Application Descriptions

HVAC General Functional Blocks

HVAC Schedulers

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Summary

This document specifies 'scheduler' Functional Blocks, as they are used in the HVAC application domain.

(HVAC) Schedulers are used to control a HVAC System/Plant in dependence of time (& date).

Version 01.00.01 is a KNX Approved Standard.

This document is part of the KNX Specifications v2.1.

Document updates

Version	Date	Modifications
1.0	2002.03.28	editorial: TFI approved, version for KNX Handbook 1.0
1.0	2009.05.11	Editorial updated in view of publication in the KNX Specifications v1.0.
1.0	2009.06.16	Update in view of publication in the KNX Specifications v2.0.
01.00.01	2013.10.29	Editorial updates for the publication of KNX Specifications 2.1.

References

[01]   Chapter 3/7/2   "Datapoint Types"
[02]   Chapter 7/1/1   "System Clock""
[03]   Chapter 7/10/1   "HVAC Sensor Functional Blocks"
[04]   Chapter 7/10/2   "HVAC HMI Functional Blocks"
[05]   Chapter 7/10/3   "HVAC Actuator Functional Blocks"
[06]   Chapter 7/10/4   "HVAC Common Functional Blocks"
[07]   Chapter 7/10/9   "Property Identifiers"
[08]   Chapter 7/10/10   HVAC Interface Object Type Identifier"
[09]   Part 7/11   "Hot Water Heating - Introduction"
[10]   Part 7/12   "Direct Electric Heating"
[11]   Part 7/13   "Terminal Unit Functional Blocks"
[12]   Part 7/14   "Ventilation & Air Conditioning and Cold Water"
[13]   Part 10/1   "Logical Tag Extended"

Contents

1 Introduction

1.1 Scope

This document is part of the KNX HVAC Application Interworking Standard. It contains the Specification of Functional Blocks (FBs) used for time dependent HVAC Control.

This version of the document contains Functional Block specifications for

- the time dependent HVAC Control, HVAC Mode driven (FB 'HVAC Mode Scheduler' HVACS),
- time dependent Domestic Hot Water Control (FB 'DHW Mode Scheduler' DHWS),
- the time dependent DHW Circulation Pump Control (FB 'DHW Circulation Pump Scheduler'), and
- the time dependent HVAC Control, temperature driven (FB 'Absolute Room Temperature Setpoint Scheduler' ARTSS).

1.2 Objectives

This document includes the information necessary to build interoperable HVAC HWH products using the KNX Bus. Runtime process Interworking between HVAC control devices at the application level is the focus.

Data-interfaces for time schedule parameter settings are not in the focus and therefore, are not part of this document.

In addition, this document specifies the specific mechanisms for zoning and runtime process data distribution used in HVAC for an 'easy installation' system (LTE-HEE Mode [13]).

This is a technical specification with informative material provided as needed to convey key concepts. The approach taken here is a top-down view of interoperability. The HVAC system model is based on the decomposition of the distributed HVAC application by means of FBs, i.e. black-box description of FBs including data-interface and relationship to other FBs.

Every FB may be part of a complex device (e.g. a boiler & heating controller) containing more than one FB. Because of this modular approach, there is no attempt in this specification to describe or dictate the internal construction of a FB or to describe specific device types.

This document only includes details of the transport protocol as needed to specify interoperability and easy installation mechanisms. The document does not specifically cover implementation aspects, but guidelines are included where appropriate.

This part of the KNX HVAC specification is mainly but not completely independent of the underlying protocol since specific mechanisms for "easy configuration" and runtime data distribution must be available on the network.

Completely protocol dependent parts of the Schedulers Specification such as data encoding and Datapoint-types, object address tables, group address tables etc. are not part of this document.

1.3 Dependence on Configuration Modes

The main focus of this document is the specification of the **Basic FBs** and the **LTE specific parts**.

The document provides all necessary information needed:

- for a complete implementation of the FBs in LTE-Mode
- for the implementation of mandatory objects used for runtime Interworking in Standard Mode (Basic FB)

1.3.1 Runtime Interworking

Mode dependent (S-Mode, Ctrl-Mode, PB-Mode) implementation of optional runtime Interworking objects is not specified in this document, e.g. E-Mode Channel definitions.

The following table (example) shows the mode dependencies concerning runtime Interworking

		Basic FB	STANDARD MODE — S-Mode	EXTENDED MODE — Standard Mode Interface	LTE-Mode
Inputs	Inp1	**NA**	NA	NA	M
	Inp2	**NA**	NA	NA	O
	Inp3	**(GO$_b$)**		(GO)	O
Outputs	Outp1	**NA**	NA	NA	M
	- Outp1-1	**GO$_b$**	GO	GO	NA
	- Outp1-2	**GO$_b$**	GO	GO	NA
	Outp2	**GO$_b$**	GO	GO	M

Inp1: is mandatory M in LTE-Mode but the information is not available NA in the Basic FB and all other modes because the Datapoint Type (DPT) is <u>today</u> not available in Standard Mode and there are no products on the market with this functionality.

Inp2: is optional O in LTE-Mode but the information is not available NA in the Basic FB and all other modes because the DPT is <u>today</u> not available in Standard Mode and there are no products on the market with this functionality.

Inp3: is optional O in LTE-Mode and an optional Group Object in the Basic FB (GO$_b$). The Datapoint is optionally supported as Group Object in the LTE Standard Mode Interface (GO).
For all other modes the implementation is not defined. This is indicated by an empty field.

Outp1: is mandatory M in LTE-Mode and has a structured DPT or a DPT with extended features which is today not available in Standard Mode. In the Basic FB the information of Outp1 is split up into Outp1-1 and Outp1-2 (separate Datapoints with standard DPT).
Outp1-1 and Outp1-2 are mandatory Group Objects GO in the Basic FB and are therefore mandatory in all modes.

Outp2: is mandatory in all modes

1.3.2 Parameters and Diagnostic Data

LTE implementation:

- Parameters and Diagnostic Data of a FB shall be implemented as Properties of the corresponding Interface Object which are accessed using individual addressing.

- These Properties are addressed via the standard Interface Object Type (IO Type) for this FB. This IO Type is also used for Datapoint addressing in the LTE runtime Interworking model

- <u>Standard DPT or HVAC specific DPT with extended features</u> are used where appropriate.

Other modes:

- Parameters and Diagnostic Data can in principle be implemented as memory mapped Datapoints or Group Objects or Properties of an Interface Object using individual addressing. This document does not lay down how to implement Parameters and Diagnostic Data in S, LT-R, LT-S, Ctrl, Pb and A-Mode.

- In case of **Memory Mapped** Datapoints the DPT may be manufacturer specific

- In case of **Group Objects** standard DPT shall be used instead of HVAC specific (extended) DPT. The description of these Group Objects shall be part of the mode-dependent specification (e.g. Channel definition).

- In case of **Properties**, the implementation of HVAC specific DPT with extended features may be a problem (depending on the available microcontroller resources). The manufacturer has the choice:
  - ⇨ to use the LTE style Property implementation as specified in this document (with the DPT and IO Type for LTE implementations)   **IO Type^{used} = IO Type$^{HVAC-LTE}$**
  - ⇨ to implement these Properties using standard DPT only.
    In this case, the same Property ID but a different IO Type shall be used since the DPT of a Property shall be unambiguous for each IO Type.
    Simple IOT mapping rule: IO Type^{used} = IO Type^{standardDPT} = IO Type$^{HVAC-LTE}$ + 10000d
    (e.g. HVACS$^{HVAC-LTE}$ = 110 => HVACS^{standardDPT} = 10110)
  - ⇨ It is allowed to implement in a device both Interface Object Types IO Type$^{HVAC-LTE}$ and IO Type^{standardDPT}. The implementation of parameters and diagnostic data of one given FB shall however be complete. It is thus not allowed to implement part of the Datapoints of a FB in IO Type^{standardDPT} and the remaining in IO Type^{HVACLTE}.

	Implementation of Parameter and Diagnostic Data			
	Property based		**Group Object**	**Memory mapped**
	HVAC-LTE style	**Standard DPT**		
IO Type	IO Type$^{HVAC-LTE}$ e.g. HVACS=110	IO Type$^{HVAC-LTE}$ + 10000 e.g. HVACS=10110		
Property ID	Property ID x	=> same Property ID x		
DPT	if standard DPT	=> same standard DPT	=> same standard DPT	company specific
	if HVAC-LTE specific*) e.g. 201.100	=> mapped standard DPT, e.g. 20.103	=> mapped standard DPT, e.g. 20.103	

In this document only the **HVAC-LTE style** of Parameters and Diagnostic Data is specified for IO Type$^{HVAC-LTE}$.

In the FB Datapoint overview those Parameters and Diagnostic Data with HVAC-LTE specific (extended) DPT are marked " ***)** "
The mapping of HVAC specific DPT to standard DPT is generic and described in the document **[01]**.

1.4   Abbreviations

Abbreviation   Description

General:

cs	company specific
CP	Circulation Pump
DPT	Datapoint Type
FB	FB
IO	Interface Object
IR	InfoReport (LTE AL-Service)
LTE	Logical Tag Extended Mode, see [13] Volume 10-1, LTE Specification
NA	not allowed / not available
DEH	Direct Electrical Heating
DHW	Domestic Hot Water
HWH	Hot Water Heating
TU	Terminal Units
VAC	Ventilation, Air Condition and Cold Water

FBs:

ARTSS	Absolute Room Temperature Setpoint Scheduler
DHWCPS	DHW Circulation Pump Scheduler
DHWCPC	DHW Circulation Pump Controller
DHWS	DHW Mode Scheduler
DHWSM	DHW Setpoint Manager
HVACS	HVAC Mode Scheduler
RSMHD	Room Setpoint Manager HVAC Mode Driven
RSMTD	Room Setpoint Manager Temperature Driven
SCLO	System Clock

2 FB „HVAC Mode Scheduler" (HVACS)

2.1 Aims and objectives

The FB 'HVAC Mode Scheduler' is used in simple applications / plants, where no supervisor (BMS) is available. This means there is no FB 'Programme to HVAC Mode Converter' in the same zone (logical tag).

The FB 'HVAC Mode Scheduler' is providing the *HVACMode*, the *HVACModeNext* and the *EnableComfort*. These signals are provided for the FB 'Room Setpoint Manager (HVAC Mode Driven)' RSMHD.

HVAC Mode Scheduler information typically is related with a single device or small number of devices within a single apartment/floor or room. Therefore, in an 'easy installation' plant with LTE-HEE Mode devices, scheduler dependent HVAC process data (HVAC Mode) is distributed within geographical zones like apartment_x.room_y. In a Standard Mode system, scheduler dependent process data is distributed with Standard Mode Group Objects.

A device may consist of several time channels, this means this FB may be realised more than once in a device, each block belonging to another binding group or zone.

The device with the FB HVACS needs an internal clock. This internal clock may be the 'local clock' related to the FB 'System Clock'. If FB 'System Clock' is not available or implemented, the FB HVACS itself may use (optional) inputs for time and date reception as input for the devices internal/local clock.

2.2 Functional Specifications

The HVAC Mode Scheduling Programme is characterised by "switching points". A "switching point" is defined by output value(s) and a date and/or time value. The output value(s) has/have to be sent if the local clock matches the switching points date & time value.

The following output signals are provided by the HVACS:

- HVACMode   All 3 signals are information from a scheduling programme and

- HVACModeNext   provided for the room setpoint manager (HVAC Mode driven).

- EnableComfort

If SCLO is not implemented in a device, the following inputs may be used in the same way as with SCLO in slave mode, they are intended as synchronisation input to the device's internal/local clock.

- System Clock   System Clock Input (Date & Time)

- Time   Time Input, Standard Mode only

- Date   date Input, Standard Mode only

Parameters:

The Time Schedule or "internal programme" (switching points with their output value(s)) is given by parameters. These parameter(s) are manufacturer specific.

Time Schedules in a bus device may be changed by a management station or a complex bus device (with sophisticated user interface/MMI). That means, change of time schedule parameters is not only an action during configuration phase of an installation, but also during runtime.
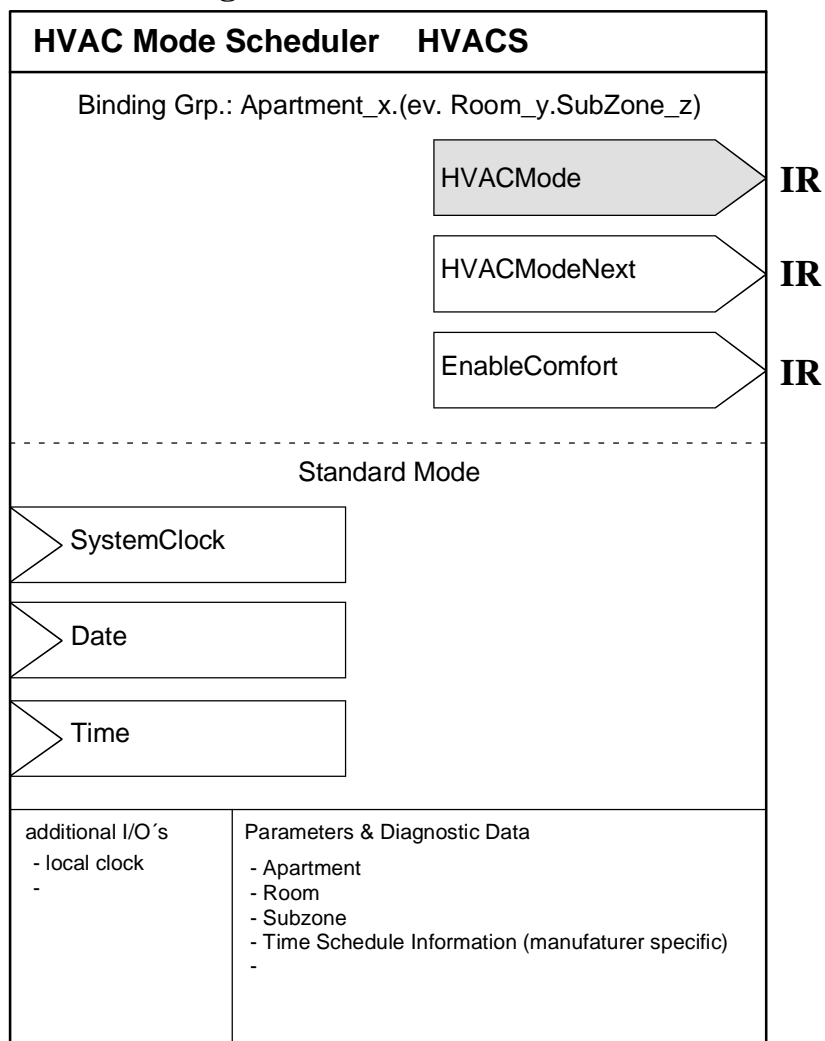
For LTE-HEE mode implementation, zoning parameters are included in this document.

2.3 Constraints

Apartment.Room(.Subzone) is a structured/compound zoning address, each part with its own Z_8 Status. If one part of the this compound zoning address is 'Out of Service' all parts are Out of Service.

2.4   Functional Block diagram

```
┌─────────────────────────────────────────────────────┐
│ HVAC Mode Scheduler    HVACS                          │
├─────────────────────────────────────────────────────┤
│                                                       │
│       Binding Grp.: Apartment_x.(ev. Room_y.SubZone_z)│
│                                                       │
│                          ┌──────────────────┐         │
│                          │ HVACMode          ╲   IR   │
│                          └──────────────────┘         │
│                                                       │
│                          ┌──────────────────┐         │
│                          │ HVACModeNext      ╲   IR   │
│                          └──────────────────┘         │
│                                                       │
│                          ┌──────────────────┐         │
│                          │ EnableComfort     ╲   IR   │
│                          └──────────────────┘         │
│  - - - - - - - - - - - - - - - - - - - - - - - - - -  │
│                      Standard Mode                    │
│  ┌──────────────────────┐                             │
│  ╱ SystemClock          │                             │
│  └──────────────────────┘                             │
│                                                       │
│  ┌──────────────────────┐                             │
│  ╱ Date                 │                             │
│  └──────────────────────┘                             │
│                                                       │
│  ┌──────────────────────┐                             │
│  ╱ Time                 │                             │
│  └──────────────────────┘                             │
│                                                       │
│  ┌──────────────┬──────────────────────────────────┐ │
│  │ additional I/O´s│ Parameters & Diagnostic Data   │ │
│  │  - local clock │                                 │ │
│  │  -             │  - Apartment                    │ │
│  │                │  - Room                         │ │
│  │                │  - Subzone                      │ │
│  │                │  - Time Schedule Information     │ │
│  │                │    (manufaturer specific)       │ │
│  │                │  -                              │ │
│  └──────────────┴──────────────────────────────────┘ │
└─────────────────────────────────────────────────────┘
```

2.5   Datapoints

Data Point	Description	Data Point Type	DPT ID
Outputs			
HVACMode	Actual HVAC mode; input to RSMHD – LTE-Mode – Standard Mode	DPT_HVACMode_Z DPT_HVACMode	201.100 20.102
HVACModeNext	Next HVAC mode plus time to next status input to RSMHD	DPT_HVACModeNext	206.100
EnableComfort	allow RSMHD to go to Comfort	DPT_Enable	1.003
Inputs			
SystemClock	System Clock as input for the device's local clock; available only in Standard Mode	DPT_DateTime	19.001
Date	alternative to SystemClock; only in Standard Mode	DPT_Date	10.001
Time	alternative to SystemClock; only in Standard Mode	DPT_Time	11.001
Parameters			
Apartment	LTE zone: Apartment number	DPT_UcountValue8_Z	202.002
Room	LTE zone: Room number	DPT_UcountValue8_Z	202.002
Subzone	LTE zone: Subzone number	DPT_UcountValue8_Z	202.002
Diagnostic Data			
---	---	---	

Table 2–1: HVACS - Overview on runtime Interworking and parameter properties

			STANDARD MODE	EXTENDED MODE	
		Basic FB	S-Mode	Standard Mode Interface	LTE-Mode
Outputs	**HVACMode**	GO$_b$	GO	GO	M
	HVACModeNext	NA [1]	NA	NA	O
	EnableComfort	(GO$_b$)	(GO)	(GO)	O
Inputs	**SystemClock**	(GO$_b$)	(GO)	(GO)	NA
	Date	(GO$_b$)	(GO)	(GO)	NA
	Time	(GO$_b$)	(GO)	(GO)	NA

[1] *optional in LTE-Mode; the information is NA in the Basic FB and all other modes because the Datapoint Type is* <u>today</u> *not yet available in Standard Mode. Splitting of DPT is not possible because of necessary data consistency*

Table 2–2: HVACS Runtime Interworking - dependence on Configuration Modes

		Support
Parameter	Apartment	M
	Room	O
	Subzone	O

Table 2–3: HVACS LTE specific Properties

		Support
Parameter	---	

Table 2–4: HVACS Properties of Interface Objects (or memory mapped DP)

2.5.1   Detailed specification of the Datapoints

2.5.1.1   Output: HVACMode

Standard Mode:

DP Name:	HVACMode			Abbr.:	---		Mandatory	☒
FB Name:	HVACS						Can be internal	☒
Description								
see LTE-HEE Mode								
For Standard Mode transmission, a simple datatype (without Z_8 status/command field) is used.								
Datapoint Type								
DPT_Name:	DPT_HVACMode							
DPT Format:	N_8				DPT_ID:		20.102	
Field	Description			Supp.	Range	Unit		Default
HVACMode	see LTE-HEE Mode				1..4 [1]			cs
Access Type								
♦ Output								
this → M	☒		this → 1	☐				
Spontaneous	☒	COV:	☒	Δ-Value:	[2]	MinRepTime:		10sec
		Cyclic	☒	Period:	15 min			
Request	☒							
Communication Type								
♦ Group Object Datapoint							Mandatory:	☒
Default Group Address:		---						
Dynamics								
Power down:	Save:		☐					
Power up:	Value:	No initialisation:		☐		Default value:		☐
		Saved value:		☐		Actual value:		☒
	Transmit on bus:			☒ [3]				☐
Exception Handling								
Special Features								
[1] value 0 ='Auto' is not allowed								
[2] COV / transmission condition: local time of the device matches a schedule's switching point.								
[3] actual value is sent as soon as local time is valid (not "corrupted", no fault, ….)								

LTE-HEE Mode:

FB:	HVACS	LTE Server Output Name:	HVACMode		Mandatory ☒ Optional ☐

Description:

The HVAC mode signal is used by the FB "Room Setpoint Manager (HVAC Mode Driven)" (RSMHD) to calculate the effective HVAC mode (further description see description of FB RSMHD).
According to TC247 the following HVAC-Modes are used: Comfort, Standby, Economy, Building Protection

DPT:	Name	DPT_HVACMode_Z		DPT ID	201.100	Datatype format	N_8Z_8

Field	Description	Sup.	Range	Unit	COV	Default
HVACMode	HVAC Operating Mode	M	[1 …4] [1]	enum.	see [2]	cs
Status - all flags	standard Status attributes not supported	NA	fixed to '0'	bitset		
Command - all commands	standard Command, write only not supported	NA		enum.		

Communication:

 Binding Group:

Class		Type		Default	
Geographical	☒	Apartment.Room.Subzone		cs	
Application Specific	☐				
Unassigned	☐	Broadcast ☐	Configurable ☐		

DP Address:	IO Type(ID):	110 (HVACS)	Property ID:	51

LTE-Services (event):	COV ☒	MinRepTime:	10 sec	Heartbeat:	15 min
InfoReport ☒	Output per default communicating ☐		Binding Group Wildcard allowed ☒		
(LTE Read-Response polling of the output shall always be supported)	Tx Prio: High ☐		Normal ☒		Low ☐
	Transm after Powerup [3] : Stored Value ☐ Act Value ☒ Default Value ☐				

Property-Service (individual access):	Read only ☒		Read/Write ☐	

Exception Handling:			Save at Powerdown ☐

Special Features:

[1] value 'Auto' is not allowed
[2] COV / transmission condition: local time of the device matches a schedule's switching point.
[3] actual value is sent as soon as local time is valid (not "corrupted", no fault, ….)

2.5.1.2 Output: HVACModeNext

Standard Mode: NA

LTE-HEE Mode:

FB:	HVACS	LTE Server Output Name:	HVACModeNext			Mandatory ☐ Optional ☒	
Description:							
Provides next HVAC Mode for FB RSMHD and the time delay (in minutes) until this next HVAC mode							
DPT:	Name	DPT_HVACModeNext		DPT ID	206.100	Datatype format $U_{16} N_8$	
Field		Description		Sup.	Range	Unit	COV	Default
Time [1]		Delay Time in minutes		M	[0 … 65535] [2]	min	---	cs
HVACMode		next HVAC Operating Mode		M	[0 …4] [2]	enum.	see [3]	cs

Field	Description	Sup.	Range	Unit	COV	Default
Time [1]	Delay Time in minutes	M	[0 … 65535] [2]	min	---	cs
HVACMode	next HVAC Operating Mode	M	[0 …4] [2]	enum.	see [3]	cs

Communication:				
Binding Group:				
Class	Type			Default
Geographical ☒	Apartment.Room.Subzone			cs
Application Specific ☐				
Unassigned ☐	Broadcast ☐	Configurable ☐		
DP Address:	IO Type(ID): 110 (HVACS)		Property ID: 52	
LTE-Services (event):	COV ☒ MinRepTime: 10 sec			Heartbeat: 15 min
InfoReport ☒	Output per default communicating ☐		Binding Group Wildcard allowed ☒	
(LTE Read-Response polling of the output shall always be supported)	Tx Prio: High ☐	Normal ☒		Low ☐
	Transm after Powerup [4]: Stored Value ☐ Act Value ☒ Default Value ☐			
Property-Service (individual access):	Read only ☒		Read/Write ☐	
Exception Handling:			Save at Powerdown ☐	

Special Features:
[1] As long as the 'real' time to next mode is out of range (> 65535 minutes) the maximum time delay (= "65535 minutes to next mode") is sent.
[2] see table 'Interpretation of Time and HVACMode fields'
[3] transmission condition: Heartbeat & COV ("new" next mode when **HVACMode** has changed → sent after **HVACMode**
[4] actual value is sent as soon as local time is valid (not "corrupted", no fault, ….)

Interpretation of Time and HVACMode fields:

Time	HVACMode	
= 0 (Undefined)	= 0 (Undefined)	the content of the Datapoint is void / undefined ⇨ no next HVAC Mode available for an undefined time period, i.e. if the HVACS can't calculate neither a 'current HVACMode' nor a delay time to the 'next HVACMode'.
= 0 (Undefined)	= {1..4}	defined and valid HVACMode but the delay time is undefined (unknown) ⇨ in cases, where a time delay until next mode can't be calculated in the HVACS → 'next HVACMode' = current 'HVACMode'
> 0	= 0 (Undefined)	undefined (unknown) HVACMode during a defined delay time ⇨ **not allowed for output HVACModeNext of HVACS**
> 0	= {1..4}	defined and valid HVACMode and delay time ⇨ normal case

2.5.1.3 Output: EnableComfort

Standard Mode:

DP Name:	EnableComfort			Abbr.:	---		Mandatory	☒
FB Name:	HVACS						Can be internal	☒
Description								
see LTE-HEE Mode								
Datapoint Type								
DPT_Name:	DPT_Enable							
DPT Format:	B_1			DPT_ID:		1.003		
Field	Description			Supp.	Range	Unit	Default	
	see LTE-HEE Mode description			M	{0,1}	boolean	cs	
Access Type								
♦ Output								
this → M	☒		this → 1	☐				
Spontaneous	☒	COV:	☒	Δ-Value:	[1]	MinRepTime:		10sec
		Cyclic	☒	Period:	15 min			
Request	☒							
Communication Type								
♦ Group Object Datapoint						Mandatory:	☒	
Default Group Address:		---						
Dynamics								
Power down:	Save:		☐					
Power up:	Value:	No initialisation:		☐	Default value:		☐	
		Saved value:		☐	Actual value:		☒	
	Transmit on bus:			☒			☐	
Exception Handling								
Special Features								
[1] Transmission conditions for this signal, e.g. enable/disable condition depending on the different HVAC modes, are company specific.								

LTE-HEE Mode:

FB:	HVACS	LTE Server Output Name:	**EnableComfort**		Mandatory ☐ Optional ☒

Description:
The "Enable Comfort" can be used to lock local Comfort-Mode (MMI) when the plant is working in another mode. Typically, if the HVAC Mode is 'Building Protection' or 'Eco' for a whole plant, going to 'Comfort' for a single room, e.g. by means of a 'Comfort' push button in the room, should not be allowed.

DPT:	Name	DPT_Enable		DPT ID	1.003		Datatype format	boolean B_1
Field		Description		Sup.	Range	Unit	COV	Default
				M	{0,1}	boolean	see [1]	cs

Communication:				
Binding Group:				
Class		Type		Default
Geographical	☒	Apartment.Room.Subzone		cs
Application Specific	☐			
Unassigned	☐	Broadcast ☐	Configurable ☐	
DP Address:		IO Type(ID): 110 (HVACS)	Property ID: 53	
LTE-Services (event):		COV ☒ MinRepTime: 10 sec	Heartbeat: 15 min	
InfoReport	☒	Output per default communicating ☐	Binding Group Wildcard allowed ☒	
(LTE Read-Response polling of the output shall always be supported)		Tx Prio: High ☐ Normal ☒ Low ☐		
		Transm after Powerup : Stored Value ☐ Act Value ☒ Default Value ☐		
Property-Service (individual access):		Read only ☒ Read/Write ☐		
Exception Handling:			Save at Powerdown ☐	
Special Features:				
[1] Transmission conditions for this signal, e.g. enable/disable condition depending on the different HVAC modes, are company specific.				

2.5.1.4 Input: SystemClock

Standard Mode:

See **[02]**, description of SCLO input *SystemClock* (SCLO in slave mode).

LTE-HEE mode: NA

2.5.1.5 Input: Date

Standard Mode:

See **[02]**, description of SCLO input *Date* (SCLO in slave mode).

LTE-HEE mode: NA

2.5.1.6 Input: Time

Standard Mode:

See **[02]**, description of SCLO input *Time* (SCLO in slave mode).

LTE-HEE mode: NA

2.5.1.7 Parameter: Apartment

FB:	HVACS	Property Name (<u>Server</u>): Apartment				Mandatory ☒ Optional ☐	
Description:							
LTE zone: Apartment number							
DPT:	Name	DPT_UcountValue8_Z	DPT ID	202.002	Datatype format	U_8Z_8	
Field		Description			Sup.	Range	Unit	Default

Field	Description	Sup.	Range	Unit	Default
CounterValue	Apartment number	M	1..126	--	1
Status - OutOfService - all other flags	 zone active /inactive not supported, fixed to '0'	 O NA	 true/false	bitset	 false
Command - NormalWrite - SetOSV & ResetOSV - all other commands	 set zone inactive / active not supported	 M O NA		enum	

Communication:				
DP Address:	IO Type(ID):	110 (HVACS)	Property ID:	101
(in the server)	Start-Index:	1	N° of elements	1
Property access:	Read only ☐		Read/Write ☒	
Exception Handling:	Value after Powerup:	Stored Value ☒ Act Value ☐	Default Value ☐	
--				
Special Features:				
HVACS DP's are not LTE communicating if zone is 'OutOfService'. If Apartment is 'OutOfService' also the corresponding Room and Subzone is 'OutOfService' (common flag)				

2.5.1.8 Parameter: Room

FB:	HVACS	Property Name (<u>Server</u>): Room				Mandatory ☐ Optional ☒	
Description:							
LTE zone: Room number							
DPT:	Name	DPT_UcountValue8_Z	DPT ID	202.002	Datatype format	U_8Z_8	
Field		Description			Sup.	Range	Unit	Default

Field	Description	Sup.	Range	Unit	Default
CounterValue	Room number	M	0, 1..63	--	0 or 1
Status - OutOfService - all other flags	 zone active /inactive not supported, fixed to '0'	 O NA	 true/false	bitset	 false
Command - NormalWrite - SetOSV & ResetOSV - all other commands	 set zone inactive / active not supported	 M O NA		enum	

Communication:				
DP Address:	IO Type(ID):	110 (HVACS)	Property ID:	102
(in the server)	Start-Index:	1	N° of elements	1
Property access:	Read only ☐		Read/Write ☒	
Exception Handling:	Value after Powerup:	Stored Value ☒ Act Value ☐	Default Value ☐	
--				
Special Features:				
HVACS DP's are not LTE communicating if zone is 'OutOfService'. If Apartment is 'OutOfService' also the corresponding Room and Subzone is 'OutOfService' (common flag)				

2.5.1.9 Parameter: Subzone

FB:	HVACS	Property Name (Server):	Subzone			Mandatory ☐ Optional ☒

Description:
LTE zone: Subzone number within the Apartment.Room. Subzone value is a parameter used or fixed value '*' (=0)

DPT:	Name	DPT_UcountValue8_Z		DPT ID	202.002	Datatype format	U_8Z_8
Field		Description		Sup.	Range	Unit	Default
CounterValue		Subzone number		M	0, 1..15	--	0 or 1
Status - OutOfService - all other flags		 zone active /inactive not supported, fixed to '0'		 O NA	 true/false	bitset	 false
Command - NormalWrite - SetOSV & ResetOSV - all other commands		 set zone inactive / active not supported		 M O NA		enum	

Communication:				
DP Address: **(in the server)**	IO Type(ID): Start-Index:	110 (HVACS) 1	Property ID: N° of elements	103 1
Property access:	Read only ☐		Read/Write ☒	
Exception Handling:	Value after Powerup:	Stored Value ☒	Act Value ☐	Default Value ☐

Special Features:
HVACS DP's are not LTE communicating if zone is 'OutOfService'. If Apartment is 'OutOfService' also the corresponding Subzone is 'OutOfService' (common flag)

3 FB „DHW Mode Scheduler" (DHWS)

3.1 Aims and objectives

The FB „DHW Mode Scheduler" (DHW = Domestic Hot Water) is used in simple applications / plants, where no supervisor (BMS) is available. This means there is no 'Programme to DHW Mode Converter' in the same zone (logical tag).

The FB „DHW Mode Scheduler" is providing the *DHWMode*, the *DHWModeNext* and the *EnableDHWPrep*. These signals are provided for the 'Domestic Hot Water Setpoint Manager' (DHWSM).

DHW Mode Scheduler information typically is related with a single device or small number of devices within a DHW Zone. Therefore, in an 'easy installation' plant with LTE-HEE Mode devices, scheduler dependent HVAC process data (DHW Mode) is distributed within an application specific zone (DHW Zone). In a Standard Mode system, scheduler dependent DHW process data is distributed with Standard Mode Group Objects.

A device may consist of several time channels, this means this FB may be realised more than once in a device, each block belonging to another binding group.

The device with the FB DHWS needs an internal clock, which may be autonomous or may be related to the FB 'System Clock' If FB 'System Clock' is not available or implemented, the FB DHWS itself may use (optional) inputs for time and date reception as input for the devices internal/local clock.

3.2 Functional Specifications

The DHW Mode Scheduling Programme is characterised by "switching points". ". A "switching point" is defined by output value(s) and a date and/or time value. The output value(s) has/have to be sent if the local clock matches the switching points date & time value.

The following output signals are provided by the DHWS:

- DHWMode   All 3 signals are information from a scheduling programme and

- DHWModeNext   provided for the DHW setpoint manager

- EnableDHWPrep

If SCLO is not implemented in a device, the following inputs may be used in the same way as with SCLO in slave mode, they are intended as synchronisation input to the device's internal/local clock.

- System Clock   System Clock Input (Date & Time)
- Time   Time Input, Standard Mode only
- Date   date Input, Standard Mode only

Parameters:

The Time Schedule or "internal programme" (switching points with their output value(s)) is given by parameters. These parameter(s) are manufacturer specific.
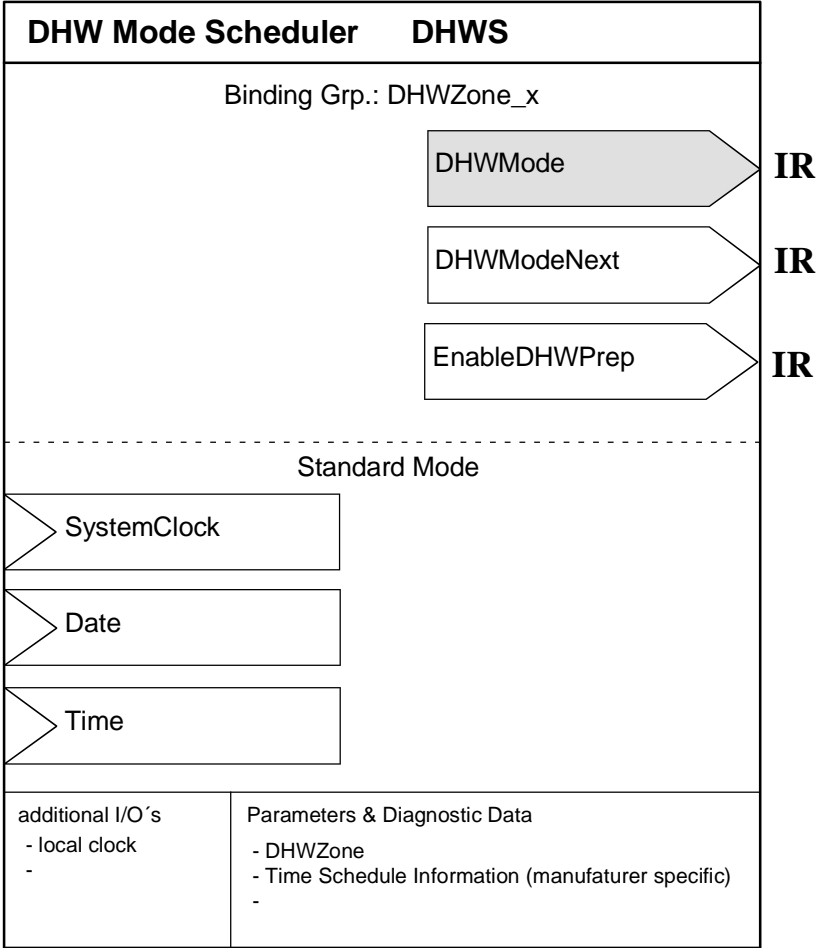
Time Schedules in a bus device may be changed by a management station or a complex bus device (with sophisticated user interface/MMI). That means, change of time schedule parameters is not only an action during configuration phase of an installation, but also during runtime.

For LTE-HEE mode implementation, zoning parameters are included in this document.

3.3 Constraints

3.4 Functional Block diagram

```
┌─────────────────────────────────────────────────┐
│ DHW Mode Scheduler        DHWS                   │
├─────────────────────────────────────────────────┤
│              Binding Grp.: DHWZone_x             │
│                                                  │
│                   ┌──────────────────────┐       │
│                   │ DHWMode              >│  IR   │
│                   └──────────────────────┘       │
│                                                  │
│                   ┌──────────────────────┐       │
│                   │ DHWModeNext          >│  IR   │
│                   └──────────────────────┘       │
│                                                  │
│                   ┌──────────────────────┐       │
│                   │ EnableDHWPrep        >│  IR   │
│                   └──────────────────────┘       │
│ - - - - - - - - - - - - - - - - - - - - - - - -  │
│                   Standard Mode                  │
│  ┌>──────────────────┐                           │
│  │  SystemClock       │                          │
│  └────────────────────┘                          │
│  ┌>──────────────────┐                           │
│  │  Date              │                          │
│  └────────────────────┘                          │
│  ┌>──────────────────┐                           │
│  │  Time              │                          │
│  └────────────────────┘                          │
├─────────────────────┬───────────────────────────┤
│ additional I/O´s    │ Parameters & Diagnostic Data│
│  - local clock      │                            │
│  -                  │  - DHWZone                 │
│                     │  - Time Schedule Information│
│                     │    (manufaturer specific)  │
│                     │  -                         │
└─────────────────────┴───────────────────────────┘
```

3.5 Datapoints

Data Point	Description	Data Point Type	DPT ID
Outputs			
DHWMode	Actual DHW mode; input to DHWSM – LTE-Mode – Standard Mode	DPT_DHWMode_Z DPT_DHWMode	201.102 20.103
DHWModeNext	Next DHW mode plus time to next status input to DHWSM	DPT_DHWModeNext	206.102
EnableDHWPrep	indicates whether energy supply for DHW load is available or not	DPT_Enable	1.003
Inputs			
SystemClock	System Clock as input for the device's local clock; available only in Standard Mode	DPT_DateTime	19.001
Date	alternative to SystemClock; only in Standard Mode	DPT_Date	10.001
Time	alternative to SystemClock; only in Standard Mode	DPT_Time	11.001
Parameters			
DHWZone	LTE zone: number of the DHW Zone	DPT_UcountValue8_Z	202.002
Diagnostic Data			
---	---	---	

Table 3–1: DHWS - Overview on runtime Interworking and parameter properties

		Basic FB	STANDARD MODE S-Mode	STANDARD MODE Standard Mode Interface	EXTENDED MODE LTE-Mode
Outputs	**DHWMode**	**GO$_b$**	GO	GO	M
	DHWModeNext	**NA** [1]	NA	NA	O
	EnableDHWPrep	**(GO$_b$)**	(GO)	(GO)	O
Inputs	**SystemClock**	**(GO$_b$)**	(GO)	(GO)	NA
	Date	**(GO$_b$)**	(GO)	(GO)	NA
	Time	**(GO$_b$)**	(GO)	(GO)	NA

[1] *optional in LTE-Mode; the information is NA in the Basic FB and all other modes because the Datapoint Type is today not yet available in Standard Mode. Splitting of DPT is not possible because of necessary data consistency*

Table 3–2: DHWS Runtime Interworking - dependence on Configuration Modes

		Support
Parameter	DHWZone	M

Table 3–3: DHWS LTE specific Properties

		Support
Parameter	---	

Table 3–4: DHWS Properties of Interface Objects (or memory mapped DP)

3.5.1   Detailed specification of the Datapoints

3.5.1.1 Output: DHWMode

Standard Mode:

DP Name:	DHWMode			Abbr.:	---		Mandatory	☒
FB Name:	DHWS						Can be internal	☒
Description								
see LTE-HEE Mode								
For Standard Mode transmission, a simple datatype (without Z_8 status/command field) is used.								
Datapoint Type								
DPT_Name:	DPT_DHWMode							
DPT Format:	N_8				DPT_ID:		20.103	
Field	Description			Supp.	Range	Unit	Default	
DHWMode	see LTE-HEE Mode				1..4 [1]		cs	
Access Type								
♦ Output								
this → M	☒		this → 1	☐				
Spontaneous	☒	COV:	☒	Δ-Value:	[2]	MinRepTime:		10sec
		Cyclic	☒	Period:	15 min			
Request	☒							
Communication Type								
♦ Group Object Datapoint						Mandatory:	☒	
Default Group Address:		---						
Dynamics								
Power down:	Save:		☐					
Power up:	Value:	No initialisation:	☐		Default value:		☐	
		Saved value:	☐		Actual value:		☒	
	Transmit on bus:		☒ [3]				☐	
Exception Handling								
Special Features								

[1]   value 0='Auto' is not allowed
[2]   COV / transmission condition: local time of the device matches a schedule's switching point.
[3]   actual value is sent as soon as local time is valid (not "corrupted", no fault, ….)

LTE-HEE Mode:

FB:	DHWS	LTE Server Output Name:	DHWMode		Mandatory ☒ Optional ☐

Description:

The DHW mode signal is used by the FB "Domestic Hot Water Setpoint Manager" (DHWSM) to calculate the effective DHW mode (further description see description of FB DHWSM).
The following DHW-Modes are used: LegioProtect, Normal, Reduced, Off/FrostProtect

DPT:	Name	DPT_DHWMode_Z		DPT ID	201.102	Datatype format	N_8Z_8	
Field		**Description**		**Sup.**	**Range**	**Unit**	**COV**	**Default**
DHWMode		DHW Operating Mode		M	[1 …4] [1]	enum.	see [2]	cs
Status - all flags		standard Status attributes not supported		NA	fixed to '0'	bitset		
Command - all commands		standard Command, write only not supported		NA		enum.		

Communication:

Binding Group:					
Class		Type		Default	
Geographical ☐					
Application Specific ☒		DHWZone		cs	
Unassigned ☐		Broadcast ☐	Configurable ☐		

DP Address:	IO Type(ID):	111 (DHWS)	Property ID:	51	
LTE-Services (event):	COV ☒	MinRepTime:	10 sec	Heartbeat:	15 min
InfoReport ☒	Output per default communicating ☐		Binding Group Wildcard allowed ☒		
(LTE Read-Response polling of the output shall always be supported)	Tx Prio: High ☐		Normal ☒		Low ☐
	Transm after Powerup [3] : Stored Value ☐ Act Value ☒ Default Value ☐				

Property-Service (individual access):	Read only ☒	Read/Write ☐	

Exception Handling:		Save at Powerdown ☐

Special Features:

[1] value 'Auto' is not allowed
[2] COV / transmission condition: local time of the device matches a schedule's switching point.
[3] actual value is sent as soon as local time is valid (not "corrupted", no fault, ….)

3.5.1.2 Output: DHWModeNext

Standard Mode: NA

LTE-HEE Mode:

FB:	DHWS	LTE Server Output Name:	DHWModeNext				Mandatory ☐ Optional ☒
Description:							
Provides next DHW Mode for FB RSMHD and the time delay (in minutes) until this next DHW mode							
DPT:	Name	DPT_DHWModeNext		DPT ID	206.102	Datatype format	$U_{16} N_8$
Field		Description		Sup.	Range	Unit	COV	Default
Time [1]		Delay Time in minutes		M	[0 … 65535] [2]	min	---	cs
DHWMode		next DHW Operating Mode		M	[0 …4] [2]	enum.	see [3]	cs

Communication:				
Binding Group:				
Class	Type			Default
Geographical ☐				
Application Specific ☒	DHWZone			cs
Unassigned ☐	Broadcast ☐	Configurable ☐		
DP Address:	IO Type(ID):	111 (DHWS)	Property ID:	52
LTE-Services (event):	COV ☒	MinRepTime: 10 sec		Heartbeat: 15 min
InfoReport ☒	Output per default communicating ☐		Binding Group Wildcard allowed ☒	
(LTE Read-Response polling of the output shall always be supported)	Tx Prio: High ☐		Normal ☒	Low ☐
	Transm after Powerup [4]: Stored Value ☐ Act Value ☒ Default Value ☐			
Property-Service (individual access):	Read only ☒		Read/Write ☐	
Exception Handling:			Save at Powerdown ☐	

Special Features:				

[1] As long as the 'real' time to next mode is out of range (> 65535 minutes) the maximum time delay (= "65535 minutes to next mode") is sent.
[2] see table 'Interpretation of Time and DHWMode fields'
[3] transmission condition: Heartbeat & COV ("new" next mode when *DHWMode* has changed → sent after *DHWMode*
[4] actual value is sent as soon as local time is valid (not "corrupted", no fault, ….)

Interpretation of Time and DHWMode fields:

Time	DHWMode	
= 0 (Undefined)	= 0 (Undefined)	the content of the Datapoint is void / undefined ⇨ no next DHW Mode available for an undefined time period, i.e. if the DHWS can't calculate neither a 'current DHWMode' nor a delay time to the 'next DHWMode'.
= 0 (Undefined)	= {1..4}	defined and valid DHWMode but the delay time is undefined (unknown) ⇨ in cases, where a time delay until next mode can't be calculated in the DHWS → 'next DHWMode' = current 'DHWMode'
> 0	= 0 (Undefined)	undefined (unknown) DHWMode during a defined delay time ⇨ **not allowed for output DHWModeNext of DHWS**
> 0	= {1..4}	defined and valid DHWMode and delay time ⇨ normal case

3.5.1.3 Output: EnableDHWPrep

Standard Mode:

DP Name:	EnableDHWPrep			Abbr.:	---		Mandatory	☐
FB Name:	DHWS						Can be internal	☒
Description								
see LTE-HEE Mode								
For Standard Mode transmission, a simple datatype (without Z_8 status/command field) is used.								
Datapoint Type								
DPT_Name:		DPT_Enable						
DPT Format:		B_1			DPT_ID:		1.003	
Field		Description		Supp.	Range	Unit	Default	
		see LTE-HEE Mode description		M	{0,1}	boolean	cs	

Access Type								
♦	Output							
	this → M	☒		this → 1	☐			
	Spontaneous	☒	COV:	☒	Δ-Value:	1)	MinRepTime:	10sec
			Cyclic	☒	Period:	15 min		
	Request	☒						

Communication Type					
♦	Group Object Datapoint			Mandatory:	☒
	Default Group Address:		---		

Dynamics						
	Power down:	Save:	☐			
	Power up:	Value:	No initialisation:	☐	Default value:	☐
			Saved value:	☐	Actual value:	☒
		Transmit on bus:		☒		☐

Exception Handling

Special Features
1) Transmission conditions for this signal, e.g. enable/disable condition depending on the different DHW modes, are company specific.

LTE-HEE Mode:

FB:	**DHWS**	**LTE Server Output Name:**	**EnableDHWPrep**		Mandatory ☐ Optional ☒
Description:					

DPT:	Name	DPT_Enable		DPT ID	1.003		Datatype format	B$_1$
Field		Description		Sup.	Range	Unit	COV	Default
				M	{0,1}	boolean	see [1]	cs

Communication:				
Binding Group:				
Class		Type		Default
Geographical	☐			
Application Specific	☒	DHWZone		cs
Unassigned	☐	Broadcast ☐	Configurable ☐	
DP Address:		IO Type(ID): 111 (DHWS)	Property ID: 53	
LTE-Services (event):		COV ☒ MinRepTime: 10 sec	Heartbeat: 15 min	
InfoReport ☒		Output per default communicating ☐	Binding Group Wildcard allowed ☒	
(LTE Read-Response polling of the output shall always be supported)		Tx Prio: High ☐	Normal ☒ Low ☐	
		Transm after Powerup : Stored Value ☐ Act Value ☒ Default Value ☐		
Property-Service (individual access):		Read only ☒	Read/Write ☐	
Exception Handling:			Save at Powerdown ☐	

Special Features:				
[1] Transmission conditions for this signal, e.g. enable/disable condition depending on the different DHW modes, are company specific.				

3.5.1.4 Input: SystemClock

Standard Mode:

See **[02]**, description of SCLO input *SystemClock* (SCLO in slave mode).

LTE-HEE mode: NA

3.5.1.5 Input: Date

Standard Mode:

See **[02]**, description of SCLO input *Date* (SCLO in slave mode).

LTE-HEE mode: NA

3.5.1.6 Input: Time

Standard Mode:

See **[02]**, description of SCLO input *Time* (SCLO in slave mode).

LTE-HEE mode: NA

3.5.1.7 Parameter: DHWZone

FB:	DHWS	Property Name (<u>Server</u>): DHWZone						Mandatory ☒ Optional ☐
Description:								
LTE zone: DHW Zone number								
DPT:	Name	DPT_UcountValue8_Z		DPT ID	202.002	Datatype format	U_8Z_8	
Field		Description			Sup.	Range	Unit	Default
CounterValue		number of DHW Zone			M	[1..31]	--	1
Status - OutOfService - all other flags		 zone active /inactive not supported, fixed to '0'			 O NA	 true/false	bitset	 false
Command - NormalWrite - SetOSV & ResetOSV - all other commands		 set zone inactive / active not supported			 M O NA		enum	
Communication:								
DP Address: **(in the server)**		IO Type(ID):	111 (DHWS)		Property ID:		101	
		Start-Index:	1		N° of elements		1	
Property access:		Read only	☐		Read/Write	☒		
Exception Handling:		Value after Powerup:		Stored Value ☒	Act Value ☐	Default Value ☐		
--								
Special Features:								
DHWS DP's are not LTE communicating if DHWZone is 'OutOfService'.								

4 FB „DHW Circulation Pump Scheduler" (DHWCPS)

4.1 Aims and objectives

The FB „DHW Circulation Pump Scheduler" DHWCPS is providing the *EnableDHWCP*, signal. This signal is provided for the 'Domestic Hot Water Circulation Pump Controller' (DHWCPC).

The FB DHWCPS typically is independent of the FB DHWS.

DHW Circulation Pump Scheduler information is sent to one single device (with FB DHW Circulation Pump Controller) within a DHW Zone. Therefore, in an 'easy installation' plant with LTE-HEE Mode devices, scheduler dependent HVAC process data (*EnableDHWCP*) is distributed within an application specific zone (DHW Zone). In a Standard Mode system, scheduler dependent DHW process data is distributed with Standard Mode Group Objects.

A device may consist of several time channels, this means this FB may be realised more than once in a device, each block belonging to another binding group.

The device with the FB DHWCPS needs an internal clock, which may be autonomous or may be related to the FB 'System Clock' If FB 'System Clock' is not available or implemented, the FB DHWCPS itself may use (optional) inputs for time and date reception as input for the devices internal/local clock.

4.2 Functional Specifications

The DHW Circulation Pump Scheduling Programme is characterised by "switching points". ". A "switching point" is defined by output value(s) and a date and/or time value. The output value(s) has/have to be sent if the local clock matches the switching points date & time value.

The following output signal is provided by the DHWCPS:

- EnableDHWCP   This signal is provided for the DHW Circulation Pump Controller (DHWCPC). It enables / disables the circulation pump independent of the actual DHW Mode (schedule for DHW circulation may be independent of DHW load).

If SCLO is not implemented in a device, the following inputs may be used in the same way as with SCLO in slave mode, they are intended as synchronisation input to the device's internal/local clock.

- System Clock   System Clock Input (Date & Time)
- Time   Time Input, Standard Mode only
- Date   date Input, Standard Mode only

Parameters:

The Time Schedule or "internal programme" (switching points with their output value(s)) is given by parameters. These parameter(s) are manufacturer specific.

Time Schedules in a bus device may be changed by a management station or a complex bus device (with sophisticated user interface/MMI). That means, change of time schedule parameters is not only an action during configuration phase of an installation, but also during runtime.

For LTE-HEE mode implementation, zoning parameters are included in this document.

4.3 Constraints

In a LTE-HEE System, only one DHW Circulation Pump Scheduler is allowed per DHW Zone.

4.4   Functional Block diagram
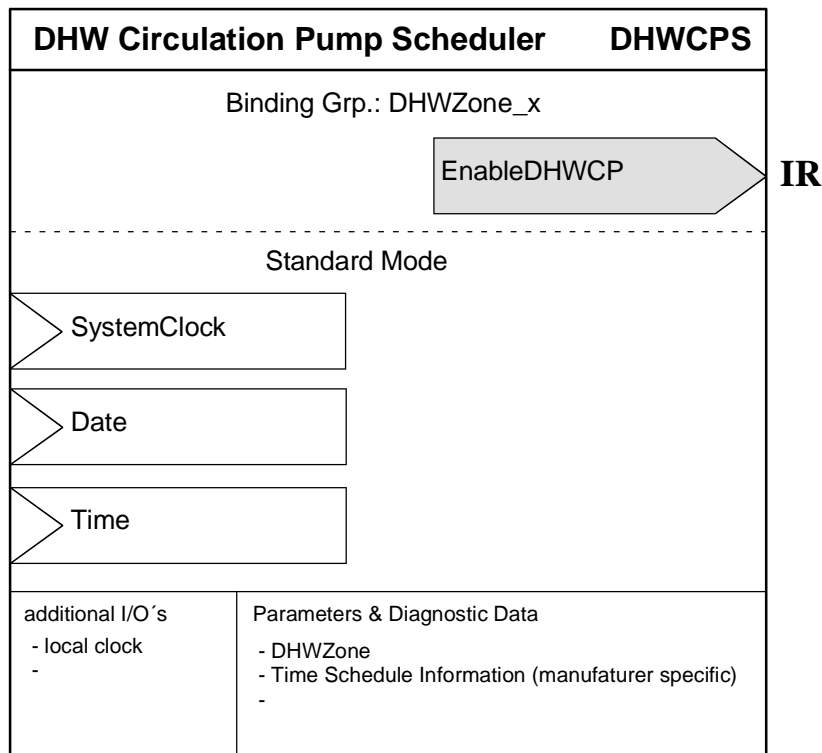
4.5   Datapoints

Data Point	Description	Data Point Type	DPT ID
Outputs			
EnableDHWCP	enables / disables DHW circulation pump (controlled by FB DHWCPC)	DPT_Enable	1.003
Inputs			
SystemClock	System Clock as input for the device's local clock; available only in Standard Mode	DPT_DateTime	19.001
Date	alternative to SystemClock; only in Standard Mode	DPT_Date	10.001
Time	alternative to SystemClock; only in Standard Mode	DPT_Time	11.001
Parameters			
DHWZone	LTE zone: number of the DHW Zone	DPT_UcountValue8_Z	202.002
Diagnostic Data			
---	---	---	

Table 4–1: DHWCPS - Overview on runtime Interworking and parameter properties

| | | Basic FB | STANDARD MODE | EXTENDED MODE | |
			S-Mode	Standard Mode Interface	LTE-Mode
Outputs	**EnableDHWCP**	GO$_b$	GO	GO	M
Inputs	**SystemClock**	(GO$_b$)	(GO)	(GO)	NA
	Date	(GO$_b$)	(GO)	(GO)	NA
	Time	(GO$_b$)	(GO)	(GO)	NA

Table 4–2: DHWCPS Runtime Interworking - dependence on Configuration Modes

		Support
Parameter	DHWZone	M

Table 4–3: DHWCPS LTE specific Properties

		Support
Parameter	---	

Table 4–4: DHWCPS Properties of Interface Objects (or memory mapped DP)

4.5.1   Detailed specification of the Datapoints

4.5.1.1   Output: EnableDHWCP

Standard Mode:

DP Name:	EnableDHWCP			Abbr.:	---		Mandatory	☒
FB Name:	DHWCPS						Can be internal	☒
Description								
see LTE-HEE Mode								
Datapoint Type								
DPT_Name:	DPT_Enable							
DPT Format:	B₁				DPT_ID:		1.003	
Field	Description				Supp.	Range	Unit	Default
	see LTE-HEE Mode description				M	{0,1}	boolean	cs
Access Type								
♦ Output								
	this → M	☒		this → 1	☐			
	Spontaneous	☒	COV:	☒	Δ-Value:	¹⁾	MinRepTime:	10sec
			Cyclic	☒	Period:	15 min		
	Request	☒						
Communication Type								
♦ Group Object Datapoint							Mandatory:	☒
	Default Group Address:		---					
Dynamics								
	Power down:	Save:		☐				
	Power up:	Value:	No initialisation:		☐	Default value:		☐
			Saved value:		☐	Actual value:		☒
		Transmit on bus:		☒ ²⁾				☐
Exception Handling								
Special Features								

¹⁾   COV / transmission condition: local time of the device matches a schedule's switching point.

²⁾   actual value is sent as soon as local time is valid (not "corrupted", no fault, ….)

LTE-HEE Mode:

FB:	DHWCPS	LTE Server Output Name:	EnableDHWCP		Mandatory ☒ Optional ☐

Description:

The 'Enable DHW Circulation Pump' signal is used by the FB "Domestic Hot Water Circulation Pump Controller" (DHWCPC). Independent of the current DHW Mode, On/Off switching of the DHW Circulation Pump is enabled/disabled.

For further description see description of FB DHWCPC in [09].

DPT:	Name	DPT_Enable		DPT ID	1.003		Datatype format	B_1
Field			Description		Sup.	Range	Unit	COV	Default
					M	{0,1}	boolean	see [1]	cs

Communication:

Binding Group:

Class		Type		Default	
Geographical	☐				
Application Specific	☒	DHWZone		cs	
Unassigned	☐	Broadcast ☐	Configurable ☐		

DP Address:	IO Type(ID):	112 (DHWCPS)	Property ID:	51

LTE-Services (event):	COV ☒	MinRepTime: 10 sec	Heartbeat: 15 min
InfoReport ☒	Output per default communicating ☐	Binding Group Wildcard allowed ☒	
(LTE Read-Response polling of the output shall always be supported)	Tx Prio: High ☐	Normal ☒	Low ☐
	Transm after Powerup [2]: Stored Value ☐ Act Value ☒ Default Value ☐		

Property-Service (individual access):	Read only ☒	Read/Write ☐

Exception Handling:		Save at Powerdown ☐

Special Features:

[1] COV / transmission condition: local time of the device matches a schedule's switching point.

[2] actual value is sent as soon as local time is valid (not "corrupted", no fault, ….)

4.5.1.2 Input: SystemClock

Standard Mode:

See **[02]**, description of SCLO input *SystemClock* (SCLO in slave mode).

LTE-HEE mode: NA

4.5.1.3 Input: Date

Standard Mode:

See **[02]**, description of SCLO input *Date* (SCLO in slave mode).

LTE-HEE mode: NA

4.5.1.4 Input: Time

Standard Mode:

See **[02]**, description of SCLO input *Time* (SCLO in slave mode).

LTE-HEE mode: NA

4.5.1.5 Parameter: DHWZone

FB:	DHWCPS	Property Name (Server):	DHWZone			Mandatory ☒ Optional ☐

Description:						
LTE zone: DHW Zone number						

DPT:	Name	DPT_UcountValue8_Z		DPT ID	202.002	Datatype format	U_8Z_8

Field	Description	Sup.	Range	Unit	Default
CounterValue	number of DHW Zone	M	[1..31]	--	1
Status - OutOfService - all other flags	 zone active /inactive not supported, fixed to '0'	 O NA	 true/false	bitset	 false
Command - NormalWrite - SetOSV & ResetOSV - all other commands	 set zone inactive / active not supported	 M O NA		enum	

Communication:				
DP Address:	IO Type(ID):	112 (DHWCPS)	Property ID:	101
(in the server)	Start-Index:	1	N° of elements	1
Property access:	Read only ☐		Read/Write ☒	
Exception Handling:	Value after Powerup:	Stored Value ☒	Act Value ☐	Default Value ☐
--				
Special Features:				
DHWCPS DP's are not LTE communicating if DHWZone is 'OutOfService'.				

5 FB "Absolute Room Temperature Setpoint Scheduler" (ARTSS)

5.1   Aims and objectives

The FB 'Absolute Room Temperature Setpoint Scheduler' is used in simple applications / plants, where no supervisor (BMS) is available or it makes part of a supervisor.

The FB 'Absolute Room Temperature Setpoint Scheduler' is providing the *RoomTempSetpAbs* and the *TempRoomSetpAbsNext*. These signals are provided for the FB 'Room Setpoint Manager Temperature Driven)' RSMTD.

Absolute Room Temperature Setpoint Scheduler information typically is related with a single device or small number of devices within a single apartment/floor or room. Therefore, in an 'easy installation' plant with LTE-HEE Mode devices, scheduler dependent HVAC process data (here temperature setpoints) is distributed within geographical zones like Apartment_x.Room_y. In a Standard Mode system, scheduler dependent process data is distributed with Standard Mode Group Objects.

A device may consist of several time channels, this means this FB may be realised more than once in a device, each block belonging to another binding group or zone.

The device with the FB ARTSS needs an internal clock. This internal clock may be the 'local clock' related to the FB 'System Clock'. If the FB 'System Clock' is not available or implemented, the FB ARTSS itself may use (optional) inputs for time and date reception as input for the devices internal/local clock.

5.2   Functional Specifications

The Absolute Room Temperature Scheduling Programme is characterised by "switching points". A "switching point" is defined by output value(s) and a date and/or time value. The output value(s) has/have to be sent if the local clock matches the switching points date & time value.

The following output signals are provided by the ARTSS:

- TempRoomSetpAbs   Both signals are information from a scheduling programme and
- TempRoomSetpAbsNext   provided for the room setpoint manager (temperature driven).

If the FB SCLO (System Clock) is not implemented in a device, the following inputs may be used in the same way as with SCLO in slave mode, they are intended as synchronisation input to the device's internal/local clock.

- System Clock   System Clock Input (Date & Time)
- Time   Time Input, Standard Mode only
- Date   date Input, Standard Mode only

Parameters:

The Time Schedule or "internal programme" (switching points with their output value(s)) is given by parameters. These parameter(s) are manufacturer specific.

Time Schedules in a bus device may be changed by a management station or a complex bus device (with sophisticated user interface/MMI). That means, change of time schedule parameters is not only an action during configuration phase of an installation, but also during runtime.

For LTE-HEE mode implementation, zoning parameters are included in this document.

5.3   Constraints

- Apartment.Room(.Subzone) is a structured/compound zoning address, each part with its own Z_8 Status. If one part of the this compound zoning address is 'Out of Service' all parts are Out of Service.

5.4   Functional Block diagram
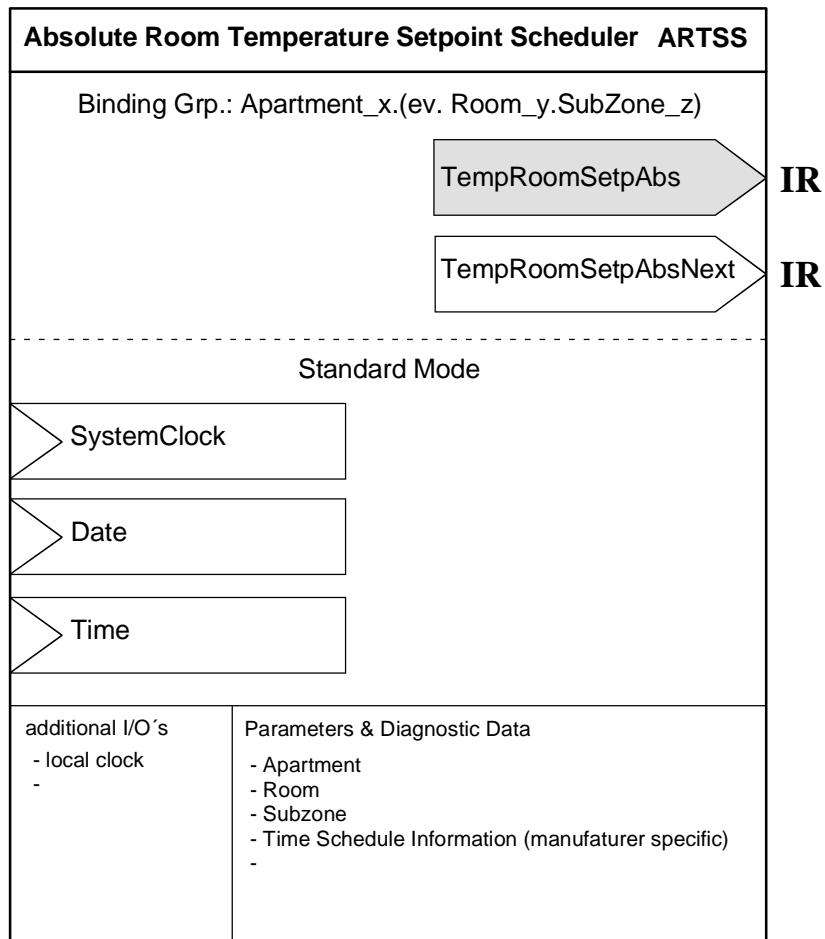
5.5   Datapoints

Data Point	Description	Data Point Type	DPT ID
Outputs			
TempRoomSetpAbs	Present temperature setpoint; input to RSMTD – LTE-Mode – Standard Mode	DPT_TempHVACAbs_Z DPT_Value_Temp	205.100 9.001
TempRoomSetpAbsNext	Next temperature setpoint plus time to next status input to RSMTD	DPT_TempHVACAbsNext	220.100
Inputs			
SystemClock	System Clock as input for the device's local clock; available only in Standard Mode	DPT_DateTime	19.001
Date	alternative to SystemClock; only in Standard Mode	DPT_Date	10.001
Time	alternative to SystemClock; only in Standard Mode	DPT_Time	11.001
Parameters			
Apartment	LTE zone: Apartment number	DPT_UcountValue8_Z	202.002
Room	LTE zone: Room number	DPT_UcountValue8_Z	202.002
Subzone	LTE zone: Subzone number	DPT_UcountValue8_Z	202.002
Diagnostic Data			
---	---	---	

Table 5–1: ARTSS - Overview on runtime Interworking and parameter properties

		Basic FB	STANDARD MODE S-Mode	EXTENDED MODE Standard Mode Interface	LTE-Mode
Outputs	TempRoomSetpAbs	**GO$_b$**	GO	GO	M
	TempRoomSetpAbs Next	**NA** [1]	NA	NA	O
Inputs	**SystemClock**	**(GO$_b$)**	(GO)	(GO)	NA
	Date	**(GO$_b$)**	(GO)	(GO)	NA
	Time	**(GO$_b$)**	(GO)	(GO)	NA

[1] *optional in LTE-Mode; the information is NA in the Basic FB and all other modes because the Datapoint Type is <u>today</u> not yet available in Standard Mode. Splitting of DPT is not possible because of necessary data consistency*

Table 5–2: ARTSS Runtime Interworking - dependence on Configuration Modes

		Support
Parameter	Apartment	M
	Room	O
	Subzone	O

Table 5–3: ARTSS LTE specific Properties

		Support
Parameter	---	

Table 5–4: ARTSS Properties of Interface Objects (or memory mapped DP)

5.5.1   Detailed specification of the Datapoints

5.5.1.1 Output: TemRoomSetpAbs

Standard Mode:

DP Name:	TempRoomSetpAbs		Abbr.:	---		Mandatory	☒
FB Name:	ARTSS					Can be internal	☒
Description							
see LTE-HEE Mode							
For Standard Mode transmission, a simple datatype (without Z_8 status/command field) is used.							
Datapoint Type							
DPT_Name:	DPT_Value_Temp						
DPT Format:	F_{16}			DPT_ID:		9.001	
Field	Description			Supp.	Range	Unit	Default
					full	°C	cs
Access Type							
♦ Output							
this → M	☒		this → 1	☐			
Spontaneous	☒	COV:	☒	Δ-Value:	[1]	MinRepTime:	10sec
		Cyclic	☒	Period:	15 min (recommended value)		
Request	☒						
Communication Type							
♦ Group Object Datapoint						Mandatory:	☒
Default Group Address:		---					
Dynamics							
Power down:	Save:		☐				
Power up:	Value:	No initialisation:		☐		Default value:	☐
		Saved value:		☐		Actual value:	☒
	Transmit on bus:			☒	[2]		☐
Exception Handling							
Special Features							
[1] COV / transmission condition: local time of the device matches a schedule's switching point.							
[2] actual value is sent as soon as local time is valid (not "corrupted", no fault, ….)							

LTE-HEE Mode:

FB:	ARTSS	LTE Server Output Name:	**TempRoomSetpAbs**		Mandatory ☒ Optional ☐
Description:					
The temperature setpoint is used by the FB "Room Setpoint Manager Temperature Driven" (RSMTD) (further description see description of FB RSMTD).					

DPT:	Name	DPT_TempHVACAbs_Z		DPT ID	205.100	Datatype format	$V_{16}Z_8$	
Field		Description		Sup.	Range	Unit	COV	Default
Temperature		Setpoint value		M	full	°C	see [1]	cs
Status - all flags		Standard STATUS attributes not supported		NA	false	bitset		
Command - all commands		standard Command, write only not supported		NA		enum.		

Communication:					
Binding Group:					
Class		Type		Default	
Geographical ☒		Apartment . Room . Subzone		cs	
Application Specific ☐					
Unassigned ☐		Broadcast ☐ Configurable ☐			
DP Address:		IO Type(ID): 113 (ARTSS)		Property ID: 51	
LTE-Services (event):		COV ☒ MinRepTime: 10 sec Heartbeat: 15 min			
InfoReport ☒		Output per default communicating ☐		Binding Group Wildcard allowed ☒	
(LTE Read-Response polling of the output shall always be supported)		Tx Prio: High ☐ Normal ☒ Low ☐			
		Transm after Powerup [2]: Stored Value ☐ Act Value ☒ Default Value ☐			
Property-Service (individual access):		Read only ☒ Read/Write ☐			
Exception Handling:				Save at Powerdown ☐	

Special Features:					
[1] COV / transmission condition: local time of the device matches a schedule's switching point. [2] actual value is sent as soon as local time is valid (not "corrupted", no fault, ….)					

5.5.1.2 Output: TempRoomSetpAbsNext

Standard Mode: NA

LTE-HEE Mode:

FB:	ARTSS	LTE Server Output Name:	TempRoomSetpAbsNext			Mandatory ☐ Optional ☒
Description:						
Provides next temperature setpoint for FB RSMTD and the time delay (in minutes) until this next value						

DPT:	Name	DPT_TempHVACAbsNext		DPT ID	220.100	Datatype format	U_{16} V_{16}
Field		Description		Sup.	Range	Unit	COV	Default
Time [1]		Delay Time in minutes		M	[0 … 65535]	min	---	cs
Temperature		next setpoint value		M	full	°C	see [2]	cs

Communication:				
Binding Group:				
Class		Type		Default
Geographical	☒	Apartment . Room . Subzone		cs
Application Specific	☐			
Unassigned	☐	Broadcast ☐ Configurable ☐		
DP Address:		IO Type(ID): 113 (ARTSS)	Property ID: 52	
LTE-Services (event):		COV ☒ MinRepTime: 10 sec	Heartbeat: 15 min	
InfoReport	☒	Output per default communicating ☐	Binding Group Wildcard allowed ☒	
(LTE Read-Response polling of the output shall always be supported)		Tx Prio: High ☐	Normal ☒	Low ☐
		Transm after Powerup [3]: Stored Value ☐ Act Value ☒ Default Value ☐		
Property-Service (individual access):		Read only ☒	Read/Write ☐	
Exception Handling:				Save at Powerdown ☐

Special Features:				
[1] As long as the 'real' time to next mode is out of range (> 65535 minutes) the maximum time delay (= "65535 minutes to next mode") is sent.				
[2] transmission condition: Heartbeat & COV ("new" next setpoint when *TempRoomSetpAbs* has changed → sent after *TempRoomSetpAbs*				
[3] actual value is sent as soon as local time is valid (not "corrupted", no fault, ….)				

5.5.1.3 Input: SystemClock

Standard Mode:

See **[02]**, description of SCLO input *SystemClock* (SCLO in slave mode).

LTE-HEE mode: NA

5.5.1.4 Input: Date

Standard Mode:

See **[02]**, description of SCLO input *Date* (SCLO in slave mode).

LTE-HEE mode: NA

5.5.1.5 Input: Time

Standard Mode:

See **[02]**, description of SCLO input *Time* (SCLO in slave mode).

LTE-HEE mode: NA

5.5.1.6 Parameter: Apartment

FB:	ARTSS	Property Name (<u>Server</u>):	Apartment				Mandatory ☒ Optional ☐	
Description:								
LTE zone: Apartment number								
DPT:	Name	DPT_UcountValue8_Z		DPT ID	202.002	Datatype format	U_8Z_8	
Field		Description		Sup.	Range	Unit	Default	
CounterValue		Apartment number		M	1..126	--	1	
Status - OutOfService - all other flags		zone active /inactive not supported, fixed to '0'		O NA	true/false	bitset	false	
Command - NormalWrite - SetOSV & ResetOSV - all other commands		set zone inactive / active not supported		M O NA		enum		
Communication:								
DP Address: **(in the server)**		IO Type(ID):	113 (ARTSS)		Property ID:	101		
		Start-Index:	1		N° of elements	1		
Property access:		Read only	☐	Read/Write		☒		
Exception Handling:		Value after Powerup:	Stored Value ☒	Act Value ☐		Default Value ☐		
--								
Special Features:								
ARTSS DP's are not LTE communicating if zone is 'OutOfService'. If Apartment is 'OutOfService' also the corresponding Room and Subzone is 'OutOfService' (common flag)								

5.5.1.7 Parameter: Room

FB:	ARTSS	Property Name (<u>Server</u>): Room		Mandatory ☐ Optional ☒

Description:							
LTE zone: Room number							

DPT:	Name	DPT_UcountValue8_Z		DPT ID	202.002	Datatype format	U_8Z_8
Field		**Description**		**Sup.**	**Range**	**Unit**	**Default**
CounterValue		Room number		M	0, 1..63	--	0 or 1
Status - OutOfService - all other flags		 zone active /inactive not supported, fixed to '0'		 O NA	 true/false	bitset	 false
Command - NormalWrite - SetOSV & ResetOSV - all other commands		 set zone inactive / active not supported		 M O NA		enum	

Communication:					
DP Address:	IO Type(ID):	113 (ARTSS)	Property ID:	102	
(in the server)	Start-Index:	1	N° of elements	1	
Property access:	Read only ☐		Read/Write ☒		
Exception Handling:	Value after Powerup:	Stored Value ☒	Act Value ☐	Default Value ☐	
--					
Special Features:					
ARTSS DP's are not LTE communicating if zone is 'OutOfService'. If Apartment is 'OutOfService' also the corresponding Room and Subzone is 'OutOfService' (common flag)					

5.5.1.8 Parameter: Subzone

FB:	ARTSS	Property Name (<u>Server</u>): Subzone		Mandatory ☐ Optional ☒

Description:							
LTE zone: Subzone number within the Apartment.Room. Subzone value is a parameter used or fixed value '*' (=0)							

DPT:	Name	DPT_UcountValue8_Z		DPT ID	202.002	Datatype format	U_8Z_8
Field		**Description**		**Sup.**	**Range**	**Unit**	**Default**
CounterValue		Subzone number		M	0, 1..15	--	0 or 1
Status - OutOfService - all other flags		 zone active /inactive not supported, fixed to '0'		 O NA	 true/false	bitset	 false
Command - NormalWrite - SetOSV & ResetOSV - all other commands		 set zone inactive / active not supported		 M O NA		enum	

Communication:					
DP Address:	IO Type(ID):	113 (ARTSS)	Property ID:	103	
(in the server)	Start-Index:	1	N° of elements	1	
Property access:	Read only ☐		Read/Write ☒		
Exception Handling:	Value after Powerup:	Stored Value ☒	Act Value ☐	Default Value ☐	

Special Features:					
ARTSS DP's are not LTE communicating if zone is 'OutOfService'. If Apartment is 'OutOfService' also the corresponding Subzone is 'OutOfService' (common flag)					