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BACtwin

BACtwin in public buildings

(BACtwin 2026)

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Mechanical and Electrical Engineering Working Party of National, Regional and Local Authorities

BACtwin in public buildings

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For reasons of clarity and readability, this recommendation does not use pair forms. Instead, the grammatically masculine form is used in a generalized way (generic masculine). This form of designation includes both female and male persons, who are of course addressed on an equal footing.

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List of changes

The directory documents changes in the content of the BACtwin specification compared to the previous version. Subordinate changes (spelling, punctuation, sentence structure, format, etc.) are not mentioned. Within the text, changes are marked with blue color.

Date	Version	Chapter/Section	Short description of change
22.03.2026	**AMEV1.2**	**BACtwin 2026**	
		2.1 BACtwin UAK	TBS and BAC addressing consistent
		2.1.1. Trade	Abbreviations according to VDI 3814
		2.1.2 Plant, Partial plant	PIS & UAK. reference to Section 4.1
		2.1.5 Aggregate	Principle of modeling explained
		2.1.9 Numbering	Numbering specified
		2.1.10 User-specific Location UAK	Meaningful specification of the Installation Location
		2.1.13 Presentation of BACtwin UAK	UAK elements can be used across trades in every UAK block
		2.1.16 Example for customizing BACtwin UAK	Notes on customizing specified
		2.3 Object template	Several Clarifications
		2.8 Object Type Structured View	Property Structured_Object_List added; responsibility must be clarified
		3.2 BACtwin-capable engineering tool	Table 20 corrected in line 1: Table 19
		4.1 BAC planning, partizipation of other project participants	Clarification; Reference to BACtwin-capable tools; application of location and function UAK in service phases (HOAI)
		4.2 Caracter Set, Minimum number of characters	Clarification: Minimum number of characters per transition
		4.3 Priority control, commandabiity	Section renamed; definition of usage types for value objects
		4.8 Availability, number of outages, downtime	Reference period generalized
		4.11 BACtwin-capable operator requirement	Clarification; Table 27 Operator specification further developed
		App. 1 AMEV attestation AS-C and AS-D	Version year as basis
14.02.2025	**AMEV1.1**	**BACtwin 2025**	List of changes in BACtwin 2025
12.04.2024	**AMEV1**	**BACtwin 2024**	

Analogous to the list of changes of the BACtwin specification, each BACtwin library (XLSX file) also contains a worksheet with a change log listing the changed worksheets.

Within a modified worksheet, each change is marked with blue color at the changed location and additionally in column A. A template with a new or significantly changed scope of the subordinate elements receives an updated version number (e.g. AMEV1.x) and a new UUID.

Foreword

Despite the progress made in building automation, the practical use of BAC systems must be further improved (see [Waide: Energy CO2 saving through building automation], [Fütterer, Schild, Müller: BAC in der Praxis]). The German [Building Energy Act] of 16.10.2023 makes building automation mandatory for many non-residential buildings and places specific requirements on energy efficiency, company and manufacturer neutrality. BAC systems must be adapted to climate change, but also to the increasing shortage of skilled personnel.

The necessary improvements can be realized more easily with IT-based BAC concepts. As people are unable to master the complex BAC mass data manually, the greatest possible standardization of BAC processes is expedient.

The BACtwin concept consistently implements these objectives. The abbreviation BACtwin stands for "Digital Twin in Building Automation with BACnet" and is based on the Digital Twin in the context of Industry 4.0 and BIM in the construction industry. The central BACtwin objectives are IT-supported standardization, digitalization and automation of BACnet projects.

The AMEV BACtwin recommendation is based on [AMEV BACnet 2017] and new concepts and experiences in the D-A-CH area (e.g. Austrian Armed Forces, University of Basel, Deutsche Bahn). The AMEV AK BACtwin has combined these impulses into a comprehensive, coherent data management system.

The BACtwin data model is designed as a modular system, which is based on a machine-interpreTable UAK (user addressing key analogous to [VDI 3814 Blatt 4.1]. Predefined object and aggregate templates simplify the BACnet application for standard functions, but also facilitate complex BACnet applications. The data model supports data exchange without media discontinuity and enables automated 1:1 check.

The data model significantly increases the performance of planning, engineering and testing tools. BACtwin users can conFigure common standard aggregates easily and quickly. Thanks to the standardizations, sustainable, economical building operation can be largely automated and, with the help of technical monitoring (TMon), optimized in a more targeted manner and continuously maintained.

The BACtwin data model creates the basis for neutral and sustainable use of the BACnet protocol, for the implementation of the requirements in the German [Building Energy Act] (see §71a Building Automation) and for the integration of building automation in BIM projects.

At the heart of the BACtwin recommendation is the BACtwin Library, whose templates and Tables define the BACtwin data model (XLSX). This BACtwin description (PDF) contains additional explanations. The AMEV makes the library and description available for download free of charge on its homepage (Open Source approach).

The recommendation was the result of cooperation between experienced BACnet, BA and IT experts in the D-A-CH region, especially BAC planners and BAC operators, BACnet and BAC manufacturers as well as software and tool manufacturers. We would like to thank all those who have supported the BACtwin concept through their cooperation or contributions.

The BACnet Interest Group Europe (BIG-EU) was informed about the AMEV recommendation BACtwin prior to publication.

Robert Schmidt
AMEV chair

Jürgen Hardkop
Chair of the AMEV BACtwin

1 Introduction

1.1 BACnet applications without BACtwin concept

The BACnet protocol for BAC is standardized as [DIN EN ISO 16484-5] and recognized worldwide. BACnet offers an unparalleled scope of information and can be used universally for BAC projects and almost all trades. The wealth of information on offer often poses problems for builders and planners. Despite intensified further training, BACnet specialists are still a small minority. Despite this, BACnet occupies a leading position in building automation and is the norm in public buildings. Different methods of using BACnet have developed.

The advantages of manufacturer-specific BACnet applications were initially used by many builders. In the initial phase, this was an understandable strategy for dealing with the new communication protocol. However, BACnet operators have to accept extensive dependence on the respective BACnet company, e.g. unexpected changes to products or company strategies. This constellation is also problematic in terms of public procurement law and is not a permanent solution.

The first recommendation for manufacturer-neutral BACnet applications in public buildings was published in "AMEV BACnet 2007". The central element was the specification of AMEV profiles for AS (Automation station) and MOU (Management and operating unit). The AMEV profile (e.g. AS-B) have proven themselves and are recognized in the D-A-CH area. From 2011, the AMEV simplified the testing procedure and issued AMEV test certificates for the AMEV profiles AS-A and AS-B together with WSPCert.

Incomplete usage specifications continue to cause problems. The central obstacle is the complexity caused by countless BACnet properties, the relevance of which is not always transparent for builders, planning and operation. The BACnet standard does not contain any rules for the implementation of specific tasks (e.g. in control systems or regulations) in objects. As there is no standardized data structure for project data, data exchange without media disruptions is not possible. Acceptance tests are only carried out manually and on a random basis. The groundbreaking inventory of the ÖBH [Kranz, Fritzenwallner: Digitaler Zwilling] also shows that the interpretations of the standard by the BAC manufacturers differ significantly.

In vendor-neutral BACnet projects with several BA companies (multi-vendor projects), a profile-based BACnet concept alone is not sufficient to ensure the desired user-oriented and optimized operation.

1.2 Introduction to the BACtwin Concept

The problems described above usually occur when IT-supported processes and applications have grown historically. Typical consequences of such developments include data islands, interface problems, media disruptions and inconsistent data usage.

The core problem is the lack of an overall digital concept, which can be solved by the digital twin. The digital twin is a comprehensive data model that represents real processes (e.g. BA systems) or objects and consists of models and data of the processes or objects.

Thanks to the standardization of the BACnet protocol, the advantages of the digital twin can also be used for BACnet-based BAC systems. The digital data model for BACnet-based BA systems is referred to as BACtwin (short for: digital twin in building automation with BACnet). This abbreviation is intended to avoid confusion with other digital twins (e.g. Industry 4.0) and with conventional BACnet systems (without a digital twin).

BACtwin is a data model that describes basic BAC functions as well as standard aggregates, assemblies and systems on the basis of the BACnet protocol (DIN EN ISO 16484-5) in a manufacturer-neutral manner and makes them available as an open interface.

The BACtwin concept consists of the BACtwin Library, which defines the digital data model (see Figure 1, yellow, orange) and the BACtwin Specification, which explains the BACtwin Library and provides instructions for BACtwin implementations.

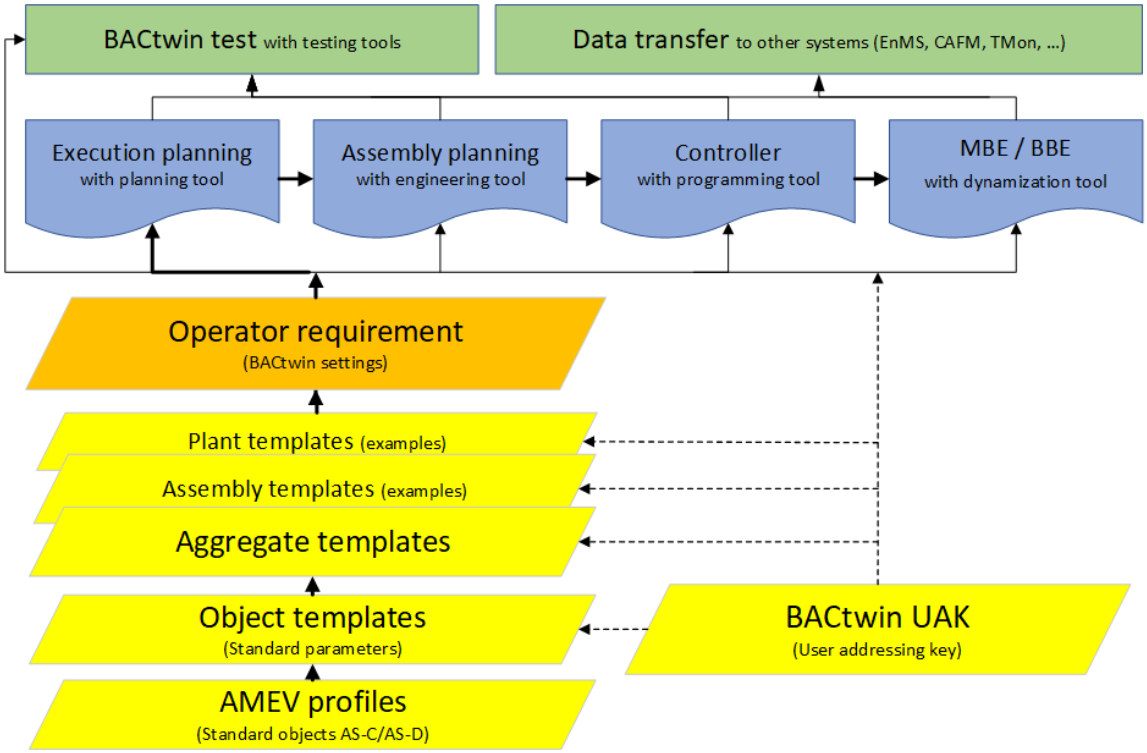

Figure 1 BACtwin library (yellow, orange) und BACtwin-capable SW tools (blue, green)

The BACtwin data model is designed to be machine-interpreTable, user-friendly and future-proof. It captures all project data relevant for planning, engineering and operation, but avoids redundancies. Relevant objects and processes are mapped consistently over the entire life cycle, i.e. starting with planning, during construction and operation through to recycling or disposal.

The machine-readable and interpreTable user address key (UAK) plays a key role in the data model. The BACtwin UAK offers logical structures, practice-oriented, accurate terms and a comprehensive, cross-trade data scope.

The worksheets of the BACtwin Library are called templates (e.g. object templates) or Tables. Important Tables (i.e. with inheritance of IT properties) are referred to as templates.

More than 300 object templates have been standardized on the basis of the BACtwin UAK and the updated AMEV profiles. These object templates are used to conFigure more than 100 aggregate templates for standard aggregates (e.g. single-stage pump) according to the modular principle. Approximately 50 templates for standard assemblies are defined on the basis of the aggregate templates (e.g. reheater). The plant templates are created as examples for several standard plants (e.g. weather station).

In addition, check Tables display selected data content in a direct context so that users can more easily overview and check the data consistency in this context (e.g. all UAK abbreviations sorted alphabetically, overview of the Priority_Array).

To ensure that the BACnet terms are unambiguous, the standard terms are used in Tables and templates. Due to machine interpretability, the standard terms must not be changed (e.g. abbreviated). In the BACtwin description, special standard terms are supplemented by German terms (in brackets) to make them easier to understand.

BACtwin-capable software tools (SW tools) are required for project management, which support IT-supported, consistent processing of BACnet project data and simplify the planning and construction of efficient BAC systems. To this end, software and BACnet manufacturers integrate the BACtwin library as a reference model for BACtwin implementation in their planning, engineering and testing tools.

Users do not fill out the XLSX Tables, but use BACtwin-capable SW tools. The planning tools and engineering tools (shown in blue in Figure 1) are used to conFigure the project-specific aggregates, assemblies and plants required. If required, the predefined standard aggregates can be modified for specific projects as so-called project aggregates.

The developed BAC project data is bundled in the project library. The structures and designations of the project data are based on the structures and terms of the BACtwin library. Due to the different contents, the lists of project data (= IT-supported work results) are referred to as lists (e.g. aggregate lists).

Table 1 compares the names of the templates/Tables of the BACtwin library with the names of the lists of BACtwin project data.

BACtwin library (templates, Tables)	**BACtwin project data** (lists)
Object templates	Object lists
Aggregate templates	Aggregate lists
Assembly templates	Assembly lists
Plant templates	Plant lists
BACS function table	BACS function lists
BACtwin table	BACtwin lists
BACtwin Library	Project Library

Table 1 Synopsis BACtwin library – BACtwin project data

In the BACtwin data model, the responsibilities for the project data are clearly defined. The client or operation, BAC planning and BAC execution have different tasks to fulfill. Depending on the project phase and responsibility, the project library is filled with the required entries.

BACtwin-capable checking tools (shown in green in Figure 1) are used for automated checking of the extensive data in a project library. The checking tools enable 1:1 checks of the relevant BAC project data, detect deviations, gaps etc. and document necessary corrections. To do this, they compare the BAC planning with the operator requirement (orange in Figure 1) and the execution with the planning.

In the operator requirement (see Table 28), the client/operator specifies the application of the BACtwin concept in his organizational area (e.g. the location-specific addressing and his user-specific selection of the available BACtwin variants).

Standardized data formats and interfaces are used in all project phases to ensure IT-supported data exchange without media disruptions and loss of information.

The BACtwin Library comprises three parts (XLSX files):

- **Library 1:** BACtwin UAK
- **Library 2:** AMEV profiles, object templates
- **Library 3:** Aggregate templates, additional worksheets

The libraries are interlinked (see Figure 1) and together form the data model of the BACtwin concept. Each library represents the associated Tables on the Worksheet Inhalt (= **Content**).

Note: *The English translations of texts, templates and tables are limited to raw translations of the plain texts. Suggestions for translating the BACtwin abbreviations and terms are listed in Library 1 in Worksheet 4.2 BAS de-en. Complete English translations are only useful once*

the suggested translations e.g. of abbreviations have been revised and accepted by native English speakers (suggestions are welcome – see Section 4.11).

The following principles were taken into account when defining the BACtwin data model:

Goal 1 Standardization as far as possible

Public buildings often have several thousand BAC data points and an even higher number of properties and parameters (BACtwin: at least 20 parameters/object). The verifiability and manageability of this mass BA data is of central importance in BA projects and system operation.

The data model is not aimed at the largest possible number of implemented BA functions, but at the sensible selection and uniform specification of the basic BA functions. The focus on essentials has proven itself in the AMEV profiles and should also be taken into account when using the data model in BACtwin projects.

Clients and operators should only allow individual changes to the standard templates or reductions in the standard functions in justified cases. The advantages of changes must clearly outweigh the disadvantages - even in the long term.

Rarely used or "exotic" aggregates that have to be checked manually should be avoided. The omission of standard functions, e.g. to reduce investment costs, is also critical. BA mass data should not be planner- or manufacturer-specific, but should be neutrally standardized and automatically tesTable.

Goal 2 End-to-end digitalization

The BACtwin data model is universally applicable for the BA systems of municipalities, federal states, the federal government, universities, hospitals and other builders and operators. The data model is standardized in a manufacturer-neutral way.

The BACtwin data model is based on the state of the art. A BACnet-based, machine-interpretable standard is defined for each common BAC function. This is the minimum requirement, but can be used differently in justified exceptional cases. It can be extended for innovative solutions.

In BACnet systems, the object information (properties) is implemented in automation station.

The data model contains all input/output functions that are necessary for efficient operation. The data model contains all messages required for operational monitoring. It also includes messages that lead to uncontrolled energy consumption in the event of malfunctions or incorrect operation (e.g. manual positions)

The data model contains all data recordings with which energy malfunctions can be subsequently determined and evaluated. The data series can be historized in a database and serve as a basis for technical monitoring during commissioning and operation.

The standard-compliant BAC project data can be checked automatically using test tools. The greatest possible standardization, digitalization and automation significantly improves the efficiency of BAC projects, BAC operations and the FM processes based on them.

Goal 3 Future-proofing

The data model is designed as an expandable modular system. It is adapted to further developments in technology (e.g. new revisions, technologies, TMon experiences, BIM projects, sustainability reports). The data model is kept permanently consistent through versioning. Future extensions can be planned and built using the latest version of the BACtwin model.

The data model is described in the following chapter. For a better understanding, the templates and Tables explained are shown, but only as excerpts. The BACtwin libraries contain all templates and Tables with all the details.

2 The BACtwin data model

2.1 BACtwin UAK

The complex mass data in BAC systems can only be managed efficiently with the help of powerful IT tools. However, the basic prerequisite for the use of IT tools is that machine-interpretable addressing, designations, abbreviations and data content are used in the BA systems in accordance with standardized specifications of the builders or operators.

The key element of the BACtwin concept is a machine-readable and interpretable user addressing key. Thanks to the BACtwin UAK, BACtwin-capable IT tools can clearly identify the addressed elements (e.g. aggregates, functions) and interpret, for example, their arrangement and function in the overall system.

In BACtwin systems, the user addresses are defined in the Object_Name property of the BACnet objects as a unique ID using abbreviations. The user address is based on a UAK, which is made up of the location UAK with location-related UAK blocks and the BACtwin UAK with function-related UAK blocks (= function UAK).

In existing buildings and systems, UAK are used according to the individual specifications of the builders or operators. They can continue to be used in existing buildings, but are generally not suitable for low-effort 1:1 evaluation with testing tools such as TMon software.

In order to utilize the advantages of the BACtwin concept, BAC systems must have a machine-interpretable UAK that supports automated evaluations in combination with other IT systems (TMon, BIM, CAFM, etc.).

For this purpose, the AMEV working group BACtwin has developed the machine-interpretable BACtwin UAK on the basis of [VDI 3814 Blatt 4.1]. The BACtwin UAK should be integrated into the new construction, renovation or expansion of BAC systems - if necessary in addition to an existing UAK concept. The BACtwin UAK supports automated evaluations even in very complex BAC systems. In contrast to older existing UAKs, it also addresses the BACnet object types of the AMEV profiles.

Table 2 contains an exemplary structure of the BACtwin UAK with the function-related BACtwin UAK blocks.

UAK block	Designation	Explanation	Character	Example
1.	Trade	Cost group (DIN 276-1)	1-3	420
2.	Plant	Abbreviation with number	5-9	CON01
3.	Assembly	Abbreviation with number	11-15	SHS01
4.	Medium, Position	Abbreviation	17-19	HTF
5.	Aggregate	Abbreviation with number	21-25	#####
6.	Operating Equipment (OE)	Abbreviation with number	27-31	T~~01
7	OE Function	Abbreviation with number (without extension)	33-37	MS~01
8. (opt.)	OE Function Extension	Abbreviation for extension (e.g. TL, EE), otherwise free	38-40	_TL

Table 2 Structure of BACtwin UAK (example)

For the BACtwin UAK in Table 2 (420_CON01_SHS01_HTF_#####_T~~01_MS~TL01), 40 characters are required (with separator).

BACnet-capable products should support at least 64 characters for the "Object_Name" property in accordance with ([DIN EN ISO 16484-5] Tab. K4). This means that up to 23 characters are available for the location UAK.

User-specific adjustments (see 4.11) can change the number of characters in the BACtwin UAK and in the location UAK.

The BACtwin UAK has a machine-interpretable structure with uniform UAK lengths.

The UAK blocks are separated by an underscore "_". A degree sign "°" is used as a separator within a UAK block. Partial plants can be inserted in the UAK block Plant using degree characters or the floor number can be separated from the room number when addressing room automation.

Abbreviations have three digits. A missing letter is filled in with a tilde "~" (e.g. MS~01). A missing UAK block (e.g. assembly group in sanitary facilities) is filled in with hash marks "#####". The underscore, tilde and hash characters belong to the UTF-8 character set.

A non-proportional font with the same letter widths is recommended for Tables; see the following example of the Consolas font for Tables.
Example of Consolas font: `420_VBA01_STH01_HZV_#####_T~~01_MS~TL01`

In UAK, an abbreviation and the corresponding designation each form a unique character.

The UAK blocks are divided horizontally according to trades. Each UAK block contains a selection of common elements for each trade. In the case of frequently used elements, there may be multiple mentions across trades (e.g. VLV = valve, PMP = pump). If terms and abbreviations required in a trade are missing, the appropriate terms and abbreviations can be taken from other trades.

As room automation (originally VDI 3813) will in future be described together with system automation in VDI 3814, the elements of room automation have been classified in trade 480. This amalgamation is also reflected in DIN 276.

The addressing of Technical building services (TBS) and BAC must be consistent for all trades and comply with the operator's specifications. It may only occur once per building. The UAK, which consists of local and BACtwin UAK, must be unique within the real estate portfolio.

The completion of the BACtwin UAK in the HOAI service phases is explained in Section 4.1.

The UAK blocks and other aspects of BACtwin UAK are explained below.

2.1.1 Trade

A trade comprises construction services that are provided and maintained by specialized experts. The structures of the trades are based on the cost groups according to DIN 276-1 and the abbreviations and designations according to VDI 3814 Blatt 4.1 (see Table 3).

No.	Cost group (DIN 276-1)	Abbreviation (VDI 3814 Blatt 4.1)		Designation (VDI 3814 Blatt 4.1)
1.	330	GWS	G	Gates, doors, windows, sunshades
2.	400	TBS	T	Technical building services (general)
3.	410	SAN	W	Sanitary (sewage, water, gas)
4.	420	HTG	H	Heating
5.	430	VEN	V	Ventilation
6.	434	REF	F	Refrigeration
7.	440	ELT	E	Electric power
8.	450	CIT	I	Communication and IT
9.	460	CVR	C	Conveyor
10.	470	USS	U	Usage specific services
11.	480	BAC	B	Building automation and control
12.	550	TSO	O	Technical services in outdoor facilities

Table 3 Trade

Numerical cost groups in accordance with DIN 276-1 (e.g. 420) are recommended, as they create a link to higher-level approaches (e.g. BIM, FM).

Alternatively, alphabetical abbreviations according to VDI 3814 Blatt 4.1 and BACtwin UAK (e.g. HZG) can be selected (operator requirement in Section 4.11).

In the event of overlaps, the main aggregate is used (e.g. CHP heat-led = KG 420, CHP electricity-led = KG 440). In the case of room automation systems, the responsibilities of the building owner or operator must be clarified according to the local conditions.

2.1.2 Plant, Partial plant

A plant forms a functional unit that belongs together in the trade, which can, for example, consist of assemblies, aggregates and equipment and can perform certain functions.

Note: *The UAK must not be confused with the plant identification system (PIS) in accordance with [VDI 3814 Blatt 4.1]. The PIS does not address individual BAC functions, but is limited to the higher level of the systems. The UAK addresses specific BAC functions by means of user addresses. The connection is explained in Section 4.1.*

If partial plants are to be addressed, the plant block can be extended. Two additional digits identify the complete plant (00) and the partial plants (01-99). A degree sign "°" separates the additional digits from the overall installation.

Example of partial plants

430_VTP01°**00**_FAS02_SA~_#####_#####_CS~01	Complete Plant
430_VTP01°**01**_FAS02_SA~_#####_#####_CS~01	Partial plant 01
430_VTP01°**02**_FAS02_SA~_#####_#####_CS~01	Partial plant 02

The BACtwin UAK requires a larger number of characters when addressing partial plants. This must be taken into account in the operator requirement for the local UAK.

Rooms are also addressed in the UAK block Plant (see Section 2.1.12 Room automation).

2.1.3 Assembly

An assembly forms a functional unit in a plant that can consist of several aggregates and operating equipment, e.g. a heater assembly in ventilation technology or a low-voltage main distribution board in an electrical distribution system. If there is no assembly group (e.g. in sanitary systems), the empty space in the UAK block is filled with "#####".

2.1.4 Medium, Position

Aggregates and operating equipment must be addressed within plant and assemblies. Each aggregate and operating equipment is usually assigned to a medium, e.g. a physical carrier (liquid, gas, etc.) such as heating water, supply air, oxygen. In addition, an aggregate and equipment can be used at a specific position of the medium (e.g. forward (flow), return, inlet, outlet).

In the UAK block Medium, Position, a three-character abbreviation usually identifies the medium with two characters (e.g. heating water = HT) and the position with the third character (e.g. F = Forward (flow) or R = return). Examples for heaters are heating water forward (flow) (HTF) and heating water return (HTR). If the position is not required, the third position is a tilde, e.g. supply air (SA~).

The arrangement of the UAK block Medium, Position before the UAK block Aggregate ensures that the numbering always starts at 1 for the same aggregates in different media or positions.

2.1.5 Aggregate

An aggregate is a component that consists of one or more items of equipment, e.g. a fan with motor, frequency converter, repair switch and LO/ID, an individual sensor or combined sensor or a room operating unit with several operating elements and sensors.

During modeling, the operating resources that are functionally linked to the unit (e.g., sensors, monitors, flow sensors) are assigned to the unit. For example, a flow switch in the water of the associated pump (unit) is added as an operating message.

The operating equipment associated with the aggregate is listed in the following UAK block Operating equipment (e.g. motor, FI, repair switch and LO/ID). The functions of the individual operating equipment (e.g. switching command, operating message, fault message) are specified in the following UAK block OE function.

In this BACtwin, only physical aggregates (hardware) are taken into account. There are also virtual aggregates, e.g. application functions or macros in accordance with VDI 3814 Blatt 3.1ff with the associated objects. Virtual aggregates are considered at a later point in time.

If no aggregate exists, the UAK block Aggregate is filled with "#####".

2.1.6 Operating equipment (OE)

An operating equipment is a component that fulfills one task. It can consist of hardware (tangible, e.g. motor, sensor) or virtual information (e.g. efficiency).

A component with several properties (e.g. a combined sensor) is not classified as a piece of equipment, but rather as an aggregate with several pieces of equipment.

2.1.7 OE function

The OE function specifies a signal of the operating equipment. This can be e.g. the measured value of the room temperature, for which there can also be a setpoint. With a flap there are e.g. the functions switching command, feedback OPEN and feedback CLOSED.

2.1.8 OE function extension

If an object of the type Trend Log (TL) or Event Enrollment (EE) references another data point (e.g. data recording, alarm), the referencing object receives a three-digit extension _TL or _EE, which is added after the function identifier and numbering (e.g. MS~01_TL).

References an object of type Schedule (SCH), e.g. B. a value object (AV, BV, MV), the referencing object receives the extension _SH (schedule).

Alternatively, the extension TL, EE or SH (without underscore) can be inserted between the function identifier and the numbering (e.g. MS~TL01).

The resulting difference in length is obvious and intentional. Alternatively, the original data point can be filled with “~~” if the length difference is not desired.

2.1.9 Numbering

There is no numbering for the UAK blocks Trade and Medium, Position.

Identical plants, assemblies, aggregates, Operating equipment and functions that are used in parallel are distinguished by numbering (e.g. fans 01 - n in a fan wall).

The number is only increased if, in addition to the current UAK block, all preceding UAK blocks are identical.

It is important to ensure that the TBS numbering is consistent with the UAK numbering. The numbering of the plants starts afresh in each building.

Example numbering

```
430_VTP01_ERH01_SA~_SSR01_T~~01_MS~01
430_VTP01_ERH01_HTF_SSR01_T~~01_MS~01
430_VTP01_ERH01_HTR_SSR01_T~~01_MS~01

430_VTP02_ERH01_SA~_SSR01_T~~01_MS~01
430_VTP02_ERH01_HZV_SSR01_T~~01_MS~01
430_VTP02_ERH01_HTF_SSR01_T~~01_MS~01
```

For an assembly, the distinction should be made in the UAK block Medium, Position, for example:

`HTA01_HTF_VLV01_#####_SP01` and
`HTA01_HTR_VLV01_#####_SP01.`

As a rule, two-digit numbers are provided. Users can set single-digit numbers for selected UAK blocks system-wide.

Three-digit numbers are possible but should be avoided due to the limited UAK length. If necessary, division into effective areas is recommended (e.g. fire dampers are separated by the medium in front of the UAK into exhaust, recirculation and supply air, each < 99).

2.1.10 User-specific Location UAK

The location-related part of the UAK depends on the conditions of the properties, buildings, components and rooms. AMEV specifications for standardized Location UAK do not make sense. It is the task of the organization (e.g. municipality, university, state administration, federal administration) to define the Location UAK across the organization clearly, uniformly and in a future-proof manner (if necessary using CAFM, digital spatial register, BIM) and to specify it in a binding manner.

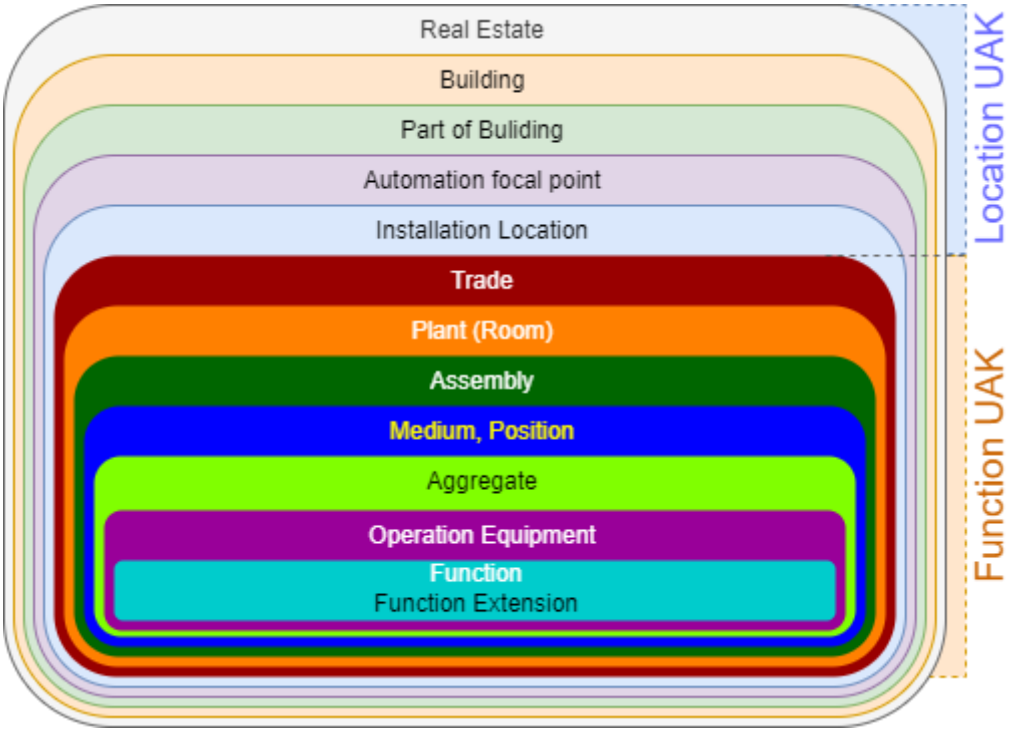

Figure 2 BACtwin UAK with Location UAK as shell model

Figure 2 shows the interaction between the BACtwin UAK (= functional UAK) and the user-specifically defined Location UAK (here an example) as a shell model.

In the location UAK, the “Installation Location” is used to find the relevant field device.

In addition, it may be useful to specify the Installation Location in the property description.

2.1.11 User-specific Description

The property description contains plain text according to the specifications of the Library 1, specified by the client or operator according to Section 4.11.

The following Example Description is recommended as content.

Below is an Alternative Description that starts begins with the signal information instead of the location information. The Alternative Description can be selected (Section 4.11).

Example Description:
House 1 Room 5.20 (warehouse) Heater heating water flow temperature reading

Alternative Description:
Reading temperature heating water flow heater room 5.20 (warehouse) house 1

2.1.12 Room automation

In a room automation system, the aggregates from different trades in the respective room work together in an interdisciplinary manner like a plant.

The effective location of the room automation (RA) is addressed in a position-oriented manner in the UAK block system (e.g. as “plant” RAR).

The addressing of the room automation is based on the shell model (see VDI 3813 Sheet 1). The spatial structure is mapped depending on the Building, Area, Room or Segment (e.g. with RAB, RAA, RAR, RAS).

Since room numbers can change during operation and only the description can be changed by the BAC operator, room numbers should preferably be integrated into the description. Additional information for BACtwin-capable room automation can be found in Section 4.10.

2.1.13 Presentation of BACtwin UAK

Table 4 BACtwin UAK (excerpt) below, contains an overview of the UAK blocks as an excerpt; the associated abbreviations and designations are sorted by trade.

Italic text explains the respective designation.
Example: WAZ, water meter *(main meter)*.

Grayed out abbreviations are not recommended (e.g. blurred, obsolete); the abbreviations recommended as replacements are listed in brackets.
Example: FLH, surface heating (recommended: FBH, WDH, DKH).

In Table 4 the Content Description columns are hidden for better clarity.

Library 1 contains in Worksheet 4 BACtwin-BAS the complete BACtwin UAK. In addition to the UAK blocks, abbreviations and names, there are also the Content Description columns.

In Worksheet 4, the assignment of, for example, aggregates to a trade is not mandatory, but rather illustrative.

For didactic reasons, the single sensor (SSR) aggregate, for example, is only shown in trade 480, Building Automation. The UAK elements within a UAK block can be used across trades.

Worksheet 4 BACtwin-BAS contains - in addition to the UAK blocks, abbreviations, and designations - the columns Content Description. Using the Content Description column, the description in the aggregate templates can be created automatically by means of concatenation. On this basis, user-specific adaptation of the plain texts can be carried out efficiently.

In addition, the library 1 contains more worksheets that have been set up for the practical application of the BACtwin UAK.

Worksheet 4.1 BAS Beispiel presents a UAK example in tabular form (explanations follow in Section 2.1.16).

Worksheet 4.2 BAS de-en lists all abbreviations and designations in alphabetical order in one column each (across UAK blocks, without multiple answers). At the same time, English translations are proposed for the abbreviations and names.

In addition, each UAK abbreviation has, among other things, a UUID (Universally Unique Identifier) that supports the import and use of the UAK abbreviation and the associated names in databases without naming conflicts.

Additional required abbreviations, names and translations can be communicated to the AMEV (see Section 4.11).

Table 4 BACtwin UAK (excerpt)

1. Gewerk			2. Anlage		3. Baugruppe		4. Medium/Position		5. Aggregat		6. Betriebsmittel		7. Funktion		8. Funktion-Erweiterung	
KG	Kürzel	Bezeichnung	Kürzel	Bezeichnung	Kürzel	Bezeichnung	Kürzel	Bezeichnung	Kürzel	Bezeichnung	Kürzel	Bezeichnung	Kürzel	Bezeichnung	Kürzel	Bezeichnung
1	2	3	4	5	7	8	10	11	13	14	16	17	19	20	22	23
330	TTF	Türen, Tore, Fenster	330	Türen, Tore, Fenster, Sonnenschutz	330	Türen, Tore, Fenster, Sonnenschutz	330	Türen, Tore, Fenster, Sonnenschutz	330	Türen, Tore, Fenster, Sonnenschutz	330	Türen, Tore, Fenster, Sonnenschutz		***Signal:***		
			FAA	Fassadenanlage (ohne Raumbezug)	SON	Sonnenschutz, Beschattung, Verdun	FA~	Fassade	TOR	Tor	MOT	Motor	AF~	Anforderung	EE	referenzierte Meldung
							RU~	Raum	TUR	Tür	FEG	Fenstergriff	AFH	Anforderung Heizen	TL	referenzierte Datenaufzeichnung
			RWA	Rauch- und Wärmeabzugsanlage	NRA	Natürlicher Rauchabzug			BST	Brandschutztür	FEK	Fensterkontakt	AFK	Anforderung Kühlen	ZP	referenzierter Zeitplan
							[nnn]	Ausrichtung (*in °; nnn = 000-360*)	SLS	Schleuse	G~~	Position, Länge, Amplitude	AFT	Anforderung Temperieren		
			RAG	Gebäude (*Schalenmodell*)	MFT	Multifunktionstüre	n00	Fassade Nord	DRK	Drehkreuz	GS~	Position schaltend, Endschalter	AFL	Anforderung Lüften		
			RAA	Abschnit			o00	Fassade Ost			WIN	Winkel	AFV	Anforderung Voll		
			RAB	Bereich (*Schalenmodell*)			s00	Fassade Süd	FEN	Fenster			AFR	Anforderung Reduziert		
			RAR	Raum (*Schalenmodell*)			w00	Fassade West	JAL	Jalousie			BB~	Betriebsbereit		
			RAS	Segment (*Schalenmodell*)					MAR	Markise			BEE	Befehl Extern Einspeiseleistung		
									ROL	Rolladen			BLZ	Belegungszustand (*z.B. Raum*)		
									VEG	Verdunklung, Vorhang			BM~	Betriebsmeldung		
													BSM	Betriebssammelmeldung		
									RSA	Rauchschutzabschluss (*vormals RSV*)			BZ~	Betriebsstunden Zählwert		
													FR~	Freigabe		
									RWS	Rettungswegesystem (*vormals FWS, Fluchtwegesicherungsanlage*)			FRA	Freigabe Absenkbetrieb (z.B. AT-Abschaltung HK)		
													FRK	Freigabe Komfortbetrieb (z.B. AT-Abschaltung HK)		
													MW~	Messwert		
													MWB	Messwert Bezug (*Elektro Zweirichtungszähler*)		
400	TGA	Technische Anlagen	400	Technische Anlagen	400	Technische Anlagen	400	Technische Anlagen	400	Technische Anlagen	400	Technische Anlagen	MWC	Messwert berechnet		
					SLE	Leuchte (*Signalleuchte*)	400	Heizung/Kälte (Kombi-System)	PPE	Pumpe	FU~	Frequenzumrichter	MWE	Messwert Einspeisung (*Elektro Zweirichtungszähler*)		
					MEB	Messbox	%%V	Vorlauf			FEE	Funktional eigenständige Einrichtung	MWK	Messwert Kälte (*nur bei Kombizähler*)		
							%%R	Rücklauf	SSK	Schaltschrank	ASR	Autarke Steuer- oder Regeleinheit	MWW	Messwert Wärme (*nur bei Kombizähler*)		
					RVT	Raumverteiler	%%Z	Zulauf			BYP	Bypass	RBE	Rückmeldung Befehl Extern Einspeiseleistung		
							%%A	Ablauf	EF~	Einzelfühler (*ein Signal*)			RM~	Rückmeldung		
							%%I	Eintritt (*Input*)	MFE	Mehrfachfühler Einheit (*mehrere Sig*	REP	Reparaturschalter	RMA	Rückmeldung Auf		
			VTA	Verteilanlage	TKR	Temperierkreis (*Zweileiter Heiz-/ Kü*	%%X	Austritt (*Exit*)			REV	Revisionsschalter (*AT, CH*)	RME	Rückmeldung Ein		
					TVT	Temperierverteiler (*Zweileiter Heiz-/*	%%H	Warm (*Hot*) (empfohlen z.B. %%V,	ELZ	Elektrozähler (*Hauptzähler*)			RMS	Rückmeldung Aus		
							%%C	Kalt (*Cold*) (empfohlen z.B. %%R,	WMZ	Wärmemengenzähler (*Hauptzähler*)	PD~	Differenzdruck	RMZ	Rückmeldung Zu		
							%%U	unten	GMZ	Gasmengenzähler (*Hauptzähler*)			RMG	Rückmeldung Erde (Ground)		
							%%M	mitte	BSZ	Brennstoffzähler (*Hauptzähler*)	MSH	Feuchte relativ schaltend hoch, Rege	RVM	Revisionsmeldung (*Sicherheitsschalter*)		
							%%O	oben	DMZ	Dampfmengenzähler (*Hauptzähler*)			RW~	Rückführwert		
							%%B	Boden	KMZ	Kältemengenzähler (*Hauptzähler*)	G~~	Position, Länge, Amplitude	SB~	Schaltbefehl		
							%%W	Wand	KWZ	Kombinierter Kälte- und Wärmemeng	GS~	Position schaltend, Endschalter	SBA	Schalt-,Stellbefehl Auf		
							%%D	Decke	WAZ	Wasserzähler (*Hauptzähler*)			SBE	Schaltbefehl Ein		
							%%S	Schacht	MMZ	Medienmengenzähler			SBM	Schaltbefehl Mehrstufig		
							%%K	Kabine	STZ	Stückmengenzähler			SBR	Schaltbefehl Reduzierung		
							%%L	maschinenraumlos					SBS	Schaltbefehl Aus		
							%%N	außen					SBZ	Schalt-,Stellbefehl Zu		
													SM~	Störmeldung		
							HK~	Heizung-, Kälte-					SN~	Seriennummer (*z.B. Zähler...*)		
							HKV	Heizung-, Kälte-Vorlauf					ST~	Stellsignal		
							HKR	Heizung-, Kälte-Rücklauf					STC	Stellsignal errechnet		
							HKH	Heizung-, Kälte-Warm (*Hot*)					SVM	Sollwertverstellung, mechanisch (empfohlen: SWV)		
							HKC	Heizung-, Kälte-Kalt (*Cold*)					SW~	Sollwert		
							OL~	Öl					SWV	Sollwertversteller		
							AG~	Abgas					WBS	Wiederbereitschaftsschaltung (*z.B. Fahrtreppe*)		
							BE~	Beckenwasser					ZTW	Zeitwert (*Periode*)		
							RU~	Raum					ZW~	Zählwert		
							AU~	Außenluft					ZWB	Zählwert Bezug (*Elektro Zweirichtungszähler*)		
													ZWE	Zählwert Einspeisung (*Elektro Zweirichtungszähler*)		
													ZWK	Zählwert Kälte (*nur bei Kombizähler*)		
410	GWA	Abwasser-, Wasse	410	Abwasser-, Wasser-, Gasanlagen	410	Abwasser-, Wasser-, Gasanlagen	410	Abwasser-, Wasser-, Gasanlagen	410	Abwasser-, Wasser-, Gasanlagen	410	Abwasser-, Wasser-, Gasanlagen	ZWW	Zählwert Wärme (*nur bei Kombizähler*)		
			NZA	Netzanschluss			AW~	Abwasser	PPE	Pumpe	MOT	Motor		***Signal Meldung:***		
							AWA	Abwasser-Ablauf	VEN	Ventil	FU~	Frequenzumrichter	AM~	Alarmmeldung		
			EZA	Erzeugungsanlage	TWE	Trinkwassererwärmungsanlage (bis	AWZ	Abwasser-Zulauf	KLA	Klappe	EC~	Elektronisch drehzahlgeregelt	ANO	Anormalmeldung		
					PFS	Pufferspeicher							BZG	Betriebsstunden Grenzwert (empfohlen: High-,Low_limit verwenden)		
					KBS	Kombispeicher (Hygienespeicher)	BU~	Brunnenwasser	BGH	Begleitheizung	WFL	Wasserfilter	GM~	Gefahrmeldung		
					WWS	Warmwasserstation (Frischwasserst	WG~	Grau-, Brauchwasser	EWH	Elektroheizung (*TWW-Bereitung*)			GW~	Grenzwert (empfohlen: High-,Low_limit verwenden)		
					HEZ	Wasserstofferzeugung	WGA	Grau-, Brauchwasser-Ablauf			LVB	Lokale Vorrangbedienung	GWC	Grenzwert berechnet (empfohlen: High-,Low_limit verwenden)		
							WGZ	Grau-, Brauchwasser-Zulauf	WAZ	Wasserzähler	REP	Reparaturschalter	GWH	Grenzwert High (MAX) (empfohlen: High-,Low_limit verwenden)		
			AFA	Aufbereitungsanlage	DOS	Dosieranlage	RG~	Regenwasser					GWL	Grenzwert Low (MIN) (empfohlen: High-,Low_limit verwenden)		
					EHA	Enthärtungsanlage	RGA	Regenwasser-Ablauf	STB	Sicherheitstemperaturbegrenzer	TS~	Temperatur schaltend (*z.B. Thermos*	HD~	LVB-Handmeldung		
					UOA	Umkehrosmoseanlage	RGZ	Regenwasser-Zulauf	STW	Sicherheitstemperaturwächter	TSH	Temperatur schaltend hoch	HDG	Handmeldung Analog		
					VEA	Vollentsalzungsanlage							HDB	Handmeldung Binär		
					NEU	Neutralisationsanlage	TW~	Trinkwasser			GS~	Position schaltend, Endschalter	HDA	Handmeldung Binär Auf		
							TWA	Trinkwasser-Ablauf					HDZ	Handmeldung Binär Zu		
			VTA	Verteilanlage	WZN	Wasserzirkulation (*Trinkwasserzirkul*	TWZ	Trinkwasser-Zulauf			HZE	Heizelement	HDE	Handmeldung Binär Ein		
													HDS	Handmeldung Binär Aus		

2.1.14 Existing Plant

As soon as automation technology is renovated with new automation devices, the BACtwin concept must be implemented. This is done in the knowledge that different BA concepts and philosophies can be in operation in parallel until the BACtwin concept is implemented throughout the entire property.

In the transition phase, it may be advantageous for the operator in individual cases to migrate the inventory, at least in basic terms, to the BACtwin concept within the scope of technical and economic possibilities.

A translation according to 2.1.15 can potentially transform an existing UAK into a machine-interpreTable BACtwin UAK that has the advantages of automaTable check routines.

2.1.15 Translation of existing UAK

By translating existing UAK, old BAC systems can be adapted to a consistent operator concept (e.g. alarm management using Notification Class according to the BACtwin concept) or old systems can be integrated into a BACtwin based TMon monitoring.

Translations can also be advantageous when renovating or migrating automation devices and when automatically creating MOU system images.

To test the feasibility, an operator has developed an EXCEL-based tool that enables automated translation of large parts of their own existing UAK into the BACtwin UAK. The practical test using the example of a high-tech building with around 4,000 data points and a well-structured existing UAK showed that a large proportion of the data points could be translated automatically. The other data points had to be clarified manually using diagrams and descriptions.

The UAK translation Worksheet (Table 5) presents the inventory data and the automatically translated BACtwin UAK as an example. The special cases that need to be clarified are marked in color.

Based on this experience, AI-based BACtwin converters are expected to be able to process UAK of existing systems and map them to the BACtwin standard.

# keyname	device obj.-instance	object-name	Gebäude	Gewerk	Anlage	Anl.-Nr.	Teil-Anl.	Baugruppe	Baugruppen-Nr.	Medium, Position	Aggregat	Aggregat-Nr.	Betriebsmittel	Betriebsmitte-Nr.	Funktion	Anhang	Funktion-Nr.	*BAS neu*	*Länge*
3329/01	3329001	3329'IP01'SSC01'DDC01'SY97	3329	480	ASP	01		###	##	###	ASE	01	###	##	DEV		01	3329_480_ASP01__#####_###_ASE01_#####_DEV01	43
3329/01/110/00/00/P.12/CDI/k	3329001	3329'ER31'DIG01'INT01'BM55	3329	470	LAB	31		DIG	01	###	###	##	###	##	BM~		01	3329_470_LAB31__DIG01_###_#####_#####_BM~01	43
3329/01/110/00/00/P.11/CDI/k	3329001	3329'ER31'DIG01'INT02'BM55	3329	470	LAB	31		DIG	01	###	###	##	###	##	BM~		01	3329_470_LAB31__DIG01_###_#####_#####_BM~01	43
3329/01/110/00/00/P.13/CDI/k	3329001	3329'ER31'DIG01'INT03'SM73	3329	470	LAB	31		DIG	01	###	###	##	###	##	SSM		01	3329_470_LAB31__DIG01_###_#####_#####_SSM01	43
3329/01/109/00/00/P.62/CDI/k	3329001	3329'ER34'DIG01'INT01'BM55	3329	470	LAB	34		DIG	01	###	###	##	###	##	BM~		01	3329_470_LAB34__DIG01_###_#####_#####_BM~01	43
3329/01/109/00/00/P.61/CDI/k	3329001	3329'ER34'DIG01'INT02'BM55	3329	470	LAB	34		DIG	01	###	###	##	###	##	BM~		01	3329_470_LAB34__DIG01_###_#####_#####_BM~01	43
3329/01/109/00/00/P.63/CDI/k	3329001	3329'ER34'DIG01'INT03'SM73	3329	470	LAB	34		DIG	01	###	###	##	###	##	SSM		01	3329_470_LAB34__DIG01_###_#####_#####_SSM01	43
3329/01/109/00/00/P.64/CDI/k	3329001	3329'ER40'DIG01'INT02'BM55	3329	470	LAB	40		DIG	01	###	###	##	###	##	BM~		01	3329_470_LAB40__DIG01_###_#####_#####_BM~01	43
3329/01/110/00/00/P.02/CDI/k	3329001	3329'ER40'DIG01'INT03'SM73	3329	470	LAB	40		DIG	01	###	###	##	###	##	SSM		01	3329_470_LAB40__DIG01_###_#####_#####_SSM01	43
3329/01/110/00/00/P.04/CDI/k	3329001	3329'ER46'DIG01'INT01'BM55	3329	470	LAB	46		DIG	01	###	###	##	###	##	BM~		01	3329_470_LAB46__DIG01_###_#####_#####_BM~01	43
3329/01/110/00/00/P.03/CDI/k	3329001	3329'ER46'DIG01'INT02'BM55	3329	470	LAB	46		DIG	01	###	###	##	###	##	BM~		01	3329_470_LAB46__DIG01_###_#####_#####_BM~01	43
3329/01/110/00/00/P.05/CDI/k	3329001	3329'ER46'DIG01'INT03'SM73	3329	470	LAB	46		DIG	01	###	###	##	###	##	SSM		01	3329_470_LAB46__DIG01_###_#####_#####_SSM01	43
3329/01/000/91/03/S336.01/5574	3329001	3329'IP01'SSC01'ATF01'SM00	3329	480	ASP	01		###	##	AU~	EF~	01	T~~	01	#NV		01	#NV	#NV
3329/01/000/00/00/SY_MsgOut.01/CB_NC	3329001	3329'IP01'SSC01'DDC01'GM98	3329	480	ASP	01		###	##	###	ASE	01	###	##	NC~		01	3329_480_ASP01__#####_###_ASE01_#####_NC~01	43
3329/01/000/00/00/SY_MsgOut.04/CB_NC	3329001	3329'IP01'SSC01'DDC01'HM98	3329	480	ASP	01		###	##	###	ASE	01	###	##	NC~		01	3329_480_ASP01__#####_###_ASE01_#####_NC~01	43
3329/01/000/00/00/SY_MsgOut.02/CB_NC	3329001	3329'IP01'SSC01'DDC01'SM98	3329	480	ASP	01		###	##	###	ASE	01	###	##	NC~		01	3329_480_ASP01__#####_###_ASE01_#####_NC~01	43
3329/01/000/91/03/S066.03/2	3329001	3329'IP01'SSC01'DDC01'WM17	3329	480	ASP	01		###	##	###	ASE	01	###	##	WM~		01	3329_480_ASP01__#####_###_ASE01_#####_WM~01	43
3329/01/000/00/00/SY_MsgOut.03/CB_NC	3329001	3329'IP01'SSC01'DDC01'WM98	3329	480	ASP	01		###	##	###	ASE	01	###	##	NC~		01	3329_480_ASP01__#####_###_ASE01_#####_NC~01	43
3329/01/002/00/00/P.25/CDI/k	3329001	3329'IP01'SSC01'INT01'GM75	3329	480	ASP	01		###	##	###	SSK	01	###	##	#NV		01	#NV	#NV
3329/01/002/00/00/P.26/CDI/k	3329001	3329'IP01'SSC01'INT02'SM70	3329	480	ASP	01		###	##	###	SSK	01	MCB	01	SM~		01	3329_480_ASP01__#####_###_SSK01_MCB01_SM~01	43
3329/01/002/00/00/P.27/CDI/k	3329001	3329'IP01'SSC01'INT03'SM70	3329	480	ASP	01		###	##	###	SSK	01	MCB	01	SM~		01	3329_480_ASP01__#####_###_SSK01_MCB01_SM~01	43
3329/01/002/00/00/P.01/CDI/k	3329001	3329'IP01'SSC01'INT04'HM45	3329	480	ASP	01		###	##	###	SSK	01	###	##	ETR		01	3329_480_ASP01__#####_###_SSK01_#####_ETR01	43
3329/01/002/00/00/P.32/CDO/K	3329001	3329'IP01'SSC01'INT05'SB73	3329	480	ASP	01		###	##	###	SSK	01	LAM	01	SBE		01	3329_480_ASP01__#####_###_SSK01_LAM01_SBE01	43
3329/01/002/00/00/P.28/CDI/k	3329001	3329'IP01'SSC01'INT06'SM72	3329	480	ASP	01		###	##	###	SSK	01	EHF	01	SM~		01	3329_480_ASP01__#####_###_SSK01_EHF01_SM~01	43
3329/01/002/00/00/P.29/CDI/k	3329001	3329'IP01'SSC01'INT07'SM71	3329	480	ASP	01		###	##	###	SSK	01	EPH	01	SM~		01	3329_480_ASP01__#####_###_SSK01_EPH01_SM~01	43
3329/01/002/00/00/P.30/CDI/k	3329001	3329'IP01'SSC01'INT08'HM40	3329	480	ASP	01		###	##	###	SSK	01	HS~	01	WM~		01	3329_480_ASP01__#####_###_SSK01_HS~01_WM~01	43
3329/01/002/00/00/P.31/CDI/k	3329001	3329'IP01'SSC01'INT09'HM42	3329	480	ASP	01		###	##	###	SSK	01	LVB	01	HD~		01	3329_480_ASP01__#####_###_SSK01_LVB01_HD~01	43
3329/01/000/91/99/M.01/1	3329001	3329'IP09'SSC01'DDC03'IM59	3329	480	ASP	09		###	##	###	ASE	03	###	##	#NV		01	#NV	#NV
3329/01/000/91/99/M.02/5	3329001	3329'IP09'SSC01'DDC03'SM74	3329	480	ASP	09		###	##	###	ASE	03	###	##	#NV		01	#NV	#NV

Table 5 UAK translation (example)

2.1.16 Example for customizing BACtwin UAK

The logical structure and data volume of the BACtwin UAK must be used in such a way that the BACtwin systems can be addressed and monitored in a machine-interpreTable form.

Due to a shortage of skilled workers, cost pressures, energy optimization, legislation, etc., the networking of BAC systems across buildings and locations continues to increase. Even smaller buildings are increasingly being equipped with complex technology (e.g., photovoltaics, heat pumps). As complexity increases, so does the need for differentiated addressing and monitoring.

In a networked BAC system, a reduction in UAK blocks would cause a system failure and make system-wide automated BAC evaluations impossible. The advantages of easy testability during commissioning in terms of GEG would be lost.

Builders/operators are recommended to select the options available in the data model for adapting the BACtwin UAK based on their needs (e.g. number of digits for numbering) and to specify them system-wide in the operator requirement (see Table 27 Operator requirement). Structural changes to the BACtwin UAK are not recommended.

A uniform BACtwin UAK is a great advantage for an organization-wide networked BAC system. When introducing the BACtwin UAK structure, it is important to consider the property with the most complex UAK requirements. The addressing of room automation and partial plants as well as future buildings must be taken into account.

If room automation or partial plants are to be expected in a property, the corresponding expansion must be provided in the UAK block system. When addressing BA systems without room automation and without Partial plants, the unused positions must be filled with hash marks (#).

The following Figure shows an **example of an organization-wide UAK** of a state administration (with Location UAK and BACtwin UAK).

The example in Figure 3 (in contrast to the example in Table 2) also addresses partial plants and uses a total of 63 digits.

In Library 1, the example is available as **Worksheet 4.1 BAS Beispiel** in ediTable Table form.

1 2 3 4 5 6	7	8 9 10 11 12 13	14	15 16 17 18 19	20	21 22 23	24	25 26 27 28 29	30	31 32	33	34 35 36 37 38	39	40 41 42	43	44 45 46 47 48	49	50 51 52 53 54	55	56 57 58 59 60	61	62 63
						1 2 3	4	5 6 7 8 9	10	11 12	13	14 15 16 17 18	19	20 21 22	23	24 25 26 27 28	29	30 31 32 33 34	35	36 37 38 39 40	41	42 43
Nutzerspezifischer Orts-BAS (Beispiel)						BACtwin-BAS gemäß Betreibervorgabe (Beispiel)																
1 2 3 4 5 6	_	1 2 3 4 5 6	_	1 1 2 3 4	_	1 2 3	_	1 2 3 1 2	*	1 2	_	1 2 3 1 2	_	1 2 3	_	1 2 3 1 2	_	1 2 3 1 2	_	1 2 3 1 2	_	1 2
Gebäude- ID (ID für GA)		Montageort		Informationsquelle		Gewerk		Anlage		Teil-anlage		Baugruppe		Medium, Position		Aggregat		Betriebsmittel		BM-Funktion		Erweit-erung
4.OG, Raum 1																						
AGG_TUR1_AMEV1																						
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR xx	°	0 1	_	### ##	_	###	_	TUR xx	_	### ##	_	SV~ 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR xx	°	0 1	_	### ##	_	###	_	TUR xx	_	GS~ xx	_	RMA 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR xx	°	0 1	_	### ##	_	###	_	TUR xx	_	GS~ xx	_	RMA 01	_	TL
BGP_BMA_AMEV1																						
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	BMA 01	_	###	_	### ##	_	### ##	_	SV~ 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	BMA 01	_	###	_	BMZ 01	_	### ##	_	SSM 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	BMA 01	_	###	_	BEK 01	_	### ##	_	GM~ 01		
AGG_ASE_B_AMEV1												0 0	_	RUD	_							
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	SV~ 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	DEV 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	CAL 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	CAL 02		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	NC~ 10		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	NC~ 15		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	NC~ 20		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	NC~ 30		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	NC~ 40		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	NC~ 42		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	NC~ 45		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	NC~ 50		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	NC~ 60		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	NC~ 70		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	### ##	_	NC~ 80		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	RVT 01	_	RU~	_	AS~ 01	_	PBT 01	_	SM~ 01		
AGG_Projektionswand																						
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	AME 01	_	RU~	_	PJW 01	_	MOT 01	_	SV~ 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	AME 01	_	RU~	_	PJW 01	_	MOT 01	_	SBA 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	AME 01	_	RU~	_	PJW 01	_	MOT 01	_	SBZ 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	AME 01	_	RU~	_	PJW 01	_	MOT 01	_	SBA 01	_	TL
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	AME 01	_	RU~	_	PJW 01	_	MOT 01	_	SBZ 01	_	TL
AGG_Projektor (Beamer)																						
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	AME 01	_	RU~	_	PJR 01	_	### 01	_	SV~ 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	AME 01	_	RU~	_	PJR 01	_	### 01	_	SB~ 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	AME 01	_	RU~	_	PJR 01	_	### 01	_	SB~ 01	_	TL
BGP_Projektion																						
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	AME 01	_	RU~	_	### 01	_	### 01	_	SV~ 01		
A B F 4 3 8	_	0 4 y y z z	_	R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	AME 01	_	RU~	_	### 01	_	### 01	_	0 0		
A B F 4 3 8		0 4 y y z z		R 0 0 0 1	_	480	_	RAR 04	°	0 1	_	AME 01	_	RU~	_	### 01	_	### 01	_	0 0		

Figure 3 UAK (example of a state administration)

2.2 AMEV profile

In addition to the standardized UAK, uniform BACnet minimum requirements must be met to ensure planning, engineering and operation of the BACnet systems through predefined standards.

The AMEV recommendation [AMEV BACnet 2017] defines the AMEV profiles AS-A and AS-B for automation stations based on BACnet Revision 12 and describes a procedure for creating AMEV attestations for these AMEV profiles. BACnet manufacturers have currently had AMEV attestations created for around 240 AS models. In the D-A-CH area, the AMEV profile AS-B is used as standard.

In order to be able to implement the BACtwin concept promptly, the AMEV profiles for automation stations are being further developed in two stages as AMEV profiles AS-C and AS-D.

Important innovations in the AMEV profile AS-C and AS-D are shown in Figure 3.

AMEV profile	Overview of important innovations
AS-C	Introduction of **additional properties from revisions 14 and 16**
	Higher **minimum number of characters of properties** according to Tab. K4 of the BACnet standard
	Introduction of selected **Event_Parameter** of the object type Event_Enrollment
	Requirements for **Calendar and Schedule objects** slightly modified
AS-D	Introduction of the additional object type **Structured_View**

Figure 4 New features in the AMEV profile AS-C and AS-D

The AMEV profile AS-D includes the AMEV profile AS-C and the Structured View (SV) object type. The BACtwin concept uses the SV objects for the modular representation of the system structures and the data content of standardized aggregates, assemblies and plants. This enables the automation of time-consuming and error-prone manual processes (e.g. data transfer, documentation, testing).

The Library 2 defines in Table 6 the BIBBs, object types, properties, conformance codes and other performance features to be supported by the AMEV profile AS-C and AS-D in the sense of a minimum requirement as a test Table.

The Table below shows an excerpt from the test Table for the new AMEV profiles.

The procedure for creating the AMEV attestations defined in the AMEV recommendation [AMEV BACnet 2017] has proven itself and is also used for new automation stations with the AMEV profiles AS-C and AS-D.

The form of AMEV attestation for profile AS-C and AS-D is shown in Appendix 1.

The integration of the SV objects into new AS with AMEV profile AS-D should be strived for as soon as possible. In order to avoid market restrictions for AS with AMEV profile AS-D, the SV object is initially only required in planning tools and in the exchange format. The AMEV profile AS-D can be required as soon as several AS with an attestation for the AMEV profile AS-D are available.

Proprietary BACnet objects are not allowed for standard BA functions. The replacement of standardized BACnet objects, properties and services with manufacturer-specific ones is not permitted.

When engineering the BACnet devices, all BACnet objects and properties used must be created visibly so that they can be easily recognized by common BACnet testing tools.

AMEV-Profile AS-C und AS-D
(Prüftabelle)

1. Allgemeine Angaben

Anbieter	
Vendor ID	
Typ Nummer	
Firmware-Revision	
Prüf-Bericht	

Profil AS-C

2. BIBBs

BIBBs	Vorgabe	geprüft
1	2	3
DS-RP-A	X	
DS-RP-B	X	
DS-RPM-A	X	
DS-RPM-B	X	
DS-WP-A	X	
DS-WP-B	X	
DS-WPM-B	X	
DS-COV-A	X	
DS-COV-B	X	
AE-N-I-B	X	
AE-ACK-B	X	
AE-ESUM-B	X	
AE-INFO-B	X	
SCHED-I-B	X	
DM-DDB-A	X	
DM-DDB-B	X	
DM-DOB-B	X	
DM-DCC-B	X	
DM-TS-B	X[T]	
DM-UTC-B	X[T]	
DM-RD-B	X	
DM-BR-B	X	
DS-COVP-B	X	
AE-N-E-B	X	
AE-ASUM-B	X	
SCHED-E-B	X	
T-VMT-I-B	X	
T-VMT-E-B	X	
T-ATR-B	X	
DM-OCD-B	X	

3. Objekttypen und DC/DD-Fähigkeiten

Objekttyp	Vorgabe	geprüft
1	2	3
AI	X	
AO	X	
AV	X	
BI	X	
BO	X	
BV	X	
CAL (mit DC/DD)	X	
DEV	X	
EE (mit DC/DD)	X	
FIL	X	
LP	X	
MI *	X	
MO *	X	
MV	X	
NC (mit DC/DD)	X	
SCH (mit DD(DC)	X	
TL (mit DC/DD)	X	

Profil AS-D

2. BIBBs

BIBBs	Vorgabe	geprüft
1	2	3
DS-RP-A	X	
DS-RP-B	X	
DS-RPM-A	X	
DS-RPM-B	X	
DS-WP-A	X	
DS-WP-B	X	
DS-WPM-B	X	
DS-COV-A	X	
DS-COV-B	X	
AE-N-I-B	X	
AE-ACK-B	X	
AE-ESUM-B	X	
AE-INFO-B	X	
SCHED-I-B	X	
DM-DDB-A	X	
DM-DDB-B	X	
DM-DOB-B	X	
DM-DCC-B	X	
DM-TS-B	X[T]	
DM-UTC-B	X[T]	
DM-RD-B	X	
DM-BR-B	X	
DS-COVP-B	X	
AE-N-E-B	X	
AE-ASUM-B	X	
SCHED-E-B	X	
T-VMT-I-B	X	
T-VMT-E-B	X	
T-ATR-B	X	
DM-OCD-B	X	

3. Objekttypen und DC/DD-Fähigkeiten

Objekttyp	Vorgabe	geprüft
1	2	3
AI	X	
AO	X	
AV	X	
BI	X	
BO	X	
BV	X	
CAL (mit DC/DD)	X	
DEV	X	
EE (mit DC/DD)	X	
FIL	X	
LP	X	
MI *	X	
MO *	X	
MV	X	
NC (mit DC/DD)	X	
SCH (mit DD(DC)	X	
SV	X	
TL (mit DC/DD)	X	

Table 6 AMEV profile AS-C and AS-D (check Table - excerpt)

2.3 Object template

An object template serves as a building block for defining standard aggregates according to the modular principle. An object template defines a standard BAC function using a BACnet object, the properties of this object and the recommended parameters.

The object templates are sorted according to object types and compiled into object-specific object templates (XLSX Worksheets) as follows in the Library 2:

Worksheet 8.1	AI templates	Worksheet 8.8	LP templates
Worksheet 8.2	AO und AV templates	Worksheet 8.9	MI templates
Worksheet 8.3	BI templates	Worksheet 8.10	MO und MV templates
Worksheet 8.4	BO und BV templates	Worksheet 8.11	NC templates
Worksheet 8.5	CAL templates	Worksheet 8.12	SCH templates
Worksheet 8.6	DEV templates	Worksheet 8.13	SV templates
Worksheet 8.7	EE templates	Worksheet 8.14	TL templates

Table 7 Object templates (overview)

The 14 worksheets define the object templates with the necessary standardized BACnet and BAC information. The goal is for a BACnet-based standard to be available for every common BAC function.

Each object template receives a unique identifier, which enables the template properties to be passed on to other information carriers, and a name in plain text.

The object template identifier includes several parts that are formed from abbreviations based on the UAK and use underscores as separators:

1. **OBJ** abbreviation of the **object type**, three digits (e.g. **AI** = analog input)
2. **FCT** abbreviation of the **OE function**, two/three digits (e.g. **MS** = reading)
3. **Suffix** optional, indicates **variants**, one/multi-part (e.g. **T** = temperature)
4. **Version** names the **source and version** of the template (e.g. **AMEV1**)

Example Object template
Hot water temperature reading **AI_MS_T_H_WM_AMEV1**

The example names 1. an AI object that 2. records and displays the measured value for 3. the hot water temperature and 4. is defined as version AMEV1.

For complex object types, the OE function (2nd part) in the template identifier is omitted.

The **Table 8 AI template en (example)** below shows the AI object templates as an example.

For each AI template, Table 8 names the object template identifier, the plain text name, the properties to be parameterized and checked and the recommended parameters (e.g. units of measured values and limit values for error messages).

The recommended default value or value range is defined for each property to be parameterized (shown in orange). Sensible adjustment of recommended values in consultation with the building owner/operator is permissible (see e.g. 4.6.1 Regulation).

Parameters in **square brackets [ ]** are default values that must be set to meaningful values in the project (e.g. measured pressure value in air conditioning plants, parameters for COV_Increment, Low_Limit, High_Limit).

If the value of a property is not parameterized but is generated internally within the system and requires testing, the recommended testing value is defined (shown in turquoise).

The implementation of the properties to be parameterized takes place in three steps:
1. Basic specification 2. Detailed definition 3. Implementation.

The responsibilities for the three steps are identified by code letters:
B = builder/operator **P** = BA planning **X** = executing company.

Responsibility lies with the executing company for properties that only require inspection.

The object templates are sorted according to the PropSort column. The structure and use of the PropSort identifier are explained in Section 2.7.

The BACS Function List entries column names necessary entries in the BAC function list (with area and column as well as number of the respective BA function) according to [VDI 3814 Blatt 4.3]. The information must be automatically transferred to the project-specific BACS-FL list by the BA planning software.

Each object template has a UUID (Universally Unique Identifier), which supports the import and use of templates in databases without naming conflicts (column B).

Library 2 completely represents the standardized object templates in Worksheet 8.1 to 8.14 for each object type. In the worksheets the English-language object templates (outlined in red) are below the German-language object templates.

Worksheet 8 summarizes Worksheets 8.1 to 8.14. It was created by machine and separates German (**8 BACtwin_Objects_DE**) and English (**8 BACtwin_Objects_EN**).

If an additional, non-standard object template is required in a project-specific special case, BAC planning can generate a **special object template** in the planning software by modifying a standard object template.

The newly generated special object template must receive a unique special object identifier and a plain text name.

The special object identifier should be based on the identifier of available standard object templates and the BACtwin UAK. Due to the project-specific modeling, AMEV1 is omitted as a source and version. Instead of AMEV1, a unique designation of the builder's or operator's choice must be specified (e.g. name, version).

Example Special object identifier
Temperature reading **AI_MS_T_NAME1**

In addition, each special object template must have a UUID that supports the import and use of the template in databases without naming conflicts.

Compared to such individual solutions, standardized solutions offer important advantages (system-compliant, transparent, reusable, automatically verifiable).

Therefore, missing object templates should preferably be submitted to AMEV for standardization (see Section 4.11).

Table 8 AI template en (example)

ObjSort + No.	Object Template Identifier	Comment	BACS FL entries (1.1.1)	BACS FL entries (2.2.1)	BACS FL entries (3.1.1)	BACS FL entries (3.1.3)	Object_Name	Application	Status_Flags	Event_State	Reliability	Out_Of_Service	Units	Min_Pres_Value	Max_Pres_Value	Resolution	COV_Increment	Time_Delay	Notification_Class	Low_Limit	High_Limit	Deadband	Limit_Enable	Event_Enable	Notify_Type	Event_Time_Stamps	Event_Message_Texts	Event_Message_Texts_Config	Event_Detection_Enable	Event_Algorithm_Inhibit(_Ref)	Time_Delay_Normal	Reliability_Evaluation_Inhibit
	PropSort						a11						b11	c45	c46	b41	b17	c43	c11	c47	c48	c50	c49	c12	c13			c14	c15	c41|c42	c44	
	Conformance Code						R		R	R	W[1]	W	W	R	R	R	W	W	W	W	W	W	W	W	W	R	R	W	W	R[A]	W	R[T]|O
	Basic spezification *						B *						B	P	P	P	B	P	B	P	P	P	P	B	B			B	B	P	P	
	Detailed definition *						P *						P	P	P	P	P	P	P	P	P	P	P	P	P			P	P	P	P	
	Implementation *						X *		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X
	Default value (parameterization)						ja		no	no	no	no	yes	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	yes	yes	no	yes	no
a101	AI_MW_T_AMEV1	Temperature	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				> 0	> 0	fix	[fix]	[fix]	fix	fix	{t,t,t}	Alarm	*	*	***	{t}		1	
a102	AI_MW_T_AU_AMEV1	Temperature outside	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				0,2	120	300	[-20]	[40]	0,2	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a103	AI_MW_T_H_NT_AMEV1	Heating Low Temperature	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				0,5	1	300	[10]	[50]	0,5	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a104	AI_MW_T_H_HT_AMEV1	Heating High Temperature	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				1	1	300	[10]	[90]	1	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a105	AI_MW_T_H_HW_AMEV1	Sensor Temperature Hot water	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				1,5	1	300	[10]	[160]	1,5	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a106	AI_MW_T_H_TO_AMEV1	Sensor Temperature Thermo Oil	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				3	1	300	[0]	[300]	3	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a107	AI_MW_T_H_WW_AMEV1	Sensor Temperature Warm water	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				1	60	300	[55]	[75]	1	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a108	AI_MW_T_H_AG_AMEV1	Sensor Temperature Exhaust Gas	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				10	1	300	[-20]	[1300]	10	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a109	AI_MW_T_L_RU_AMEV1	Sensor Temperature Ventilation Room	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				0,5	60	300	[5]	[40]	0,5	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a110	AI_MW_T_L_TP_AMEV1	Sensor Temperature Dew point	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				0,1	60	300	[10]	[20]	0,1	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a111	AI_MW_T_K_NT_AMEV1	Sensor Temperature Cold Low Temperature	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				0,1	60	300	[4]	[14]	0,1	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a112	AI_MW_T_K_HT_AMEV1	Sensor Temperature Cold High Temperature	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				0,1	60	300	[12]	[22]	0,1	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a113	AI_MW_T_K_KW_AMEV1	Sensor Temperature Cold water	X	X	X	X	[UAK]	Temperature Reading	{f,f,f,f}	0	0	{f}	°C				0,5	60	300	[-20]	[45]	0,5	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a114	AI_MW_X_L_RU_AMEV1	Sensor Humidity absolute Room	X	X	X	X	[UAK]	Humidity absolute Reading	{f,f,f,f}	0	0	{f}	g/m³				0,1	240	300	[4]	[11,5]	0,1	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a115	AI_MW_X_L_AU_AMEV1	Sensor Humidity absolute Outside	X		X	X	[UAK]	Humidity absolute Reading	{f,f,f,f}	0	0	{f}	g/m³				0,1						{f,f}	{t,t,t}	Alarm	*	*	***	{f}		1	
a116	AI_MW_M_L_RU_AMEV1	Sensor Humidity 0-100% RH Room	X	X	X	X	[UAK]	Humidity relative Reading	{f,f,f,f}	0	0	{f}	%r.F.				3	240	300	[30]	[70]	3	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a117	AI_MW_M_L_AU_AMEV1	Sensor Humidity 0-100% RH Outside	X		X	X	[UAK]	Humidity relative Reading	{f,f,f,f}	0	0	{f}	%r.F.				3						{f,f}	{t,t,t}	Alarm	*	*	***	{f}		1	
a118	AI_MW_P_AMEV1	Sensor Pressure	X	X	X	X	[UAK]	Pressure Reading	{f,f,f,f}	0	0	{f}	Pa				fix	fix	300	[fix]	[fix]	[fix]	fix	{t,t,t}	Alarm	*	*	***	{t}		1	
a119	AI_MW_P_GAS_AMEV1	Sensor Compressed Gas (e.g. natural gas, technical gases)	X	X	X	X	[UAK]	Pressure Reading	{f,f,f,f}	0	0	{f}	bar				fix	fix	300	[fix]	[fix]	[fix]	fix	{t,t,t}	Alarm	*	*	***	{t}		1	
a120	AI_MW_P_GM_AMEV1	Sensors Compressed Gas Hazard (see NC100)	X	X	X	X	[UAK]	Pressure Reading	{f,f,f,f}	0	0	{f}	bar				fix	fix	100	[fix]	[fix]	[fix]	fix	{t,t,t}	Alarm	*	*	***	{t}		1	
a121	AI_MW_P_L_AMEV1	Sensor Pressure 0-1000Pa Ventilation	X	X	X	X	[UAK]	Pressure Reading	{f,f,f,f}	0	0	{f}	Pa				[30]	120	300	[0]	[500]	[30]	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a122	AI_MW_P_Tem_AMEV1	Sensor Pressure 0-10bar heating	X	X	X	X	[UAK]	Pressure Reading	{f,f,f,f}	0	0	{f}	bar				0,1	30	300	[1,5]	[5]	0,1	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a123	AI_MW_PD_L_AMEV1	Sensor Differential Pressure 0-5000/(+-50 ring scale)Pa differentia	X	X	X	X	[UAK]	Pressure difference Reading	{f,f,f,f}	0	0	{f}	Pa				[150/3	120	300	[0/-40]	[500/40	[150/3]	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1/120	
a124	AI_MW_PD_Tem_AMEV1	Sensor Differential Pressure 0-5.5bar differential pressure heating	X	X	X	X	[UAK]	Pressure difference Reading	{f,f,f,f}	0	0	{f}	bar				0,1	30	300	[1,5]	[5]	0,1	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a125	AI_MW_F_AMEV1	Sensor Volume Flow Counter, Volume Flow Controller	X	X	X	X	[UAK]	Volume flow Measured value	{f,f,f,f}	0	0	{f}	m³/h				fix	fix	300	[fix]	[fix]		fix	{t,t,t}	Alarm	*	*	***	{t}		1	
a126	AI_MW_J_AMEV1	Sensor Power Counter	X	X	X	X	[UAK]	Performance Metric	{f,f,f,f}	0	0	{f}	kW				fix	fix	300	[fix]	[fix]		fix	{t,t,t}	Alarm	*	*	***	{t}		1	
a127	AI_MW_QCD_AMEV1	Sensor CO2 Carbon dioxide	X	X	X	X	[UAK]	CO2 Reading	{f,f,f,f}	0	0	{f}	ppm				50	3600	300	[400]	[1200]	50	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a128	AI_MW_QCO_AMEV1	Sensor CO Carbon monoxide	X	X	X	X	[UAK]	CO Reading	{f,f,f,f}	0	0	{f}	ppm				[1]	3600	200	[0]	[30]	1	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a129	AI_MW_QPH_AMEV1	Sensor Conductivity	X	X	X	X	[UAK]	PH Reading	{f,f,f,f}	0	0	{f}	pH				[0,1]	3600	300	[6]	[8]	[0,1]	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a130	AI_MW_E_RU_AMEV1	Sensor Illuminance Room	X	X	X	X	[UAK]	Illuminance Reading	{f,f,f,f}	0	0	{f}	lx				50	3600	300	0	[1000]	50	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a131	AI_MW_E_AU_AMEV1	Sensor Illuminance Outside	X		X	X	[UAK]	Illuminance Reading	{f,f,f,f}	0	0	{f}	lx				50	3600	300				{f,f}	{f,t,t}	Alarm	*	*	***	{t}		1	
a132	AI_MW_R_AU_AMEV1	Sensor Global Radiation Outside	X		X	X	[UAK]	Global radiation Reading	{f,f,f,f}	0	0	{f}	W/m²				50	3600	300				{f,f}	{f,t,t}	Alarm	*	*	***	{t}		1	
a133	AI_MW_L_AMEV1	Sensor Level	X	X	X	X	[UAK]	Level Reading	{f,f,f,f}	0	0	{f}	[%]				[0,5]	3600	300	[20]	[100]	[1]	{t,t}	{t,t,t}	Alarm	*	*	***	{t}		1	
a134	AI_RW_AMEV1	Feedbackk value	X		X	X	[UAK]	Feedbackk value	{f,f,f,f}	0	0	{f}	%				3	60	300	[0]	[100]	3	{f,f}	{f,t,t}	Alarm	*	*	***	{t}		1	
a135	AI_MW_WIG_AMEV1	Sensor: Thermal Anemometer/Star Anemometer	X		X	X	[UAK]	Wind speed Reading	{f,f,f,f}	0	0	{f}	m/s				0,1	60	300				{f,f}	{f,t,t}	Alarm	*	*	***	{t}		1	
a136	AI_MW_RW_AMEV1	Performance feedback	X		X	X	[UAK]	Performance Feedback	{f,f,f,f}	0	0	{f}	%				3	60	300	[0]	[100]	3	{f,f}	{f,t,t}	Alarm	*	*	***	{t}		1	
a137	AI_MW_LTF_AMEV1	Conductivity	X		X	X	[UAK]	Conductivity Measured Value	{f,f,f,f}	0	0	{f}	S/m				[0,1]	60	300				{f,f}	{f,t,t}	Alarm	*	*	***	{t}		1	
a138	AI_SW_J_AMEV1	Setpoint Power (feed-in)	X	X	X	X	[UAK]	Power Setpoint	{f,f,f,f}	0	0	{f}	%				fix	fix	300	[fix]	[fix]		fix	{t,t,t}	Alarm	*	*	***	{t}		1	

** B (Builder/Operator), P (Planning), X (Executing Company)*

Default value (parameterization) and test value

Test value (internally generated value)

[] => Default value (suggestion)

** Can be used for testing in the 1:1 test*

**** Implementation according to Chapter 4.5*

2.4 Aggregate template

2.4.1 Standard aggregate

An aggregate template configures a **standard aggregate** according to the modular principle using predefined object templates. Aggregate templates serve as components for defining standard assemblies and standard plants.

An aggregate template defines a practical standard set of BAC functions for a standard aggregate (e.g. single-stage pump). Available best practice solutions are taken into account (e.g. specifications according to [AMEV TMon 2020]).

For the standard aggregate, the required object templates are selected from the Library 2 and configured as an aggregate template using the identifiers of the object templates. The aggregate template defines the BAC equipment of the standard aggregate based on the object templates used and - through inheritance - also the associated properties and parameters.

Each aggregate template receives a unique identifier, which enables the template properties to be passed on to other information carriers, and a plain text label.

The aggregate identifier includes several parts that are formed from abbreviations based on the UAK and use underscores as separators:

1.	**AGG**	type of **template**, three digits	(e.g. **AGG** = aggregate)
2.	**PMP**	abbreviation of the **aggregate**, three digits	(e.g. **PMP** = pump)
3.	**Suffix**	optional, indicates **variants**, one/multi-part	(e.g. **S1** = single-stage)
4.	**Version**	names the **source and version** of the template	(e.g. **AMEV1**)

Example aggregate identifier
Single-stage pump **AGG_PMP_S1_AMEV1**

As an example, the single-stage pump aggregate template is shown in Table 9:

Aggregate identifier	**Aggregate designation**
AGG_PMP_S1_AMEV1	**Single-stage pump**
Objekt-Template	**Objekt Description (Excerpt)**
SV_AGG	pump
BO_SC[1]	switching command
EE_CMDF[1]	execution control
BI_OMS	operating message
TL_BN	recording operating message
BI_FM	fault message
EE_CCP	manual message UBE (Priority_Array) (ab Rev. 22 Required)
BI_LOM[2]	Local override message (LO/ID)
MV_HD_AEM[2]	
EE_COB[2]	

Table 9 Example Aggregate template: single-stage pump

The data points of the single-stage pump are explained below as examples.

[1] **Execution control** with Intrinsic Reporting (BO) or Algorithmic Reporting (additionally EE).
[2] **Manual reporting of a local priority operation** (LO/ID) with BI, MV or EE object.

The aggregate template begins with a Structured View object (condition: AS with AMEV profile AS-D). It names the aggregate template (e.g. SV_AGG_PMP_S1_AMEV1) and maps the structure of the aggregate template and the associated object templates. Further explanations of the SV object follow in Section 2.7 Structured_View Objects.

The pump has a switching command (BO_SC 1), the operating message (BI_OMS) and a fault message (BI_FM).

For a single-stage pump, the **switching command** is usually used to switch the motor using a closing relay on the AS. The operating message can come from the pump directly (potential-free contact) or, if necessary, from an auxiliary contact of the power contactor.

The **operating message** data recording records the operating status of the pump (ON/OFF with time stamp) and is used for energy reasons (e.g. TMon evaluation).

The **fault message** can be generated directly from the pump (potential-free contact as a break contact) or from an auxiliary contact (break contact) of the electrical protection device.

The **execution control** monitors whether the operating message corresponds to the switching command. For example, a switching command may be present, but the pump is not running. Or there is an operating message (pump pumps water) even though there is no switching command (unnecessary energy consumption, possibly hydraulic problems). The execution control can be implemented either with intrinsic reporting of the BO_SB or with an additional EE object (EE_CMDF) (footnote 1). In both cases, the BACnet event algorithm Command_Failure is used.

The **manual message** UBE (Universal Control Unit) is a generic term for an intervention via an MOU, a display or another control unit in order to influence the priority control of the pump. Only the entries in the Property Priority_Array that do not represent automatic operation are displayed (see Section 4.3). In the future (i.e. from Rev. 22) a property Current_Command in an EE object should report the manual message UBE.

The **local override message** LO/ID[2] (local override/indication device) indicates that a local intervention has taken place after the automatic operation of the pump switching command. The LO/ID hand report can only be withdrawn at the LO/ID.

Builders or operators must take possible variants into account when configuring.

Variant 1.1	**BO_SC[1]**	Intrinsic reporting delivers the desired function.
Variant 1.2	**EE_CMDF[1]**	Algorithmic reporting provides verifiable information.

Figure 5 Command execution control by means of BO or EE object (examples)

The **execution control** can be implemented with intrinsic reporting (e.g. BO object) or algorithmic reporting (additional EE object) (variant 1). In the aggregate templates with execution control, a suiTable object template is defined for each variant 1.1 and 1.2 (see Figure 6).

Variant 2.1	**BI_LOM[2]**	The BI object only shows the manual intervention, but not the status of the intervention; can be implemented by all manufacturers.
Variant 2.2	**MV_LOM_AEM[2]**	The MV object displays the manual intervention and the status of the local intervention; can be achieved by many manufacturers.
Variant 2.3	**EE_COB[2]**	The EE object displays the manual intervention and the status of the local intervention; can be achieved by many manufacturers.

Figure 6 Local overdrive message (LO/ID) using BI, MV or EE object (examples)

The **Local overdrive message** (LO/ID) can be implemented with BI, MV/MI or EE objects (variant 2).

Each variant reports a manual signal (LO/ID), which may lead to increased energy consumption by overriding the automated control of a device (e.g. pump, fan, valve).

In the aggregate templates with Local overdrive message (LO/ID), a suiTable object template is defined for each variant 2.1, 2.2 and 2.3 (see Figure 5). The builder or operator should not make decisions about permissible variants in each individual case, but rather on a needs-based basis (e.g. according to the operator concept) and documented as operator requirements across projects and properties (see Section 4.11).

Analogous to the single-stage pump, the aggregate templates in Library 3 define the recommended data points of common aggregates. With standard aggregates, the energetically relevant information is recorded in order to use the trend logs, e.g. B. to be able to use it for TMon evaluations. A central objective is also to be able to automatically check the aggregates and plants against the specifications of the respective templates.

According to Section 71a [Building Energy Act], a non-residential building must be equipped with digital energy monitoring technology, through which continuous monitoring, logging and analysis of the consumption of all main energy sources and all building technical systems can be carried out. The data collected must be made accessible via a common and freely configurable interface so that evaluations can be carried out regardless of the company or manufacturer.

The aggregate templates define consumption meters for energy monitoring according to [AMEV TMon 2020]. The meters support plant, building and comfort monitoring in accordance with [VDI 6041] and provide the necessary information for detecting technical and operational errors and for determining operational parameters (e.g. utilization levels).

The Table 10 below shows an excerpt of templates of standard aggregates.

Library 3 completely displays the aggregate templates for all predefined standard aggregates in Worksheet 10 Aggregate-Templates (see column Type: **Aggregate**).

The order of the standard aggregates depends - analogous to BACtwin UAK - on the trades in accordance with DIN 276.

Each aggregate template has a UUID that supports importing and using the standard aggregate in databases without naming conflicts (column C).

The grouping function is enabled for each aggregate (button: 1). Grouping can be done individually (button: +) or for all aggregates at the same time (button: 2).

The Object_Name in column L begins with a "*" as a substitute for the Location UAK.

In addition, Library 3 contains in Worksheet 10.1 AggTempl de-en English translations of the names of the aggregate templates.

Additional standard aggregates required can be communicated to the AMEV (see 4.11).

Typ	Gewerk	Aggregate-/Baugruppen-/Anlagen-Template-Kennung	Aggregate-/Baugruppen-/Anlagen-Template-Bezeichnung	Referenziertes Template	Description Präfix: [Orts-BAS]	Description Beispiele aus BAS-Tabelle: [Anlage/Raum], [Baugruppe], [Medium, Position]	Description Beispiele aus BAS-Tabelle: [Aggregate], [Betriebsmittel], [BM-Funktion], [BM-Funktions-Erweiterung]	Object_Name Beispiel	Gewerk-Kennung	Anlagen-Kennung	Anlagen-Nummer	Baugruppen-Kennung	Baugruppen-Nummer	Medium, Position	Aggregate-Kennung	Aggregate-Nummer	Betriebsmittel-Kennung	Betriebsmittel-Nummer	BM-Funktions-Kennung	BM-Funktions-Nummer	BM-Funktions-Erweiterung	Kommentar
1		4		6	7	8	9	10	1	1	1	1	1	1	1	1	1	2	2	2	2	
	##	Türen, Tore, Fenster, Sonnenschutz																				
Aggregat	##	AGG_FEN_AMEV1	Fensterkontakt Raumautomation																			
Aggregat				SV_AGG_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster	'480_RARxx_#####_RU´_FENxx_#####_SV´01	480	RAR	xx	###	##	RU´	FEN	xx	###	##	SV´	01		
Aggregat				BI_RM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Endschalter Rückmeldung Auf	'480_RARxx_#####_RU´_FENxx_GS´xx_RMA01	480	RAR	xx	###	##	RU´	FEN	xx	GS´	xx	RMA	01		
Aggregat				TL_BM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Endschalter Rückmeldung Auf Datenaufzeichu	'480_RARxx_#####_RU´_FENxx_GS´xx_RMA01_	480	RAR	xx	###	##	RU´	FEN	xx	GS´	xx	RMA	01	TL	
Aggregat	##	AGG_FEN_ANT_AMEV1	Fenster mit Antrieb Raumautomation																			
Aggregat				SV_AGG_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster	'480_RARxx_#####_RU´_FENxx_#####_SV´01	480	RAR	xx	###	##	RU´	FEN	xx	###	##	SV´	01		
Aggregat				BO_SB_AMEV1[1]	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Schaltbefehl	'480_RARxx_#####_RU´_FENxx_MOTxx_SB´01	480	RAR	xx	###	##	RU´	FEN	xx	MOT	xx	SB´	01		
Aggregat				EE_CMDF_AMEV1[1]	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Ausführkontrolle	'480_RARxx_#####_RU´_FENxx_MOTxx_AK´01_E	480	RAR	xx	###	##	RU´	FEN	xx	MOT	xx	AK´	01	EE	
Aggregat				BI_RM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Endschalter Rückmeldung Zu	'480_RARxx_#####_RU´_FENxx_GS´xx_RMZ01	480	RAR	xx	###	##	RU´	FEN	xx	GS´	xx	RMZ	01		
Aggregat				TL_BM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Endschalter Rückmeldung Zu Datenaufzeichun	'480_RARxx_#####_RU´_FENxx_GS´xx_RMZ01_T	480	RAR	xx	###	##	RU´	FEN	xx	GS´	xx	RMZ	01	TL	
Aggregat	##	AGG_FEN_ANT_KOM_AMEV1	Fenster mit kommunikativem Antrieb Raumautomation																			
Aggregat				SV_AGG_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster	'480_RARxx_#####_RU´_FENxx_#####_SV´01	480	RAR	xx	###	##	RU´	FEN	xx	###	##	SV´	01		
Aggregat				BI_RM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Endschalter Rückmeldung Zu	'480_RARxx_#####_RU´_FENxx_GS´xx_RMZ01	480	RAR	xx	###	##	RU´	FEN	xx	GS´	xx	RMZ	01		
Aggregat				TL_BM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Endschalter Rückmeldung Zu Datenaufzeichun	'480_RARxx_#####_RU´_FENxx_GS´xx_RMZ01_T	480	RAR	xx	###	##	RU´	FEN	xx	GS´	xx	RMZ	01	TL	
Aggregat				AV_ST_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Stellsignal	'480_RARxx_#####_RU´_FENxx_MOTxx_ST´01	480	RAR	xx	###	##	RU´	FEN	xx	MOT	xx	ST´	01		
Aggregat				EE_FLIM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Abweichung	'480_RARxx_#####_RU´_FENxx_MOTxx_ABW01_	480	RAR	xx	###	##	RU´	FEN	xx	MOT	xx	ABW	01	EE	
Aggregat				AI_RW_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Rückführwert	'480_RARxx_#####_RU´_FENxx_MOTxx_RW´01	480	RAR	xx	###	##	RU´	FEN	xx	MOT	xx	RW´	01		
Aggregat				EE_CCP_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Bedieneinheit Hand	'480_RARxx_#####_RU´_FENxx_UBExx_HD´01_E	480	RAR	xx	###	##	RU´	FEN	xx	UBE	xx	HD´	01	EE	
Aggregat				TL_AM_P_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Rückführwert Datenaufzeichnung	'480_RARxx_#####_RU´_FENxx_MOTxx_RW´01_	480	RAR	xx	###	##	RU´	FEN	xx	MOT	xx	RW´	01	TL	
Aggregat				BI_HD_AMEV1[2]	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster LVB Hand	'480_RARxx_#####_RU´_FENxx_LVBxx_HD´01	480	RAR	xx	###	##	RU´	FEN	xx	LVB	xx	HD´	01		
Aggregat				MV_HD_ASGM_AMEV1[2]	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster LVB Hand	'480_RARxx_#####_RU´_FENxx_LVBxx_HD´01	480	RAR	xx	###	##	RU´	FEN	xx	LVB	xx	HD´	01		
Aggregat				EE_COB_AMEV1[2]	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster LVB Hand	'480_RARxx_#####_RU´_FENxx_LVBxx_HD´01_E	480	RAR	xx	###	##	RU´	FEN	xx	LVB	xx	HD´	01	EE	
Aggregat				BI_SM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Störmeldung	'480_RARxx_#####_RU´_FENxx_#####_SM´01	480	RAR	xx	###	##	RU´	FEN	xx	###	##	SM´	01		
Aggregat				BI_WM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Wartungsmeldung	'480_RARxx_#####_RU´_FENxx_#####_WM´01	480	RAR	xx	###	##	RU´	FEN	xx	###	##	WM´	01		
Aggregat				AV_MWC_ZFA_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Raum	Fenster Rückmeldung Zu	'480_RARxx_#####_RU´_FENxx_#####_RMZ01	480	RAR	xx	###	##	RU´	FEN	xx	###	##	RMZ	01		
Aggregat	##	AGG_FEK_GMA_AMEV1	Fensterkontakt Gefahrenmeldeanlage																			
Aggregat				SV_AGG_AMEV1	[Ortsbezug]	Fernmelde- und IT-Anlagen Gefahrenmeldeanlage Einbruchme	Fenster	'450_GMAxx_EMAxx_###_FENxx_#####_SV´01	450	GMA	xx	EMA	xx	###	FEN	xx	###	##	SV´	01		
Aggregat				BI_AM_ZOF_AMEV1	[Ortsbezug]	Fernmelde- und IT-Anlagen Gefahrenmeldeanlage Einbruchme	Fenster Endschalter Rückmeldung Zu	'450_GMAxx_EMAxx_###_FENxx_GS´xx_RMZ01	450	GMA	xx	EMA	xx	###	FEN	xx	GS´	xx	RMZ	01		
Aggregat	##	AGG_FEN_FEK_GMA_AMEV1	Fensterkontakt Gefahrenmeldeanlage und Raumautomation kombiniert																			
Aggregat				SV_AGG_AMEV1	[Ortsbezug]	Türen, Tore, Fenster, Sonnenschutz Bereich Raum	Fenster	'330_RABxx_#####_RU´_FENxx_#####_SV´01	330	RAB	xx	###	##	RU´	FEN	xx	###	##	SV´	01		
Aggregat				BI_RM_AMEV1	[Ortsbezug]	Türen, Tore, Fenster, Sonnenschutz Bereich Raum	Fenster Endschalter Rückmeldung Zu	'330_RABxx_#####_RU´_FENxx_GS´xx_RMZ01	330	RAB	xx	###	##	RU´	FEN	xx	GS´	xx	RMZ	01		
Aggregat				TL_BM_AMEV1	[Ortsbezug]	Türen, Tore, Fenster, Sonnenschutz Bereich Raum	Fenster Endschalter Rückmeldung Zu Datenaufzeichun	'330_RABxx_#####_RU´_FENxx_GS´xx_RMZ01_T	330	RAB	xx	###	##	RU´	FEN	xx	GS´	xx	RMZ	01	TL	
Aggregat	##	AGG_FEN_FEG1_AMEV1	Fenstergriff Zu/Auf																			
Aggregat				SV_AGG_AMEV1	[Ortsbezug]	Gebäudeautomationssystem	Fenster	'480_RARxx_#####_###_FENxx_#####_SV´01	480	RAR	xx	###	##	###	FEN	xx	###	##	SV´	01		
Aggregat				BI_RM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem	Fenster Fenstergriff Rückmeldung Auf	'480_RARxx_#####_###_FENxx_FEGxx_RMA01	480	RAR	xx	###	##	###	FEN	xx	FEG	xx	RMA	01		
Aggregat				TL_BM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem	Fenster Fenstergriff Rückmeldung Auf Datenaufzeichu	'480_RARxx_#####_###_FENxx_FEGxx_RMA01_	480	RAR	xx	###	##	###	FEN	xx	FEG	xx	RMA	01	TL	
Aggregat	##	AGG_FEN_FEG2_AMEV1	Fenstergriff Zu/Gekippt/Auf																			
Aggregat				SV_AGG_AMEV1	[Ortsbezug]	Gebäudeautomationssystem	Fenster	'480_RARxx_#####_###_FENxx_#####_SV´01	480	RAR	xx	###	##	###	FEN	xx	###	##	SV´	01		
Aggregat				MV_RM_ZKA_AMEV1	[Ortsbezug]	Gebäudeautomationssystem	Fenster Fenstergriff Rückmeldung	'480_RARxx_#####_###_FENxx_FEGxx_RM´01	480	RAR	xx	###	##	###	FEN	xx	FEG	xx	RM´	01		
Aggregat				TL_MS_AMEV1	[Ortsbezug]	Gebäudeautomationssystem	Fenster Fenstergriff Rückmeldung Datenaufzeichnung	'480_RARxx_#####_###_FENxx_FEGxx_RM´01_T	480	RAR	xx	###	##	###	FEN	xx	FEG	xx	RM´	01	TL	
Aggregat	##	AGG_TUR_AMEV1	Tür Zu/Auf																			
Aggregat				SV_AGG_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Segment	Tür	'480_RASxx_#####_###_TURxx_#####_SV´01	480	RAS	xx	###	##	###	TUR	xx	###	##	SV´	01		
Aggregat				BI_RM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Segment	Tür Endschalter Rückmeldung Auf	'480_RASxx_#####_###_TURxx_GS´xx_RMA01	480	RAS	xx	###	##	###	TUR	xx	GS´	xx	RMA	01		
Aggregat				TL_BM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Segment	Tür Endschalter Rückmeldung Auf Datenaufzeichnung	'480_RASxx_#####_###_TURxx_GS´xx_RMA01_	480	RAS	xx	###	##	###	TUR	xx	GS´	xx	RMA	01	TL	
Aggregat	##	AGG_TUR_ANT_AMEV1	Tür mit Antrieb																			
Aggregat				SV_AGG_AMEV1	[Ortsbezug]	Türen, Tore, Fenster, Sonnenschutz Fassadenanlage Fassade M	Tür	'330_FAAxx_#####_n00_TURxx_#####_SV´01	330	FAA	xx	###	##	n00	TUR	xx	###	##	SV´	01		
Aggregat				BO_SB_AMEV1	[Ortsbezug]	Türen, Tore, Fenster, Sonnenschutz Fassadenanlage Fassade M	Tür Schaltbefehl Auf	'330_FAAxx_#####_n00_TURxx_MOTxx_SBA01	330	FAA		###	##	n00	TUR		MOT		SBA	01		

Table 10 Aggregate template (example)

2.4.2 Project aggregate

If important BAC functions of a standard aggregate do not fit, it can be modified into a project aggregate using only AMEV standard object templates. Advantages of project aggregates can include be:

- Expansion through additional BAC functions, e.g. innovative solutions,
- Exchange of unwanted BAC functions and using desired BA functions),
- Deselecting BAC functions that are not required (e.g. object template for repair switches).

The disadvantages of project aggregates should also be taken into account, e.g. B. the increased individual effort in the planning and testing tools, the increasing lack of transparency of the project data and the possible waiver of energy-, cost- or testing-relevant information.

Before agreeing to project aggregates, builders and operators should carefully consider whether they will permanently improve BAC operations or make them more difficult. The transparency of mass data in BAC systems must be given high priority.

If the BAC planning proposes a project aggregate, it must document the reasons and special features so that the positive effects can be checked by the builder/operator before approval, implemented efficiently during the BAC execution and monitored during acceptance and in BAC operation.

Builders and operators should pay attention to verifiability and apply strict standards when approving changes to the standard templates. In each individual case, the advantages of changes must clearly outweigh the disadvantages - even in the long term.

Reductions in standard functions or individual changes to standard templates are only permitted in justified special cases.

The two Tables below represent examples of project aggregates.

In example 1, an object template of the standard pump aggregate is deselected in one step. The Local override message (LO/ID) can be deselected if, in a special case, a control cabinet is not barrier-free accessible (e.g. ceiling installation of the pump).

Example 1

Standard aggregate	**Project aggregate**	**Aggregate designation**
AGG_PMP_S1_AMEV1	**AGG_PMP_S1_NAME1**	**Single-stage pump**
Object template	**Object template**	**Object description (excerpt)**
SV_AGG	SV_AGG	Pump
BO_SC[1]	*BO_SC*[1]	Switching command
EE_CMDF[1]	*EE_CMDF*[1]	Operational report
BI_OMS	BI_OMS	Execution control
TL_BN	TL_BN	Data recording operating message
BI_FM	BI_FM	Fault message
EE_CCP	EE_CCP	Hand message UBE
BI_LOM o.ä.[2]		not applic.: manual message LO/ID

Table 11 Example project aggregate with an object template deselected

In example 2, two additional object templates are added to the standard pump aggregate in one step.

This allows the operating hours to be recorded, e.g. B. point out necessary maintenance in connection with the pump (e.g. dirt trap).

The inspection report at the repair desk must also be provided if a repair desk is required according to the recognized rules of technology.

Example 2

Standard aggregate	Project aggregate	Aggregate designation
AGG_PMP_S1_AMEV1	**AGG_PMP_S1_NAME1**	**Single-stage pump**
Object template	**Object template**	**Object description (excerpt)**
SV_AGG	SV_AGG	Pump
BO_SC[1]	BO_SC[1]	Switching command
EE_CMDF[1]	EE_CMDF[1]	Operational report
BI_OMS	BI_OMS	Execution control
TL_BN	TL_BN	Data recording operating message
BI_FM	BI_FM	Fault message
EE_CCP	EE_CCP	Hand message UBE
BI_LOM o.ä.[2]	BI_LOM o.ä.[2]	Handmeldung LO/ID
	AV_MWC_BZ	Additionally: operating hours
	BI_MM_REP	Additionally: repair switch

Table 12 Example project aggregate with two additional object templates

A project aggregate is generated by BAC planning selecting a standard aggregate in the planning tool and modifying the standard aggregate template as required.

The modification changes the scope of the BAC functions of a standard aggregate.

If only recommended parameters of a standard aggregate are adjusted as required (e.g. when adjusting according to Section 4.6.1), this is not a modification.

A new project aggregate template must receive a unique project aggregate identifier and plain text name based on the standard aggregate used and the BACtwin UAK. Due to the project-specific modeling, AMEV1 is omitted as a source and version. Instead of AMEV1, a unique name of the builder's or operator's choice must be specified (e.g. AGG_PMP_S1_NAME1).

The project aggregate identifier is inserted into the project-specific aggregate list. The aggregate list names the standard and project aggregates and object templates used.

In addition, each project aggregate must be given a UUID that supports the import and use of the project aggregate in databases without naming conflicts.

In order to use the advantages of standardization for project aggregates and e.g. to reduce the necessary additional effort, the project aggregates desired by the operator should be typified as far as possible. Needs-based standardization across the entire property portfolio is recommended when defining the operator requirements (see 4.11).

2.4.3 Special aggregate

The procedure for generating a project aggregate described above also applies mutatis mutandis to generating a special aggregate. The main difference is that a project aggregate only uses standardized object templates and can therefore be checked automatically with little additional effort and risk.

In contrast, a special aggregate uses at least one individually defined object template and is therefore associated with an increased risk with regard to system integration and with additional manual testing effort.

For these reasons, the use of **special aggregates should be avoided** as far as possible.

2.5 Assembly template

An assembly template configures a **standard assembly** according to the modular principle using standard aggregates and standard BA functions. Assembly templates serve as components for standard plants.

An assembly template defines a practical standard set of BA functions for a standard assembly (e.g. reheater). Available best practice solutions are taken into account (e.g. specifications according to [AMEV TMon 2020]).

For a standard assembly, the appropriate aggregate and object templates are selected from the Library 2 and 3 and configured into the desired assembly template using the respective identifiers. The assembly template defines the standard aggregates and standard BA functions associated with the standard assembly as well as - by means of inheritance - the associated object templates and their properties and parameters.

Each assembly template receives a unique identifier, which enables the object properties to be passed on to other information carriers, and a plain text name.

The assembly identifier includes several parts that are formed from abbreviations based on the UAK and use underscores as separators:

1.	**ASY**	type of the **template**, three digits	(**ASY** = assembly template)
2.	**Typ**	abbreviation of the **assembly**, three digits	(e.g. **RHT** = reheater)
3.	**Suffix**	optional, indicates **variants**, one/multi-part	(not applicable in example)
4.	**Version**	names the **source and version** of the template	(e.g. **AMEV1**)

Example assembly identifier

Reheater	**ASY_RHT_AMEV1**

The Table 13 Assembly template en (overview) below shows the English names of the standardized assembly templates.

In **Library 3**, the assembly templates are shown in full in Worksheet 10 (see column Type: **Assembly**). To distinguish them from the object templates used, the identifiers of the aggregate templates used are marked different green.

Each standard assembly has a UUID that supports the import and use of the standard assembly in databases without naming conflicts (column C).

The example BACtwin templates for standard assemblies only cover parts of the assemblies required in BACtwin projects. The BAC planning must develop the project assemblies required for the overall function based on BACtwin templates.

A project assembly is generated in the planning software using available aggregate and object templates (analogous to the definition of project aggregates).

The new project assembly template receives a unique project assembly identifier and a plain text name, both of which are inserted into the assembly list. The project-specific assembly list names the standard and project assemblies and object templates used.

The identifier of the project assembly should be based on the identifier of available assemblies and the BACtwin UAK. Due to the project-specific modeling, AMEV1 is omitted as a source and version. Instead of AMEV1, a unique name of the builder's or operator's choice must be specified (e.g. BGP_RHT_NAME1).

In addition, each project assembly must receive a UUID that supports the import and use of the project assembly in databases without naming conflicts.

Type	Trade (Cost Group de as ordinal number)	Aggregate/ Assembly/Plant/ Template Identifier (de)	Aggregate/ Assembly/ Plant Template Name (en draft)	Referenced Template (de)	Description (de) Prefix: [Location UAK]	Description (de) Examples from UAK Table: [Plant/Room], [Assembly], [Medium, Position]	Description (de) Examples from UAK Table: [Aggregate], [Operating Equipment], [OE Function], [OE Function Extension]	Object_Name Example (de)	Trade (Cost Group de)	Plant Abbreviation (de)	Plant Number	Assembly Abbreviation (de	Assembly Number	Medium, Position (de)	Aggregate Abbreviation (d	Aggregate Number	Operating Equipment Abbr.	Operating Equipment Numb	OE Function Abbreviation (	OE Function Number	OE Function Extension	Comment (de)
1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Assembly	330	BGP_MFT_KOM_AMEV1	Multifunctional door communication																			
Assembly	410	BGP_SM_AMEV1	Fault message individually (e.g. pipe trace heating)																			
Assembly	420	BGP_FWU1_AMEV1	District heating transfer < 300 kW according to DIN EN 12828																			
Assembly	420	BGP_FWU2_AMEV1	District heating transfer > 300 kW according to DIN EN 12828																			
Assembly	420	BGP_KES_aM_AMEV1	Boiler with modulating burner, pump and return lift (e.g. gas)																			
Assembly	420	BGP_GT_KK1_AMEV1	Heat source circuit, energetically optimized with valve independent of pressure (e.g. cold water or geothermal energy)																			
Assembly	420	BGP_GT_KK2_AMEV1	Heat source circuit, energetically optimized with speed-controlled pump (e.g. cold water or geothermal energy)																			
Assembly	420	BGP_HZ_KU_AMEV1	Heat sink circuit (e.g. heating water circuit or recooling circuit)																			
Assembly	420	AGG_WPU_E_AMEV1	Heat pump single-stage up to 50kW																			
Assembly	420	AGG_WPU_MOD_AMEV1	Heat pump modulating (inverter) up to 50kW																			
Assembly	430	BGP_WRG_ROT_AMEV1	Heat recovery with rotary heat exchanger																			
Assembly	430	BGP_WRG_KGS_AMEV1	Heat recovery with cross, counterflow heat exchanger																			
Assembly	430	BGP_WRG_KVS_AMEV1	Heat recovery system with closed-loop system																			
Assembly	430	BGP_VER3_AMEV1	Fan wall (e.g. supply air, 3 fans)																			
Assembly	430	BGP_VRB2_VER3_AMEV1	Fan wall (e.g. supply air, 2 fan assemblies with 3 fans each)																			
Assembly	430	BGP_VEH_AMEV1	Preheater																			
Assembly	430	BGP_KHL_AMEV1	Cooler																			
Assembly	430	BGP_NEH_AMEV1	Reheater																			
Assembly	430	BGP_BEF_UMSP_AMEV1	Humidifier (circulating spray humidifier)																			
Assembly	430	BGP_BEF_HDSP_AMEV1	Humidifier (High Pressure Spray Humidifier)																			
Assembly	430	BGP_BEF_SB_AMEV1	Humidifier switching on/off (evaporative humidifier, contact humidifier, trickle humidifier)																			
Assembly	430	BGP_BEF_ST_AMEV1	Humidifiers continuously analogue (evaporative humidifiers, contact humidifiers, trickle humidifiers, hybrid humidifiers)																			
Assembly	430	BGP_BEF_EDH_AMEV1	Steam humidification with self-steam generator																			
Assembly	430	BGP_BEF_FDH_AMEV1	Steam humidification with extraneous steam																			
Assembly	434	BGP_GT_KK1_AMEV1	Heat source circuit, energetically optimized with valve independent of pressure (e.g. cold water or geothermal energy)																			
Assembly	434	BGP_GT_KK2_AMEV1	Heat source circuit, energetically optimized with speed-controlled pump (e.g. cold water or geothermal energy)																			
Assembly	434	BGP_HZ_KU_AMEV1	Heat sink circuit (e.g. heating water circuit or recooling circuit)																			
Assembly	434	BGP_RKWg1_ST_AMEV1	Recooling unit dry with on speed-controlled fan(s)																			
Assembly	434	BGP_RKWg2_ST_AMEV1	Recooling plant with flow water, several speed-controlled fans																			
Assembly	434	BGP_RKWg3_ST_AMEV1	Recooling plant with circulating water, several speed-controlled fans																			
Assembly	434	BGP_ULK_AMEV1	Convection cooler with cold water connection or as a split unit																			
Assembly	440	BGP_TRF1_AMEV1	Transformer (medium voltage, oil insulated)																			
Assembly	440	BGP_TRF2_AMEV1	Transformer																			
Assembly	440	BGP_EEG_SB_AMEV1	Feed-in management Step-by-step (german EEG)																			
Assembly	440	BGP_EEG_ST_AMEV1	Feed-in management Infinitely variable (german EEG)																			
Assembly	440	BGP_PVA_AMEV1	Photovoltaic system																			
Assembly	440	BGP_NSU_SSM_AMEV1	Low Voltage Subdistribution Collective Fault Message																			
Assembly	440	BGP_NSU_AMEV1	Low Voltage Sub-Distribution																			
Assembly	440	BGP_USV_AMEV1	UPS system (central)																			
Assembly	440	BGP_NEA_AMEV1	Emergency power supply system simple																			
Assembly	450	BGP_BMA_AMEV1	Fire shutdown																			
Assembly	460	BGP_PTA_AMEV1	Lift																			
Assembly	460	BGP_RPA_AMEV1	Pneumatic tube system																			
Assembly	470	BGP_DIG_AMEV1	Digestorium (Switzerland: Chapel)																			
Assembly	470	BGP_CHS_AMEV1	Chemical cabinet																			
Assembly	480	BGP_TME_RU_ST_AMEV1	Room automation temperature control																			
Assembly	480	BGP_LTA_RU_ST_AMEV1	Room automation ventilation																			
Assembly	480	BGP_ABL_RU_ST_AMEV1	Room Automation Lighting																			
Assembly	480	BGP_SON_RU_ST_AMEV1	Room automation sun protection																			

Table 13 Assembly template de-en (overview)

2.6 Plant template

A plant template configures a **standard plant** according to the modular principle with the help of standard assemblies, standard aggregates and standard BAC functions. A plant template defines a practical minimum set of BAC functions for a standard plant (e.g. air conditioning plant). Available best practice solutions are taken into account (e.g. specifications according to [AMEV TMon 2020]).

For the plant template, the appropriate assembly templates and aggregate templates are selected from the Library 2 and 3 and configured into the required plant template using their identifiers. The plant template defines the standard assemblies, standard aggregates and standard BAC functions associated with the standard plant and, by means of inheritance, the associated object templates, their properties and parameters.

Each plant template receives a unique identifier, which enables the object properties to be passed on to other information carriers, and a name in plain text.

The plant identifier comprises several parts that are formed from abbreviations based on the UAK and use underscores as separators:

1. **PLT**	type of **template**, three digits	(**PLT** = plant template)
2. **Type**	Abbreviation of the **plant**, three digits	(e.g. **WET**=weather station)
3. **Suffix**	optional, indicates **variants,** one/multi-part	(not applicable in example)
4. **Version**	names the **source and version** of the template	(e.g. **AMEV1**)

Example assembly identifier

Weather station	**PLT_WET_AMEV1**

The following Table 14 shows exemplary plant templates.

In **Library 3**, the plant templates are shown in full in Worksheet 10 (see column Type: **Plant**). To distinguish them from the object templates used, the identifiers of the aggregate, assembly and plant templates used are marked in different colors.

Each standard plant has a UUID that supports the import and use of the standard plant in databases without naming conflicts (column C).

In Library 3 the Worksheet 10.1 AggTempl de-en contains English translations of the names of the plant templates.

The example templates created for standard plants only cover parts of the required plants. The BAC planning must develop the project plants required for the overall function on the basis of BACtwin templates.

A project plant is generated in the planning software using available assembly, aggregate and object templates (analogous to the definition of project assemblies).

The new project asset template receives its own unique project asset identifier and a plain text name, both of which are inserted into the project-specific asset list. The plant list names the standard and project plants, assemblies and object templates used.

The identifier of the project plant should be based on the identifier of available plants and the BACtwin UAK. Due to the project-specific modeling, AMEV1 is omitted as a source and version. Instead of AMEV1, a unique name of the builder's or operator's choice must be specified (e.g. BGP_WET_NAME1).

In addition, each project plant must receive a UUID that supports the import and use of the project plant in databases without naming conflicts.

Type	Trade (Cost Group de as ordinal number)	Aggregate/ Assembly/Plant/ Template Identifier (de)	Aggregate/ Assembly/ Plant Template Name (en draft)	Referenced Template (de)	Description (de) Prefix: [Location UAK]	Description (de) Examples from UAK Table: [Plant/Room], [Assembly], [Medium, Position]	Description (de) Examples from UAK Table: [Aggregate], [Operating Equipment], [OE Function], [OE Function Extension]	Object_Name Example (de)	Trade (Cost Group de)	Plant Abbreviation (de)	Plant Number	Assembly Abbreviation (de)	Assembly Number	Medium, Position (de)	Aggregate Abbreviation (de)	Aggregate Number	Operating Equipment Abbr. (de)	Operating Equipment Number	OE Function Abbreviation (de)	OE Function Number	OE Function Extension
1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Plant	420	ANL_2KES_AMEV1	Boiler compound with 2 boilers																		
Plant				SV_ANL_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Erzeugungsanlage		*420_EZAxx_#####_###_#####_#####_SV~01	420	EZA	xx	###	##	###	###	##	###	##	SV~	01	
Plant				[illegible]				*420_EZAxx_KES01____	420	EZA	xx	KES	01								
Plant				[illegible]				*420_EZAxx_KES02____	420	EZA	xx	KES	02								
Plant	420	ANL_DHA1_AMEV1	Pressure maintenance < 1000 kW (membrane expansion vessel)																		
Plant				SV_ANL_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage		*420_DHGxx_#####_###_#####_#####_SV~01	420	DHG	xx	###	##	###	###	##	###	##	SV~	01	
Plant				BI_AM_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage Heizwasser-	Wassermangelsicherung Druck schaltend niedrig Ala	*420_DHGxx_#####_HZR_WMSxx_PSLxx_AM~01	420	DHG	xx	###	##	HZR	WMS	xx	PSL	xx	AM~	01	
Plant	420	ANL_DHA2_AMEV1	Pressure maintenance 1000 kW < 4000 kW (pressure maintenance system)																		
Plant				SV_ANL_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage		*420_DHGxx_#####_###_#####_#####_SV~01	420	DHG	xx	###	##	###	###	##	###	##	SV~	01	
Plant				BI_BM_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage Heizwasser-	Pumpe Betriebsmeldung	*420_DHGxx_#####_HZR_PPExx_MOTxx_BM~01	420	DHG	xx	###	##	HZR	PPE	xx	MOT	xx	BM~	01	
Plant				TL_BM_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage Heizwasser-	Pumpe Betriebsmeldung Datenaufzeichung	*420_DHGxx_#####_HZR_PPExx_MOTxx_BM~01_TL	420	DHG	xx	###	##	HZR	PPE	xx	MOT	xx	BM~	01	TL
Plant				BI_SM_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage Heizwasser-	Sammelstörmeldung	*420_DHGxx_#####_HZR_#####_#####_SSM01	420	DHG	xx	###	##	HZR	###	##	###	##	SSM	01	
Plant				BI_HD_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage Heizwasser-	LVB Hand	*420_DHGxx_#####_HZR_#####_LVBxx_HD~01	420	DHG	xx	###	##	HZR	###	##	LVB	xx	HD~	01	
Plant				AI_MW_P_Tem_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage Heizwasser-	Druck Messwert	*420_DHGxx_#####_HZR_EF~xx_P~~xx_MW~01	420	DHG	xx	###	##	HZR	EF~	xx	P~~	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage Heizwasser-	Druck Messwert Datenaufzeichung	*420_DHGxx_#####_HZR_EF~xx_P~~xx_MW~01_TL	420	DHG	xx	###	##	HZR	EF~	xx	P~~	xx	MW~	01	TL
Plant				AV_ZW_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage Heizwasser-	Wasserzähler Menge Zählwert	*420_DHGxx_#####_HZR_WAZxx_F~~xx_ZW~01	420	DHG	xx	###	##	HZR	WAZ	xx	F~~	xx	ZW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage Heizwasser-	Wasserzähler Menge Zählwert Datenaufzeichung	*420_DHGxx_#####_HZR_WAZxx_F~~xx_ZW~01_TL	420	DHG	xx	###	##	HZR	WAZ	xx	F~~	xx	ZW~	01	TL
Plant				BI_SM_AMEV1	[Ortsbezug]	Wärmeversorgungsanlagen Druckhaltungsanlage Heizwasser-	Wasserzähler Menge Störmeldung	*420_DHGxx_#####_HZR_WAZxx_F~~xx_SM~01	420	DHG	xx	###	##	HZR	WAZ	xx	F~~	xx	SM~	01	
Plant	430	ANL_WRG_KVS_AMEV1	Cross-plant heat recovery system with closed-loop system as an independent plant																		
Plant				SV_ANL_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück		*430_KVSxx_WRGxx_###_#####_#####_SV~01	430	KVS	xx	WRG	xx	###	###	##	###	##	SV~	01	
Plant				AGG_PPE_01_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerückgewinnung Umlaufwasser-Rücklauf			430	KVS	xx	WRG	xx	UWR	PPE	xx					
Plant				AGG_VEN_ST_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerückgewinnung Umlaufwasser-Rücklauf			430	KVS	xx	WRG	xx	UWR	VEN	xx					
Plant				AI_MW_T_L_RU_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Temperatur Messwert	*430_KVSxx_WRGxx_UWR_EF~xx_T~~xx_MW~01	430	KVS	xx	WRG	xx	UWR	EF~	xx	T~~	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Temperatur Messwert Datenaufzeichung	*430_KVSxx_WRGxx_UWR_EF~xx_T~~xx_MW~01_TL	430	KVS	xx	WRG	xx	UWR	EF~	xx	T~~	xx	MW~	01	TL
Plant				AI_MW_T_L_RU_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Temperatur Messwert	*430_KVSxx_WRGxx_UWV_EF~xx_T~~xx_MW~01	430	KVS	xx	WRG	xx	UWV	EF~	xx	T~~	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Temperatur Messwert Datenaufzeichung	*430_KVSxx_WRGxx_UWV_EF~xx_T~~xx_MW~01_TL	430	KVS	xx	WRG	xx	UWV	EF~	xx	T~~	xx	MW~	01	TL
Plant				AI_MW_T_L_RU_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Temperatur Messwert	*430_KVSxx_WRGxx_AU~_EF~xx_T~~xx_MW~01	430	KVS	xx	WRG	xx	AU~	EF~	xx	T~~	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Temperatur Messwert Datenaufzeichung	*430_KVSxx_WRGxx_AU~_EF~xx_T~~xx_MW~01_TL	430	KVS	xx	WRG	xx	AU~	EF~	xx	T~~	xx	MW~	01	TL
Plant				AI_MW_T_L_RU_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Temperatur Messwert	*430_KVSxx_WRGxx_ZU~_EF~xx_T~~xx_MW~01	430	KVS	xx	WRG	xx	ZU~	EF~	xx	T~~	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Temperatur Messwert Datenaufzeichung	*430_KVSxx_WRGxx_ZU~_EF~xx_T~~xx_MW~01_TL	430	KVS	xx	WRG	xx	ZU~	EF~	xx	T~~	xx	MW~	01	TL
Plant				AI_MW_T_L_RU_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Temperatur Messwert	*430_KVSxx_WRGxx_FO~_EF~xx_T~~xx_MW~01	430	KVS	xx	WRG	xx	FO~	EF~	xx	T~~	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Temperatur Messwert Datenaufzeichung	*430_KVSxx_WRGxx_FO~_EF~xx_T~~xx_MW~01_TL	430	KVS	xx	WRG	xx	FO~	EF~	xx	T~~	xx	MW~	01	TL
Plant				AV_MWC_RWZ_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Wirkungsgrad Messwert berechnet	*430_KVSxx_WRGxx_###_#####_XWGxx_MWC01	430	KVS	xx	WRG	xx	###	###	##	XWG	xx	MWC	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Kreislaufverbundsystem Wärmerück	Wirkungsgrad Messwert berechnet Datenaufzeichun	*430_KVSxx_WRGxx_###_#####_XWGxx_MWC01_TL	430	KVS	xx	WRG	xx	###	###	##	XWG	xx	MWC	01	TL
Plant	430	ANL_ABA_SSL_AMEV1	Exhaust air system (airflow monitored)																		
Plant				SV_ANL_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Abluftanlage Ventilatorbaugruppe		*430_ABAxx_VRBxx_AB~_#####_#####_SV~01	430	ABA	xx	VRB	xx	AB~	###	##	###	##	SV~	01	
Plant				AGG_VER_E_AMEV1					430	ABA	xx	VRB	xx	AB~							
Plant				BI_GM_AMEV1	[Ortsbezug]	Lufttechnische Anlagen Abluftanlage Ventilatorbaugruppe	Luftstromüberwachung Gefahrmeldung	*430_ABAxx_VRBxx_AB~_EF~xx_SSLxx_GM~01	430	ABA	xx	VRB	xx	AB~	EF~	xx	SSL	xx	GM~	01	
Plant	440	ANL_VBA_SBL1_AMEV1	Emergency lighting																		
Plant				SV_ANL_AMEV1	[Ortsbezug]	Starkstromanlagen Verbrauchsanlage Sicherheitsbeleuchtu		*440_VBAxx_SBLxx_###_#####_#####_SV~01	440	VBA	xx	SBL	xx	###	###	##	###	##	SV~	01	
Plant				BI_BB_AMEV1	[Ortsbezug]	Starkstromanlagen Verbrauchsanlage Sicherheitsbeleuchtu	Betriebsbereit	*440_VBAxx_SBLxx_###_#####_#####_BB~01	440	VBA	xx	SBL	xx	###	###	##	###	##	BB~	01	
Plant				BI_SM_AMEV1	[Ortsbezug]	Starkstromanlagen Verbrauchsanlage Sicherheitsbeleuchtu	Sammelstörmeldung	*440_VBAxx_SBLxx_###_#####_#####_SSM01	440	VBA	xx	SBL	xx	###	###	##	###	##	SSM	01	
Plant				BI_AM_AMEV1	[Ortsbezug]	Starkstromanlagen Verbrauchsanlage Sicherheitsbeleuchtu	Alarmmeldung	*440_VBAxx_SBLxx_###_#####_#####_AM~01	440	VBA	xx	SBL	xx	###	###	##	###	##	AM~	01	
Plant	480	AGG_WET_AMEV1	Weather station communication																		
Plant				SV_ANL_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene		*480_WETxx_GBGxx_###_#####_#####_SV~01	480	WET	xx	GBG	xx	###	###	##	###	##	SV~	01	
Plant				BV_SM_NAF_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene D	Störmeldung	*480_WETxx_GBGxx_DA~_#####_FEExx_SM~01	480	WET	xx	GBG	xx	DA~	###	##	FEE	xx	SM~	01	
Plant				AV_MW_WIG_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene D	Windgeschwindigkeit Messwert	*480_WETxx_GBGxx_DA~_MFExx_WIGxx_MW~01	480	WET	xx	GBG	xx	DA~	MFE	xx	WIG	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene D	Windgeschwindigkeit Messwert Datenaufzeichung	*480_WETxx_GBGxx_DA~_MFExx_WIGxx_MW~01_TL	480	WET	xx	GBG	xx	DA~	MFE	xx	WIG	xx	MW~	01	TL
Plant				AV_MW_WIR_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene D	Windrichtung Messwert	*480_WETxx_GBGxx_DA~_MFExx_WIRxx_MW~01	480	WET	xx	GBG	xx	DA~	MFE	xx	WIR	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene D	Windrichtung Messwert Datenaufzeichung	*480_WETxx_GBGxx_DA~_MFExx_WIRxx_MW~01_TL	480	WET	xx	GBG	xx	DA~	MFE	xx	WIR	xx	MW~	01	TL
Plant				AV_MW_E_AU_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene F	Beleuchtungsstärke Messwert	*480_WETxx_GBGxx_n00_MFExx_R~~xx_MW~01	480	WET	xx	GBG	xx	n00	MFE	xx	R~~	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene F	Beleuchtungsstärke Messwert Datenaufzeichung	*480_WETxx_GBGxx_n00_MFExx_R~~xx_MW~01_TL	480	WET	xx	GBG	xx	n00	MFE	xx	R~~	xx	MW~	01	TL
Plant				AV_MW_E_AU_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene F	Beleuchtungsstärke Messwert	*480_WETxx_GBGxx_o00_MFExx_R~~xx_MW~01	480	WET	xx	GBG	xx	o00	MFE	xx	R~~	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene F	Beleuchtungsstärke Messwert Datenaufzeichung	*480_WETxx_GBGxx_o00_MFExx_R~~xx_MW~01_TL	480	WET	xx	GBG	xx	o00	MFE	xx	R~~	xx	MW~	01	TL
Plant				AV_MW_E_AU_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene F	Beleuchtungsstärke Messwert	*480_WETxx_GBGxx_s00_MFExx_R~~xx_MW~01	480	WET	xx	GBG	xx	s00	MFE	xx	R~~	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene F	Beleuchtungsstärke Messwert Datenaufzeichung	*480_WETxx_GBGxx_s00_MFExx_R~~xx_MW~01_TL	480	WET	xx	GBG	xx	s00	MFE	xx	R~~	xx	MW~	01	TL
Plant				AV_MW_E_AU_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene F	Beleuchtungsstärke Messwert	*480_WETxx_GBGxx_w00_MFExx_R~~xx_MW~01	480	WET	xx	GBG	xx	w00	MFE	xx	R~~	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene F	Beleuchtungsstärke Messwert Datenaufzeichung	*480_WETxx_GBGxx_w00_MFExx_R~~xx_MW~01_TL	480	WET	xx	GBG	xx	w00	MFE	xx	R~~	xx	MW~	01	TL
Plant				AV_MW_E_AU_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene A	Beleuchtungsstärke Messwert	*480_WETxx_GBGxx_AU~_MFExx_R~~xx_MW~01	480	WET	xx	GBG	xx	AU~	MFE	xx	R~~	xx	MW~	01	
Plant				TL_AM_P_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene A	Beleuchtungsstärke Messwert Datenaufzeichung	*480_WETxx_GBGxx_AU~_MFExx_R~~xx_MW~01_TL	480	WET	xx	GBG	xx	AU~	MFE	xx	R~~	xx	MW~	01	TL
Plant				BV_RM_JN_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene D	Feuchtewächter hoch Rückmeldung	*480_WETxx_GBGxx_DA~_MFExx_MSHxx_RM~01	480	WET	xx	GBG	xx	DA~	MFE	xx	MSH	xx	RM~	01	
Plant				TL_BM_AMEV1	[Ortsbezug]	Gebäudeautomationssystem Wetterstation Baugruppenebene D	Feuchtewächter hoch Rückmeldung Datenaufzeichun	*480_WETxx_GBGxx_DA~_MFExx_MSHxx_RM~01_TL	480	WET	xx	GBG	xx	DA~	MFE	xx	MSH	xx	RM~	01	TL

Table 14 Plant template (example)

2.7 Responsibility Table, BACtwin Table

The Tables and lists of properties require careful consideration due to the high number, complexity and different meanings of the properties.

In object templates, the properties and parameters recommended for a BACnet object are defined in an object-specific Table form. A **cross-object Table form** is required to define the responsibilities for properties. The cross-object Table form is also used for BACtwin Tables and project lists.

If the properties are presented in alphabetical order, the factual context necessary for human understanding is missing. Meaningful priorities cannot be identified with this arrangement (e.g. Object_Name and Description do not appear together and do not appear first). When sorted alphabetically or numerically, the responsibilities for properties cannot be represented in a meaningful context.

In order to make it easier for users to understand and control the properties, the properties to be parameterized are arranged in a context-oriented manner in cross-object property Tables (analogous to BACS-FL). The properties are first assigned to a **functional area** (Table 15).

ID Property	Functional area	ID Object type
a	Addressing	**---**
b	Data Sharing	**B**
c	Alarm and Event Management	**C**
d	Trending	**D**
e	Scheduling	**E**
f	Loop	**F**
g - w	not used (reserve for expansions)	**G - W**
x	Structure	**X**
y	Device and Network Management	**Y**

Table 15 Functional area

In the second step, **responsibility for properties** is classified. Table 16 indicates in the left column the responsibility for the parameterization of properties with code letters:
B (builder, operator), **P** (planning) and **X** (executing company).
In the right column, each area of responsibility is assigned its own number block. The middle column contains typical application examples for properties.

ID Responsibility	Area of responsibility (examples)	Number pad
B = Builder, operator	Addressing, description, priority, status text, set-point, switching time, calendar, at least BACnet protocol revision	**B = 11 - 39**
P = BAC planning	Installation location, limit value, physical unit, default value, recording interval, controller type	**P = 41 - 69**
X = Executing company	Object instance, vendor information, software information, network setting	**X = 71 - 99**

Table 16 Area of responsibility

In order to automate the context-oriented arrangement, each property receives a three-digit alphanumeric identifier called **PropSort**.

The first position of PropSort indicates the functional area of the property with a lowercase letter for the functional area (Table 16, left column).

Two numbers in the 2nd and 3rd positions of PropSort indicate the responsibility for the property using the right column in Table 17, which provides a block of numbers for each area of responsibility. By choosing the number, the order of the property in the functional area is also determined.

Example PropSort
The **Object_Name** property belongs to the functional area a = addressing (1st digit = a). The responsibility for Object_Name lies with the client or operator (i.e. area of responsibility A = number block 11 - 39). Within the number block, Object_Name is particularly important and therefore takes first place (2nd and 3rd digits = 11).

As a result, the **PropSort** for the **Object_Name** property is: **a11**.

Analogous to the three-digit identifier PropSort, the two-digit identifier **ObjSort** enables context-oriented sorting of **objects**. A capital letter indicates the functional area of the object type (Table 16, right column). An additional number defines the order of the object template within the respective functional area.

An example of a context-oriented property Table is shown in the **responsibility Table** (Table 17) which presents the properties of the AMEV profile AS-D to be parameterized in a compact form (on 1 page DIN A4) in a context-oriented manner. Using code letters (B/P/X), it names the responsibilities for parameterization specifications of the properties. The PropSort identifier is used for the vertical sorting of the properties and the ObjSort identifier is used for the horizontal sorting of the object types.

Another example of the context-oriented representation of properties is shown below in the **BACtwin Table** (Table 18), which lists the standard aggregates vertically and the properties of the AMEV profile AS-D that need to be parameterized horizontally. For contextual horizontal sorting of properties, the identifier PropSort is used. The entries of parameter values are marked in yellow.

The BACtwin Table can be used for the documentation of BACtwin lists in project libraries and for the data exchange of BACtwin lists.

Table 15 to Table 18 are available as **Worksheets 15 to 18 in Library 3.**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
No. tot.	No. part.	Function. Area Name	Property	Prop Sort	Resp *	b1 AI	b2 AO	b3 AV	b4 BI	b5 BO	b6 BV	b7 MI	b8 MO	b9 MV	c1 NC	c2 EE	d1 TL	e1 CAL	e2 SCH	f1 LP	x1 SV	y1 DEV	y2 FIL
1	1	a. Addressing	Object_Name	a11	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
2	2		Description	a12	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
3	3		Object_Type	a13	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
4	4		Object_Identifier	a71	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	1	b. Data Sharing	Units	b11	B	B	B	B															
6	2		Polarity	b12	B				B	B													
7	3		Inactive_Text	b13	B				B	B	B												
8	4		Active_Text	b14	B				B	B	B												
9	5		State_Text	b15	B							B	B	B									
10	6		Relinquish_Default	b16	B		B	B		B	B		B	B									
11	7		COV_Increment	b17	B	B	B	B												B			
12	8		Priority_For_Writing	b18	B														B	B			
13	9		Resolution	b41	P	P	P																
14	10		Number_Of_States	b42	P							P	P	P									
15	11		Minimum_Off_Time	b43	P					P	P												
16	12		Minimum_On_Time	b44	P					P	P												
17	1	c. Alarm and Event Management	Notification_Class	c11	B	B	B	B	B	B	B	B	B	B	B	B	B		B				
18	2		Event_Enable	c12	B	B	B	B	B	B	B	B	B	B		B	B		B				
19	3		Notify_Type	c13	B	B	B	B	B	B	B	B	B	B		B	B		B				
20	4		Event_Message_Texts_Config	c14	B	B	B	B	B	B	B	B	B	B		B	B		B				
21	5		Event_Detection_Enable	c15	B	B	B	B	B	B	B	B	B	B		B	B		B				
22	6		Alarm_Value	c16	B				B		B												
23	7		Alarm_Values	c17	B							B		B									
24	8		Fault_Values	c18	B							B		B									
25	9		Feedback_Value	c19	B					B			B										
26	10		Priority	c20	B										B								
27	11		Ack_Required	c21	B										B								
28	12		Recipient_List	c22	B										B								
29	13		Event_Type	c23	B											B							
30	14		Event_Parameters	c24	B											B							
31	15		Event_Algorithm_Inhibit	c41	P	P	P	P	P	P	P	P	P	P		P							
32	16		Event_Algorithm_Inhibit_Ref	c42	P	P	P	P	P	P	P	P	P	P		P							
33	17		Time_Delay	c43	P	P	P	P	P	P	P	P	P	P						P			
34	18		Time_Delay_Normal	c44	P	P	P	P	P	P	P	P	P	P		P				P			
35	19		Min_Pres_Value	c45	P	P	P	P															
36	20		Max_Pres_Value	c46	P	P	P	P															
37	21		Low_Limit	c47	P	P	P	P															
38	22		High_Limit	c48	P	P	P	P															
39	23		Limit_Enable	c49	P	P	P	P															
40	24		Deadband	c50	P	P	P	P												X			
41	25		Object_Property_Reference	c51	P											P							
42	1	d. Trending	Enable	d11	B												B						
43	2		Log_DeviceObjectProperty	d12	B												B						
44	3		Log_Interval	d13	B												B						
45	4		COV_Resubscription_Interval	d14	B												B						
46	5		Client_COV_Increment	d15	B												B						
47	6		Stop_When_Full	d16	B												B						
48	7		Buffer_Size	d17	B												B						
49	8		Logging_Type	d18	B												B						
50	9		Trigger	d19	B												B						
51	10		Notification_Threshold	d20	B												B						
52	1	e. Time Management	Date_List	e11	B													B					
53	2		Effective_Period	e12	B														B				
54	3		Weekly_Schedule	e13	B														B				
55	4		Exception_Schedule	e14	B														B				
56	5		Schedule_Default	e15	B														B				
57	6		List_Of_Object_Property_Reference	e71	P														P				
58	1	f. Loop	Setpoint_Reference	f11	B															B			
59	2		Action	f41	P															P			
60	3		Controlled_Variable_Reference	f42	P															P			
61	4		Controlled_Variable_Units	f43	P															P			
62	5		Minimum_Output	f44	P															P			
63	6		Maximum_Output	f45	P															P			
64	7		Manipulated_Variable_Reference	f46	P															P			
65	8		Output_Units	f47	P															P			
66	9		Proportional_Constant	f71	X															X			
67	10		Proportional_Constant_Units	f72	X															X			
68	11		Derivative_Constant	f73	X															X			
69	12		Derivative_Constant_Units	f74	X															X			
70	13		Integral_Constant	f75	X															X			
71	14		Integral_Constant_Units	f76	X															X			
72	1	x. Structure	Node_Type	x11	B																B		
73	2		Node_Subtype	x12	B																B		
74	3		Subordinate_List	x13	B																B		
75	1	y. Device and Network Management	Location	y11	B																	B	
76	2		Protocol_Version	y12	B																	B	
77	3		Protocol_Revision	y13	B																	B	
78	4		Protocol_Services_Supported	y14	B																	B	
79	5		Protocol_Object_Types_Supported	y15	B																	B	
80	6		UTC_Offset	y16	B																	B	
81	7		UTC_Time_Synchronization_Recipients	y17	B																	B	
82	8		Time_Synchronization_Recipients	y18	B																	B	
83	9		Time_Synchronization_Interval	y19	B																	B	
84	10		Align_Intervals	y20	B																	B	
85	11		Interval_Offset	y21	B																	B	
86	12		Max_Master	y22	B																	B	
87	13		Max_Info_Frames	y23	B																	B	
88	14		Structured_Object_List	y24																			

*** Responsibel:** B = Builder/operator (green) P = Planning (yellow) X = Executing company (blue)

Table 17 Responsibility Table

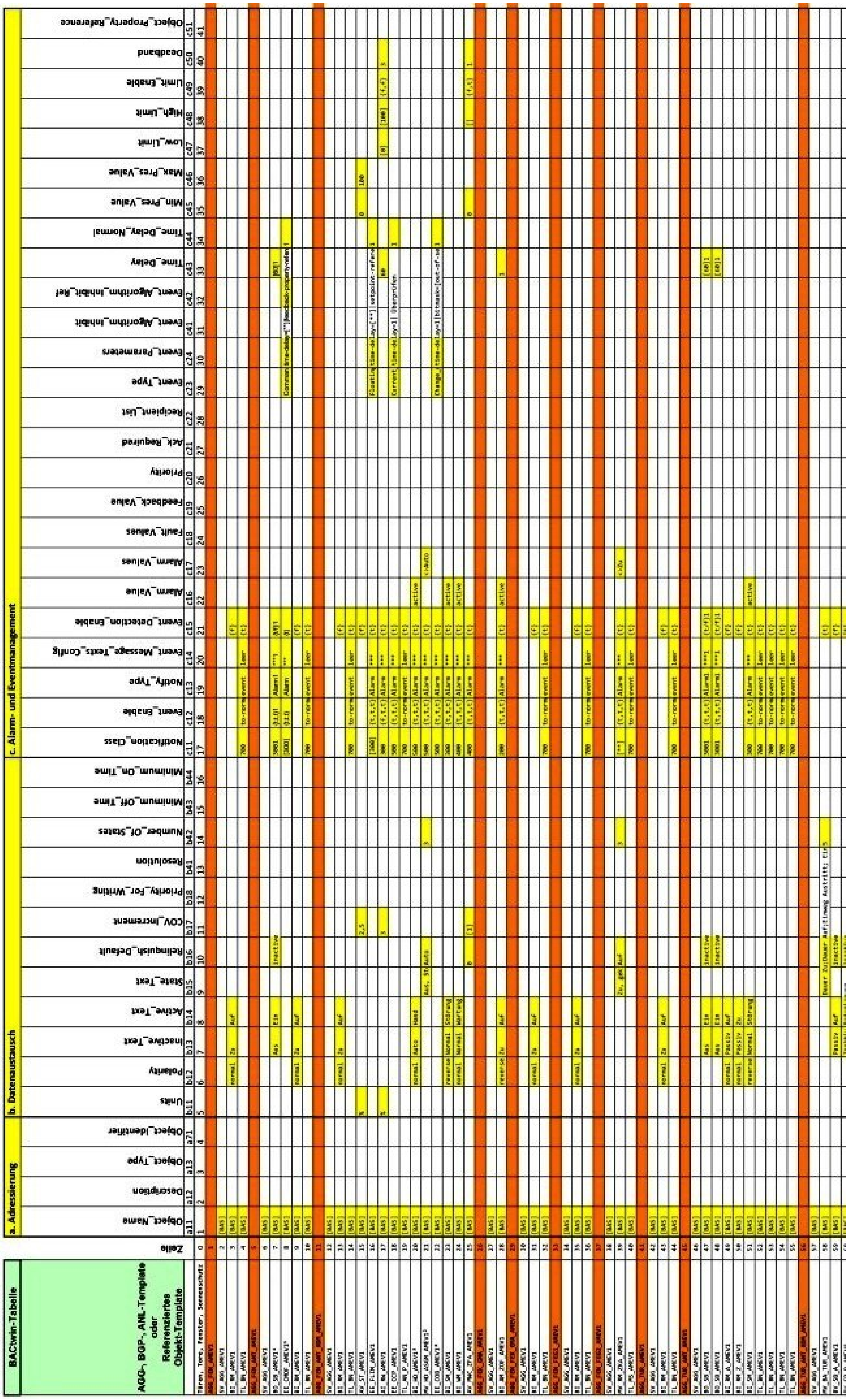

Table 18 BACtwin Table (example – excerpt)

2.8 Object type Structured View (SV)

Automation stations with the AMEV profile AS-D have SV objects that can be used to automatically check the BAC mass data and display the plant structures transparently. The use of the Structured_View object type is explained below.

Each template for a plant, assembly or aggregate is equipped with an SV object. Essential information about the templates used is stored in these SV objects. This information can be used for automated checks of planned and used templates. The implementation of the SV objects makes automated checks easier.

In addition, the respective plant structures are automatically derived from the information. The data contents of the respective aggregates, assemblies and plant templates are displayed in a logical tree structure.

An example of an automatically created plant structure is shown in Figure 7:

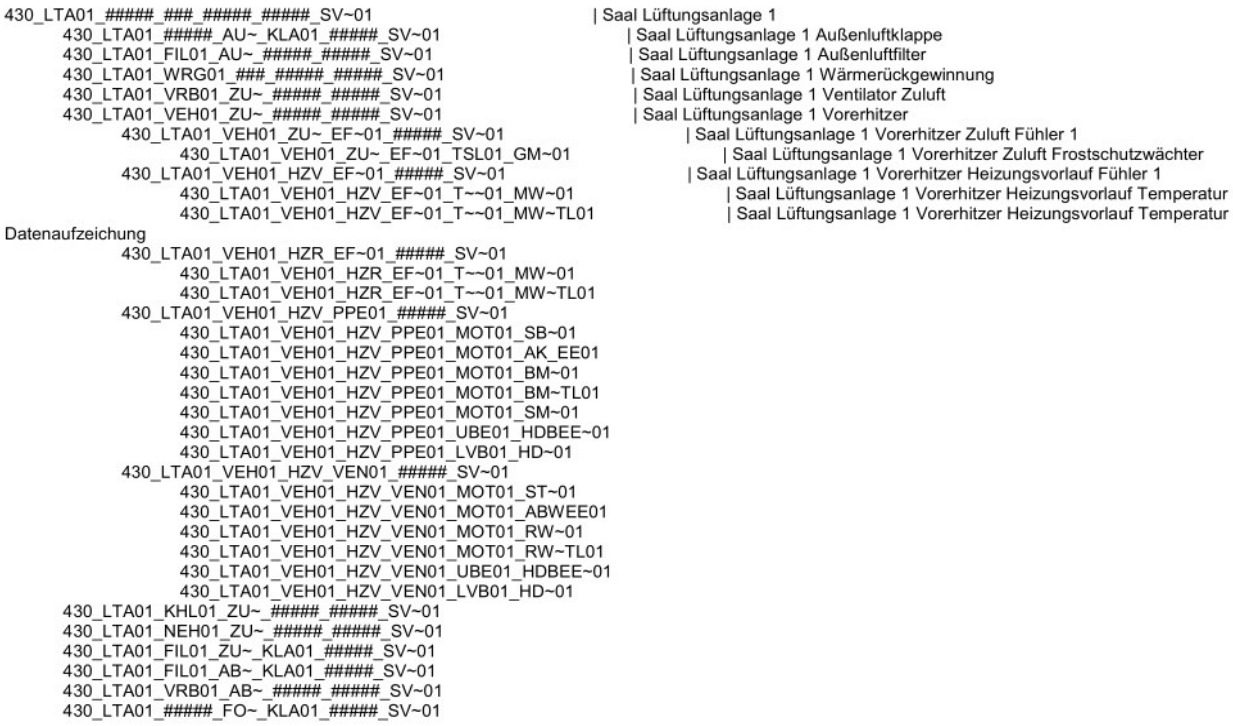

Figure 7 Automatically created plant structure (example: ventilation plant)

In real plant operation, the Object_Identifier is used to address the BACnet objects (Addressing by number). Since the Object_Identifier are only defined in the configuration (the Object_Identifier is therefore not available in planning tools and in the XML exchange format), BACtwin uses the Object_Name (Addressing by name), i.e. the UAK, in the planning phase.

In contrast to the other BACnet objects, the UAK shown in the Object_Name of the SV object is limited to the plant level (the UAK parts assembly and aggregate only contain padding characters), the assembly level (the UAK portion contains aggregate only fill characters) or the respective aggregate level.

The description of the SV object describes the template (e.g. aggregate: pump; assembly: preheater; plant: weather station) and can be displayed in the visualization.

Each SV object only contains a list of objects (array) that it references. In order to map the plant structure, it only references one level, the one directly below it.

The **Node_Type** property is used for the machine-interpretable assignment to the plant, assembly or aggregate level. For every plant, assembly and every aggregate, the appropriate permissible term is set up in the property Node_Type of the SV object (BACnet standard [DIN EN ISO 16484-5] see 12. 29. 5):

- **Aggregate** Node_Type = **EQUIPMENT**
- **Module** Node_Type = **SUBSYSTEM**
- **Facility** Node_Type = **SYSTEM**

In the **Node_Subtype** property, the aggregate template identifier from the library 3 is set up for a standard aggregate.
Example: AGG_PMP_S1_AMEV1

The modified identifier of the project aggregate is set up for a project aggregate (= project-specific modified aggregate template) in the Node_Subtype property.
Example: AGG_PMP_S1_NAME1

In addition, the object identifiers contained in the object template are specified as an array in the **Subordinate_List** property of each SV object.

All systems can be listed in the Property Structured_Object_List of the Device object. Responsibility must be clarified for the application (see Table 17).

SV and DEV object templates are defined in Library 2 in Worksheets 8.13 and 8.6.

As an example, Figure 8 below shows a heating circuit and Figure 9 an overview of the BAC-net objects associated with this heating circuit, including the SV objects with the properties Node_Type, Node_Subtype and Subordinate_List.

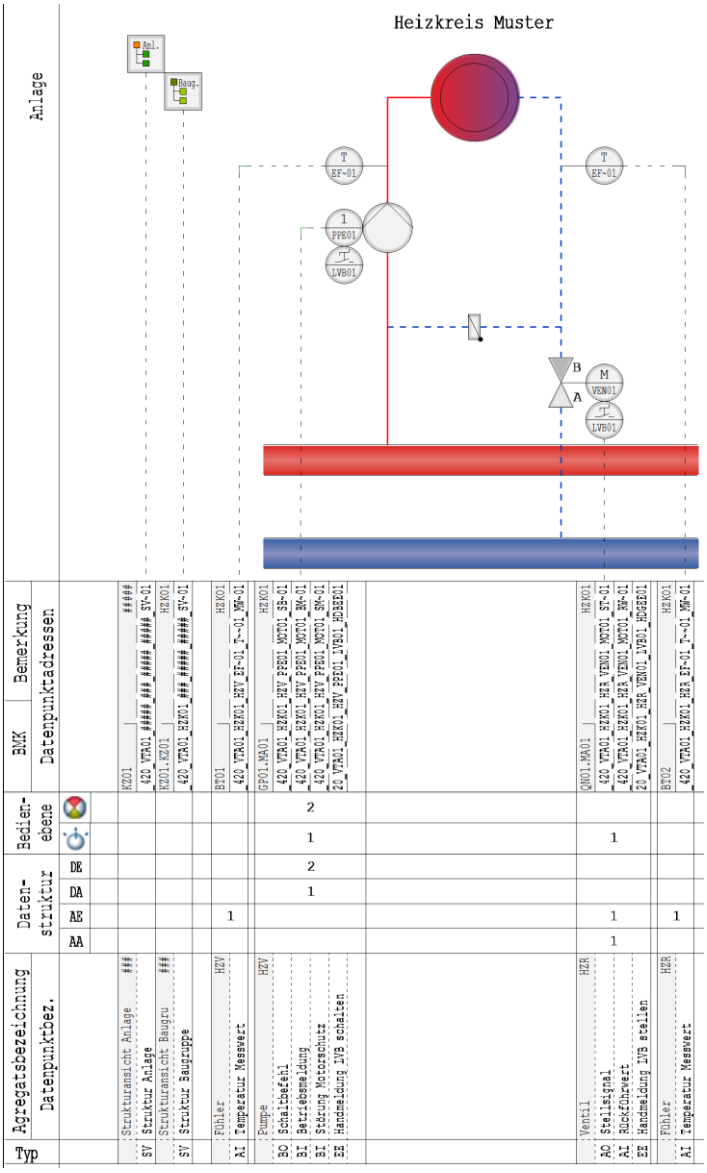

Figure 8 Example Heating circuit – graphic representation

Identifier*	Object Name	Description	Wert	Node_Type	Node_Subtype	Subordinate_List
999.SV0	ORTS-BAS_420_VTAxx_#####_###_#####_#####_SV'01	Verteilanlage xx		SYSTEM		[999.SV1]
999.SV1	ORTS-BAS_420_VTAxx_HZKxx_###_#####_#####_SV'01	Verteilanlage xx Heizkreis xx		SUBSYSTEM		[999.SV2,999.SV3,999.SV4,999.SV5]
999.SV2	ORTS-BAS_420_VTAxx_HZKxx_HZV_PPE01_#####_SV'01	Verteilanlage xx Heizkreis xx Pumpe 1		EQUIPMENT	AGG_PPE_E1_AMEV1	[999.BO0,999.EV0,999.BI0,999.TL0,999.BI1, 999.BI3,999.EV1,999.EV2]
999.BO0	ORTS-BAS_420_VTAxx_HZKxx_HZV_PPE01_PPE01_SB'01	Verteilanlage xx Heizkreis xx Pumpe 1 Schaltbefehl	Ein			
999.EV0	ORTS-BAS_420_VTAxx_HZKxx_HZV_PPE01_MOT01_AK'EE01	Verteilanlage xx Heizkreis xx Pumpe 1 Ausführkontrolle	Normal			
999.BI0	ORTS-BAS_420_VTAxx_HZKxx_HZV_PPE01_MOT01_BM'01	Verteilanlage xx Heizkreis xx Pumpe 1 Betriebsmeldung	Ein			
999.TL0	ORTS-BAS_420_VTAxx_HZKxx_HZV_PPE01_MOT01_BM'TL01	Verteilanlage xx Heizkreis xx Pumpe 1 Betriebsmeldung Datenaufzeichnung	Aufzeichnung			
999.BI1	ORTS-BAS_420_VTAxx_HZKxx_HZV_PPE01_MOT01_SM'01	Verteilanlage xx Heizkreis xx Pumpe 1 Störmeldung	Normal			
999.BI3	ORTS-BAS_420_VTAxx_HZKxx_HZV_PPE01_LVB01_HD'01	Verteilanlage xx Heizkreis xx Pumpe 1 Pumpe LVB Hand	Auto			
999.EV2	ORTS-BAS_420_VTAxx_HZKxx_HZV_PPE01_LVB01_HD'EE01	Verteilanlage xx Heizkreis xx Pumpe 1 Handmeldung LVB	Normal			
999.EV1	ORTS-BAS_420_VTAxx_HZKxx_HZV_PPE01_UBE01_HD'EE01	Verteilanlage xx Heizkreis xx Pumpe 1 Handmeldung UBE	Normal			
999.SV3	ORTS-BAS_420_VTAxx_HZKxx_HZV_VEN01_#####_SV'01	Verteilanlage xx Heizkreis xx Ventil 1		EQUIPMENT	AGG_VEN_ST_AMEV1	[999.AI1,999.EV3,999.AI1,999.TL2,999.EV4,999.EV5]
999.AI1	ORTS-BAS_420_VTAxx_HZKxx_HZV_VEN01_MOT01_ST'01	Verteilanlage xx Heizkreis xx Ventil 1 Stellsignal	12,1%			
999.EV3	ORTS-BAS_420_VTAxx_HZKxx_HZR_VEN01_MOT01_ABWEE01	Verteilanlage xx Heizkreis xx Ventil 1 Abweichung	Normal			
999.AI1	ORTS-BAS_420_VTAxx_HZKxx_HZV_VEN01_MOT01_RW'01	Verteilanlage xx Heizkreis xx Ventil 1 Rückführwert	11,8%			
999.TL2	ORTS-BAS_420_VTAxx_HZKxx_HZR_VEN01_MOT01_RW'TL01	Verteilanlage xx Heizkreis xx Ventil 1 Rückführwert Datenaufzeichnung	Aufzeichnung			
999.EV4	ORTS-BAS_420_VTAxx_HZKxx_HZR_VEN01_UBE01_HD'EE01	Verteilanlage xx Heizkreis xx Ventil 1 Handmeldung UBE	Normal			
999.EV5	ORTS-BAS_420_VTAxx_HZKxx_HZR_VEN01_LVB01_HD'EE01	Verteilanlage xx Heizkreis xx Ventil 1 Handmeldung LVB	Normal			
999.SV4	ORTS-BAS_420_VTAxx_HZKxx_HZV_EF'01_T"01_SV'01	Verteilanlage xx Heizkreis xx Vorlauf Temperaturfühler 1		EQUIPMENT	AGG_EF_NT_T_AMEV1	[999.AI0,999.TL1]
999.AI0	ORTS-BAS_420_VTAxx_HZKxx_HZV_EF'01_T"01_MW'01	Verteilanlage xx Heizkreis xx Vorlauf Temperatur 1 Messwert	42°C			
999.TL1	ORTS-BAS_420_VTAxx_HZKxx_HZV_EF'01_T"01_MW'TL01	Verteilanlage xx Heizkreis xx Vorlauf Temperatur 1 Messwert Datenaufzeichnung	Aufzeichnung			
999.SV5	ORTS-BAS_420_VTAxx_HZKxx_HZR_EF'01_T"01_SV'01	Verteilanlage xx Heizkreis xx Rücklauf Temperaturfühler 1		EQUIPMENT	AGG_EF_NT_T_AMEV1	[999.AI3,999.TL3]
999.AI3	ORTS-BAS_420_VTAxx_HZKxx_HZR_EF'01_T"01_MW'01	Verteilanlage xx Heizkreis xx Rücklauf Temperatur 1 Messwert	28°C			
999.TL3	ORTS-BAS_420_VTAxx_HZKxx_HZR_EF'01_T"01_MW'TL01	Verteilanlage xx Heizkreis xx Rücklauf Temperatur 1 Messwert Datenaufzeichnung	Aufzeichnung			

Figure 9 Example Heating circuit – Overview of objects and SV properties

3 BACtwin-capable SW tools and data exchange

3.1 BACtwin-capable planning tool

BACtwin-capable planning tools are an important prerequisite for exploiting the high potential that the BACtwin concept offers for simplification, error prevention and quality improvement in BACnet projects.

Software manufacturers are recommended to import the BACtwin Library templates into their planning tools.

A BACtwin-capable planning tool should enable the handling of the data and functions listed in Table 19. Handling includes importing/entering, editing, saving and exporting in lines 1, 3, 5 - 11, 14, 17 and 18.

1.	BACtwin libraries and project data
2.	Planning documents (plant lists, diagrams, functional descriptions) can be created from available templates.
3.	Standardized BACnet objects and properties
4.	Indication of the supported BACnet revision (at least Rev. 12, recommended Rev. 16).
5.	BACnet profiles according to AMEV BACtwin
6.	Project-specific BACtwin Library (schema, description, BA function list)
7.	Templates (OBJ, AGG, BGP, ANL) as project templates
8.	BACtwin lists (OBJ, AGG, BGP, ANL)
9.	BACtwin lists (OBJ, AGG, BGP, ANL) can be named.
10.	BACtwin UAK as a template for Object_Name/Description
11.	User-specific UAK as a template for Object_Name/Description
12.	Properties Object_Name can be generated automatically from UAK template.
13.	Properties description can be generated automatically from UAK template.
14.	Properties Description as a template
15.	Use of the BACnet and AMEV terms, AMEV can be switched between German and English.
16.	Project library (project-specific lists) can be displayed.
17.	Project library (analogous to BACtwin library)
18.	Project data (at least BACS function lists, BACS function descriptions, BACS automation schemes, BACtwin lists)

Table 19 BACtwin-capable planning tool

3.2 BACtwin-capable engineering tool

BACtwin-capable engineering tools are also an essential prerequisite for exploiting the high potential that the BACtwin concept offers for simplification, error prevention and quality improvement in BACnet projects.

BACnet manufacturers are recommended to import the BACtwin Library templates into their engineering tools.

A BACtwin-capable engineering tool should enable the data and functions listed in Tables 19 and 20 to be handled. Handling includes importing/entering, editing, saving and exporting in Table 20 line 19.

1. - 18.	Handling of data and functions according to Table 19 No. 1 to 18.
19.	Implementation documents (at least BA function lists, BA function descriptions, BA automation schemes, BACtwin lists)
20.	All BACnet objects and properties used can be switched visibly.
21.	Reverse engineering (optional).

Table 20 BACtwin-capable engineering tool

3.3 BACtwin-capable scan tool

When using the model-based BACtwin concept, the BACnet systems and project data should be automatically checked for compliance with the specifications and consistency. A scan tool carries out a comprehensive inventory and visualization of the BACnet project data in automation stations.

A BACtwin-capable scan tool should meet the requirements of Table 21:

1.	Scan and read BACnet devices: display objects used, properties, parameters.
2.	Export used objects, properties, parameters.
3.	Display and export used objects and properties for selected functional areas as BACtwin lists.
4.	Data exchange formats XLSX/CSV, XML/JSON

Table 21 BACtwin-capable scan tool

3.4 BACtwin-capable test tool

A test tool check:

a) the BACtwin planning against the operator requirement,
b) the automation stations against the BACtwin project data from the planning.

A BACtwin-capable test tool should meet the requirements of Table 22:

1.	Import/enter BACtwin Library (including operator requirement).
2.	Read in BAC planning data.
3.	Read BAC execution data.
4.	Compare a) the data from lines 2 with 1., present comparison results, comment and save.
5.	Compare b) the data from lines 3 with 2., present comparison results, comment and save.
6.	Exporting the comparison results a) and b) in XLSX/CSV, JSON/XML, HTML and PDF

Table 22 BACtwin-capable test tool

The functions of the BACtwin-capable scan tool (Table 21) and BACtwin-capable test tool (Table 22) can be combined in one program.

Table 19 to Table 22 are available as **Worksheets 19 bis 22** in **Library 3**.

3.5 BACtwin-capable data exchange

The standardized BACtwin data enables important analyzes and optimizations that improve the reliability, cost-effectiveness and sustainability of the BA systems. The BACtwin data model forms the database for the use of corresponding SW tools. When using the SW tools, automated import and export processes are helpful and recommended.

The BACtwin-capable data exchange serves the following purposes:

- Support integration of the BACtwin data model into BACtwin-enabled tools.
- Support the exchange of BIM information in/to BACtwin-enabled planning tools.
- Exchange of the results of BACnet planning in a machine-interpreTable, 1:1 verifiable form.
- Transfer of planning results to BACtwin-capable engineering and testing tools.
- Export of the BACnet engineering results in a 1:1 verifiable form.
- Export of test results from test tools for target/actual comparisons and acceptance.
- Import of planning results into simulation software for functional analysis.
- Support transfer of data records from the BA system for TMon analysis and operational optimization [AMEV TMon 2020].
- Export of operating data from the MOU for operational monitoring (e.g. aggregate addresses, message texts, trend recordings, meter readings).
- Export of operating data from the BAC system for sustainability reports (e.g. ESG reporting), CAFM analyses, (BIM) space management and energy data management in existing buildings and new buildings [AMEV Energy and Costs in competitions 2014].

Lossless data exchange must be ensured during the import and export processes described above. In order to avoid media disruptions, loss of information, double work, etc., it is essential to use **uniform data exchange formats**.

So that BACtwin systems can be implemented with as little work as possible and optimal work quality, the following is recommended:

The Tables and templates of the BACtwin Library are created in **XLSX** data format.

BACtwin-capable SW tools should be able to import the Tables from the BACtwin libraries. To enable further editing, the planning tools must be able to export BA planning data as BACtwin lists in an editable form.

BACtwin-capable planning, engineering and testing tools should also be able to support the **JSON or XML** data formats. Both data formats enable media-free data exchange and direct further processing of BAC mass data.

The BACtwin Table is recommended as a template for exchanging BACtwin project data in JSON or XML format.

In addition, the MOU should be able to transfer dynamic data from the BAC system to other IT systems (e.g. CAFM, ERP) via a secure interface.

The BACnet web service (BACnet/WS) in accordance with DIN EN ISO 16484-5 is preferably recommended for this. In Annex W to Z, the BACnet standard normatively defines the BACnet/WS RESTful WEB SERVICE INTERFACE and the XML and JSON formats for the BACnet web services. BACnet Web Services support TLS version 1.3.

The following Figure shows an example of BACtwin-capable data exchange in JSON format (according to Annex Z of the BACnet standard).

```
{
  "$base": "Object",
  "displayName": "ORTS-BAS_420_VTA01_HZK01_HZV_PPE01_MOT01_SB~01",
  "acked-transitions": {
    "$base": "BitString",
    "value": "to-offnormal;to-fault;to-normal"
  },
  "description": {
    "$base": "String",
    "value": "Verteilanlage Heizkreis Muster Pumpe 1 Schaltbefehl"
  },
  "device-type": {
    "$base": "String",
    "value": "BO Schaltbefehl"
  },
  "elapsed-active-time": {
    "$base": "Unsigned",
    "value": "123"
  },
```


Figure 10 BACtwin-capable data exchange in JSON format (example)

The data formats **JPG, PNG, SVG, DXF** or **DWG** are recommended for data exchange of graphics.

For importing, for example, location information from BIM and exporting, for example, plant information in BIM, BACtwin-capable tools should have a **bidirectional IFC interface**.

4 Additional notes for BACtwin implementation

4.1 BAC planning, participation of other project participants

Chapter 4 explains the standardization of special technical issues. In addition, standardized responsibilities are recommended for the many changing project participants (building construction, TBS and BAC planning, executing trades, etc.) in order to enable consistent implementation specifications and smooth implementation processes. User-specific specifications can be defined in Table 27.

In the case of a construction project, the builder/operator must ensure that the requirements for the BAC are fully taken into account across all trades. To this end, he prepares documents such as operator concepts and specifications in accordance with [VDI 3814 Blatt 2.1], which are mandatory for all planners (BAC, building services, building construction, etc.) and executing companies.

In the BAC specification, the templates of the BACtwin Library (e.g. addressing, object and aggregate templates) and the specifying operator requirement are integrated as a neutral, predefined basis for BAC planning and execution with BACnet (see 4.11).

The BACtwin Library supports BAC planning, but does not replace it. Even in BACtwin projects, the builder or operator should consult qualified BAC planning at an early stage. BAC planning should use a current BACtwin-capable planning tool.

For the commissioning the BAC planning, the operator requirement, the performance profile BAC according to [VDI 3814 Sheet 2.2] and the respectively valid recommendations of [AMEV BACnet 2017] and [AMEV BAC 2023] are recommended. In addition, reference is made to Chapter 3, BACtwin-capable software tools and data exchange.

On the basis of the [HOAI], [VDI 3814 Blatt 2.2] specifies the basic services of BAC planning include, for example, clarifying the use of existing addressing keys in [HOAI] service phase SP 1 Basic Determination and applying an existing addressing key up to the plant level in SP 2 Preliminary Planning. In SP 3 Design Planning, they include applying an existing addressing key up to the operating equipment level, and in SP 5 Execution Planning, applying an existing addressing key up to the functional level (UAK).

The following figure shows the phase-specific completion of the addressing key (location UAK and function UAK). In service phase SP 2, SP 3 and SP 5, the responsible specialist planners (e.g., KG 400) apply the existing addressing key to the level of detail shown according to the service phase.

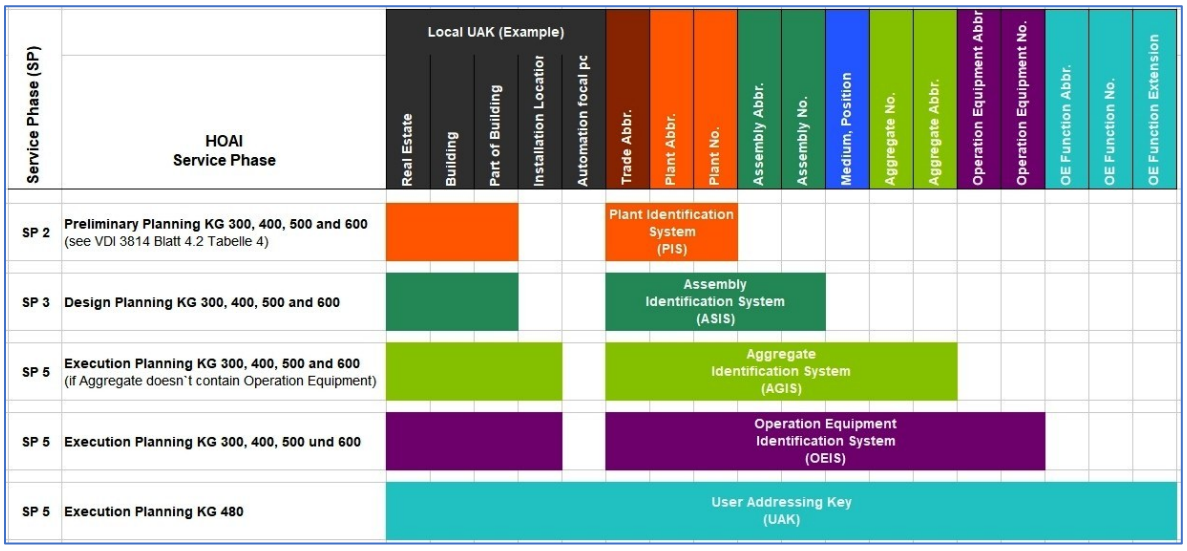

Figure 11 UAK in accordance with HOAI service phases

The Figure 11 is available as Worksheet 4.3 in Library **1**.

The aggregate templates cover the majority of the required BACtwin templates for standard aggregates. For the overall function of the plants, it is usually unavoidable that the BA planning also develops project aggregates and project assemblies based on the BACtwin templates.

The object templates do not provide fixed parameters for certain BACS functions with wide areas of application, but instead provide permissible value ranges (default values). With these default values, the BAC planning must specify the parameters that make sense for the project. As a prerequisite for its services, BAC planning requires certain information and work results (e.g. lists of technical information) from other project participants (e.g. builder/operator, building planning, TBA planning).

The information required by BAC planning and the BACS documents to be created by BAC planning are listed in [VDI 3814 Sheet 2.2] and presented in [VDI 3814 Sheet 4.2] in ediTable Table form (see Table 3 Checklist for Building Automation Planning).

The client must ensure that the other project participants provide the information required for system integration at an early stage in accordance with [HOAI] of the BAC planning (see 4.10).

4.2 Character set and minimum number of characters

BACtwin-capable devices must support the character set UTF-8.

In addition, BACtwin-capable devices must support the Minimum Character_String_Length according to Table 23.

The minimum number of characters is based on Table K-4 of the BACnet standard [DIN EN ISO 16484-5]. In State_Text, the number mentioned applies to all required states of multi-state objects (see Library 2, Tables 8.9 and 8.10).

No.	Property	AMEV profile	
		MOU	AS-C and AS-D
1	2	3	4
1	Object_Name	**64**	**64**
2	Description	**255**	**255**
3	Profile_Name	**64**	no specification
4	Device_Type	**64**	**64**
5	Inactive_Text	**32**	**32**
6	Active_Text	**32**	**32**
7	State_Text (per state)	**32**	**32**
8a	Event_Message_Texts (per transition)	**255**	**255**
8b	Event_Message_Texts_Conf (per transition)	**255**	**255**
9	Location	**64**	**64**
10	Vendor_Name	**64**	no specification
11	Model_Name	**64**	no specification
12	Application_Software_Version	**64**	no specification
13	Firmware_Revision	**64**	no specification

Table 23 Minimum Character_String_Length

4.3 Priority control, commandability

Each BACnet object that can be controlled by an application has a Priority_Array property that can set the Present_Value property.

Output objects (AO, BO, MO) and virtual objects (AV, BV, MV) require Priority_Arrays e.g. for prioritization when switching control commands or setpoint specifications.

The Priority_Arrays prioritize these control commands so that applications with higher priorities override applications with lower priorities.

Table 24 defines the priorities of the Priority_Array in a BACtwin system in further development of [KBOB recommendation BACnet application]. Some Priority_Arrays serve as reserves for special use cases (see Column Description, example).

Priority _Array	Application ([DIN EN ISO 16484-5] Tab. 19-1)	Recommendation	Description, example
1	Manual Life Safety	Manual Life Safety	e.g. Key control fire department
2	Automatic Life Safety	Automatic Life Safety	e.g. Fire switching/overcontrol by a fire emergency control
3	Available		(Reserve)
4	Available		(Reserve)
5	Critical Equipment Control	Critical Equipment Control	Override of the minimum on/off switching times if the overall damage prevented would be greater than possible damage to the device
6	Minimum On/Off	Minimum On/Off	Switch-on/off times of objects, e.g. B. compressor refrigeration machine
7	Available		(Reserve)
8	Manual Operator	Manual Intervention	Manual switching via MOU, BAE, AS or HMI by a user
9	Available		(Reserve)
10	Available	Higher-level automatic operation	Override by central function, e.g. plaster lighting
11	Available		(Reserve)
12	Available	Timer	The object to be controlled is described by the Schedule object
13	Available		(Reserve)
14	Available		(Reserve)
15	Available	Automatic operation	Functions of the control of the automatic operation (program)
16	Available		(Reserve; previously: automatic operation)
-	Relinquish_Default	Relinquish_Default	Is used when configuring in the object set

Table 24 Priority_Array

If an organization has Priority_Array solutions that have proven themselves in the BAC inventory, they can also be used in BACtwin projects.

All BACnet devices used must comply with the profiles in Table 6. However, simplifications are possible in project planning depending on the specific use for certain properties of the value objects.

The following Figure shows the types of usage of the value objects with examples and permissible simplifications of the affected properties.

Value object Usage Types	Example	Usage Type ID	Affected properties	Requirements for affected properties
Value object behaves like a commandable output object.	Control signal with AV object	**CB** (commandable)	Priority_Array	Priority_Array is necessary.
			Reliquish_Default	Relinquish_Default is wriTable.
			Present_Value	Present_Value is commandable.
			Out_Of_Service	Out_Of_Service does not have to be wriTable.
Value object uses wriTable parameters for which controllability is not useful.	Parameters for a regulation or control	**WB** (writeable)	Priority_Array	Priority_Array is not necessary.
			Reliquish_Default	Relinquish_Default is not necessary.
			Present_Value	Present_Value is wriTable. ***Note:*** *Present_Value should not reset when Out_Of_Service is reset to False.*
			Out_Of_Service	Out_Of_Service is wriTable.
Value object behaves like a non-commandable input object.	Feedback value or setpoint calculated with AV object	**RB** (readable)	Priority_Array	Priority_Array is not necessary.
			Reliquish_Default	Relinquish_Default is not necessary.
			Present_Value	Present_Value does not have to be wriTable. However, Present_Value becomes wriTable if Out_Of_Service has the value True.
			Out_Of_Service	Out_Of_Service is wriTable.

Figure 12 Value objects with or without commandability

Figure 12 is available as Worksheet 24.1 Value Objects in the Library 3.

The object templates of value objects are marked with their usage type ID in the Worksheets 8.**2 AO_AV, 8.4 BO_BV and 8.10 MO_MV** in Library 2.

4.4 Alarm und event management

Alarm and event management is used to document and manage all messages in the entire system. All reports and information must be kept decentralized by the AS. The current information must be accessible at any time from every MOU in the network. The operator must be able to acknowledge and reset alarms using MOU so that consistent alarm handling is guaranteed right up to the AS.

BACnet offers two different methods for alarm and event management:

- **Intrinsic reporting**
  Object-internal reporting supports message generation based on a single event (e.g. when the lower and upper limit values are exceeded (properties Low_Limit and High_Limit in analog objects) or when state changes occur in binary and multi-level objects. The message is conFigured in the object itself.

- **Algorithmic change reporting**
  Rule-based reporting is used to generate reports according to a specified algorithm from one or more properties of one or more objects. The message is generated in an additional object of type Event Enrollment.

A large number of simple situations in which an alarm should be generated can be conFigured using Intrinsic Reporting (or COV/COS). The Library 2 shows examples of simple alarms in Table 8.1 AI templates (see Properties Low_Limit and High_Limit, COV).

Complex situations can be conFigured more flexibly with Algorithmic Change Reporting. For example, to increase the efficiency class of buildings through energy-relevant alarms, it makes sense and is necessary to use algorithmic change reporting for these alarms. Algorithmic change reporting then monitors e.g. manual interventions or deviations from switching states. When displaying complex alarms with Algorithmic Change Reporting, the relationships between original and mirrored data points in the EE object are transparently conFigured and can be recognized on the BACnet user interface or by testing tools. In BACnet systems with large, complex alarms, Algorithmic Change Reporting can be used as the sole alarm method to enable automated configuration checks.

The **Library 2** contains examples for algorithmic change reporting with event enrollment objects in Table 8.8 EE templates.

4.4.1 Notification class

The Notification Class objects are used to manage the recipients, priorities and acknowledgment requirements of BACnet alarms. The notification classes are specified in the Notification_Class property. The classifications describe the alarm category for system messages.

Table 25 below contains an overview of the recommended reporting classes. Message classes that are not required can be deselected (see Section 4.11). The operator requirements for reporting classes must be adhered to.

No.	Object_ Identifier	Reporting class designation	Priority	Ack_Required
1	NC100	Notification class Danger People	{10,11,110}	{true,true,true}
2	NC150	Notification class Danger Property	{15,16,115}	{true,true,true}
3	NC200	Notification class Alarm	{20,21,120}	{true,true,false}
4	NC250	Notification class Pre-alarm	{25,26,125}	{true,true,false}
5	NC300	Notification class Fault	{30,31,130}	{true,true,false}
6	NC350	Notification class Abnormal	{35,36,135}	{false,false,false}
7	NC400	Notification class Maintenance	{40,41,140}	{false,false,false}
8	NC425	Notification class Maintenance (can be acknowledged)	{42,43,142}	{true,false,false}
9	NC450	Notification class Revision	{45,46,145}	{false,false,false}
10	NC500	Notification class Local override	{50,51,150}	{false,false,false}
11	NC600	Notification class System	{60,61,160}	{true,false,false}
12	NC700	Notification class Trend	{70,71,170}	{false,false,false}
13	NC800	Notification class Miscellaneous	{80,81,180}	{false,false,false}

Table 25 Notification class

The three states „to-offnormal,to-fault,to-normal“ are defined for each NC instance in the property priority of the NC objects. Table 26 contains recommended parameters. The use of different priorities for the different states serves to classify the messages according to priorities or according to the causes of the messages.

In the Ack_Required property (acknowledgment required) of the NC objects, the requirements for acknowledging messages are conFigured with three specifications {to-offnormal,to-fault,to-normal}. Table 26 contains recommended parameters (see also Table 8.7 NC templates). Project-specific specifications must be made in the Recipient_List property of the NC objects.

Depending on the cause of the message, the messages are assigned to either the “Alarm” or “Event” type. The assignment is made in the object templates via the Notify_Type property, in which e.g. B. Fault and alarm messages are generally assigned to the “Alarm” type and non-critical messages such as operational messages and TL messages are assigned to the “Event” type.

Feedback from local priority operation must be provided and must trigger an alarm with message class NC500 (manual intervention) when the status changes to manual operation.

4.4.2 Event_Type

The following Event_Types are recommended to support Algorithmic Change Reporting (excerpt from BACnet standard Rev.16 Table 12-15):

Event_Type	Application example
Change_Of_Bitstring	Monitoring of hand positions on the module (Overridden) and hand positions via the control unit (Out_Of_Service)
Change_Of_State	Monitoring of states of binary or multi-level values (or Current_Command_Priortiy from Rev.22)
Change_Of_Value	Monitoring of setpoint changes
Command_Failure	Monitoring of execution controls
Floating_Limit	Monitoring of deviations
Out_Of_Range	Monitoring of limit values

Table 26 Event_Type für Algorithmic Change Reporting

4.4.3 Message text

The message texts in the Event_Message_Text and Event_Message_Text_Config properties contain information with which the BAC operators are informed about the type of alarms or events using three array entries (e.g. danger: ...).

In existing systems, the message texts were usually designed individually based on suggestions from the BACnet manufacturers or specifications from builders and operators. In BACtwin-capable systems, the message texts are standardized uniformly and manufacturer-neutrally.

Three variants can be used as message texts:

- **Variant 1**: Danger people: [plain text], error: [plain text], normal: [plain text]
- **Variant 2**: [UAK]/[Plaintext], [UAK]/[Plaintext], [UAK]/[Plaintext]
- **Variant 3**: [Plain text], [Plain text], [Plain text]

Plain text is usually the description, but it can also be chosen differently. The desired standard specification (Section 4.11) is entered in the object templates (except CAL and DEV).

The minimum character numbers for Event_Message_Text and Event_Message_Text_Config are listed in Table 24 Minimum Character_String_Length. This character count applies to each of the three array entries.

4.4.4 Event_Algorithm_Inhibit

Message shower suppression can be set up either with the Event_Algorithm_Inhibit property or the Event_Algorithm_Inhibit_Ref property.

Report shower suppression must be set up if a report results in further reports for technical reasons.

In order to avoid pulsating alarm messages (message showers) for I/O objects with the message classes NC300 (fault), NC400 (maintenance), NC420 (maintenance, acknowledgable) and NC450 (revision), an appropriate delay time must be entered in the Time_Delay property (see object templates in library 2).

4.4.5 Reliability suppression

The property Reliability_Evaluation_Inhibit can suppress the reliability check. but is not mandatory. If it is present, the reliability suppression must be switched off (i.e. test result: "FALSE").

4.4.6 Execution control

For execution control with intrinsic reporting (e.g. BO_SC[1]), the value that represents the physical state of the data point to be monitored must be programmed to the Feedback_Value of the output object.

The same procedure should be followed for execution control with algorithmic reporting (e.g. EE_CMDF[1]).

4.5 Time management

The MOU must be able to read and write access to the calendar and schedule objects in the network. The entries must be requested from the builder or operator and documented in the MOU by the person carrying out the work.

4.5.1 Calendar object

Calendar objects contain a list in which e.g. holidays, company holidays or other events can be entered on which an Exception_Schedule (special schedule) is valid. Entries are possible as a date (e.g. 01/01/2012), date range (e.g. 01/01/2012 - 06/01/2012) or recurring day (e.g. 06/01).

The number of calendar objects must be agreed with the builder or operator. If there is no coordination, at least **3 calendar objects** must be available per AS. At least **15 date** entries can be created per calendar object.

4.5.2 Schedule object

Schedule objects change states or values according to the setting values of weekly programs and special schedules and depending on the date and time. For example, acts on virtual data points such as “entire system operating mode”, on operating parameters such as setpoints or on physical output functions.

Each AS must provide at least the number of schedule objects required by system. At least **12 switching times (6x on-off)** per weekday can be created in each Property Weekly_Schedule. At least **6 date entries or calendar object references** can be entered in each Exception_Schedule property. At least **12 switching times (6x on-off)** can be created in each Exception_Schedule property.

4.5.3 Time synchronization

The operator must create a time synchronization concept that should take the following into account.

The AS must have an integrated and battery-backed system clock for autonomous operation. The automatic time synchronization in the **BACnet/IP** network must take place via a BACnet time master, usually the MOU. An additional time synchronization, e.g. B. via an NTP server must not be set up in parallel. The AS use the system time received from the BACnet Time Master.

In the **BACnet MS/TP** network, time synchronization can be done in different ways and must be considered on a project-specific basis.

4.6 Trend recording

The recording of process values for short- and long-term archiving takes place in the AS in TL objects. Trend recordings can severely impact BA performance on the network. Their use and configuration require special care. Only standardized properties from the BACnet objects may be recorded, not proprietary values. For control purposes, the property Log_DeviceObjectProperty must be maintained and evaluated.

TL objects are programmed in the AS to which the referenced objects are physically connected. All TL objects must be set up as ring buffers, i.e. Stop_When_Full = FALSE. If the number of newly saved trend values set in the Property Notification Threshold is reached, the TL object sends a message to the MOU that the trend values should be read out.

Notify_Type must be parameterized to “Event” in all TL objects. In TL objects, Event_Enable must only be parameterized to “to-normal” (special case: Buffer_ready).

Trend recordings can be set up either event-oriented (COV) or cyclically (POLLING). In the Library 2, these specifications are defined in Table 8.9 TL templates in the Logging_Type property.

Trend recordings with POLLING

TL objects that are intended to regularly document certain states, values or trends (e.g. consumption developments, measured values for adjustments or operational analyzes) must be created in the AS with fixed intervals in the Log_Interval property (in sec.) (POLLING).

All TL OBJECTS with POLLING must be synchronized. This is done by activating the Align_Interval property or specifying a fixed start time. The MOU must automatically query trend data regularly (e.g. at least every 24 hours) to ensure secure archiving without data gaps.

Trend recordings with COV

Only trends for irregular events (e.g. operational messages, setpoints) are recorded in the AS in an event-oriented manner using COV. With COV, only changes in the system status (COV) that exceed the set COV_Increment (change threshold) are recorded. The changes can be viewed in the buffer memory.

The COV_Resubscription_Interval property is only used for trend logs on third-party controllers.

4.6.1 Regulation

The standard parameters in the object templates contain the recommended setting values for standard aggregates. If project-specific aggregates are planned with the consent of the client or operator, the associated parameters must be checked by the BA planning and determined as required.

The standard parameters refer to the adjustment phase. The setting values for the properties Log_Interval (for POLLING) and COV_Increment (for COV) were chosen to be more sensitive for the adjustment phase than the setting values for later control operation, so that undesirable operating states can be detected early during adjustment.

In special cases (e.g. heat pump), trend recordings with POLLING (e.g. power, heat quantity) or COV (e.g. operating time, temperature) can be useful. The optimal setting must be determined during adjustment.

During commissioning, the selected parameters and all other recommendations must be tested by the adjustment management (ERM) according to [AMEV TMon 2020] with the help of data recordings (trend log) and the practical suitability must be verified on site.

If more suiTable parameters are determined during adjustment, these should - after coordination with the specialist planning - be preferred to the standard parameters and documented with the date (yymmdd) in the handover documents and handed over to the operator.

The network load must also be taken into account when adjusting: In order to limit the network load in regular operation to a sensible level, the last step in adjusting the trend log objects is to double the log intervals in the Log_Interval property using POLLING. For trend log objects using COV, the COV thresholds in the COV_Increment property are doubled.

4.6.2 Memory size and reporting threshold

The property Buffer_Size (memory size) of the AS must be dimensioned such that if the MOU fails, the trend recordings are retained on the AS for at least 24 hours.

Settings of 35 - 45% of the Buffer_Size are recommended for the Notification_Threshold property. A value of around 40% ensures that, in the event of technical disruptions in the network, a message can fail without causing data gaps. By staggering the Notification_Threshold setting values in the AS, the threshold values are not exceeded at the same time.

For increased requirements, Notification_Threshold should be chosen smaller, e.g. B. 10% of the Buf-fer_Size (approx. 1 day). At the same time, Buffer_Size must be made larger for storing the trend log data in the AS (e.g. 10 days supply).

In addition, a historization server should query the data cyclically.

4.7 Loop object

Controllers must be created according to the planned control strategy and set up with the associated parameters. The controller performance is checked during commissioning. To do this, certain objects must be set to trend (see Section 4.6.1 Regulation).

The Setpoint_Reference property (address of the setpoint) must contain a reference. The Setpoint property shows the value of the object in the Setpoint_Reference property.

In the loop objects of AS with the AMEV profile AS-C and AS-D, intrinsic reporting is not required (in contrast to AS with the AMEV profile AS-B). If intrinsic reporting is still used in loop objects, the properties are set up according to the specifications of the Loop object template (Library 2, Table 8.8).

4.8 Availability, number of outages, downtime

If technical reliability is particularly important and needs to be monitored in technical systems (e.g. conveyor systems, own power supply systems, low-voltage switchgear), e.g. the following parameters are used and continuously evaluated.

The operator specifies the plant-specific desired **reference period** in the operator requirements, e.g., day (1440 min.) or year (525600 min.).

The counter Availability Value (CAV) per reference period is determined from the reference period minus the sum of downtimes (not ready for operation, collective fault) in relation to the reference period.

The counter Number of Failures (CFL) counts the sum of the fault messages during the reference period.

The counter Failure Time Average (CTA) counts the sum of downtimes divided by the number of fault messages during the reference period.

The counter Failure Total Time (CTT) counts the number of downtimes during the reference period.plus the value from the previous reference period. The total time of the failures can be evaluated in order to initiate necessary follow-up measures (e.g. maintenance, repair or replacement of the system). In these cases, the count value is reset via a virtual BACnet object.

4.9 BACtwin-capable gateway, field device and compact system

Paragraph 71a of the Building Energy Act requires cross-manufacturer and cross-technology communication of all building technology systems and applications.

BACtwin-capable **field devices**, **gateways** and data processing systems of **compact systems** (e.g. for ventilation, air conditioning, heat recovery) must meet the minimum requirements for objects, properties, conformance codes and parameters that are necessary to reproduce the corresponding standard aggregates, assemblies or plants.

Proof of the BACtwin capability of compact systems must be provided by means of an AMEV attestation (see 4.10 BACtwin-capable integral building automation, penultimate Section).

If trade-specific building automation systems cannot meet the necessary requirements of the AMEV BACtwin, these technical data processing systems must be tendered separately from the trade and delivered (with proof of their BACtwin capability) by the data handling system installer. The BACtwin capability must be clarified in the planning phase between trade planners and building services planners.

The BACnet-capable gateways, field devices and data processing systems of compact systems must be implemented according to the BACtwin concept. The following points must be noted:

- The addressing must be set up in the property Object_Name according to user-specific location UAK and BACtwin UAK as well as in the property description with user-specific plain text.
- BACnet objects must be represented according to the BACtwin concept, actually made available to the operators and be able to be checked automatically.
- No additional objects may be billed to display the alarm if the alarm is provided with object-specific properties (intrinsic reporting).
- Schedules entered in the foreign protocol must be able to be operated and monitored in BACnet Calendar and Schedule objects.
- The alarm display on local operating and display devices must correspond to that in the BACnet objects, even when alarming is deactivated.
- The time synchronization via BACnet must be effective and any further time synchronization must be switched off.
- Trend log objects provided in BACtwin templates must also be provided for BACtwin-capable field devices and compact systems.
- The representation of the data recording on local operating and display devices must correspond to the recording in the BACnet Trend Log objects.
- For counters, the values can be executed with the object type AV (without property Device_Type) or with AI (like AV, but with property Device_Type). The aggregate templates use the AV templates defined in library 2.

4.10 BACtwin-capable integral building automation

Regulations such as [DIN EN 15232] Energy efficiency of buildings from 2012 and the following 2019 [ISO 52120-1] Energy performance of buildings describe a new, needs-oriented, optimized regulation and control (see Figure 2 [ISO 52120-1]).

In the past, plant automation (in VDI 3814) and room automation (in VDI 3813) were generally considered separately. With this perspective, the plant automation systems had to provide different media (e.g. heat, cold, air) and the room automation could use these media as required. The changed perspective according to [ISO 52120-1] was adopted with the merger of VDI 3813 and VDI 3814.

The most important objective according to [ISO 52120-1] is needs orientation, from which it follows, for example:

- Room automation must be equipped with occupancy detection devices.
- Transmit demand values from the room automation to the system automation, in order to enable needs-based and energy-saving generation, storage and distribution in the various system automation systems.
- Integration of system and room automation across media and systems, in order e.g. to prevent simultaneous heating and cooling and to exploit the energetic advantages of dead zones (zero energy band).

[VDI 3814 Blatt 2.2] defines system integration as the automation networking of individual technical subsystems and their functional integration into a BAC system. The **aim of system integration** is to set up a cross-trade BAC system for the area under consideration (e.g. building, property) and the technical systems contained therein with as few different communication protocols as possible (**minimization of communication interfaces**).

With BACtwin, the BACS information is available for needs-oriented operation regardless of the manufacturer. The neutral BACtwin data model offers a good basis for implementing integral regulation and control strategies in new buildings and renovations.

In the construction project, the builder/operator must involve the BAC planning already in [HOAI] service phase SP 1 Basic Determination in order to ensure the necessary integration planning for the room and system automation in accordance with the BAC operator concept.

According to [VDI 3814 Blatt 2.2] and [VDI 3814 Blatt 4.2], the basic services of BA planning in SP 1 Basic Determination include, among other things, the clarification of the tasks for the GA on the basis of the specifications or the client's requirements planning in consultation with the project planner and the parties involved in the other specialist planning. Of particular importance are the **addressing key** and the BAC specification sheet with the BACtwin-capable operator specification according to 4.11.

In SP 2 preliminary planning, the basic services of BAC planning include, among other things, the clarification and consideration of the BAC efficiency class ([DIN EN 15232]) or the degree of automation ([DIN V 18599-11]), the compilation of the requirements for the parties involved from the specification of the BAC efficiency class and the clarification of the scope of the system integration (i.e. application of the system integration Tables according to [VDI 3814 Blatt 4.2] at least in the first column "Integration").

In SP 3 Design Planning, the basic BAC services include, among other things, the definition of the scope of system integration (i.e. application of the system integration Tables).

The early involvement of BAC planning ensures that the BACtwin specifications are defined by BAC planning across trades for the components of the building construction (e.g. sun protection) and technical equipment (e.g. heating, cooling, lighting). These specifications must be implemented in the tenders of the respective trades.

Reference is made to German [Gebäudeenergiegesetz] Section 4 (public sector obligation to provide information) and Section 108 (1) No. 14 (administrative offenses).

4.11 BACtwin-capable operator requirement

For a large organization with extensive property, building and plant inventory (e.g. university, hospital, municipality, state or federal administration), BACtwin is already helpful for purely project-related use. However, the full advantage only comes into play when it is applied uniformly throughout the organization. For this purpose, **organization-wide BACS requirements planning** in accordance with [AMEV GA 2023] and [VDI 3814 Blatt 2.1] is recommended.

As part of the requirements planning, which defines quality objectives such as utility value and sustainability, the client/operator or on his behalf prepares a **BAC specification sheet** for a construction project. The builder/operator compiles the specifications for the BAC and for the systems to be integrated in the BAC specification.

The organization also uses the BAC specification as a standard template for the planning and execution services of further construction projects and as a basis for a quality management process accompanying the project or construction.

It is recommended that the builder/operator bindingly agree on the AMEV recommendation **BACtwin** together with the user-specific **operator requirement** as a BACnet-specific BAC specification in construction projects.

For this purpose, the specification of the operator requirement is used as a comprehensively predefined basis for the planning and execution of the BAC with BACnet and integrated into the BAC specifications as a binding specification.

In the operator requirement, the organization must complete the data model with the user-specific Location UAK (see Table 27, lines 4 to 6) and specify the functional UAK (see Table 28, lines 7 to 16) – analogous to the UAK example in Library 1.

In addition, the organization must decide on the variants possible in the BACtwin data model and determine which of the variants (e.g. Table 27, lines 26 and 27) should be implemented in her construction projects.

In the operator requirement, the organization must define a clear **Location UAK** for the entire real estate portfolio in the sense of a consistent minimum standard (example in Figure 2).

The organization can leave open the standard solutions to be executed for **reporting** using BI, MV or EE objects. Alternatively, undesirable methods can be excluded from LO/ID.

The possible options for **execution control** are to be treated in the same way.

Individual recommendations from BACtwin 2024 (e.g. length of the function UAK, description, property responsibilities) can be adapted by the organization across the organization or supplemented and documented on a project-specific basis.

However, **different specifications must not be made** due to different preferences and interpretations **in individual projects**, as this would result in the loss of essential advantages of the BACtwin concept. The possibility of neutral evaluations in accordance with [Building Energy Act] § 71a building automation must be retained.

In Table 27 Operator requirement, the organization must enter the selected data model options to be implemented in column 3 (as user-specific “**BACtwin settings**”).

Table 23 to Table 27 are available as **Worksheets 23 bis 27** in the Library **3.**

Detailed operator requirements should be specified in the BACnet specifications in verifiable Table form (based on the BACtwin Library). We recommend specifications in the form of export files, e.g. B. from a sample project of a BAC planning tool.

In the case of special solutions (e.g. individual templates for special objects, aggregates, assemblies and plants), significant advantages of the BACtwin concept are lost. Each special solution is associated with increased effort and risk, as it cannot be checked automatically with BACtwin-capable testing tools. For this reason, builders and operators should **avoid special solutions** as much as possible.

Please note:

In order to be able to close any gaps in standardization (e.g. innovations, proposals for better or new translation) in a timely manner and to adapt the BACtwin-capable tools, relevant contributions or inquiries are welcome to the AMEV office (please send an email to: amev@bmwsb.bund.de).

	Area	Recommendation AMEV BACtwin	Operator requirement
	1	2	3
1	**BACtwin specification**	Minimum standard of the operator	
2	**AMEV profile**	AS-C according to Library 2	
3	**AMEV profile**	AS-D according to Library 2	
4	**Location UAK**	Number of Location UAK blocks: ……	
5	Number of characters	Including separators): …… characters	
6	Example Location UAK	……	
7	**BACtwin UAK**	According to Library 1 and Section 2.1	
8	Syntax	According to Table 2	
9	Trade	Cost group according to DIN 276-1 (numerical)	
10	Plant	Addressing of partial plants	
11	Room automation	Adressing of room automation	
12	OE function extension	Terminal. with length difference (no tildes)	
13	Numbering	Two-digit numbering according to Section 2.1.9	
14	Number of characters	Including separators: …… characters	
15	Example BACtwin UAK	……	
16	Existing UAK	Translation tool according to Section 2.1.15	
17	**Description**	Blocks see example Description Section 2.1.11	
18	Number of characters	Including separators: …… characters	
19	**Object templates**	According to Library 2 and Section 2.3	
20	Priority Array	According to Library 3 and Table 24	
21	Notification Class	According to Library 3 and Table 25	
22	Priority Array	According to Section 4.4.3 Variant: ……	
23	Time synchronization	Operator concept according to Section 4.5.3	
24	Responsibilities	According to Library 3 and Table 17Table 17 Respon-	
25	**Aggregate templates**	according to Library 3 and Section 2.4	
26	Execution control	Variant 1.1 (BO). 1.2 (addit. EE):……	
27	Manual message LO/ID LO/ID	Variant 2.1 (BI). 2.2 (MV). 2.3 (EE): ……	
28	Assembly templates	According to Library 3 and Section 2.5	
29	Plant templates	According to Library 3 and Section 2.6	
30	**Planning tool**	According to Section 3.1 and Table 19	
31	**Engineering tool**	According to Section 3.2 and Table 20	
32	**Scan tool**	According to Section 3.3 and Table 21	
33	**Test tool**	According to Section 3.3 and Table 22	
34	**Data exchange formats**	According to Section 3.5	
35	**Implementation**	BACtwin implementation according to chapter 4	
36	Requirements planning BAC	According to Section 4.11 and [VDI 3814 Blatt 2.1]	
37	Performance profile BAC	Accord. to Section 4.1. 4.10 and [VDI 3814 Blatt 2.2]	
38	UAK acc. to HOAI SP	According to Section 4.1 and Figure 11	
39	Reference period	According to Section 4.8	
40	**Gateway. field device**	BACtwin-capable according to Section 4.9	
41	**Compact system**	BACtwin-capable according to Section 4.9	
42	**Integral BACS planning**	According to Sections 4.1 and 4.10	

Table 27 Operator requirement

5 Thanks for cooperation

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Bibliography and Sources

[Textmarke_Muster]	Alle Vorschriften und Referenzen sind mit Textmarken zu versehen, die bei Verwendung im Dokument per Querverweis, hier also als [Textmarke_Muster] eingebunden werden.
[AMEV BACnet 2017]	Arbeitskreis Maschinen- und Elektrotechnik staatlicher und kommunaler Verwaltungen (AMEV): BACnet in öffentlichen Gebäuden (BACnet 2017), Berlin 2017
[AMEV BA 2023]	Arbeitskreis Maschinen- und Elektrotechnik staatlicher und kommunaler Verwaltungen (AMEV): Hinweise für Planung, Ausführung und Betrieb der Gebäudeautomation in öffentlichen Gebäuden (Gebäudeautomation 2023), Berlin 2023
[AMEV TMon 2025]	Arbeitskreis Maschinen- und Elektrotechnik staatlicher und kommunaler Verwaltungen (AMEV): Technisches Monitoring (TMon 2025), Berlin 2025
[AMEV Energie und Kosten in Wettbewerben 2014]	Arbeitskreis Maschinen- und Elektrotechnik staatlicher und kommunaler Verwaltungen (AMEV): Energiebedarf und Lebenszykluskosten in Planungswettbewerben für öffentliche Gebäude (Energie und Kosten in Wettbewerben 2014), Berlin 2014
[DB Netze: BACnet Werkstandard 3.0]	DB Netze: BACnet Werkstandard 3.0, Standardisierung der BACnet Umsetzung bei der DB Station & Service AG, Entwurf August 2020, Berlin 2020 (unveröffentlicht)
[DIN EN 15232]	DIN EN 15232:2012-09 Energieeffizienz von Gebäuden - Einfluss von Gebäudeautomation und Gebäudemanagement
[DIN EN ISO 16484-1]	DIN EN ISO 16484-1:2011-03 Systeme der Gebäudeautomation (GA), Teil 1: Projektplanung und -ausführung, Berlin 2011
[DIN EN ISO 16484-5]	DIN EN ISO 16484-5:2017-12 Systeme der Gebäudeautomation (GA), Teil 5: Datenkommunikationsprotokoll, Berlin 2017
[DIN V 18599-11]	DIN V 18599-11:2018-09 Energetische Bewertung von Gebäuden - Berechnung des Nutz-, End- und Primärenergiebedarfs für Heizung, Kühlung, Lüftung, Trinkwarmwasser und Beleuchtung - Teil 11: Gebäudeautomation
[ISO 52120-1]	ISO 52120-1:2021-12 Energy efficency of buildings
[Fütterer, Schild, Müller: BA in der Praxis]	Fütterer, Johannes; Schild, Thomas; Müller, Dirk: Gebäudeautomationssysteme in der Praxis, RWTH Aachen, Aachen 2017
[Gebäudeenergiegesetz]	Gebäudeenergiegesetz (GEG) vom 8. August 2020 (BGBl. I S. 1728), zuletzt geändert am 16. Oktober 2023 (BGBl. I Nr. 280)
[HOAI]	Verordnung über die Honorare für Architekten- und Ingenieurleistungen (Honorarordnung für Architekten und Ingenieure - HOAI), Berlin 2021
[KBOB Empfehlung BACnet Anwendung]	Koordinationskonferenz der Bau- und Liegenschaftsorgane der öffentlichen Bauherren (KBOB): Empfehlung BACnet Anwendung, Bern 2017
[Kranz: BACnet Gebäudeautomation]	Kranz, Hans R.: „BACnet Gebäudeautomation 1.12 mit Update auf 1.19 Grundlagen in deutscher Sprache", 3. vollständig überarbeitete Auflage, cci Dialog GmbH Karlsruhe 2017, ISBN 978-3-922420-53-8

[Kranz, Fritzenwallner: Digitaler Zwilling]	Kranz, Hans R. und Dr. Fritzenwallner, Rupert: „Digitaler Zwilling der Gebäudeautomation mit BACnet, Anleitung zur aufwandsarmen Systemintegration, 1. Auflage, cci Dialog GmbH Karlsruhe 2019, ISBN 978-3-922420-66-8
[MBS BACeye]	MBS GmbH: BACeye Professional device control Benutzerhandbuch, Krefeld 2014
[Ramroth: Benutzerhandbuch BACnet Prüftool]	Ramroth, Bernhard: Benutzerhandbuch BACnet Prüftool, Dortmund 2019
[RWTH Aachen, EBC: BUDO Schema]	Buildings Unified Data point naming schema for Operation management; https://github.com/RWTH-EBC/BUDO?tab=readme-ov-file#readme
[Sewe: Automatisierte Fehlererkennung]	Sewe, Erik: Automatisierte Fehlererkennung in Heizungsanlagen (Dissertation), Universität Dresden, Dresden 2018 (vergl. Sewe, Erik: OBSERVE Arbeitspaket B.3 Fehleranalyse, Plenum Ingenieurgesellschaft für Planung Energie Umwelt m.b.H., Hamburg 2018)
[Siemens, Landis & Staefa: MSR-Planungshandbuch]	Siemens Building Technologies AG, Landis & Staefa Division BC: MSR-Planungshandbuch, 4. Auflage, Karlsruhe 1999
[Uni Basel: Bieterselbstauskunft]	Universität Basel: Bieterselbstauskunft (BSA), Basel 2020 (unveröffentlicht)
[Uni Basel: Technisches Regelwerk GA]	Universität Basel: Technisches Regelwerk Gebäudeautomation (TRW-GA), Basel 2020 (unveröffentlicht)
[VDI 3814 Blatt 2.1]	VDI 3814 Blatt 2.1:2019-01 Gebäudeautomation (GA), Planung - Bedarfsplanung, Betreiberkonzept und Lastenheft, Beuth Verlag, Berlin 2019
[VDI 3814 Blatt 2.2]	VDI 3814 Blatt 2.2:2019-01 Gebäudeautomation (GA), Methoden und Arbeitsmittel für Planung, Ausführung und Übergabe – Gebäudeautomation (GA) Planung Planungsinhalte, Systemintegration und Schnittstellen, Beuth Verlag, Berlin
[VDI 3814 Blatt 4.1]	VDI 3814 Blatt 4.1:2019-01 Gebäudeautomation (GA), Methoden und Arbeitsmittel für Planung, Ausführung und Übergabe - Kennzeichnung, Adressierung und Listen, Beuth Verlag, Berlin
[VDI 3814 Blatt 4.2]	VDI 3814 Blatt 4.2:2020-01 Gebäudeautomation (GA), Methoden und Arbeitsmittel für Planung, Ausführung und Übergabe Bedarfsplanung, Planungsinhalte und Systemintegration, Beuth Verlag, Berlin 2020
[VDI 3814 Blatt 4.3]	VDI 3814 Blatt 4.3:2022-07 Gebäudeautomation (GA) - Methoden und Arbeitsmittel für Planung, Ausführung und Übergabe - GA-Automationsschema, GA-Funktionsliste, GA-Funktionsbeschreibung, Beuth Verlag, Berlin
[VDI 6041]	VDI 6041 2017-07 Facility-Management - Technisches Monitoring von Gebäuden und gebäudetechnischen Anlagen, Beuth Verlag, Berlin
[Waide: Energy CO2 saving through building automation]	Waide Strategic Efficiency Limited.: The scope for energy and CO2 savings in the EU through the use of building automation technology, Manchester (UK) 2014

AMEV

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BACnet Certification Body

AMEV Attestation for Certified BACnet Devices

1. The following BACnet device is certified as per DIN EN ISO 16484-5:

Supplier		
Product name		
Product model number		
Standard device profile		**BACnet Protocol Vers. / Rev.**
Firmware revision		

Data link Layer Options	☐ **BACnet IP (Annex J)**	☐ **BACnet over LonTalk**
	☐ **BACnet MS/TP master**	☐ **BACnet MS/TP slave**
	☐ **MS/TP baud rates:** ……	
Stat. device Binding	☐ **Yes (for MS/TP only)**	
Networking Options	☐ **BBMD**	☐ **Registr. by external devices**
	☐ **Router, medium:** ……	
Character set	☐ **UTF-8**	
Reporting options	☐ **Intrinsic Reporting**	☐ **Algorithmic Reporting**

2. The device supports BACnet functions as per AMEV profile:

☐ **AMEV profile AS-C** .....
☐ **AMEV profile AS-D** .....

3. Basis for AMEV Attestation:

☐ **Test report of Test lab** …….. dated…... number ……
☐ **AMEV recommendation BACtwin version year:** ..... (see www.amev-online.de)

4. The AMEV Attestation is only valid in combination with the certificate:

☐ **Certificate number.**……(see http://bacnetinternational.net/btl/)

(location, date) ……

…… (AMEV chair BACnet)

…… (BACnet Certification Body)