

Delivery no.: D2.6b Data Collection System SAT test



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**DTU, CEE PLDK
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Public deliverable

Confidential deliverable

Preface

EnergyLab Nordhavn – New Urban Energy Infrastructures is an exciting project which will continue until the year of 2019. The project will use Copenhagen's Nordhavn as a full-scale smart city energy lab, which main purpose is to do research and to develop and demonstrate future energy solutions of renewable energy.

The goal is to identify the most cost-effective smart energy system, which can contribute to the major climate challenges the world are facing.

Budget: The project has a total budget of DKK 143 m (€ 19 m), of this DKK84 m (€ 11 m) funded in two rounds by the Danish Energy Technology Development and Demonstration Programme (EUDP).

Forord

EnergyLab Nordhavn er et spændende projekt der løber til og med 2019. Projektet vil foregå i Københavns Nordhavn, og vil fungere som et fuldskala storbylaboratorium, der skal undersøge, udvikle og demonstrerer løsninger for fremtidens energisystem.

Målet er at finde fremtidens mest omkostningseffektive energisystem, der desuden kan bidrage til en løsning på de store klimaudfordringer verden står overfor nu og i fremtiden.

Budget: Projektets totale budget er DKK 143 mio. (EUR 19 mio.), hvoraf DKK 84 mio. (EUR 11 mio.) er blevet finansieret af Energiteknologisk Udviklings- og Demonstrationsprogram, EUDP.

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List of Abbreviations

List of documents

1. Role description

Executive Summary

This document, D2.6b is part of WP2 deliveries. The document describes the tests needed to be executed and passed in order for the Data Management System called energydata.dk to pass the System Acceptance Test.

A successful test is one of the prerequisite for the project to pass milestone M4.

Resumé

In this test it is verified that:

- Users can be created
- A data set can be defined (setting the meta data)
- Data can be read into the system via an API from a data source
- Access right to data can be managed (access to data / restricted access)
- Data reports can be created and made available.
- It is possible to define a new data set based on existing measurement.
- Data read into the system equals data in corresponding reports.

Version Control

Version	Date	Author	Description of Changes
0.1	2017-11-07	Christian Brandt Rasmussen	First draft version
0.2	2017-11-22	Anders Laage Kragh	Test for different user types and groups are added, data-set with properties added
0.3	2017-11-23	Anders Laage Kragh	Updated chapter 3.4 and chapter 3.5 with new text for defining data-set. Included Appendix B describing the data model
0.4	2017-11-28	Anders Laage Kragh	Updated after review. Summary and resume included. Appendix C added. Text updated to reflect that no user base group admin exist. Prerequisites for executing the test are included.
0.5	2017-12-12	Anders Laage Kragh	Updated after mail review
0.6	2017-12-12	Anders Laage Kragh	Clean version with all changes accepted
0.7	2017-12-15	Anders Laage Kragh	Some minor correction and updated with test results from test executed 2017-12-14.
0.8	2018-02-22	Anders Laage Kragh	Change chapter 4 to portrait lau-out
0.9	2019-01-25	Anders Laage Kragh	The conclusion has been added.

Quality Assurance

Author	Reviewer	Approver
Christian Brandt Rasmussen	Benny Stougaard Hansen	WPL group
Anders Laage Kragh	Benny Stougaard Hansen	WPL group

Status of deliverable		
Action	By	Date/Initials
Sent for review	Anders Laage Kragh, DTU	Jan. 2018
Reviewed	Benny Stougaard Hansen, ABB	26 Feb. 2018
Verified	Benny Stougaard Hansen, ABB	26 Feb. 2018
Approved	WPL group	29 jan. 2019

1. Purpose

The purpose of the data collection system acceptance test is to verify and document the dataflow from being received in the data queue system through all internal processes till data is stored in the database and is extracted through a simple user interface. The test must be fully compliant with and verify all functions as described in the M4: "Data Management System in Operation" milestone description.

2. Prerequisites

It is prerequisites for executing these test that:

- Integration to DTU user base is established, i.e. user credentials are fetched from DTU user base
- Integration to DTU mail system is done, i.e. it shall be possible to send mail from energydata.dk to a user using the DTU mail server.
- Data from sensors can be loaded to the system using the appropriate API including the required configuration.
- A copy of the data used for test shall be created, see Appendix Data flow for test

3. Test description

In the following the tests are described with purpose, method for execution. Test sheet to fill during testing also contains criterions for acceptance (expected outcome).

The test execution gives an example of a natural workflow in the system administration process, but several of the functionalities can be handled by both the system and the data administrators meaning that other workflows are possible.

The KNX data stream from temperature sensors mounted in ceiling, wall and floor of an apartment in Energylab Nordhavn will be used as test case. The data is followed from KNX Interface/bridge, trough data queue to data stream engine and database respectively.

The apartment A42 in the Terra Nova building is used in the test.

3.1 System access

Necessary profiles are created in order to setup the measurement points in the system and to test the dataset search and extractions activities.

- Login as user 0, to create the user who will be given system administrator privileges.
- Login as user 1, to create the user who will be given data administrator privileges
- Login as user 2, to create the user who will be given user-group administrator privileges
- Login as user 3, to create the user who will be a member of group 1
- Login as user 4, to create the user who will be a member of group 2
- Add user 0 to a group with System Administrator role directly in the database
- Login as system administrator and do the following:
 - Create the domain for Energylab Nordhavn KNX data source
 - Create a group for ELN KNX Data Administrators, assign the role of Data Administrator to it, and add user 1 to this group
 - Create a group for ELN KNX Group Administrators, assign the role of Group Administrator to it, and add user 2 to this group
 - Create token for Bachata

3.2 Create groups and assign users

Create user groups and users and assign privileges to these.

Login as user 2 (with user-group administrator privileges) and do:

- Create user group 1, and add user 3 to this group
- Create user group 2, and add user 4 to this group
- Log-out

Note that user group 1 has no access to data.

	User 0	User 1	User 2	User 3	User 4
System administrator privileges	x				
Data administrator privileges		x			
User group administrator privileges			x		
Member of group 1				x	
Member of group 2					x

Table 1 Overview of users and privileges

3.3 Receive data from specific data source and store in Cassandra

- Log on as data administrator
- Create dataset for each selected measurement points (see 3.4)
- Create metadata properties for each measurement point (see 3.4)
- Create token for MQTT client
- Validate data flows
 - Subscribe on MQTT
 - Subscribe on Kafka
 - Check data in Cassandra

3.4 Create dataset for selected measurement points individually

Dataset for measurement point with KNX group address 0/0/1, 0/0/2 and 0/0/4 (see Table 2) shall be created as following:

- Dataset
 - **Name:** [Apartment-ID] / [KNX group address] – select from Table 2
 - Description: Temperature measurements from sund_data

- Properties
 - Property type: slow
 - Key: “Type”
 - Datatype: string
 - Value: PT1000

 - Property type: slow
 - Key: “Unit”
 - Datatype: string
 - Value: DegC

 - Property type: slow
 - Key: “Vendor”
 - Datatype: string
 - Value: ABB

 - Property type: slow
 - Key: “Placement”
 - Datatype: string

- Value: “ select value from place Table 2 Sensor placement and KNX addresses
- Property type: fast
- Key: “Measurement”
- Datatype: Double
- Topic: elnknx/sund_data/0/0/1

- Property type: slow
- Key: “KNX Group Address”
- Datatype: string
- Value: “ select value from place Table 2 Sensor placement and KNX addresses

The table below shows KNX group addresses with corresponding placement codes for apartment A42 with apartment-ID: sund_69_05_15.

Apartment-ID	KNX Group address	Placement code
sund_69_05_15	0/0/1	TT0101
sund_69_05_15	0/0/2	TT0102
sund_69_05_15	0/0/3	TT0103
sund_69_05_15	0/0/4	TT0201
sund_69_05_15	0/0/5	TT0202
sund_69_05_15	0/0/6	TT0203
sund_69_05_15	0/0/7	TT0204
sund_69_05_15	0/0/8	TT0205
sund_69_05_15	0/0/9	TT0206
sund_69_05_15	0/0/10	TT0301
sund_69_05_15	0/0/11	TT0302
sund_69_05_15	0/0/12	TT0303

Table 2 Sensor placement and KNX addresses

For the placement code interpretation refer to appendix A

3.5 Create a data set with reference properties

Aim is to create a new data-set which contain all type 1 sensors

Create a new data set following the procedure in 3.4 for KNX group address 0/0/1 and 0/0/2

Create a reference data set this way:

- Dataset
 - **Name:** Type 1 sensors
 - Description: Type 1 sensors

- Properties
 - Property type: reference
 - Key: [apartment-ID] + [placement code] from Table 2
 - Dataset: [select a dataset with type 1 sensor matching the key-value]
 - Property: Measurement

- Property type: reference
- Key: [apartment-ID] + [placement code] from Table 2
- Dataset: [select a dataset with type 1 sensor matching the key-value]
- Property: Measurement

3.6 Grant access to data-set

Provide access to the data set created in 3.4 and 3.5 to a user group.

Login as user 1 (user with data administrator privileges) and do:

- Assign access to data created in 3.4 and 3.5 for user group 2
- Logout

3.7 Data query, streaming and extraction

Data search and extraction is checked through standard user interface.

- Log on as user 4
- Search/choose dataset
- Choose date (from and to)
- Choose export
- Receive link for data download through email.
- Download data file
- Check that the downloaded data file match the loaded data (expected data).
- Logout

- Log on as user 3
- Search/choose dataset
- When the dataset is chosen, verify that no data is listed – because user has no access to data..

Repeat above test for dataset created in 3.4 and 3.5.

4. Test sheet

Test schema for testing

Action	Expected outcome	Result	Acceptance ✓
System Access			
Login as user 0, to create the user who will be given system administrator privileges.	Login accepted		✓
Login as user 1, to create the user who will be given data administrator privileges	Login accepted		✓
Login as user 2, to create the user who will be given user-group administrator privileges	Login accepted		✓
Login as user 3, to create the user who will be a member of group 1	Login accepted		✓
Login as user 4, to create the user who will be a member of group 2	Login accepted		✓
Add user 0 to a group with System Administrator role directly directly in the database	User 0 is added to system admin group		✓
Log on as system administrator	Successful login		✓
Create the domain for Energylab Nordhavn KNX data source	Domain configured		✓
Create a group for ELN KNX Data Administrators, assign the role of Data Administrator to it, and	The group is created with data admin rights and user 1 is included in the group, i.e. user 1		✓

add user 1 to this group	has data admin credentials		
Create a group for ELN KNX Group Administrators, assign the role of Group Administrator to it, and add user 2 to this group	The group is created with group admin rights and user 2 is included in the group, i.e. user 2 has group admin credentials		✓
Create groups and assign users			
Login as user 2	Login successful		✓
As user 2 create user group 1 and add user 3 to this group	Group 1 is created and user 3 is included in the group		✓
As user 2 create user group 2 and add user 4 to this group	Group 2 is created and user 4 is included in the group		✓
Receive data from specific data source and store in Cassandra			
Log on as data administrator	Successful login		✓
Create dataset for each selected measurement point	Dataset created		✓
Create token for MQTT client	Token created		✓
Subscribe on MQTT	Check data is arriving. Validate data is according to source		✓
Subscribe on Kafka	Check data is arriving. Validate data is according to source		✓
Check data in Cassandra	Check data is arriving. Validate data is according to source		✓
Create a data set with reference properties			
Login as data administrator	Login successful		✓

Create a data set with reference properties, ref 3.5			✓
Grant access to data-set			
Login as user 1	Login successful		✓
Assign access to data created in 3.4 and 3.5 for user group 2	Access will be validated in coming test – or can it be checked in some system tables?		✓
Logout			✓
Data query and export			
Login as user 4			✓
Located and select dataset			✓
Set date to and from, search for data	Data found		✓
Download dataset from email link	Dataset downloaded	Due to missing SMTP no mail was received but it was checked and confirmed by consulting the system log, that the link was created	(✓)
Check dataset	Dataset matches chosen dates and corresponds to data from the source.		✓
Logout	Logout is succesful		✓
Login as user 3			✓
Set date to and from, search a dataset	Dataset is found		✓
For the selected data set	Verify that no data is listed – because user 3 has no access to data		✓

5. Conclusion

The acceptance test has verified that:

- Users can be created
- A data set can be defined (setting the meta data)
- Data can be read into the system via an API from a data source
- Access right to data can be managed (access to data / restricted access)
- Data reports can be created and made available.
- It is possible to define a new data set based on existing measurement.
- Data read into the system equals data in corresponding reports.

The above functionality has after the execution of the acceptance test been improved further with more functionality, e.g.:

- Batch definition of data-set (meta data)
- API for inserting data via the MQTT
- API for query and export data
- Support for controlling external devices
- A simple GUI for accessing and managing the system

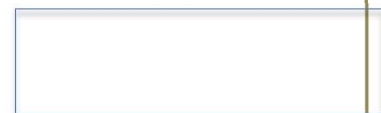
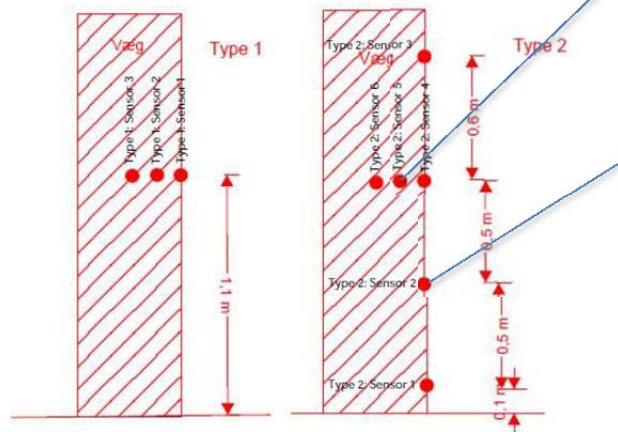
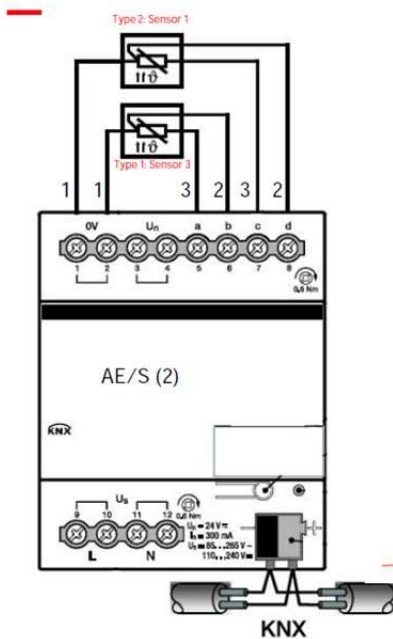
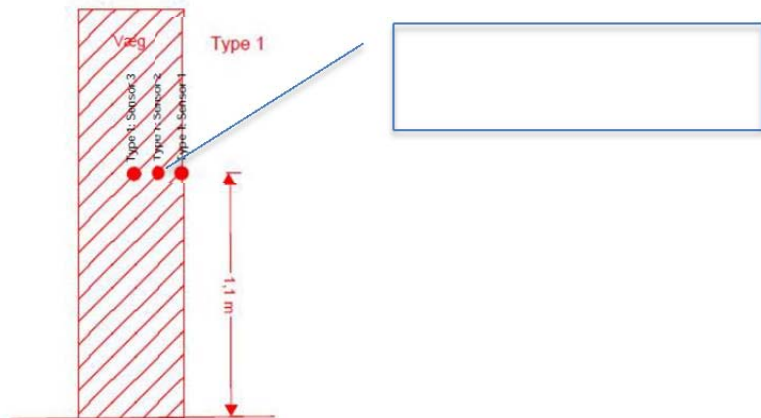
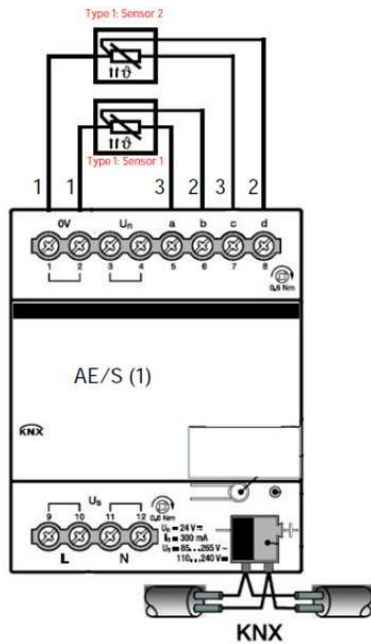
In addition, since the finalization of the acceptance test and until now, data from 13 different data providers has been incorporated in the system.

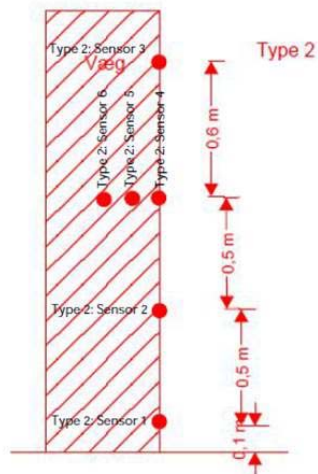
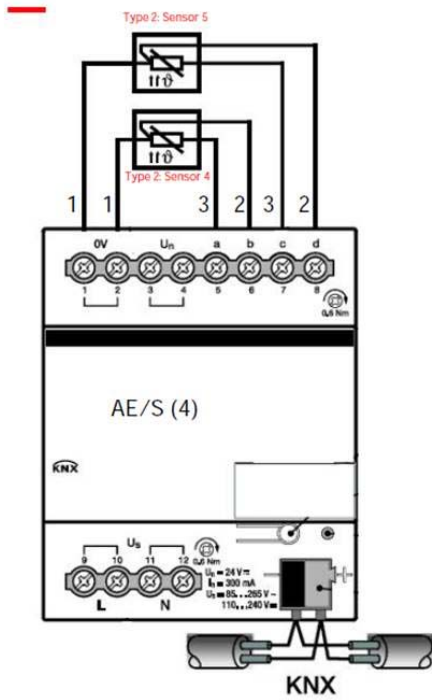
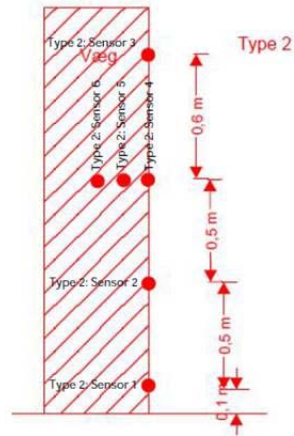
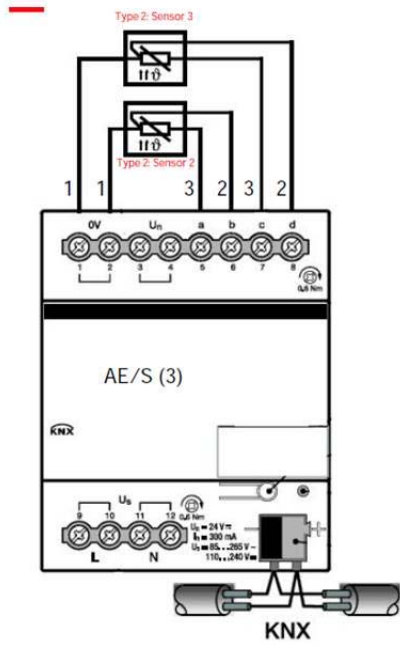
It can therefore be concluded, that a workable data collection and data warehouse solution is available for the project.

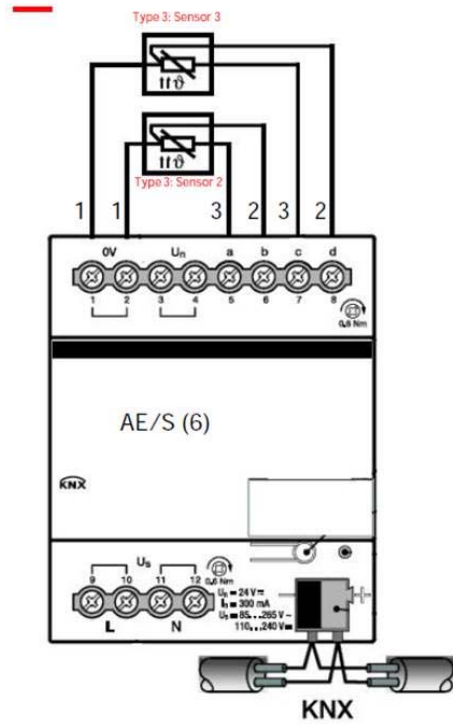
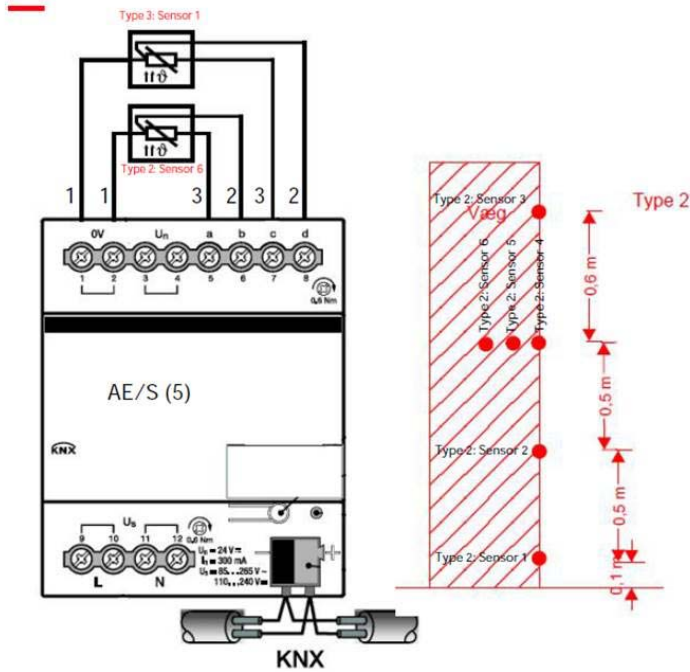
A. Appendix: Placement code interpretation

Interpretation of placement codes, please see examples below:

TTxxyy: xx refers to sensor type 1,2 or 3 yy refers to sensor number.







B. Appendix Data model

The following pictures illustrate the data model

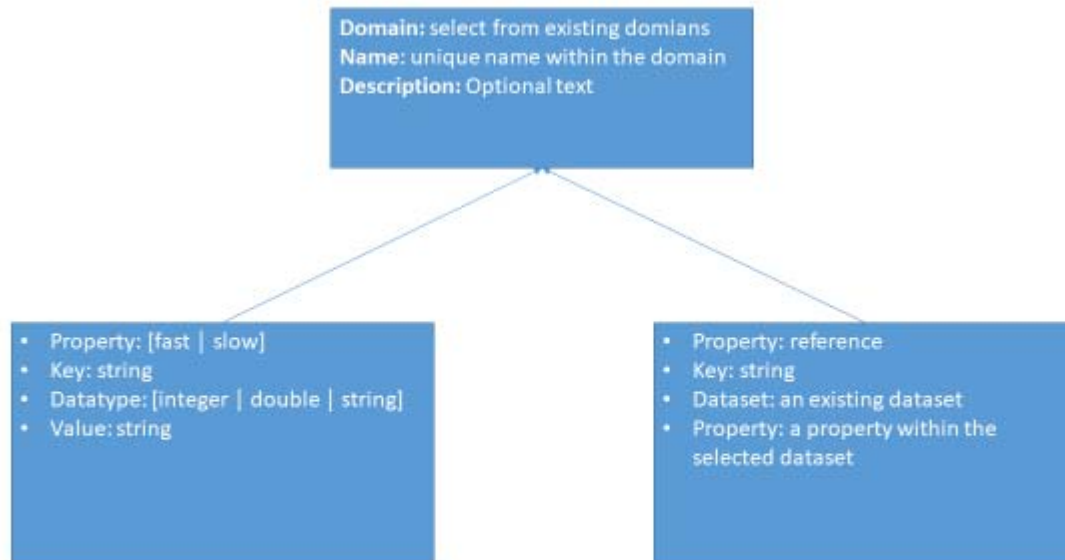


Figure 1 The datamodel

4 data set, type 1 sensors in 2 apartments

Name: sund_69_05_15 / 0/1/1
Type: PT1000
Unit: DegC
Vendor: ABB
Placement: TT0101
Measurement: <>
KNX group address: 0/1/1

Apartment 69_05_15, type 1 sensor, sensor #1

Name: sund_69_05_14 / 0/1/1
Type: PT1000
Unit: DegC
Vendor: ABB
Placement: TT0101
Measurement: <>
KNX group address: 0/1/1

Apartment 69_05_14, type 1 sensor, sensor #1

Name: sund_69_05_15 / 0/1/2
Type: PT1000
Unit: DegC
Vendor: ABB
Placement: TT0102
Measurement: <>
KNX group address: 0/1/2

Apartment 69_05_15, type 1 sensor, sensor #2

Name: sund_69_05_14 / 0/1/2
Type: PT1000
Unit: DegC
Vendor: ABB
Placement: TT0102
Measurement: <>
KNX group address: 0/1/2

Apartment 69_05_14, type 1 sensor, sensor #2

Figure 2 Example of a dataset with 4 measurements

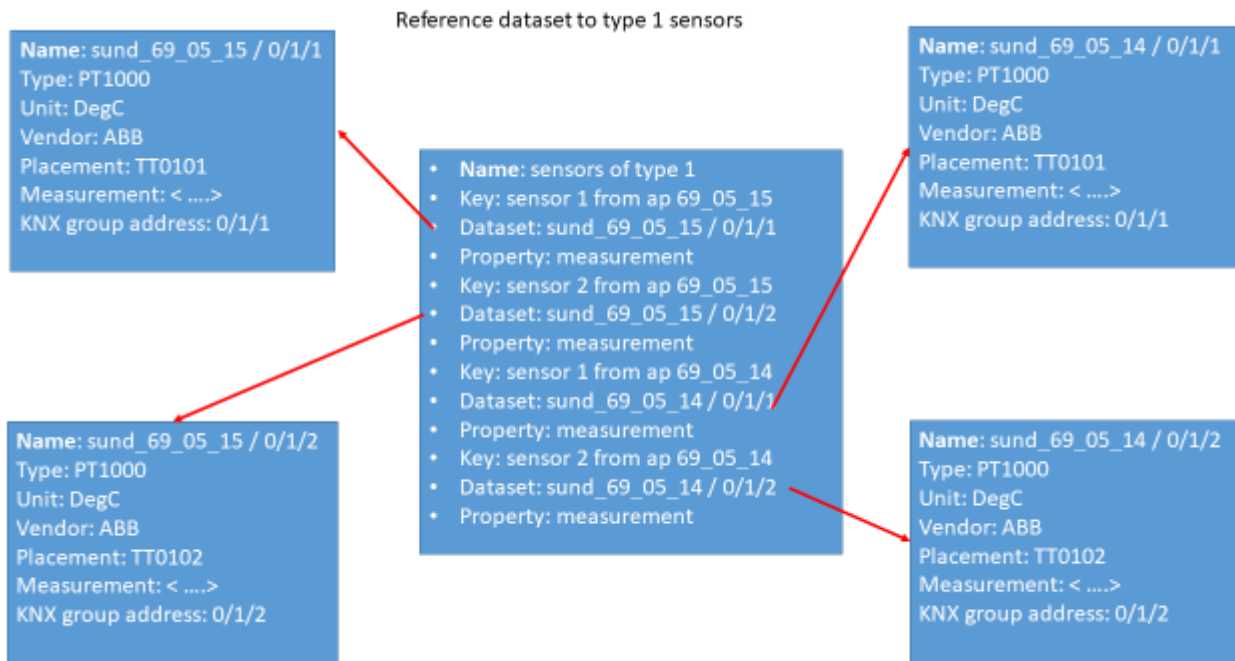


Figure 3 A dataset consisting of references to existing measurements

C. Appendix Data flow for test

In order to verify that the data reports contains correct data, i.e. data that equals the data loaded into the system, a copy of the data shall be created before the data is loaded into the database as illustrated in Figure 4

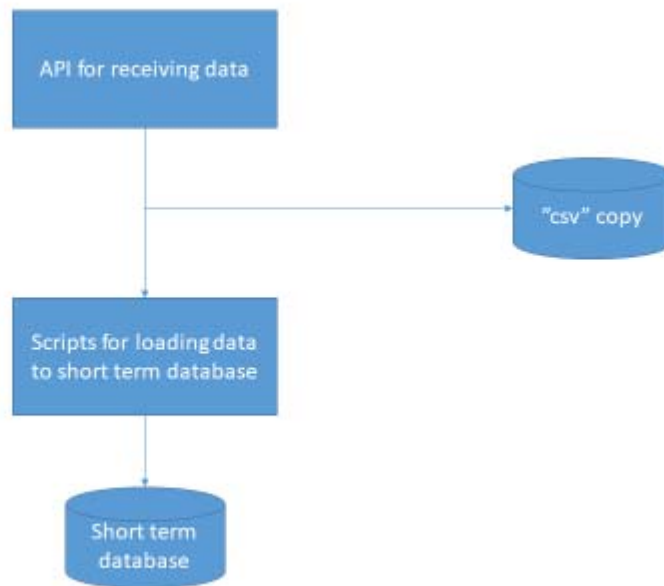


Figure 4 Data flow for test

The data is received at the API and then duplicated into a "csv" copy and a flow, that follows the load procedure and therefore is loaded into the database from where it can be extracted in reports.