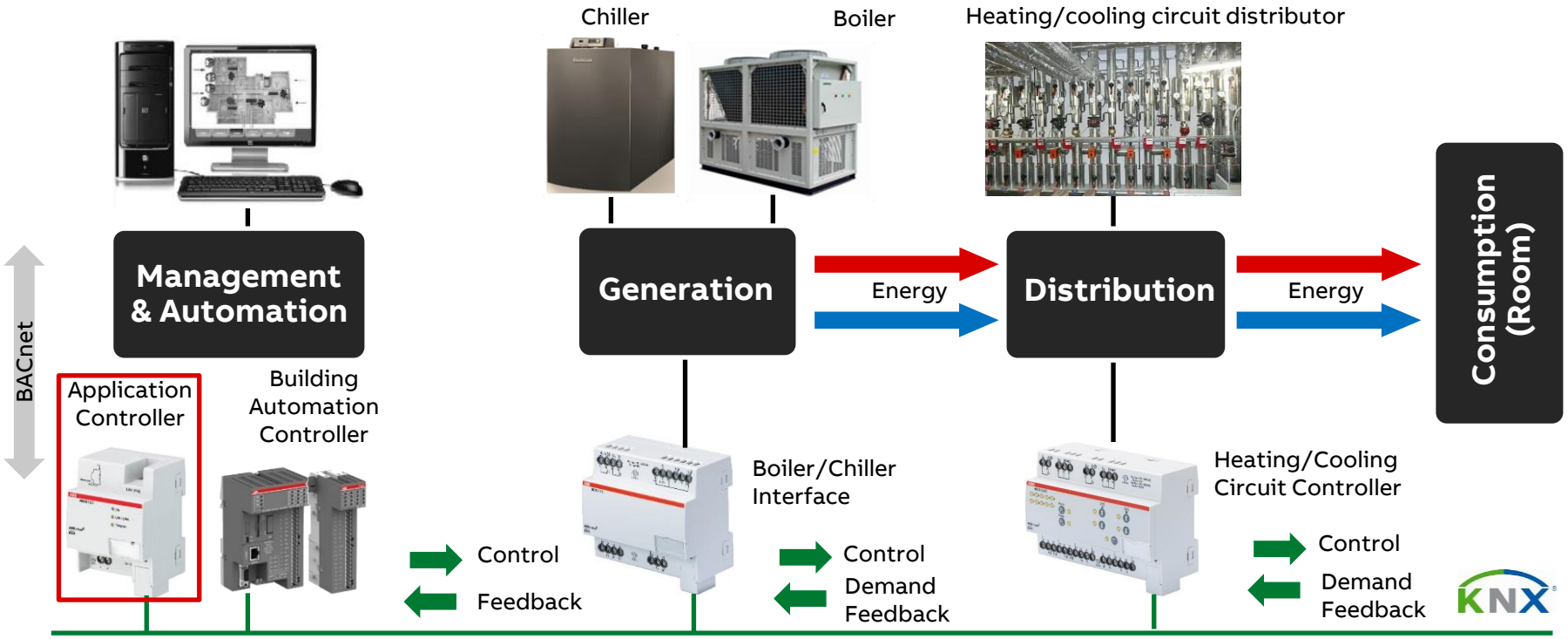
ClimaECO – Application Controller AC/S – Functions & Solutions

ClimaECO: ABB i-bus® KNX and HVAC

Room ←→ Distribution ←→ Generation ←→ Management & Automation

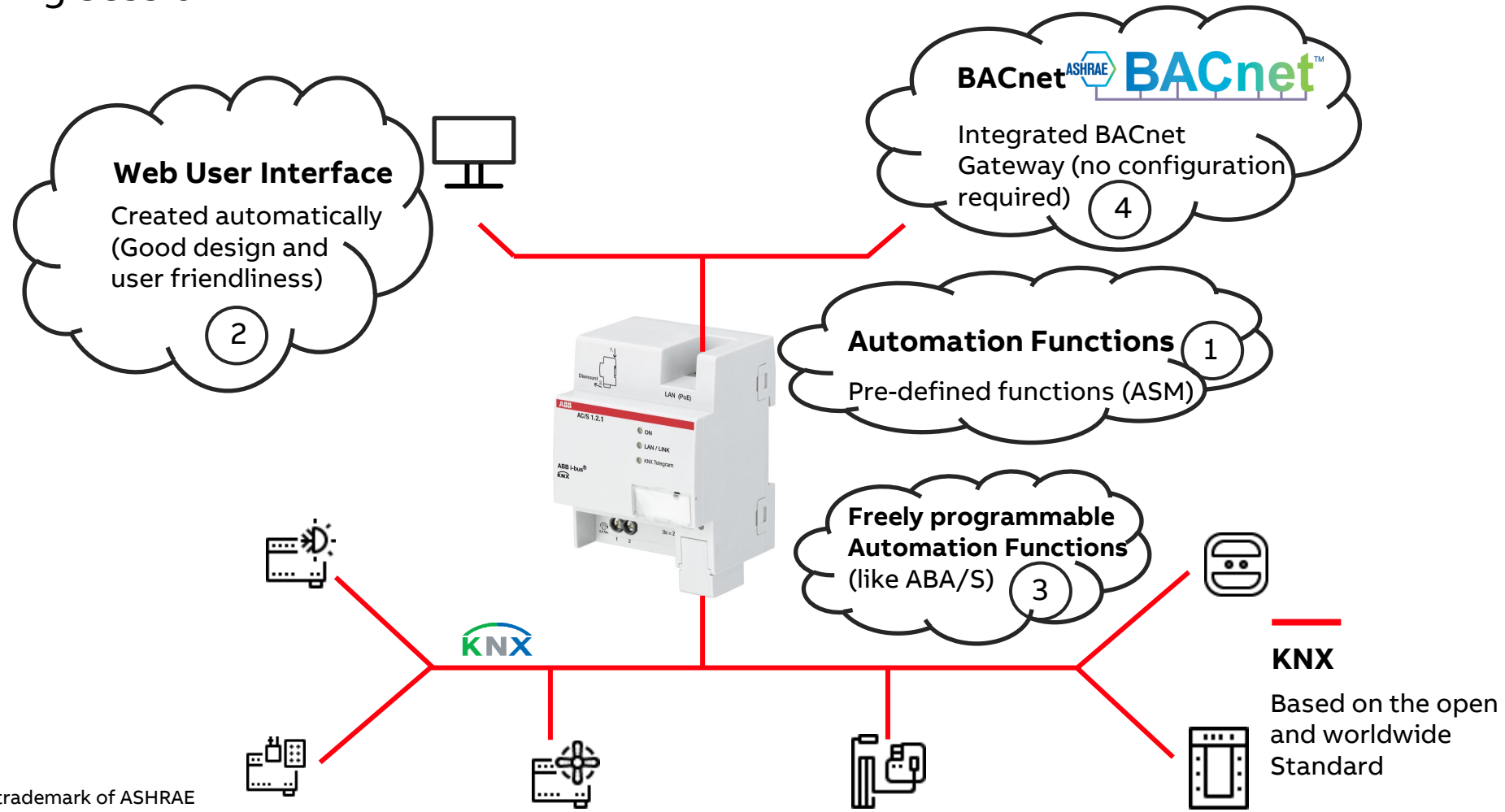
A consistent HVAC solution must cover all levels

- Management & Automation
- Generation
- Distribution
- Consumption (Room)
- Communication based on ABB i-bus® KNX
- Water based heating and cooling
- Small and medium size commercial projects
- Application Controller AC/S contains all software functions for this task and more



ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session



BACnet® is a registered trademark of ASHRAE

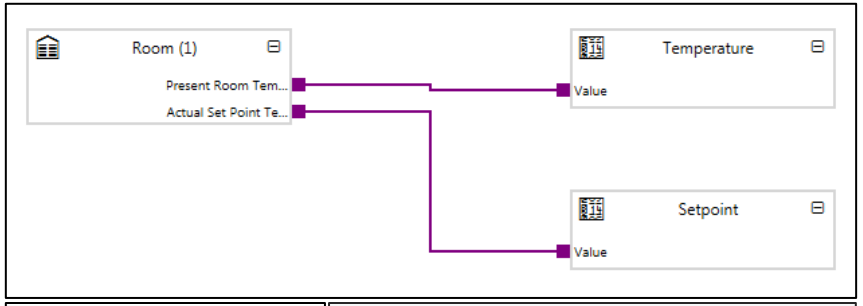
ClimaECO – Application Controller AC/S – Functions & Solutions

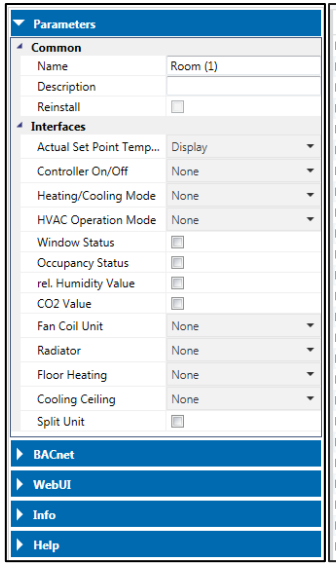
Online Learning Session

1. Application Specific Automation Modules

Predefined Automation Modules

- ASM –> **A**pplication **S**pecific Automation **M**odule
- Represent specific functionality, can execute function by itself or together with other ASM's e.g. room set points or heating/cooling circuit control
  - In- and/or outputs (sockets)
  - Parameters
  - Group objects
  - Linking view with sockets to be connected to KNX objects, WebUI, BACnet or other ASM's





Number	Name	Object Function	Length
1	HVAC mode Scheduler WebUI	Output: State	1 byte
2	Temperature Scheduler WebUI	Output: State	2 bytes
3	Value	Input: Value	2 bytes
4	Room	Input: Present Room Temperature	2 bytes
5	Room	Input: Actual Set Point Temperature	2 bytes
6	Room Set Points	Output: Cooling Protection	2 bytes
7	Room Set Points	Output: Cooling Economy	2 bytes
8	Room Set Points	Output: Cooling Standby	2 bytes
9	Room Set Points	Output: Cooling Comfort	2 bytes
10	Room Set Points	Output: Heating Comfort	2 bytes
11	Room Set Points	Output: Heating Standby	2 bytes
12	Room Set Points	Output: Heating Economy	2 bytes
13	Room Set Points	Output: Heating Protection	2 bytes
14	Cooling Distribution Circuit	Input: Valve Actuating Value	1 byte
15	Cooling Distribution Circuit	Input: Supply Temperature	2 bytes
16	Cooling Distribution Circuit	Input: Return Flow Temperature	2 bytes
17	Cooling Distribution Circuit	Output: Supply Set Point Temperature	2 bytes
18	Room (1)	Input: Present Room Temperature	2 bytes
19	Room (1)	Input: Actual Set Point Temperature	2 bytes
20	Temperature	Output: Value	2 bytes
21	Setpoint	Output: Value	2 bytes
2001	Device clock	Request time	1 bit
2002	Device clock	Date	3 bytes
2003	Device clock	Time	3 bytes
2004	Device clock	Date/Time	8 bytes

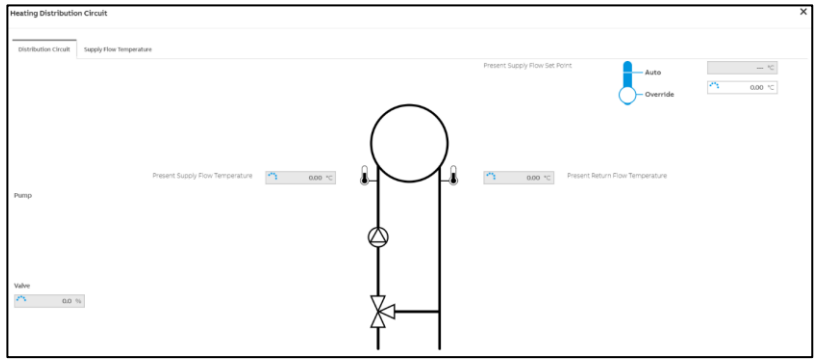
©ABB

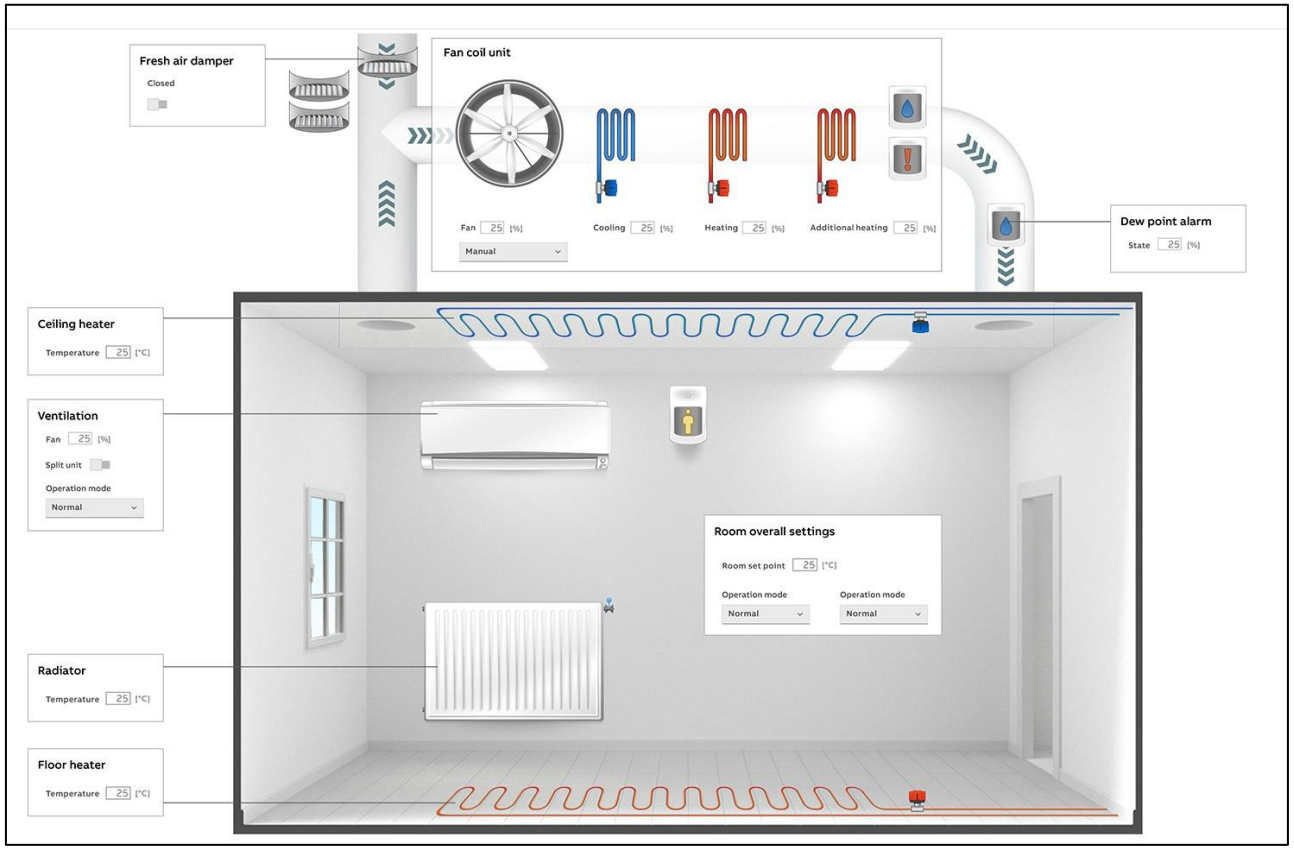
ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

2. Web User Interface (WebUI)

- The WebUI is automatically created based on the selected Automation Modules
- Predefined in Layout and functions
- Simple but powerful user interface
- During commissioning and maintenance
- Small visualization for some projects
- Access via browser and IP address of AC/S



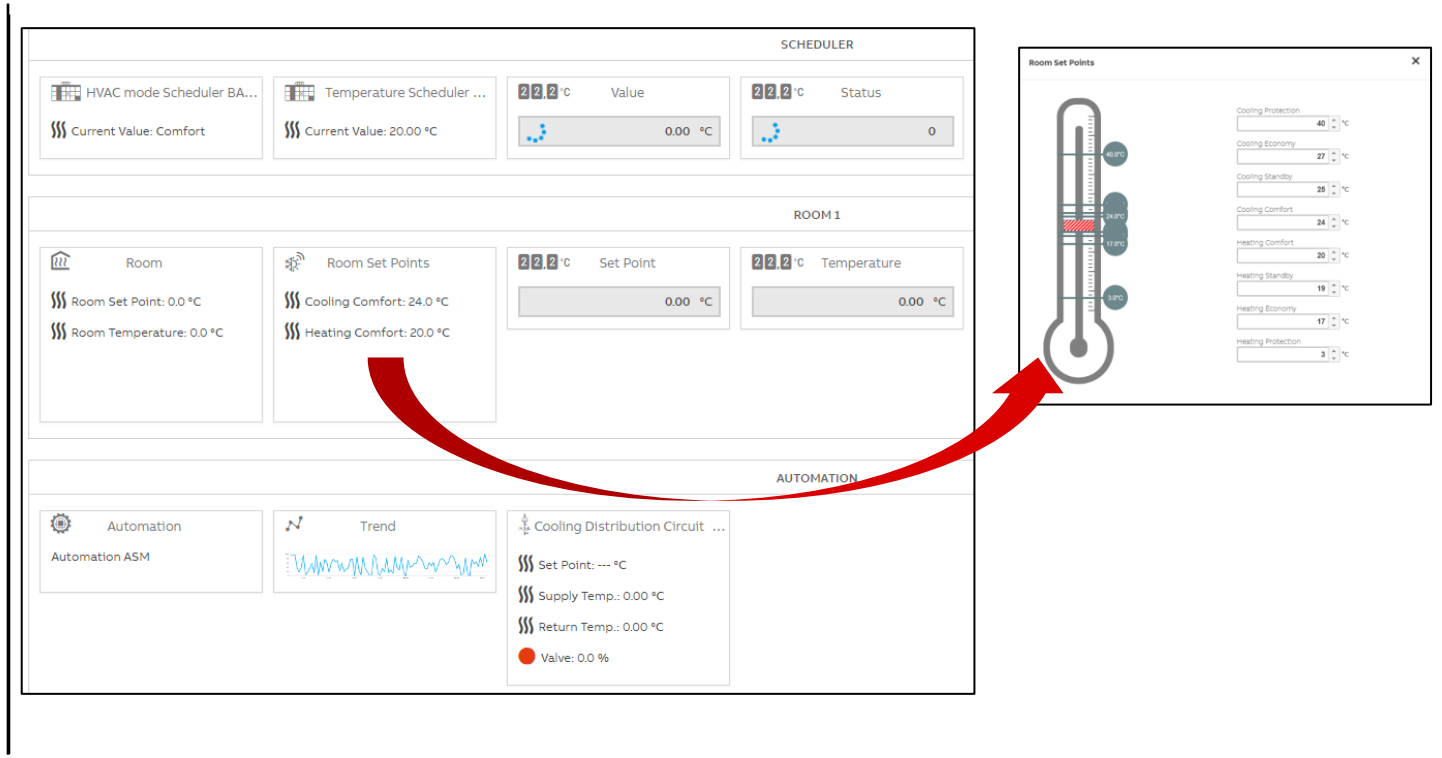


ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

2. Web User Interface (WebUI)

- All Application Specific Automation Modules (ASM) used and parametrized in the ETS project are displayed as a box to have an overview
- View according to structure in ETS
- Some values of the ASM (e.g. set point) are directly visible in the box
- Some ASM's can be opened by clicking on a box to have a detailed view with the option to adjust values

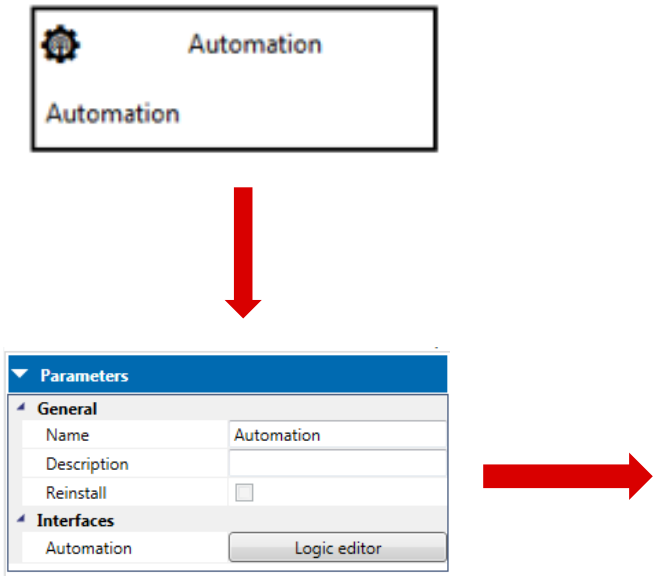


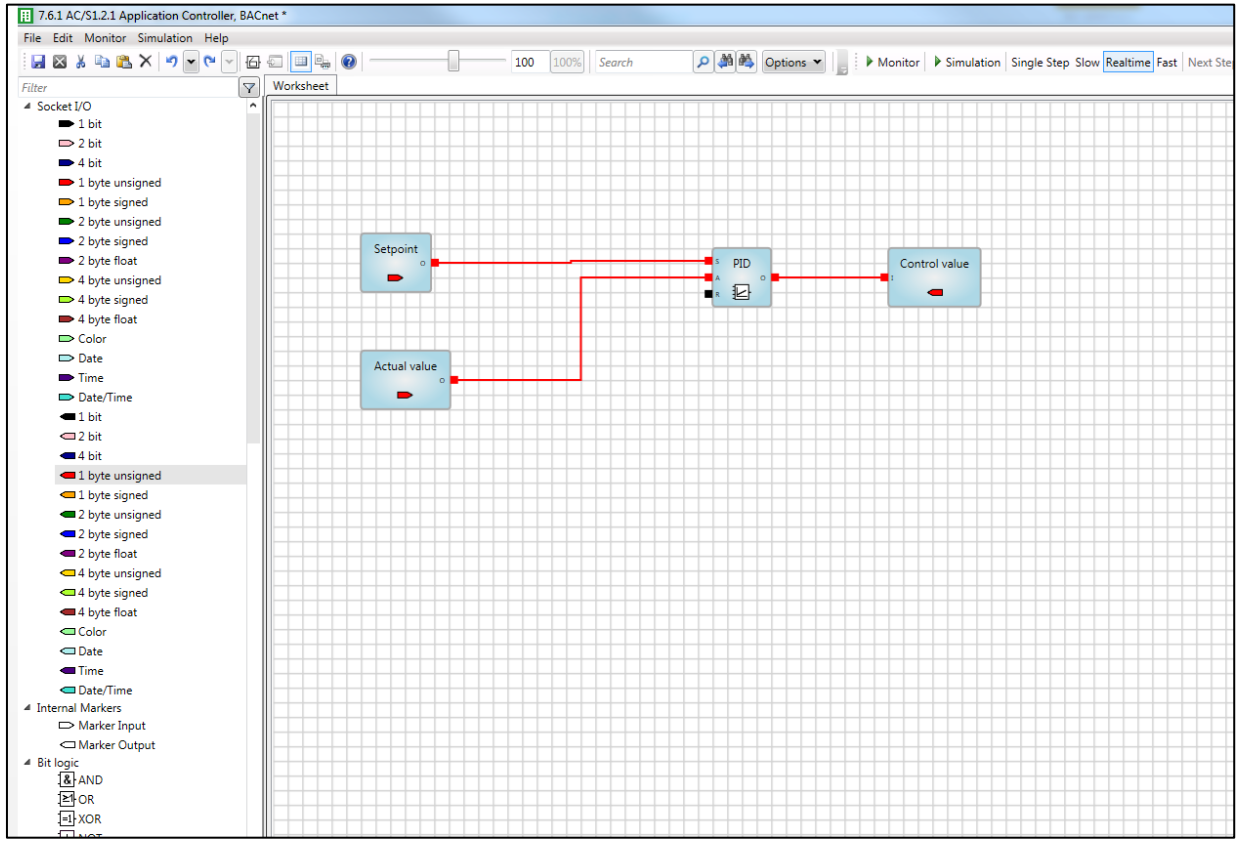
ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

3. Automation/Logic

ASM Automation: Freely programmable Logic like Logic Controller ABA/S 1.2.1



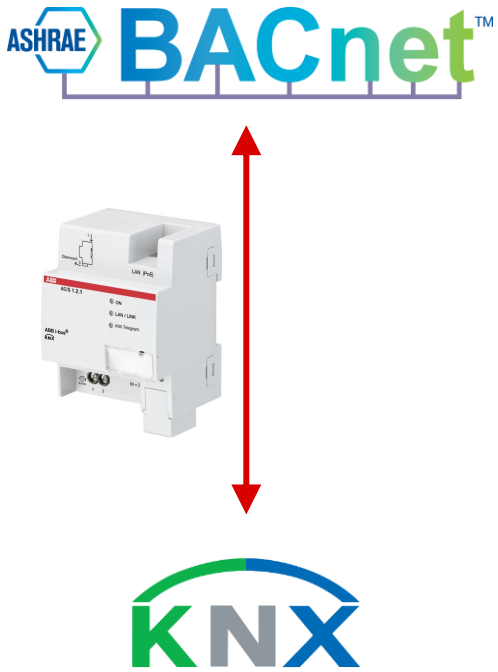


ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

4. BACnet

- Integrated KNX-BACnet Gateway to link the KNX System with the Building Management System (BMS)
- Bi-directional Data Exchange between KNX Twisted Pair (TP) and BACnet/IP (Ethernet)



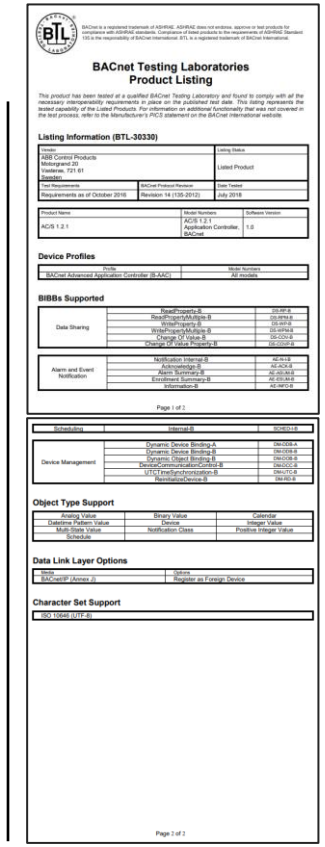
BACnet® is a registered trademark of ASHRAE

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

4. BACnet

- BACnet certified product
- BACnet Conformance Certificate
- BACnet Testing Laboratories Product Listing
- BACnet Protocol Implementation Conformance Statement



BACnet Testing Laboratories
Product Listing

Listing Information (BTL-30330)

Device Profiles

BIBBs Supported

Object Type Support

Data Link Layer Options

Character Set Support

BACnet
CONFORMANCE
CERTIFICATE

No. BTL-30330

WSPCert attests the conformance of the following BACnet implementation to the BACnet standard ISO 16484-5 protocol revision 1.14. The attested conformance refers to the BACnet Interoperability Building Blocks (BIBBs) listed on the BTL Listing bearing the above-mentioned BTL-number.

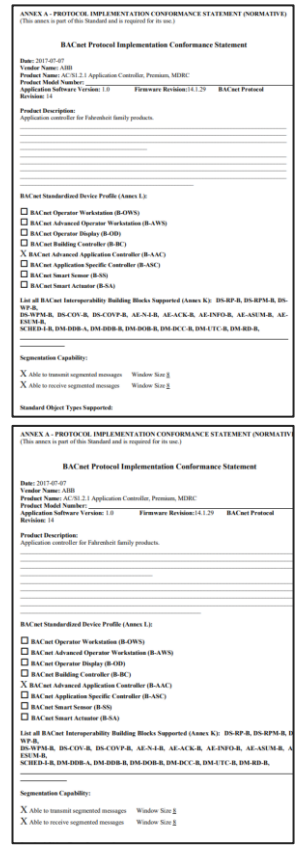
The BACnet implementation has fulfilled the requirements according to the test standard ISO 16484-6, the BTL Test Plan 15.0 and the BTL Testing Policies, see Test Report number TC-100503 of DIAL.

Product name (B-AAC)
AC/S 1.2.1
Model(s) AC/S 1.2.1 Application Controller, BACnet
Software version
1.0
Vendor
ABB Control Products
Motorgrand 20
Vasteras, 721 61, Sweden

This certificate is valid until **31-Mar-2024**.

11-Sep-2018
Date of Initial Certification

Dipl.-Ing. G. Weinmann
Head of Certification Body

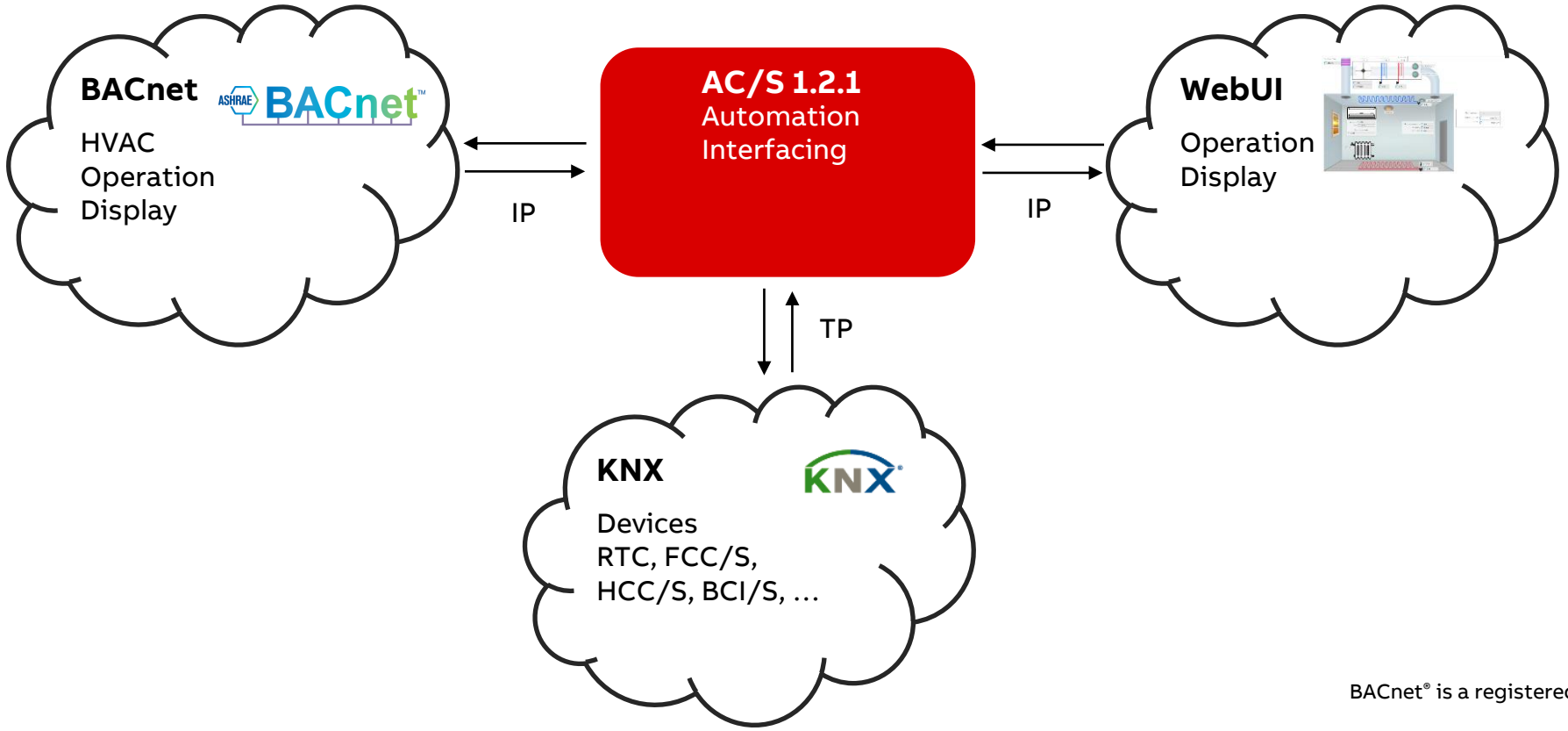


ANNEX A - PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT (NORMATIVE)

BACnet Protocol Implementation Conformance Statement

ClimaECO – Application Controller AC/S – Functions & Solutions

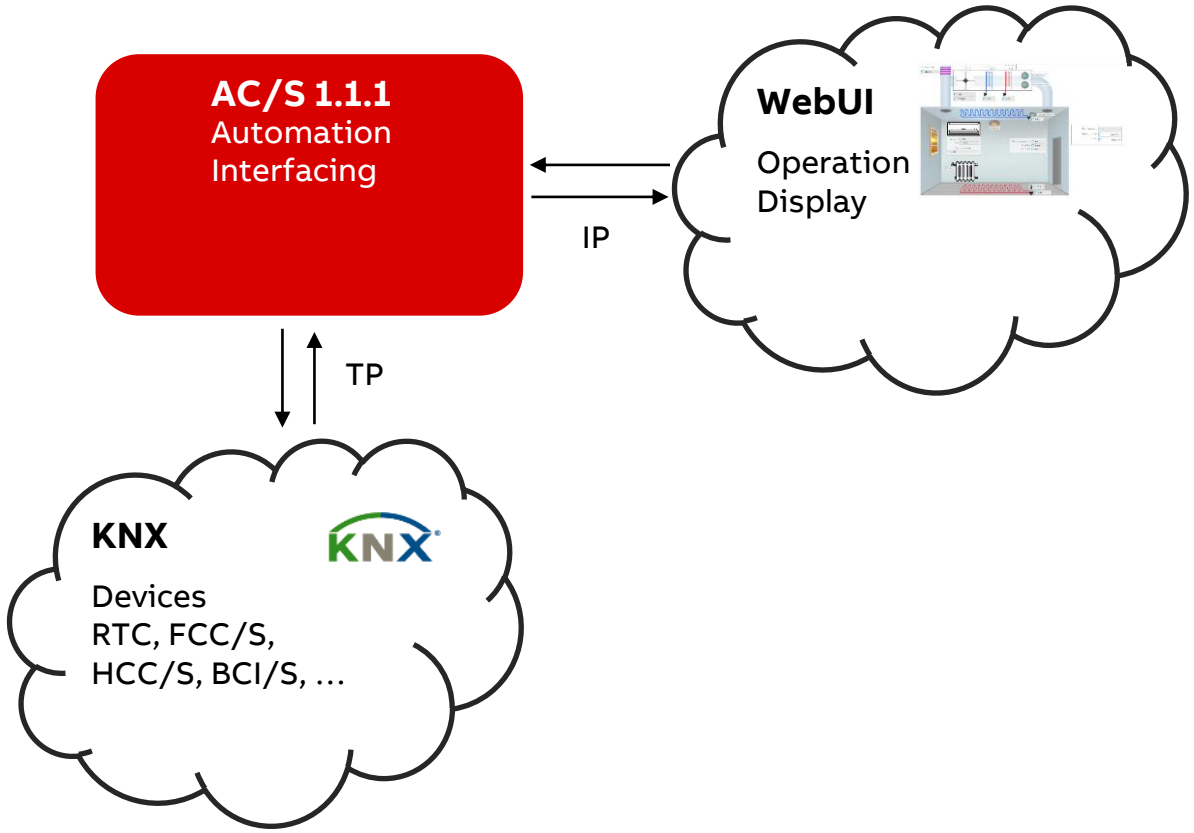
Online Learning Session



BACnet® is a registered trademark of ASHRAE

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session



ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Hardware

- Power supply
  - 24 V AC/DC or PoE (LAN connection)
- Bus connection terminal behind cover
- Reset button behind labelling cover
- LAN connection
  - PoE (Power supply), WebUI, BACnet, fast ETS Application Download, Monitor (Logic)
- LEDs (ON, LAN/Link, KNX telegram)
- Internal clock
- Training package ClimaECO in ABB Library including detailed Presentation Application Controller AC/S

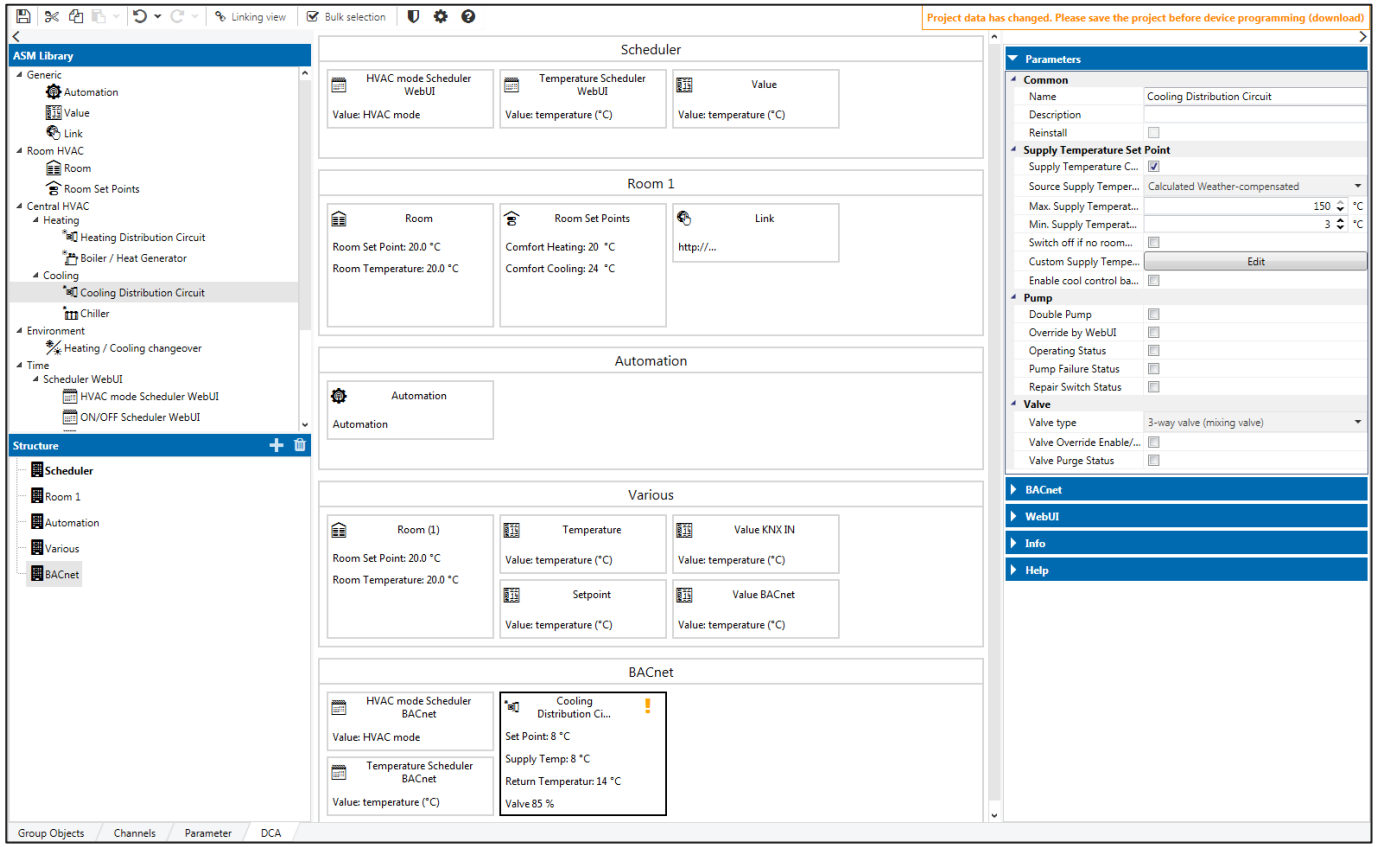
©ABB

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

ETS Application

- Fully integrated in ETS5 or ETS6
- Reliable KNX Twisted Pair (TP) Communication
- Fast ETS Download over Ethernet (IP)
- Time synchronization via
  - BACnet
  - KNX
  - NTP
- All Functions (ASM, Parameter, Linking view) integrated in DCA (Device Configuration App)
- The free of charge DCA has to be installed in the ETS and can be downloaded from the KNX Online Shop or ABB homepage at the product



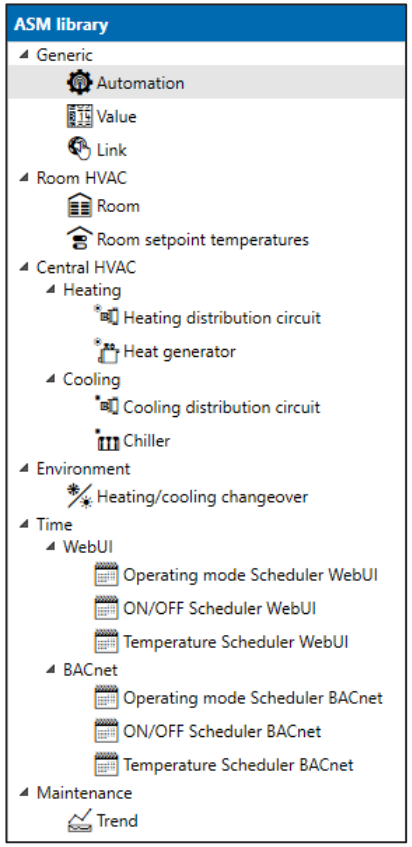
ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Overview Application specific Modules (ASM)

Within the ETS Application (DCA) a library with 17 modules exists

- Automation
  - Logic like Logic Controller ABA/S
- Value
  - Communication to all interfaces in both directions
- Link
  - Connection to a URL, email or file accessible via WebUI
- Room
  - Representation of room HVAC functions in WebUI (graphical)
- Room setpoint
  - Change of setpoints in WebUI (graphical)
- Heating distribution circuit
  - ClimaECO embedded software functionality for Heating Cooling Circuit Controller HCC/S



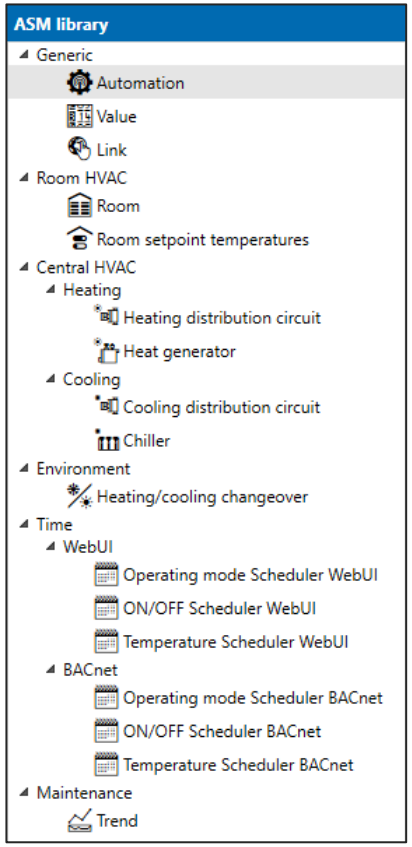
©ABB

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Overview Application specific Modules (ASM)

- Heat generator
  - ClimaECO embedded software functionality for Heating with Boiler Chiller Interface BCI/S
- Cooling distribution circuit
  - ClimaECO embedded software functionality for Cooling in Heating Cooling Circuit Controller HCC/S
- Chiller
  - ClimaECO embedded software functionality for Cooling with Boiler Chiller Interface BCI/S
- Heating Cooling Changeover
  - Manual change between heating and cooling in WebUI
- WebUI Scheduler
  - Adjustment of time functions for HVAC mode (1 byte, DPT 20.102), ON/OFF (1 bit) and temperature (2 byte, DPT 9.001)



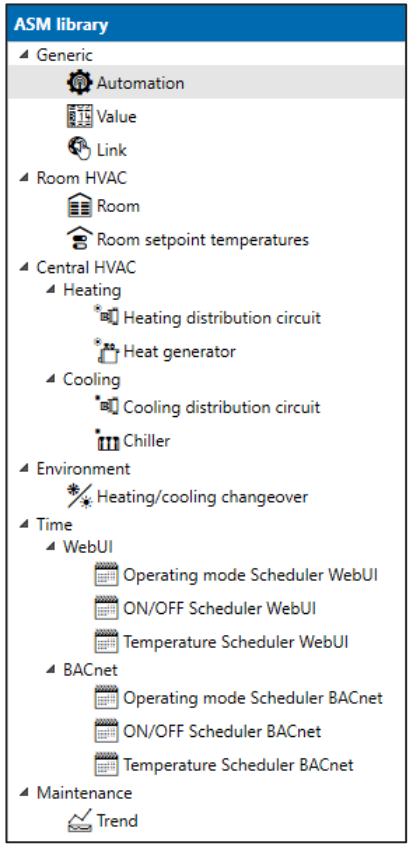
©ABB

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Overview Application specific Modules (ASM)

- BACnet Scheduler
  - The same like WebUI scheduler but the switching times are parametrized in BACnet, the execution of the schedule is done reliably by the Application Controller AC/S. The switching times can be viewed only in the WebUI
- Trend
  - Recording of dynamic values over time to be displayed in WebUI in a graphical way (line or bar graph)
  - Each Trend ASM can record up to 5 values, in total 50 trends
  - Data type from 1 bit to 4 byte
  - Range: from value every 5 s of 24 hours (17280 values) to one hour of 3 years (26280 values)
  - For correct recording time has to be synchronized (BACnet, KNX or NTP)
  - Values can be exported, e.g. pdf or xls format



©ABB

ClimaECO – Application Controller AC/S – Functions & Sol.

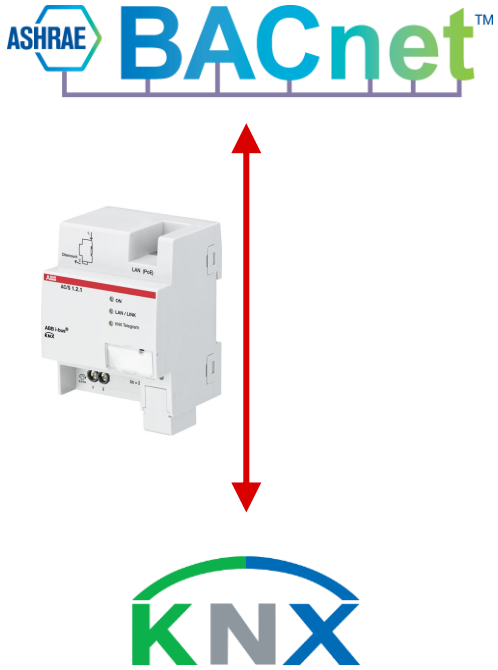
KNX – BACnet Interface

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

KNX-BACnet Interface

- No BACnet Knowledge required, fully integrated in ETS
- No configuration: predefined BACnet Objects in the Automation Modules
- Generic BACnet Objects with wide range of supported data point types
- BACnet calendar and schedule: Set your schedule by BACnet. The execution of the schedule is done reliably by the Application Controller AC/S
- Each BACnet object value can be displayed and set by Web User Interface
- BACnet can write via AC/S into KNX
- Application Controller provides values (Server) to be processed by BACnet (Client)
- 500 datapoints between KNX and BACnet per device possible



BACnet® is a registered trademark of ASHRAE

©ABB

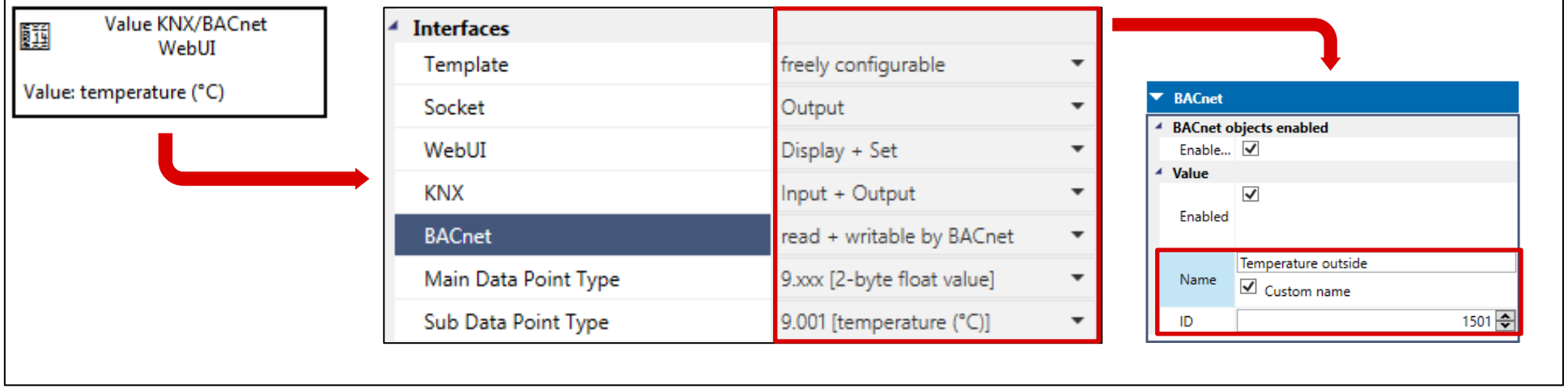
ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

KNX-BACnet Interface

- Selection in ETS/DCA of ASM Value with needed data point
- Communication direction of ASM, either via template or freely configurable, also to WebUI possible
- Access from BACnet, read or in addition write
- Name and ID of BACnet object
- Assignment of group address for KNX communication

ETS Adjustments



KNX Group address

Number	Object Function	Name	Description	Group Address	Length
1	In-/Output: Value	BACnet <--> KNX < --> WebUI		3/3/3	2 bytes

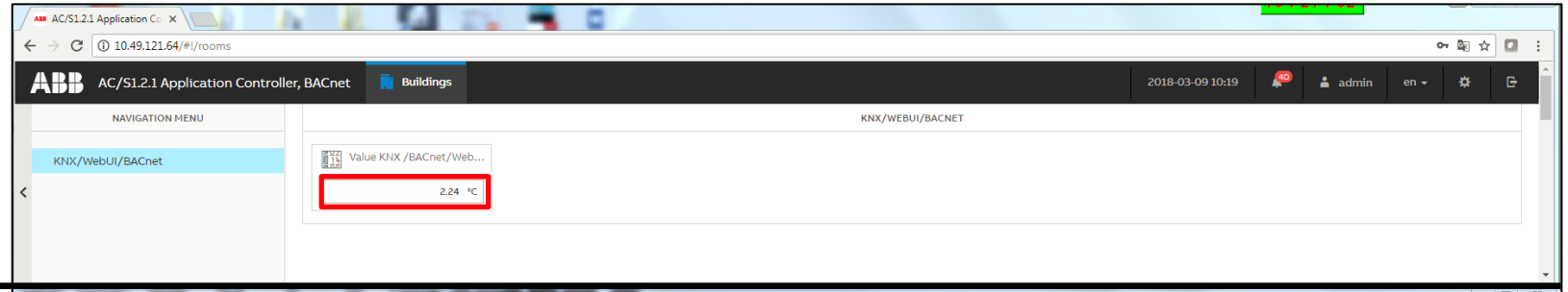
ClimaECO – Application Controller AC/S – Functions & Solutions

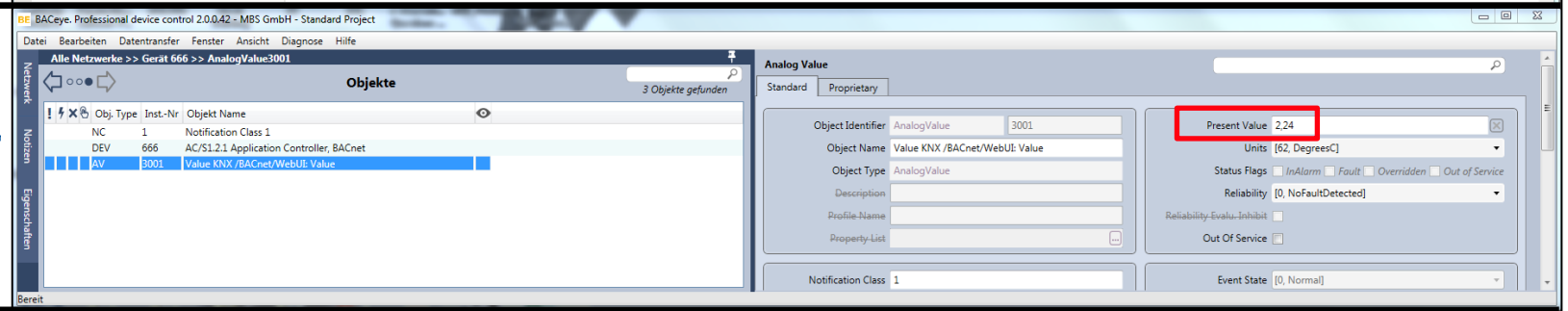
Online Learning Session

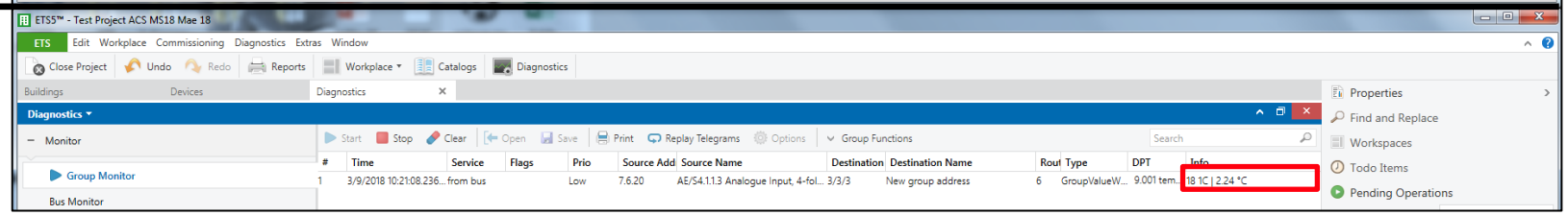
KNX-BACnet Interface

- Communication in all Directions
- WebUI - BACnet - KNX

WebUI







ClimaECO – Application Controller AC/S – Functions & Sol.

ASM Trend (Data Logger)

ClimaECO – Application Controller AC/S – Functions & Solutions

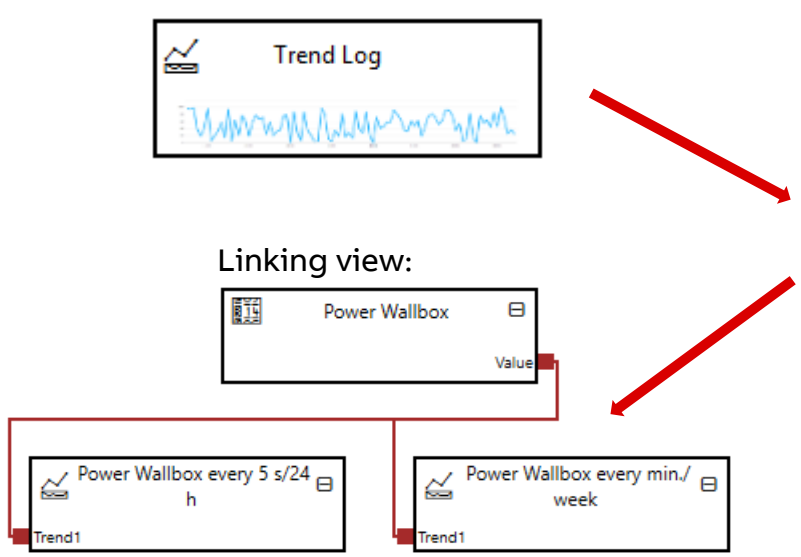
Online Learning Session

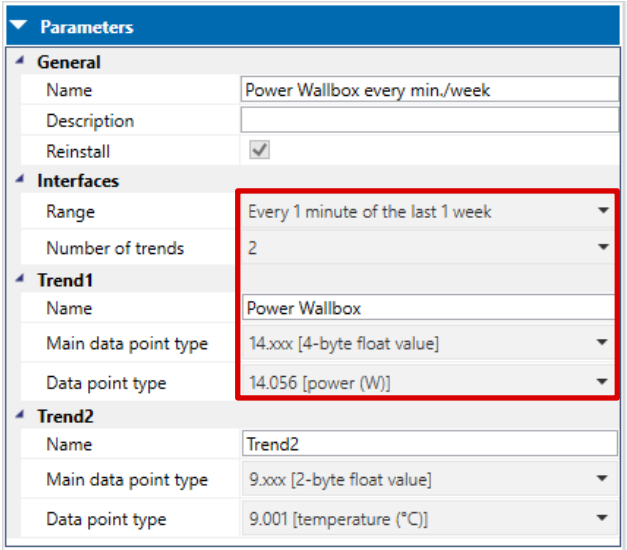
ASM Trend

Recording of dynamic values over time to be displayed in WebUI in a graphical way (line or bar graph), stored in the device, data export possible

- Selection of ASM Trend
- Range: from value every 5 s of 24 hours (17280 values) to 1 hour of 3 years (26280 values)
- Adjust data point type
- Linking view: Connect sockets of assigned Value ASM with socket of Trend ASM
- Link group address of Value ASM
- Typical trends in HVAC applications:
  - Setpoint, Control value, Room/outside temperature, Fan speed, flow/return flow temperature

ETS Adjustments



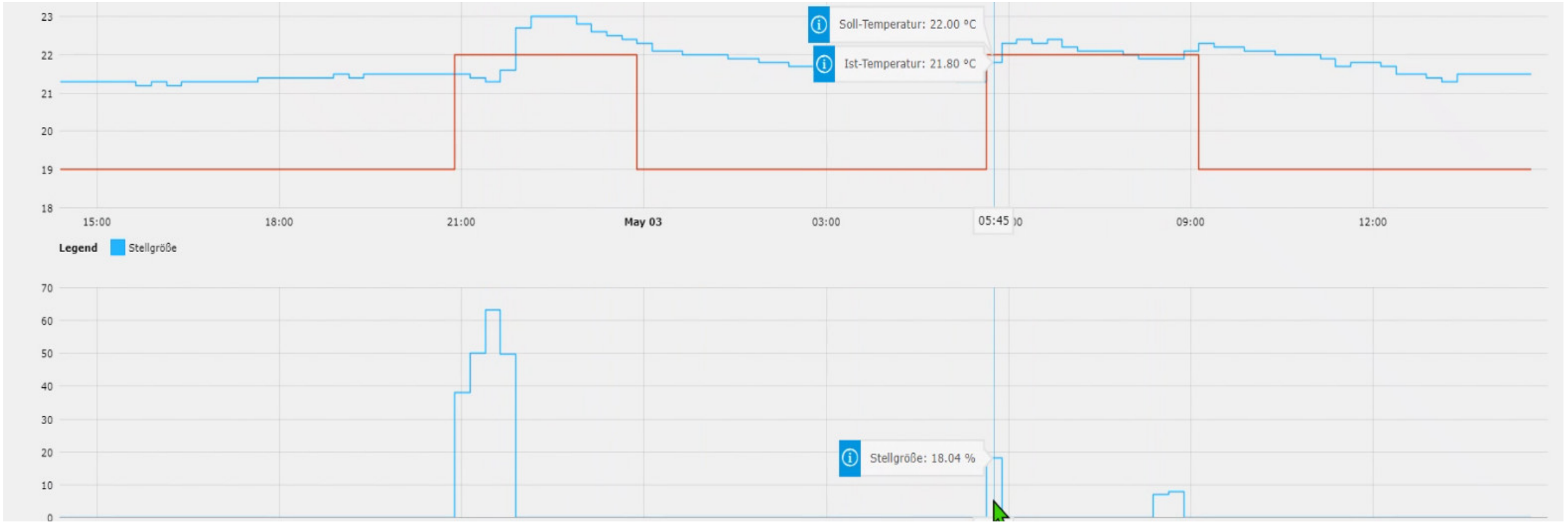


KNX Group address

0/4/37	Power Wallbox	4 bytes	Active Power total L1-L3

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session



Trend: Setpoint, room temperature and control value

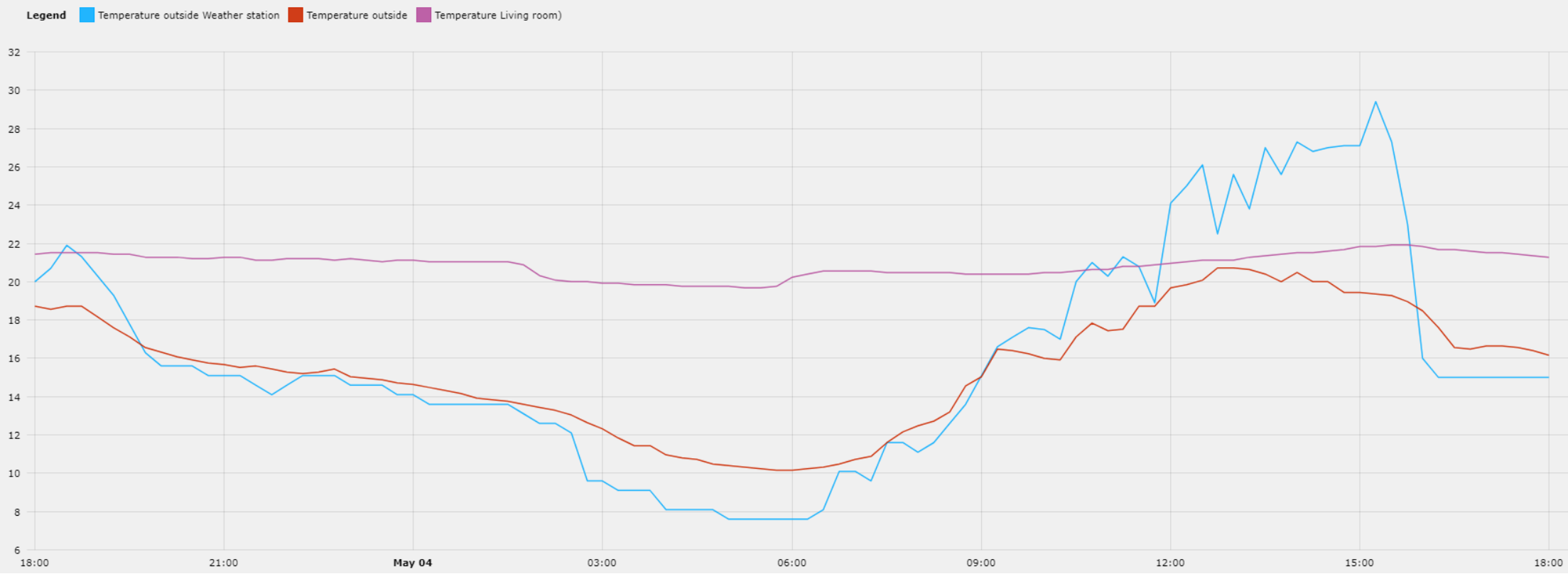
ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Trend: Temperature one year

ClimaECO – Application Controller AC/S – Functions & Solutions

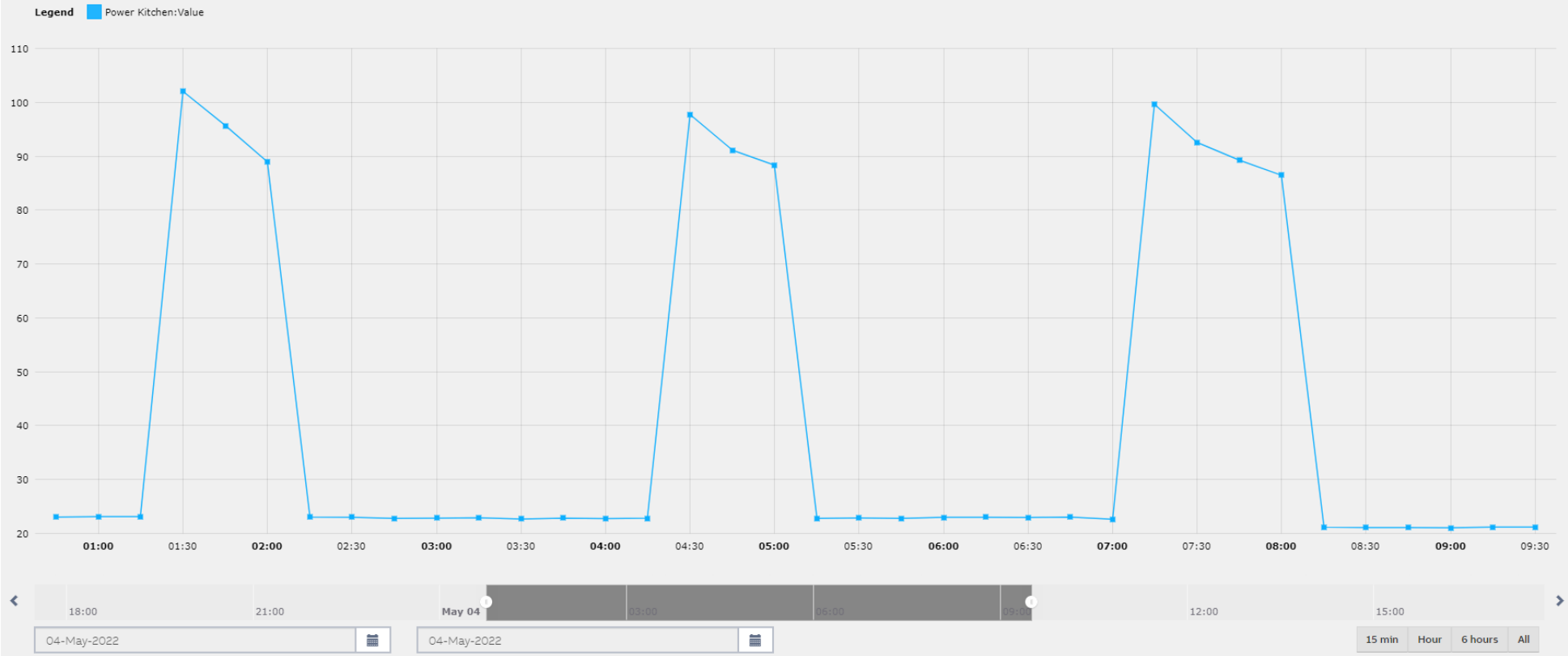
Online Learning Session



Trend: Different Temperatures

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session



Trend: Power of a Refrigerator

ClimaECO – Application Controller AC/S – Functions & Sol.

ASM Scheduler

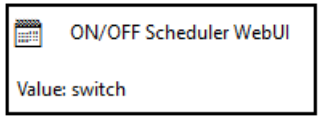
ClimaECO – Application Controller AC/S – Functions & Solutions

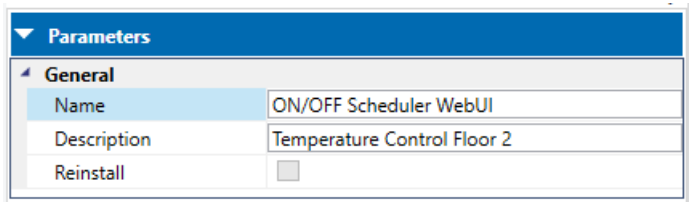
Online Learning Session

WebUI Scheduler

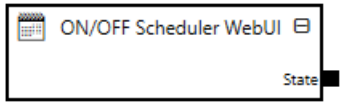
- Adjustment of time functions for
  - HVAC mode (1 byte, DPT 20.102, Comfort, Standby, Economy, Building Protection)
  - ON/OFF (1 bit)
  - Temperature (2 byte, DPT 9.001)
- No parameter adjustments, connections in linking view only when needed at further ASM
- Group address assignment to the related KNX function (socket state)
- Time functions (weekly timer) set in WebUI
  - Exceptions in WebUI: Definition of days with different time program (e.g. holiday)
  - Calendar in WebUI: Overview time program per day

ETS





Linking view:

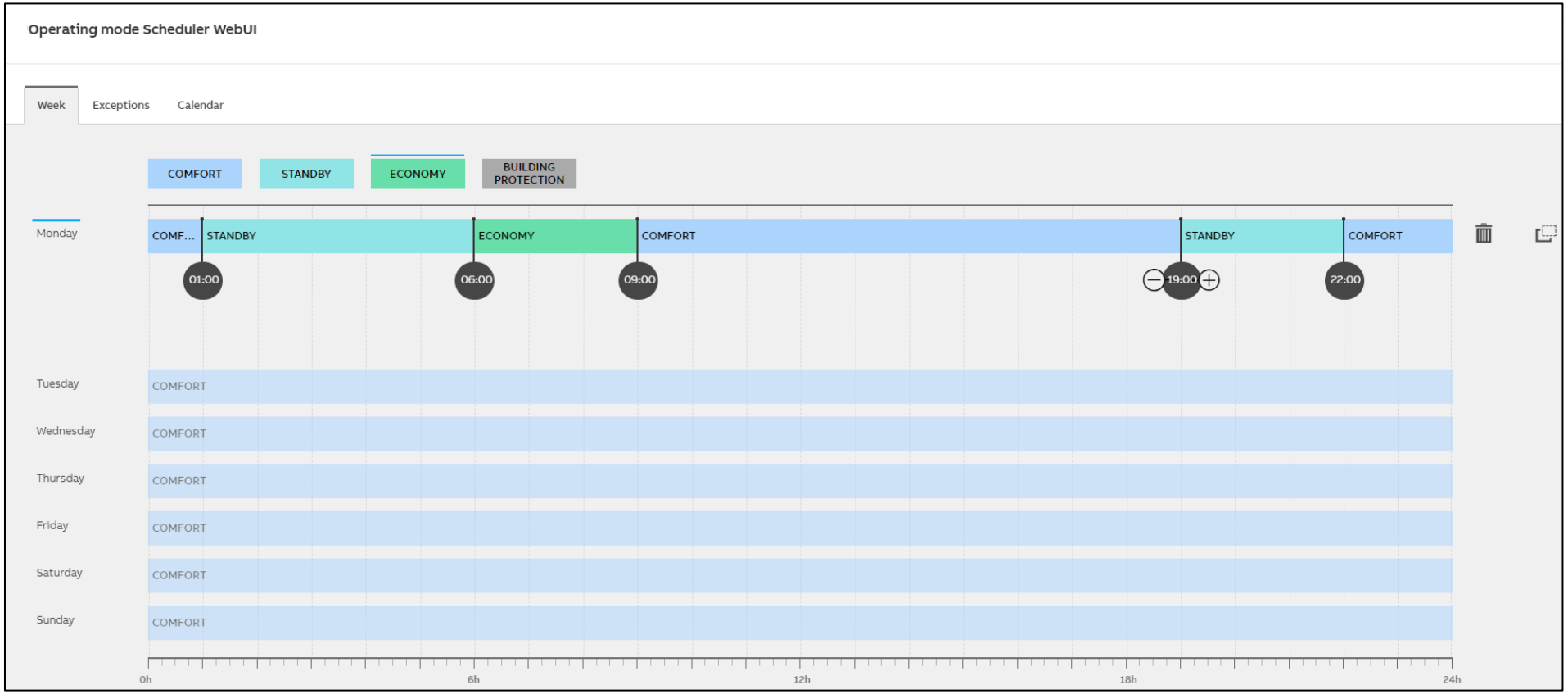


KNX Group address

ON/OFF Scheduler WebUI	Output: State	1 bit	Temperature Control Floor 2	9/2/33

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

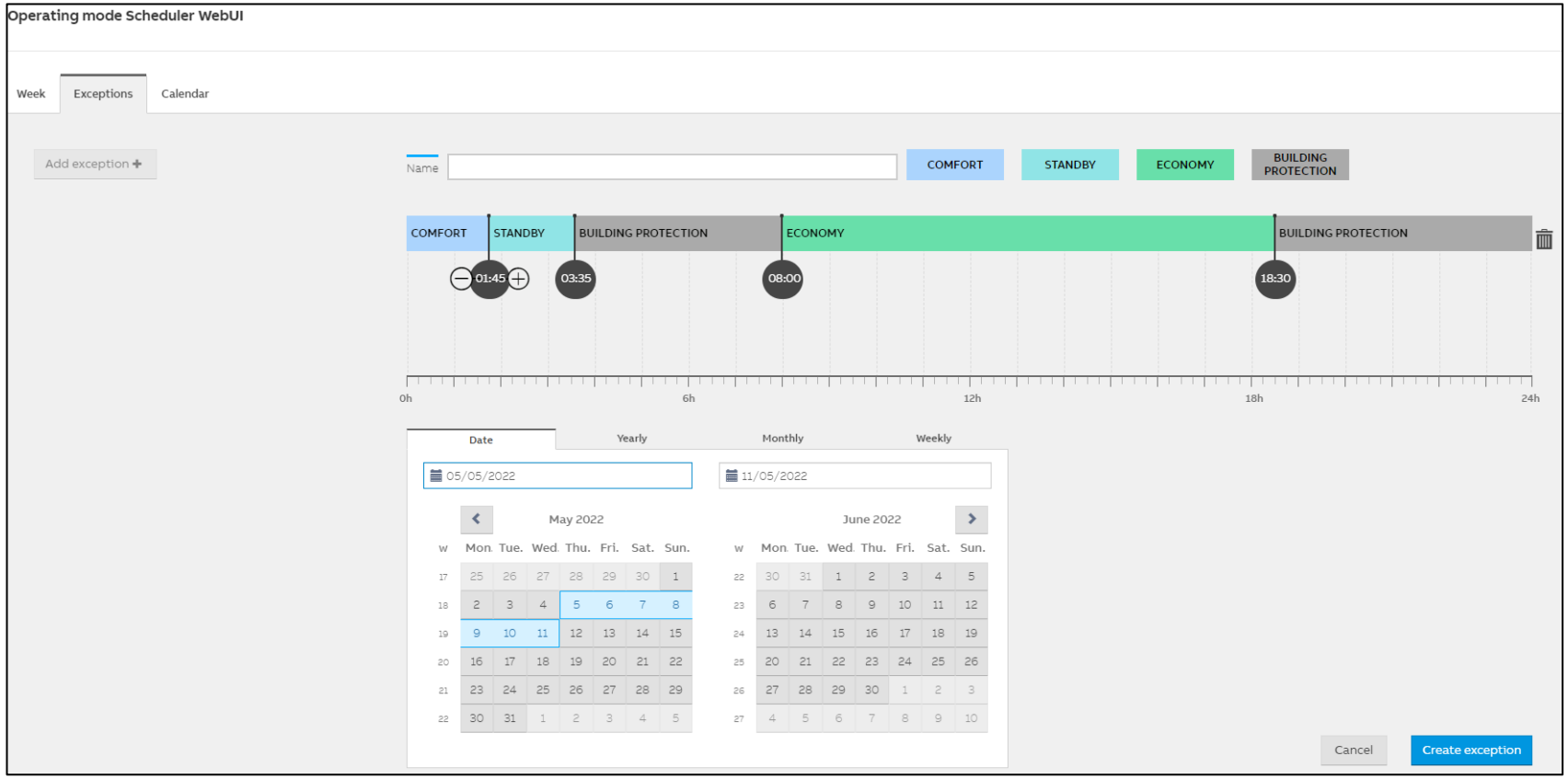


ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Exceptions

Definition of days with different time program (e.g. holiday)

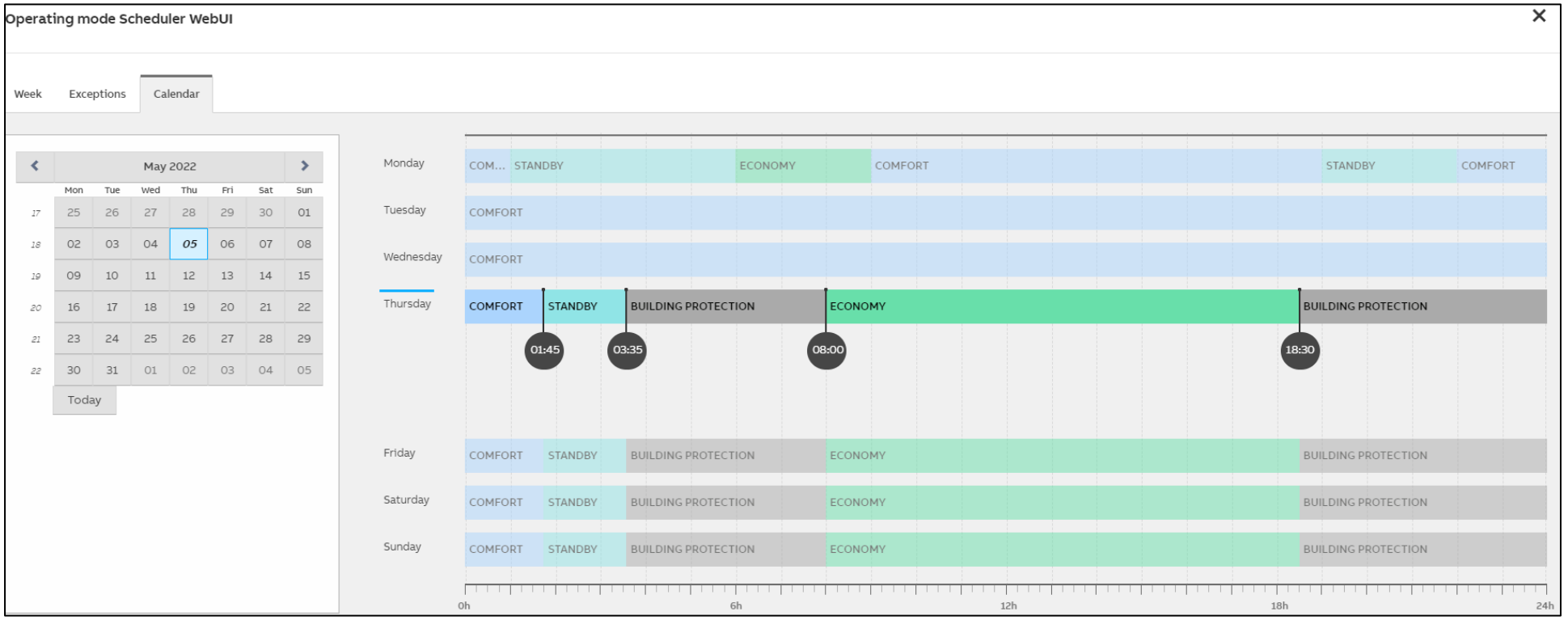


ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Calendar

Overview time program per day



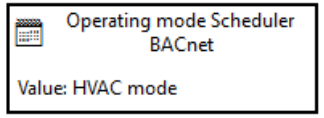
ClimaECO – Application Controller AC/S – Functions & Solutions

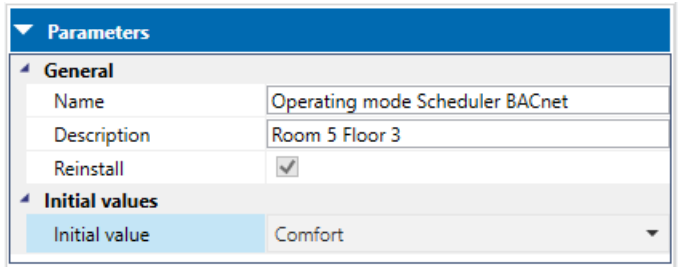
Online Learning Session

BACnet Scheduler

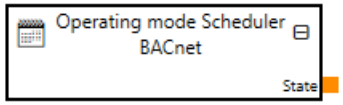
- Switching times are parametrized in BACnet
- Execution of the schedule is done by Application Controller AC/S
- Switching times can be viewed in WebUI but not changed
- Parameter initial value
- Connections in linking view only when needed at further ASM
- Group address assignment to the related KNX function (socket State)

ETS





Linking view:



KNX Group address

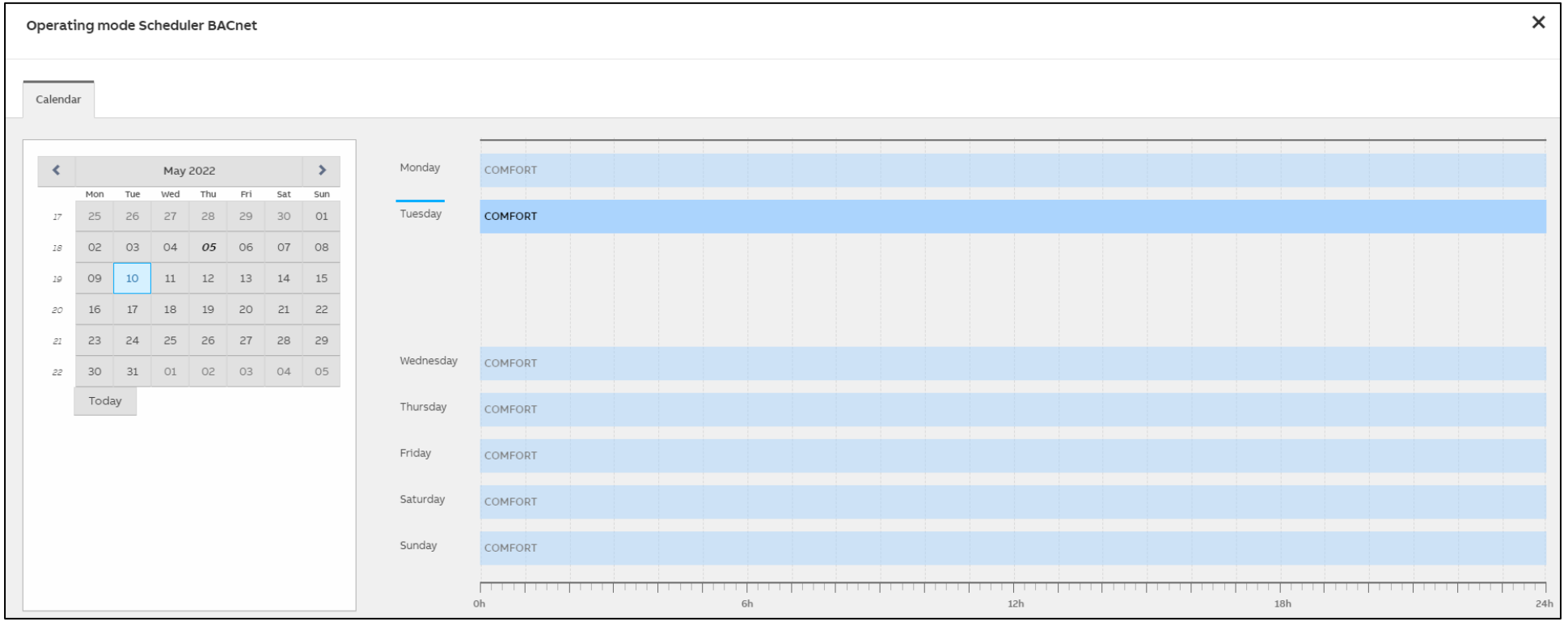
Operating mode Scheduler BACnet	Output: State	1 byte	Room 5 Floor 3	9/3/70

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Calendar

Overview time program per day, no adaptions feasible (only from BACnet)



ClimaECO – Application Controller AC/S – Functions & Sol.

ASM Heating/Cooling Distribution Control

ClimaECO – Application Controller AC/S – Functions & Solutions

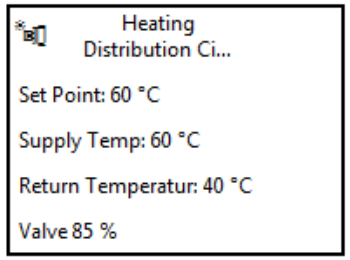
Online Learning Session

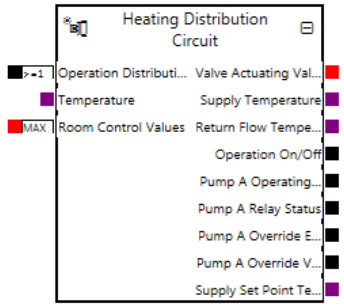
Example: ASM Heating Distribution Circuit

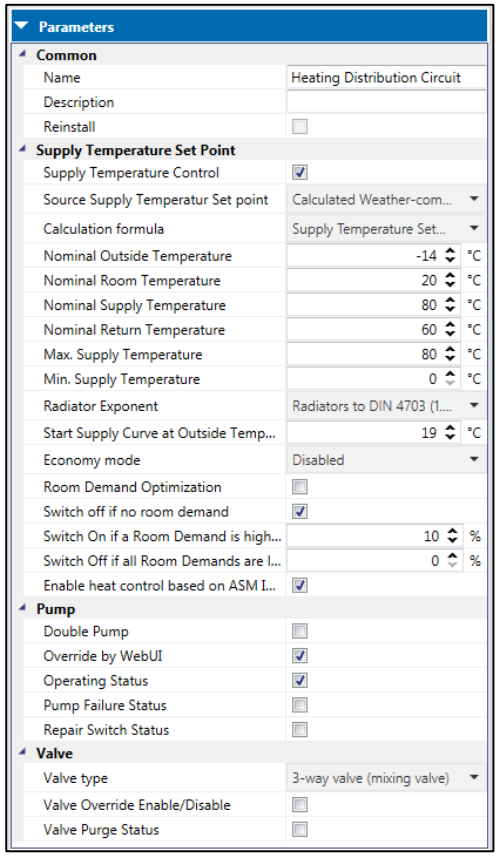
ASM with adjustable parameters works together with Heating Cooling Circuit Controller HCC/S

- Control of flow temperature of a heating circuit depending on outside temperature and optional depending on room demands (Position of valve in each room)
- Curve (Flow temperature depending on outside temperature) can be adjusted
- For room demand evaluation the valve with the most open position is relevant

- ETS Application HCC/C itself is related to device functions only, e.g. internal controller
- Other ASM for cooling circuits and boiler or chiller work the same principle



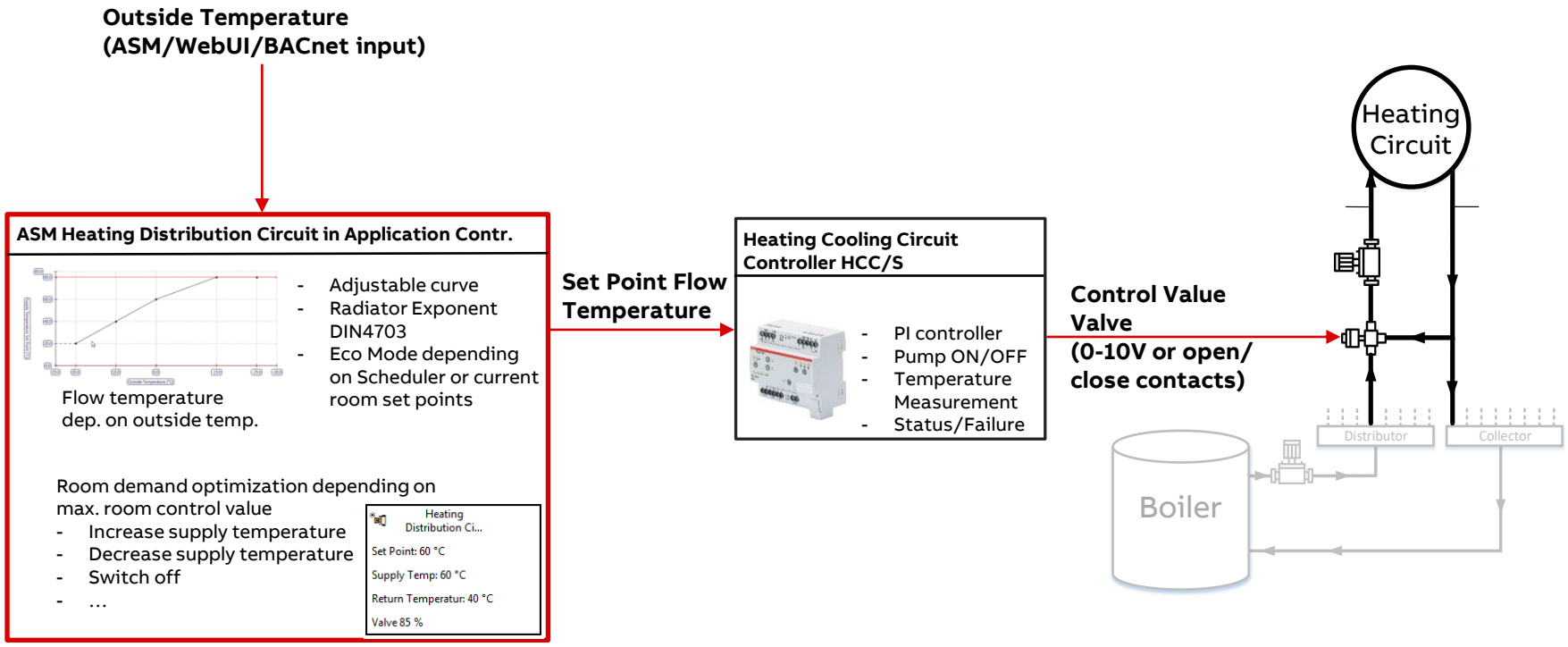




ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Function ASM Heating Distribution Circuit in context



© ABB

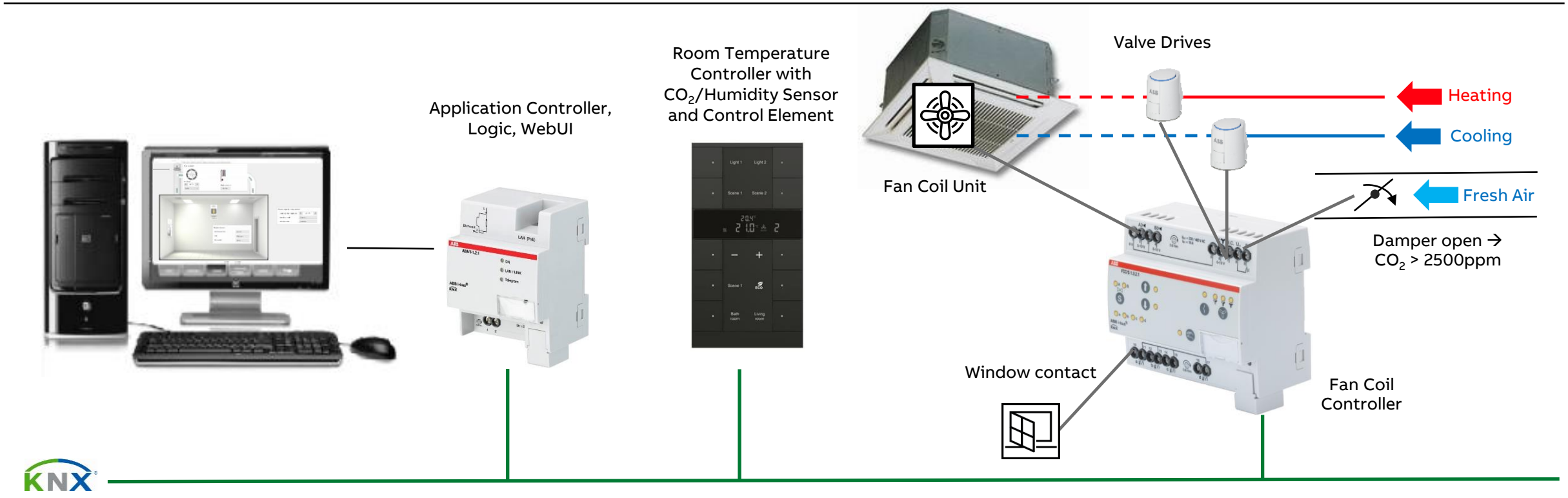
ClimaECO – Application Controller AC/S – Functions & Sol.

FanCoil Control with WebUI and additional Logic for Fresh Air Damper

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

FanCoil Control with WebUI and additional Logic for Fresh Air Damper

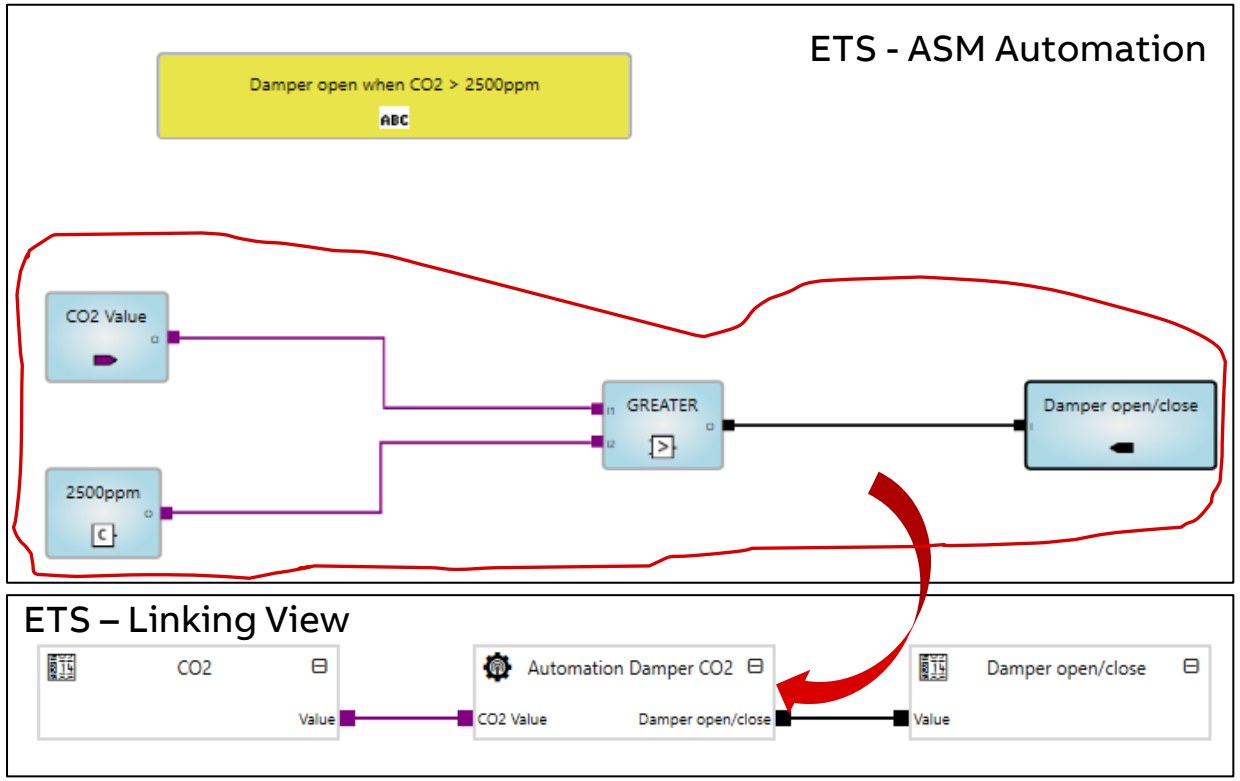


ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Logic in AC/S

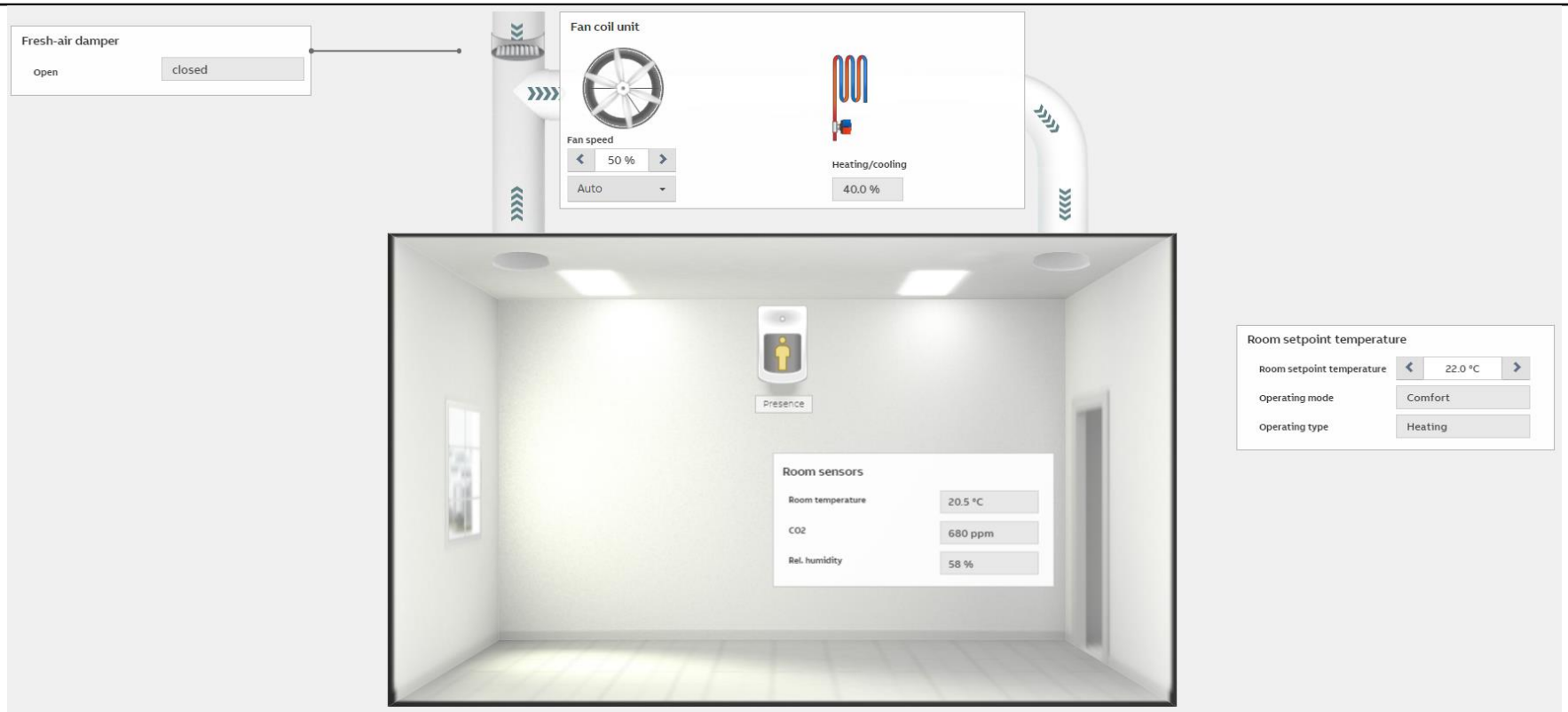
- ASM Automation
- Creation of the logic to compare fixed value CO_2 of 2500 ppm with measured value in ABB Tenton®
- Damper open when CO_2 > 2500 ppm, damper closed when < 2500ppm
- ASM Value for Damper open/close and CO_2
- Control of Damper open/close via additional switching relay of FanCoil Controller FCC/S
- Possible options:
  - Hysteresis for damper control, CO_2 < 2000 ppm closed, > 2500 open
  - Threshold changeable via WebUI
  - Continuous damper control 0-10V (analogue output), controller in AC/S or ABB Tenton®



ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

FanCoil Control with WebUI and additional Logic for Fresh Air Damper



ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Application Controller AC/S

- Damper open/close
- Damper Status
- …

FanCoil Controller FCC/S

- Switch Relay: Damper open/close
- Status Relay: Damper Status
- …

Control Element ABB Tenton®

- CO_2 Value
- …

Application Controller AC/S

- Input: CO_2 Value – CO_2 Tenton
- …

ClimaECO – Application Controller AC/S – Functions & Sol.

Online Learning Session

ClimaECO – Application Controller AC/S – Functions & Solutions

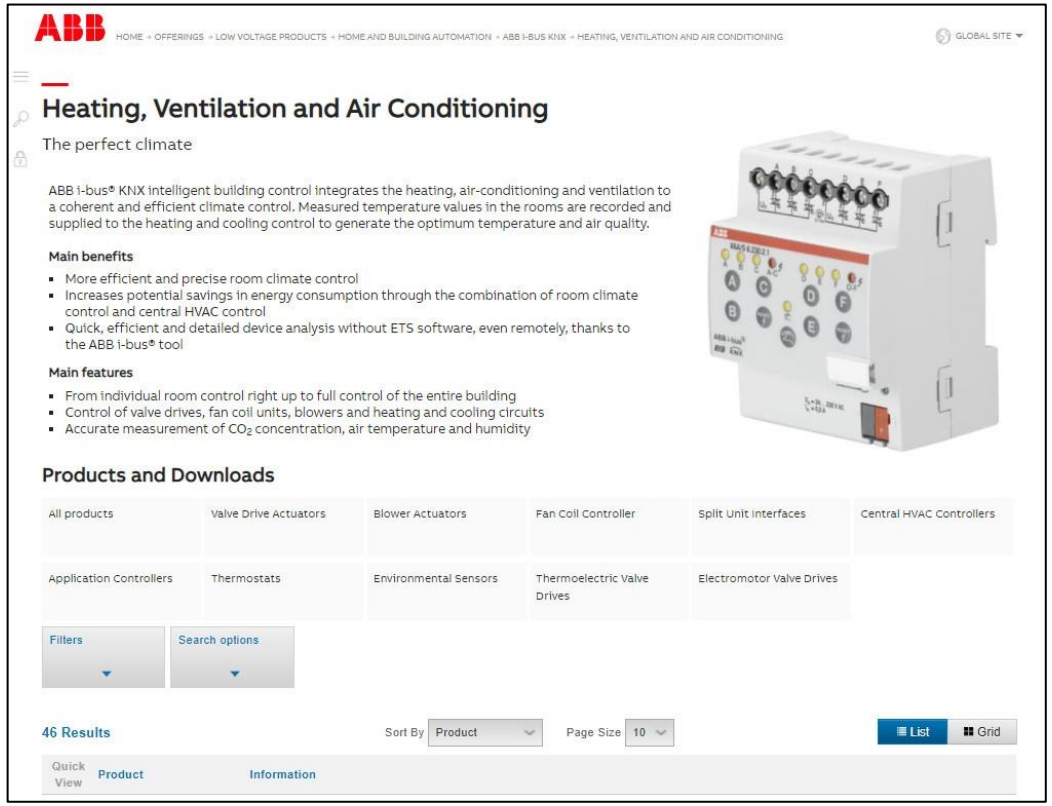
Online Learning Session

Homepage

www.abb.com/KNX

→ Products and Downloads
→ Heating, Ventilation and Air Conditioning

- ETS Application
- ABB i-bus® Tool
- Product Manual
- Engineering Guides
- Installation and Operating Instructions
- Specification Text
- …



©ABB

ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Training Material

Training & Qualification Database

– The database contains extensive training content
  - Webinar, Learning Sessions, … slides and videos
  - Presentations
  - Video tutorials
  - and more …
  - https://go.abb/ba-training
  - ww.abb.com/knx (→ Services & Tools → Training and Qualification → Training Database)

YouTube

– Channel “ABB Home and Building Automation”
  - https://www.youtube.com/user/ABBibusKNX

©ABB

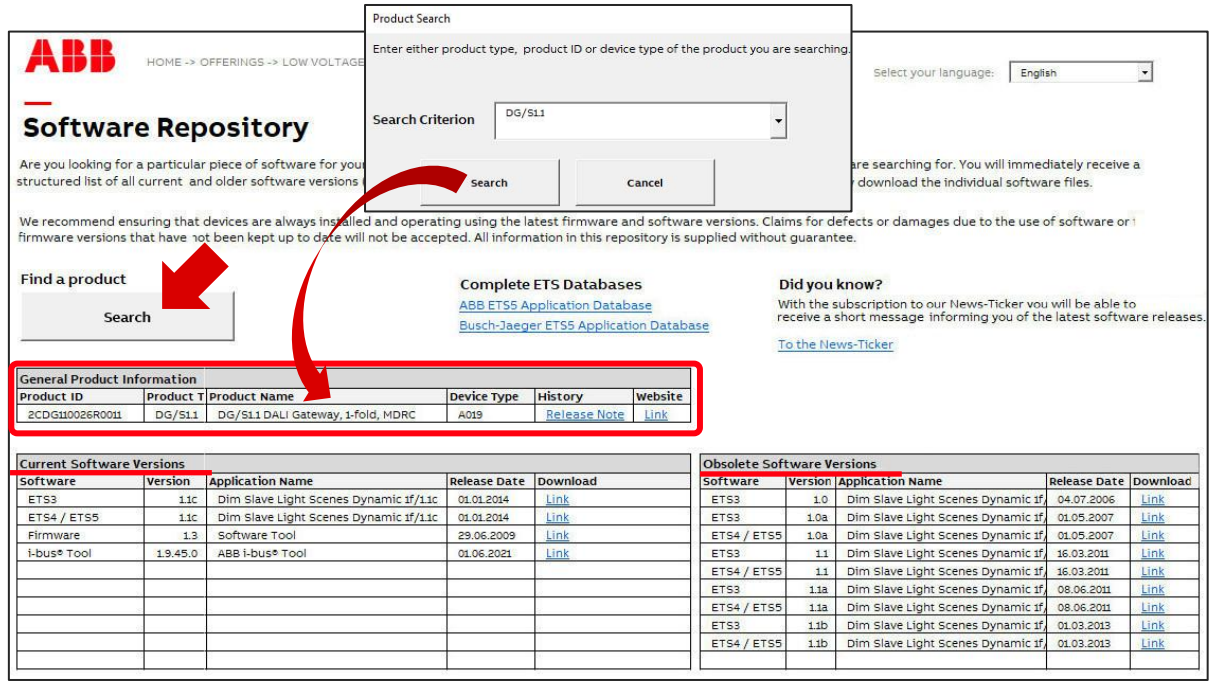
ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Software Repository

- Excel list in German and English
- Link to general product information
- Search for a KNX product and the corresponding software (firmware, ETS application) will be displayed
- Current firmware of Welcome IP and free@home devices
- A direct download of this software is possible via a link
- Historical ETS applications can also be downloaded (database for ETS App “Reconstruction Tool”)

- www.abb.com/KNX
  → Additional materials
  → Downloads for KNX
  → Software Repository



©ABB

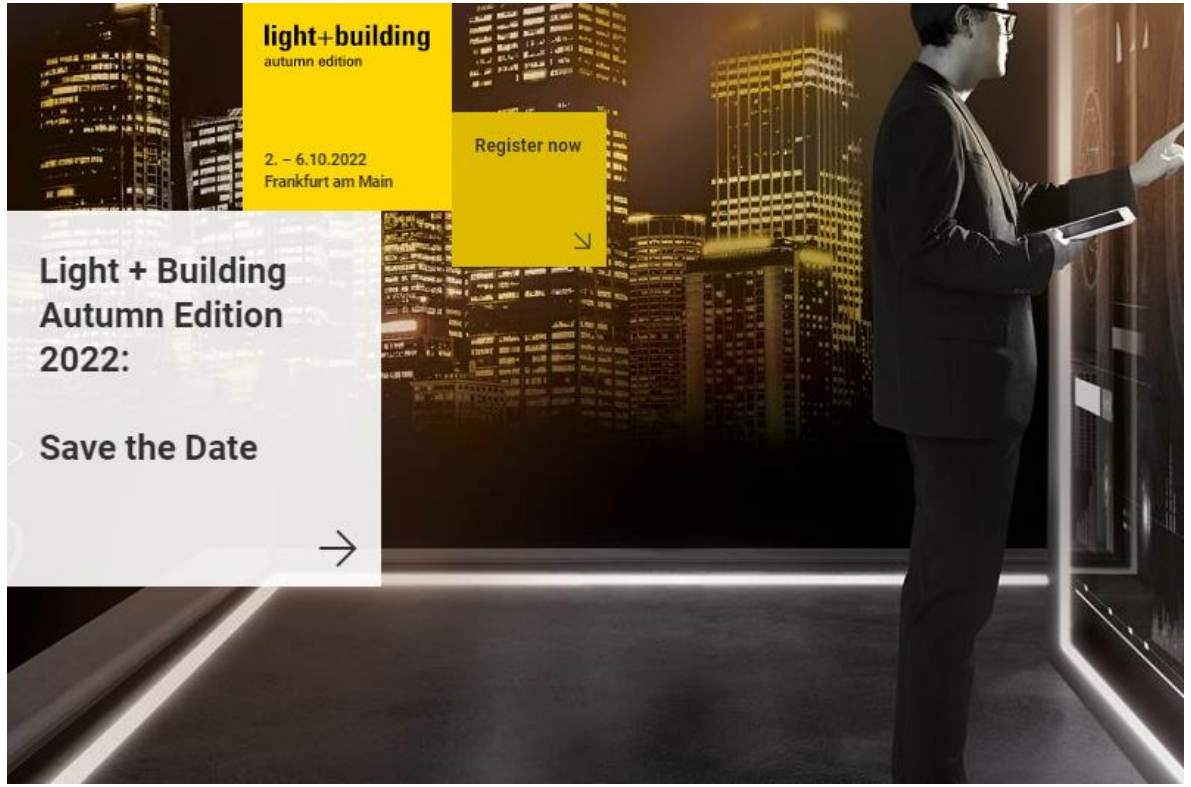
ClimaECO – Application Controller AC/S – Functions & Solutions

Online Learning Session

Light + Building Autumn Edition in October 2022

Onsite + digital: here we go

- At Light + Building the industry presents every two years the latest products for the fields of lighting, electrical engineering and home and building automation
- Light + Building opens in Frankfurt from 2nd to 6th October 2022
- The new Light + Building Digital Extension will also be available at the same time and beyond
- We plan our participation in general as a hybrid event, so that customers can join remotely
- You will find ABB and BUSCH-JAEGER booth in the NEW hall 12.0



©ABB

Disclaimer

The information in this document is subject to change without notice and should not be construed as a commitment by ABB. ABB assumes no responsibility for any errors that may appear in this document.

In no event shall ABB be liable for direct, indirect, special, incidental or consequential damages of any nature or kind arising from the use of this document, nor shall ABB be liable for incidental or consequential damages arising from use of any software or hardware described in this document.

© Copyright [2022] ABB. All rights reserved.

ABB