Open Metering System Specification

Volume 3

Tertiary Communication and OMS-MUC

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1 Introduction

This document keeps the records and results of the Open Metering working group AG-2 with scope on the functionality and tertiary communication of a functional unit called OMS-MUC.

The goal of this specification is more to describe the system architecture of the OMS-MUC than to set up a detailed technical specification.

This document is part of the Open Metering System Specification which consists of the following documents:

OMSGP	Open Metering System specification, Vol. 1 – General Part
OMSPC	Open Metering System Specification, Vol. 2 – Primary Communication
OMSTC	Open Metering System Specification, Vol. 3 – Tertiary Communication (this document) and OMS-MUC.

Please refer to [OMSGP] for definitions, abbreviations and references.

For the latest issues of the Open Metering System Specification (OMSS) and other background information please visit the internet site www.openmetering.org .

The OMS-MUC Specification is intended to be widely aligned with European requirements for Smart Metering (e.g. Dutch Smart Metering Requirements). Variations may occur due to different targets like the metering infrastructure or meter index intervals as well as different national regulations.

2 Overview

The *Multi Utility Communication Controller* (MUC) as a functional and logical unit and its communication to AMM back office systems (AMMBO) is described in this Document. The physical outline and its place of installation is not subject of this specification.

The MUC located between metering devices and the AMM back office systems is a system to provide data for billing and balancing purposes as well as to monitor the energy consumption of the consumer on a home display unit. In addition, the communication interface can be used to control remotely certain functions of the MUC and metering devices.

The ODC[1] of the tertiary interface provides OBIS coded sensor data to AMMBO.

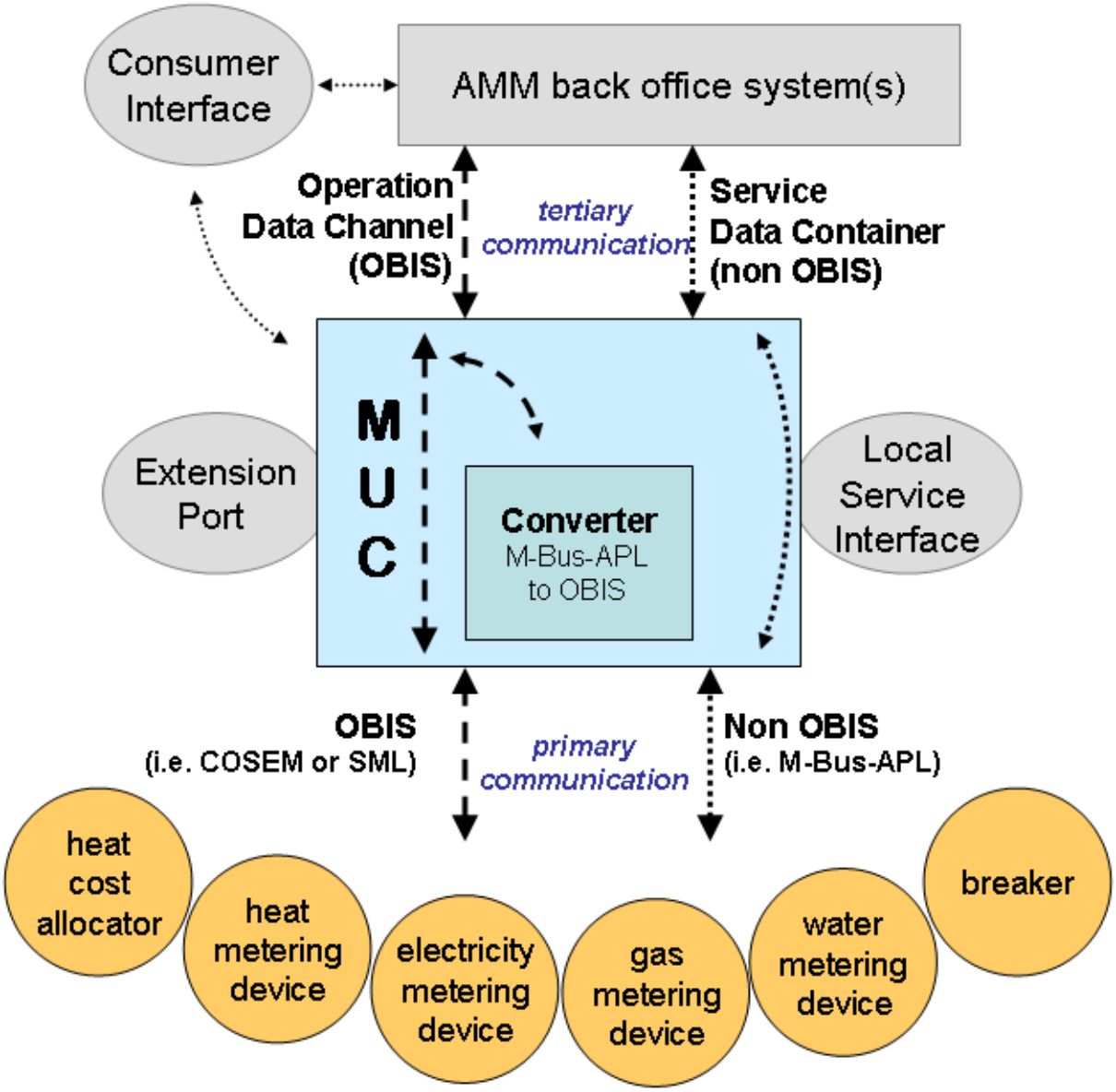

Fig. 1: System Overview

[1] Operation data channel

2.1 Communication

2.1.1 General

Fig. 1 shows the interfaces of the OMS-MUC system concept to provide data flow from the metering devices to the AMM back office.

2.1.2 Primary

The *primary communication interface* provides wired and wireless communication with metering devices.

Please refer to document [OMSPC] for a more detailed view on the metering devices.

2.1.3 Secondary

Please note that in this document, secondary communication is not explicitly mentioned.

2.1.4 Tertiary

The *tertiary communication interface* allows exchange of data with AMM back office systems.

Wide area communication to AMM back office systems as well as communication to the consumer is done via IP protocol V.4 (referring to RFC791) or higher.

2.2 Data Storage

The OMS-MUC data memory provides space for different features:

- Communication buffer
- Data memory for historic values and data logging
- Event log
- Configuration data

2.3 User and Access Management

Data access at the OMS-MUC is controlled at application level by a user management that identifies users by name and password to enable access only to those data objects assigned to the particular user.

2.4 Internal Clock

The OMS-MUC has an internal clock, which is used to mark the incoming data with timestamps.

The internal clock may be used as time base for connected sophisticated metering devices to synchronize their own clock.

2.5 Functional Description

The following part of this document describes requirements for the communication between

- MUC ↔ energy supplier (Energy trader and grid operator)
- MUC ↔ metering service provider and meter site operator

- MUC ↔ consumer.

Additionally, communication with monitoring systems for diagnosis is also described.

2.5.1 Communication Channels

Communication protocols for the Operating data channel are defined to use SML or DLMS/COSEM (see Fig. 2) always transferring OBIS coded values.

In tertiary communication, metering data are transported by the MUC to an AMM back office which allocates them to suppliers and providers.

Since battery powered meters have to use optimized data volume, some data processing has to be done on the OMS-MUC. Received non OBIS standard values from metering devices have to be processed by a converter in order to match the required AMM data format if not provided by the meter.

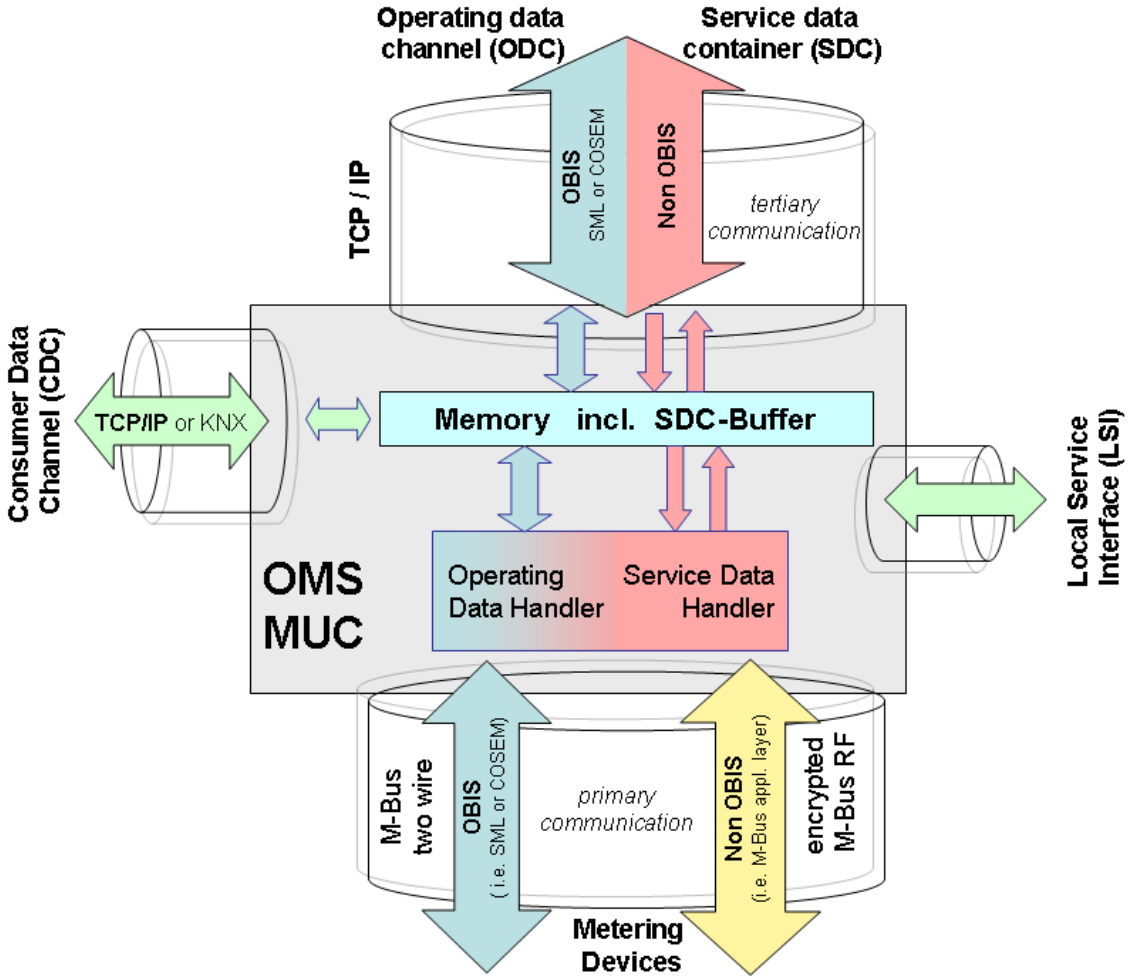

Fig. 2: OMS-MUC Communication Architecture

A direct access to metering devices should also be possible. Therefore the tertiary communication channel is split up into two sub channels:

- The *operating data channel* (ODC) provides communication to AMM back office systems for billing or other purposes. All data to be used for billing purposes are transferred via the ODC in the standardized OBIS coded format.

- The *service data container* (SDC) provides access to service data of a metering site and messages sent by connected meters. In addition, connected systems which operate on the SDC can query metering devices by sending messages. The SDC has been introduced for servicing and for additional communication features.

2.5.2 M-BUS to OBIS Conversion

The OMS-MUC contains an M-Bus to OBIS converter to translate M-Bus standard data points into OBIS classification numbers. The converter is located within the Service Data Handler / Operation Data Handler as shown in Fig. 2.

A conversion table which matches M-Bus standard data points to OBIS numbers has been defined in [OMSPC] Annex A.

3 Specifications

3.1 Data Storage

The amount of meters to be managed by a single MUC is not defined by this specification.

Operational data points are defined by the OBIS conversion table [OMSPC] Annex A which is based on the normative standards [EN 62056-61] and [EN13757-1] and aligned with the [DLMS-UA].

3.1.1 Interval Data

The OMS-MUC is defined to implement ring buffers to store data for a certain amount of time. Hereby, the following minimum requirements have to be met:

- Daily metering data should be available for the last three months.
- Monthly data should be available for the last two years.
- Load profile data have to be available for the last three months.
- The event log stores the last 100 events as a generic profile data base.

Medium	Interval time [min]
Electricity	15
Gas supplied to the connected party	60
Heat, district heating	60
Water / Warm Water	1440
Heat cost allocators	1440
Heat / Cold (sub metering)	1440

Table 1: Data Intervals

Compare [OMSPC] Table 1 ‘Intervals and reception probability for different applications and different media’.

3.1.2 Data Types

To reduce the data transfer volume telegram types are defined in [OMSPC] Annex K.

It is important to ensure at the OMS-MUC that Master data will not be lost, to provide them for AMMBO.

3.1.3 Status Information

General

Status information is a generic term for additional information about the status of the metering installation. Status information can be requested via the tertiary interface and is also available via the consumer interface and the local service interface. In addition, the meter site operator has the possibility of reading status information on the service interface.

Status Information on the Consumer Interface

[WORKITEM]

Status Information via Tertiary Communication

[WORKITEM]

Error Messages

[WORKITEM]

Fraud Detection

[WORKITEM]

3.2 Interfaces

3.2.1 Data Communication

Open Metering conformity is given if the OMS-MUC provides

- **for tertiary communication**
  - a WAN interface like e. g. Ethernet / DSL, GPRS / UMTS, PLC
- **for primary communication one of the referenced interfaces**
  - Wired M-Bus (M-Bus) Master
    able to drive 6 M-Bus loads as described in [OMSPC] Annex C.
  - Local Bus (LO-Bus) as defined in [EN 13757-6]
  - Wireless M-Bus (wM-Bus)
    the wM-Bus meters may communicate on mode T1 or S1 (unidirectional) and T2 / S2 (bidirectional back channel).

    One of the following configurations shall be supported by an OMS-MUC
    a. The MUC supports T1 and T2 or S1 and S2
    b. The MUC supports T1/T2 and S1/S2 in parallel
    c. The MUC supports T1/T2 and S1/S2 by a time slot method (which is not approved yet).

    A MUC device not covering one of the above interfaces is not conform to the Open Metering System (OMS), but may achieve OMS conformance by an upgrade if designed in a modular concept.
  - Other interface types if necessary to be supported by the OMS-MUC, e. g.
    - extension port (Ethernet)
    - RS232
    - RS485
    - PLC
    - KNX (consumer display, building automation, energy management)
    - others

    are optional and not specified by the Open Metering Specification.

The physical characteristics of the mostly utilized wired interfaces may be defined in a future issue of this document to provide a minimum of interoperability.

- **for local or in house communication**
  - Local service interface providing service data as described in 3.2.3.
    This may use one of the mandatory interfaces or an optional own interface.
  - Consumer data channel to provide consumption information to the consumer.
    This may use one of the mandatory interfaces or an optional own interface.

3.2.2 Service Data Container (SDC)

The optional service data container provides simple communication of non OBIS-Data from the meter to the AMMBO but also from the AMMBO to the meter (if the meter does support bidirectional functionality).

The communication for the meter to the OMS-MUC is defined by OMSS Vol. 2 [OMSPC]. The physical and link layer of the tertiary communication is described within this document.

The SDC does not push data to the AMMBO. Data through the SDC are always to be requested by the AMMBO from the OMS-MUC.

General

The SDC gives the purpose to manage additional communication between AMMBO and primary devices, which may not OR must not use OBIS codes.

It serves:

- Transparent communication between head end and primary device
- reading/writing manufacture specific M-Bus codes
- reading/writing special service registers (e.g. detailed error code)

Conditions

- The target device has to be listed in the MUC list of active devices.
- [WORKITEM] An OBIS-Code has to be defined to mark the DLMS- or SML- Frame as SDC.

Connection Establishment

The connection will be established from head end to the measuring device over the TCP/IP protocol. The following information has to be known by the MUC:

- Complete device address
- Total number of Jobs “N”
- “N” times Application body (Starting from CI-Field)

To ensure a high performance, batch jobs should be assisted. A batch job contains all information to handle this set of commands inside the MUC without communication between MUC and AMMBO.

Example for M-Bus:

1. OPEN (Select)
2. SND-UD (error register 1) with a succeeding REQ-UD2
3. SND-UD (error register 2) with a succeeding REQ-UD2
4. CLOSE (SND-NKE or Deselect)

Batch Job Data

- Device address
- SDC-Channel

- Total number of Jobs “N”
  Jobs 1 to N
  - unique Job number (2 byte Job-ID)
  - Properties
    REQ-UD2 yes/no
    If yes, a request REQ-UD2 is transmitted in next timeslot after the SND-UD
  - Application body, starting from CI-Field as defined in [OMSSPC]

Job request and job response are linked by the same Job ID.

Device Address

The Device address is the unique address of selected meter or actor (meter application address).

Job-Properties

The Job properties control the data transfer between AMMBO, OMS-MUC and metering device.

SDC-Channel-No.	set by	Meaning
REQ-UD2 required	AMMBO	If true a REQ-UD2 has to be transmitted immediately after the transmission of the job.
Job executed	MUC	current job was executed successful
Job failed	MUC	current job failed
Response available	MUC	Requested response is stored and may uploaded by Head end

Table 2: Properties of a Job

Job Buffer

Jobs should be buffered in a TX-Job buffer. The response of a Job has to be stored in reference to the job request. Answered jobs shall not be executed again. The avoidance of batch job overflows (to many jobs in job buffers) shall be assured by job handling in the AMMBO. The TX/RX-Job buffer shall support at least 4 Jobs.

Special Case: Inactive Devices

It may be needful to communicate with devices not active on a consulted MUC. This case may occur, if the MUC in charge is not reachable. Therefore the following steps shall be supported:

1. activation of the selected device
2. running the batch job
3. deactivation of selected device

Remark: the activation procedure of devices or actors has to be defined

To avoid collisions in the radio channel the AMMBO has to take care setting a selected metering device simultaneously active at one MUC only.

3.2.3 Local Service Interface (LSI)

The OMS-MUC controller is equipped with a Local Service Interface (LSI), which allows at any time to examine and display all relevant system functions and communication links.

The local service interface must support the configuration, status and event query for the primary and tertiary communication interfaces. In addition, the local service interface should allow the modification of important static configuration data and a MUC controller firmware upgrade.

For interoperability and process optimization in the field, an integrated web browser-based local service interface is recommended.

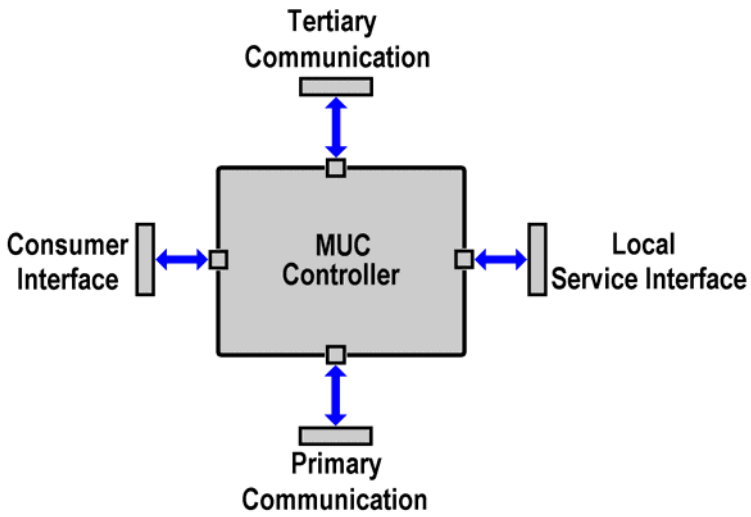

Fig. 3: Logical interface connections of a OMS-MUC controller

Function	Description	
HW Info	Hardware information query (unique device address, identification, type, version, S/N…)	M
HW Config	Hardware configuration query (feature list with available interfaces, memory size, installed options …)	M
SW Info	Software modules query (display a list with all installed software modules and version numbers – this list also contains software modules from internal subsystems, e.g. modems)	M
SW Update	Download a new firmware or new firmware parts (modules) to the MUC controller	O
SW Config	Query (M) and change (O) the static software configuration parameters	M/O
System Config	Dynamic configuration parameter query (e.g. shows the via DHCP assigned IP address for the tertiary communication interface)	M
System Status	Shows the current system status of a MUC controller: • System information (local time, RX/TX/ERROR counters) • System log file • System errors (e.g. system or software restart initiate by the	M

	watchdog timer, out of memory …) • Communication link status (e.g. RF signal quality for a GSM link, successful connection to the GPRS service, successful connection to PPPoE …)	
System Test	Start system test and display the results (e.g. calculate and compare check sum for non-volatile memory)	O
Tertiary Link Test	Start connection and link test to the AMM Back Office System and display the results	M
Primary Link Status	Display all known metering devices in the coverage of the MUC controller	M
Consumer Link Status	Display a list with successful and unsuccessful user logins	O

Table 3: Function overview of Local Service Interface

Abbreviations in Table 3:
M = mandatory
O = optional

3.3 Clock and Time Management

To ensure correct timestamps of metering data which is used for accounting and billing (like meter indexes), sophisticated metering devices must have an own internal clock. Accuracy of this device clock is defined to be better than 20ppm (compare EN/IEC62054-21:2004).

The internal clock is provided with a power reserve of 48 hours at minimum.

The device clocks (OMS-MUC and metering devices) are always running on UTC (coordinated universal time). Timestamps are considered always to be given or received in UTC. To show the local time on a device display the time offset to UTC will be deposited in the device by parameterization.

Clock synchronization of the OMS-MUC internal clock is done by using the network time protocol NTPv4 (or higher) or equivalent (e.g. DCF77). NTP time should be requested as signed telegram for secure and tamper proof system operation.

The internal clock should not differ from absolute time more than 9 seconds. If the internal clock could not be synchronized for longer than 48 hours OMS-MUC time may not be used as synch time base. Failures of the OMS-MUC time synchronization have to be accounted for in the event log.

Clock synchronization of metering devices is provided by sending out the current time of the OMS-MUC clock to any meter once a day, out of consideration if the meter has an own clock or not. This is done as long as the time is valid like described above.

No manual parameterization of the OMS-MUC must be done to assign metering devices with or without clock. But on the installation procedure a meter may give the information if it doesn't need any time information to release the MUC from sending out time messages to this meter.

3.3.1 Additional requests for local time display

Timestamps in MUC are always given in UTC (coordinated universal time). To allow display of local time an additional parameter defines the time zone which means the deviation of local time to UTC.

The Daylight Saving Time (DST) defines the local switch date and time when the local time has to be deviated (deviation range up to ± 120 min).

If DST is used, the OMS-MUC maintains a time table, which keeps DST times of ten years at least. The DST parameters including the beginning and ending DST specified in day, month and year were used by an OMS-MUC sequentially. Because of possible legal changes the table must be downloadable.

- If there is no entry defined in table for the current year, the OMS-MUC remains at local time without consideration of DST.
- OMS-MUC follows DST after powering up as long as it keeps a valid local time.

Optionally an algorithm could calculate DST. There has to be the possibility to download a new algorithm in case of legal changes.

Reference: DIN EN 62056-62 (2007)
(rem: Guideline 2000/84/CE)

3.4 Data Flow through an OMS-MUC

As shown in Fig. 4 several data types are to be transferred by the OMS-MUC.

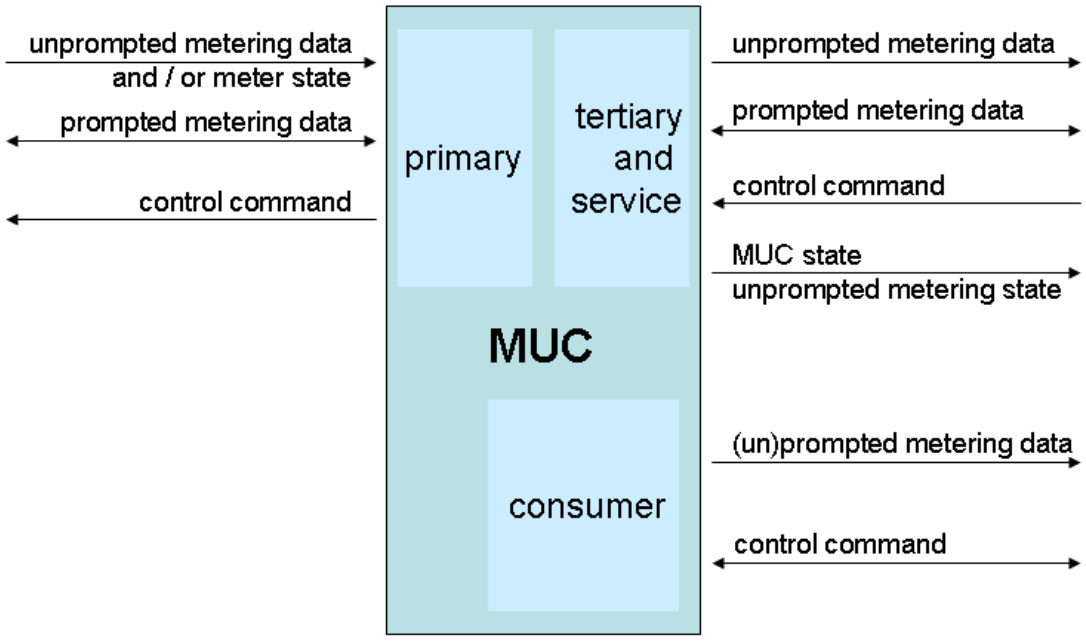

Fig. 4: Data Flow

Control commands are send from the AMMBO to the MUC to (e. g.):

- Request stored data
- Set operational parameters
- Send data or command to the consumer interface
- activate tasks to requests data from metering devices

Control commands are send from the AMMBO via the MUC to metering devices to (e. g.)

- Setting meter parameters like tariff definitions
- Request meter data or status information
- Switch actuators
- Synchronize a meter clock

Prompted Metering data are the reply of a metering device or OMS-MUC on request telegrams (pull operation).

Unprompted Metering data are sent by metering devices without request (push operation). Different telegram types may be sent due to battery lifecycle opportunities. On tertiary communication dynamic meter data always must be completed with the assigned static information (e.g. meter identification data).

3.5 Messages and Alarms

[WORKITEM]

3.6 Security

Security techniques and protocols are not defined in this stage. Commonly used techniques should be used as listed in [WELM2004].

3.6.1 Encryption on Primary Communication

The Advanced Encryption Standard 128 (AES-128) was decided to be used if meter data are to be encrypted for secure data transfer on primary communication.

Please refer to Vol.2 of the OMSS [OMSSPC] for details.

3.6.2 Encryption on Tertiary Communication

On the tertiary communication established IP security methods are used.

Details are to be specified.

3.6.3 Security Level

The security level to be provided by the OMS-MUC depends on the protection needs to be defined by a data protection analysis.

Service Level	**Security Level**
Super Admin / Key master	Setting and reset of encryption and signature keys; setting of administrator account
Administrator	Access to all user definitions and rights management, read all status information
Metering Service Provider (MSP) Meter Site Operator	Read all metering devices; send command to metering devices; send command to MUC
Consumer (Home Display Unit, Building Automation System, Energy Management)	Read all assigned metering devices after login procedure

3.8 Users and Access Control

The OMS-MUC has to provide a sufficient number of user accounts. At least one Administrator for configuration purposes must be provided. The other users could be defined by the administrator. User accounts could be bundled by user groups.

A user account is defined by

- User name
- Password
- an optional public key
- access rights, related to data points

Access rights are defined by the attributes

- read
- write

An attribute to limit the access by the valid time period (from date/time, to date/time) of an account is not defined yet.

Alternatively historic data of a deleted account should be cleared automatically.

In [Annex B: User Concept Example] a proposal of application is described.

3.9 Key Management

The Keys for encryption and access control are changeable by authorized change key commands.

Keys are organised in a tree structure. The depth of this structure may differ depending on the individual system and application.

On building up the key tree it shall be ensured always to use a method of same or higher order on the way from a brace to the root. By this the protection level of an adjacent key is limited by the protection level of root and / or the previous branch connection.

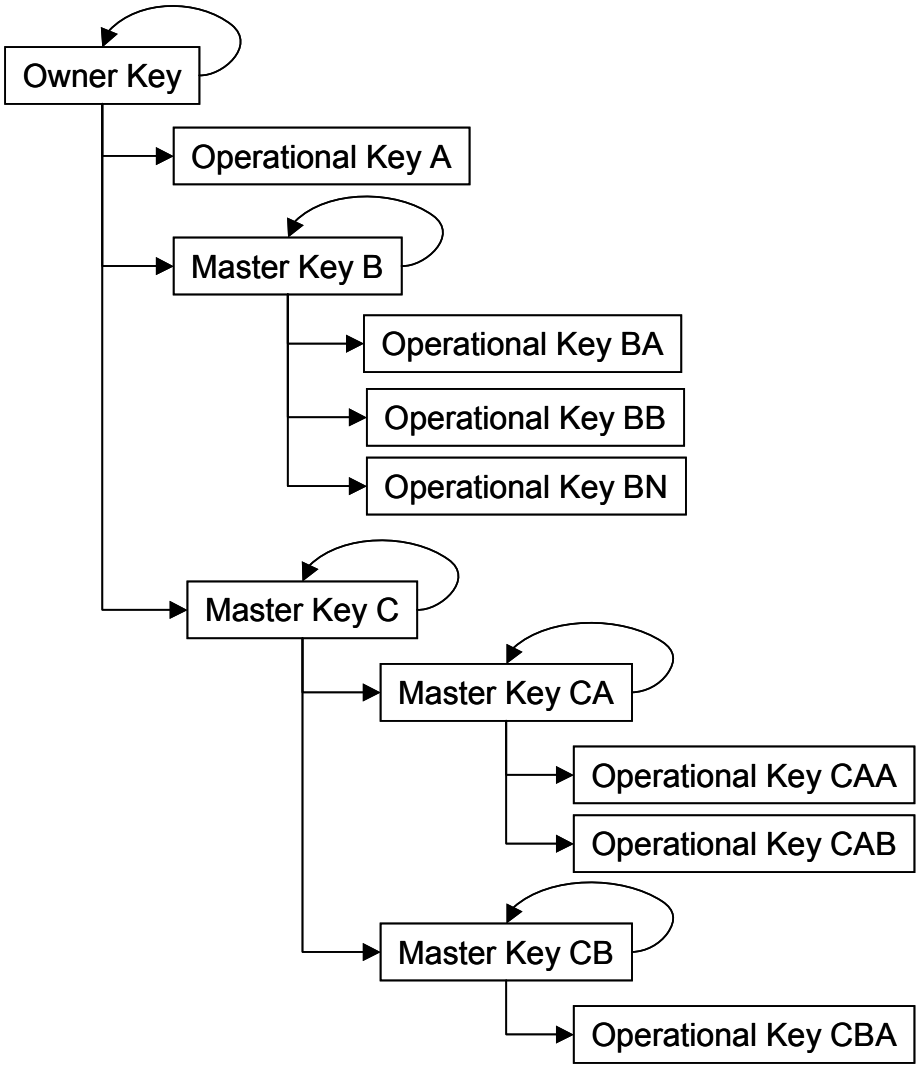

Fig. 5: Key Tree Structure

Owner Keys have to be individual for each component.

Different methods for key exchange and key usage may be used depending on the appliance.

Keys as described here are stored in a key memory (e.g. flash) managed by the application software. The key encryption key (KEK) is self-contained from these keys and substituted inside the encryption unit.

The key tree root is grounded by the owners master key (‚Owner Key'). This key should only be used to load additional keys into the OMS-MUC. The owner key must be changeable, authorized by itself since the owner may change within the period of use.

It is recommended to set a vendor-default-key on delivery state which should be changed by the owner within the field installation procedure. If the vendor-default-key is not set individually it must not be possible to load additional keys since the owner key has changed.

The key to authorize additional keys should not be used for data encryption to prevent decryption of a caught telegram by the included authorization key.

Therefore a key tree may be built up of two key classes:

- Master Key
  - no data decryption feasible
  - only used for authorization of other keys
  - may be changed by itself (self authorization)
  - the owner is a master key
- Operational Keys:
  - are used for data encryption and decryption
  - are unable to authorize other keys
  - should not be changed by themselves

So master keys are root and branches of the tree. Operational keys are the leaves.

The branches of a key tree may have different lengths.

To authorize e.g. a software up- or download an operational key directly below the owner key could be reasonable.

On an OMS-MUC used by several market partners a multilevel structure may be useful.

3.10 Unique Device Address

For Identification each OMS-MUC has its own manufacturer assigned unique address, following the common universal unique address structure as described for metering devices in [OMSPC]. This address shall not be changeable by user.

In communication the unique address of the OMS-MUC or its proper transformation is used for identification. Reference of used standards:

Task	**Applicable Standard**	**Remark**
Universal address structure	Standardisation on progress	(refer to E-DIN 43863-5)
Address conversion OMS-MUC --> wMBus	[Workitem]	Update of Standard EN 13757-3 in process
Address conversion OMS-MUC --> MBus	Not needed	
Address conversion OMS-MUC --> PowerLine	Out of scope	
Address conversion OMS-MUC --> SML	[Workitem]	
Address conversion OMS-MUC --> DLMS	[Workitem]	

The MUC will transform the address of a device coming from AMMBO into a fitting target format if necessary (i.e. at wM-Bus).

4 Annex A: Use Cases

This annex shows Use Cases to be fulfilled by the OMS hard- and software.

They describe procedures for system installation, configuration, data acquisition, event handling, device control and clock synchronization.

4.1 Installation Process – MUC

Use Case	Start of operation
Actors	Central system (AMMBO) ERP system MUC Controller
Precondition	Parameters to connect to the AMM system are known by the MUC.
Scenario	MUC Controller establishes a connection to the AMM system and delivers the event „new installation“, passing its mater data. AMM system checks authentication and authorisation if applicable, replying a positive acknowledge to the MUC Controller. These acknowledge is indicated for the technician on site (by e.g. LED, display or feedback an a PDA). For the technician the installation procedure is finished then. The AMM System is setting up an account fort he new MUC Controller with status „pending“. The technician takes over the data (DeviceID, location and time of installation ...) of the new installed MUC to transfer them to the ERP System. REMARK: This may be processed asynchronous to the MUC registration at the AMM System if the technician has no online connection. The ERP transmits the MUC master and assignment data to the AMM System. The AMM System checks these master data with its device accounts on status „pending“. On correspondence the MUC account will be assumed to the list of active devices.
Error conditions	no authentication – registration is not effected no authorisation - registration is not effected no connection to the AMM System – further proceeding beyond this definition no correspondence with the master data of devices in the field to devices at the ERP System - further proceeding beyond this definition
Notes	Even if metering devices are synchronous or asynchronous installed with the MUC, the procedure described in the Use Case „initiation of meter“ will be used.

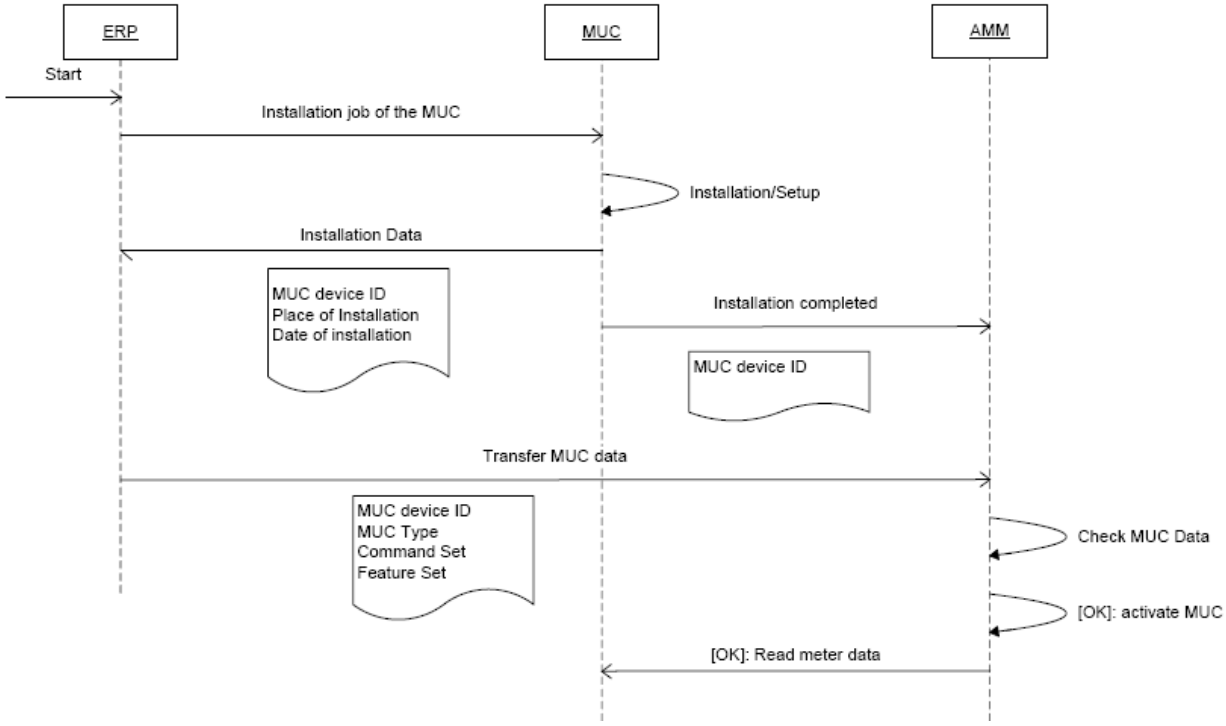

Fig. 6: Installation Process of the MUC

4.2 Installation Process – Meter – w/o Feedback

Use Case	Install meter with set up mode (push button), no feedback to technician
Actors	Metering devices (gas, water, electricity, heat, HCA, …) 2 MUC Controllers ERP AMM
Precondition	The MUC is already operating Device data are complete available at the ERP system.
Scenario	Meter installation. 1. Technician gives acknowledge of meter installation to the ERP system. 2. ERP sends meter master data and assignment to AMM. 3. Start of installation mode (manual or automatically). 4. The meter sends its installation data. 5. Both MUCs receive new meter data and send them to the AMM system. 6. AMM sends meter to MUC assignment to the assigned MUC by updating its list of active metering devices. 7. AMM sends an update of the list of passive metering devices to the other MUC. 8. The AMM System checks these master data with its device accounts on status „pending“. On correspondence the MUC account will be assumed to the list of active devices.
Error conditions	MUC does not receive any data
Notes	

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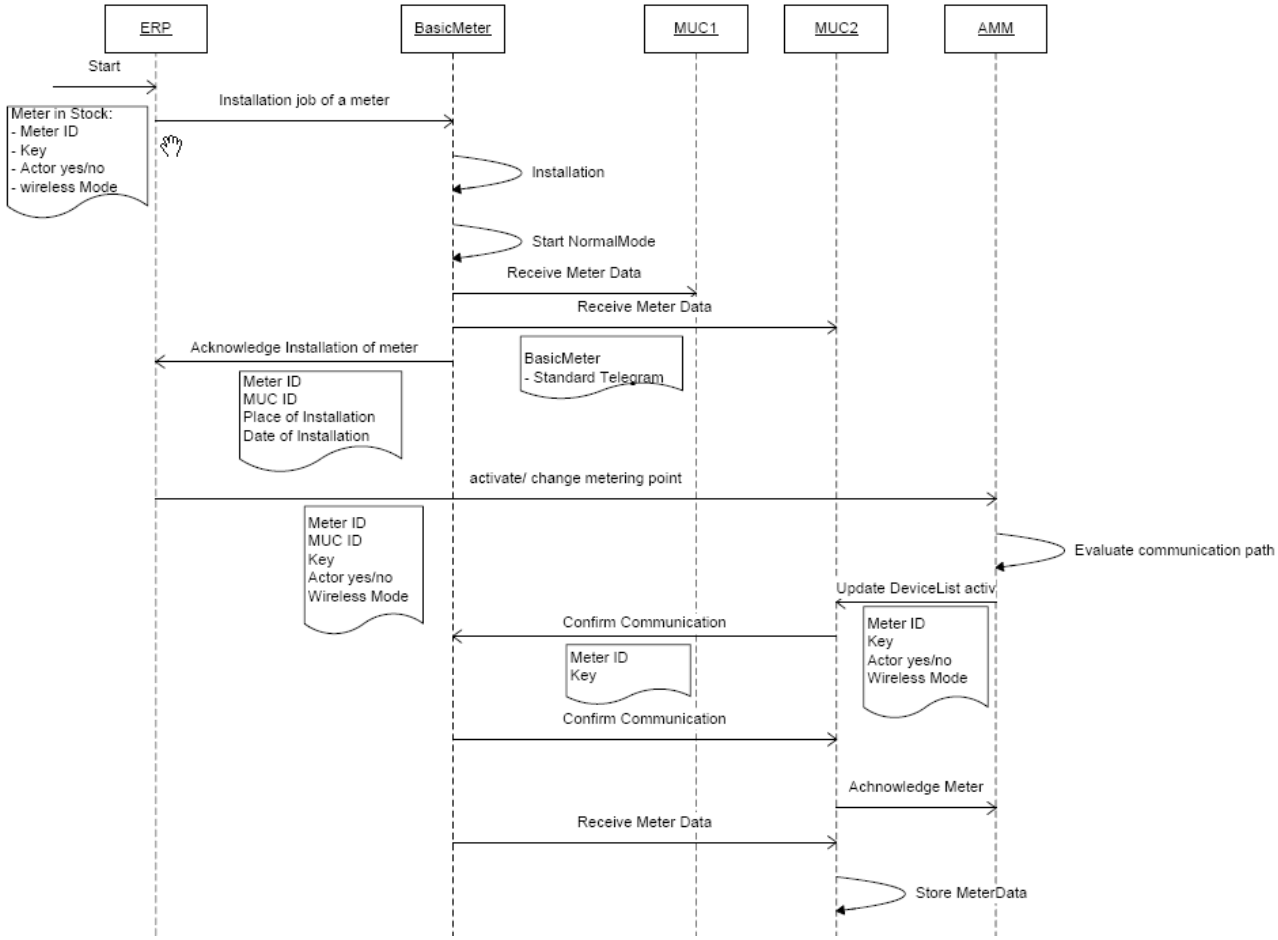

Fig. 7: Installation of Meter w/o Feedback

4.3 Installation Process – Basic Meter

In this Use Case the same preconditions are valid as described above.

Additional feedback scenarios are described below.

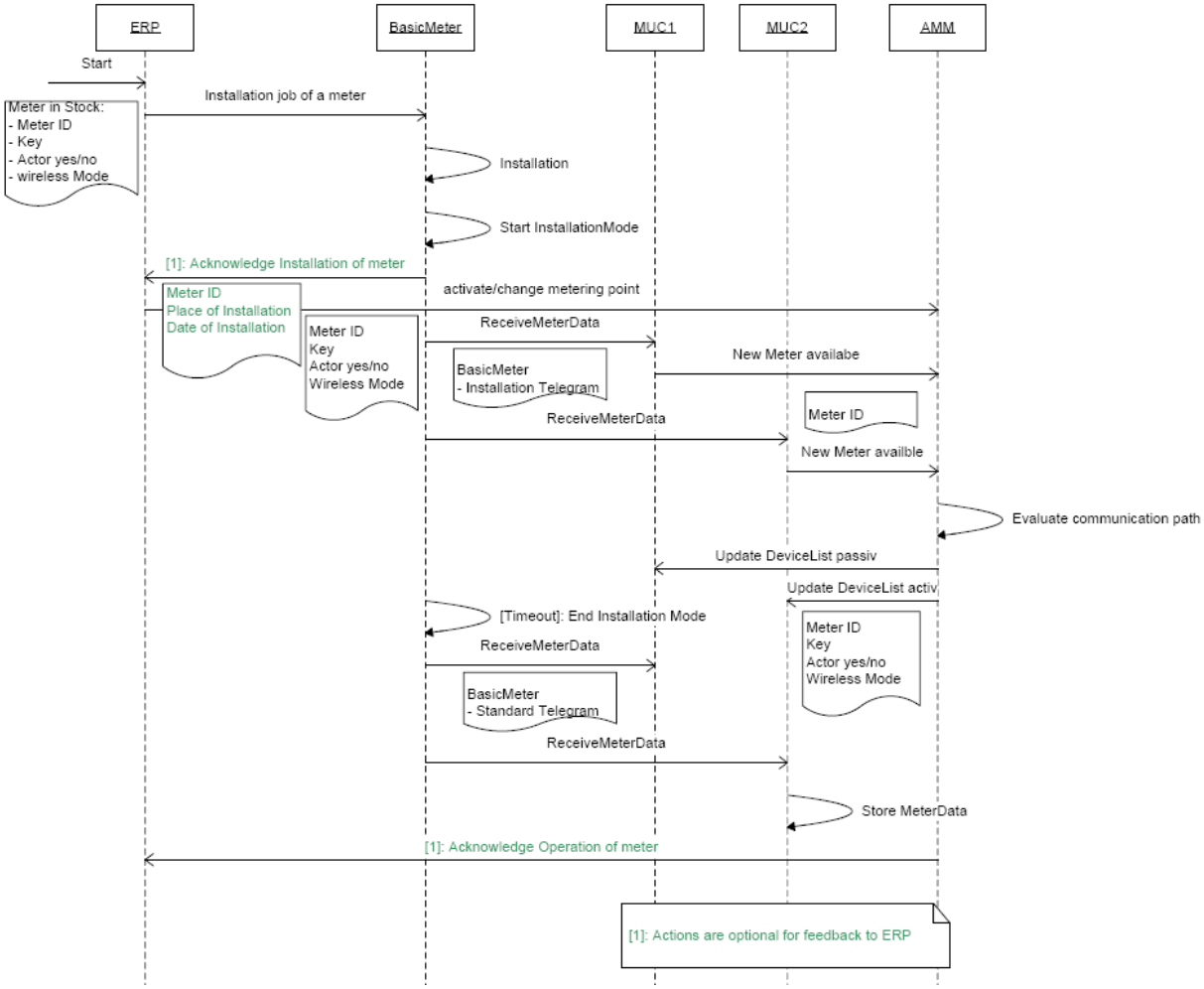

Fig. 8: Installation of Basic Meter

4.3.1 Feedback on PDA

Use case	**installation – with feedback to installer – local – feedback on PDA**
Metering device	gas/water/electricity/heat-meter
Pre condition	Follow steps 1 to 7 of the installation procedure. After step 7 the MUC is finished with the local installation of the meter.
Scenario	▪ The installer can use the PDA to read out the configuration via the local interface of the MUC ▪ The installer checks the local installation configuration like meter Ids, reception quality ...
Error scenario	▪ The MUC has been coupled to the wrong meter. ▪ The reception quality is not good enough. ▪ After key exchange the MUC can't decode the meter data.
Notes	With the help of a PDA the installer could identify many different problem. But this method requires a local interface for installation. It is only possible to verify the communication between the MUC and the meter. It is not possible to verify the complete installation up to the AMM back office.

4.3.2 Feedback on Meter

Use case	**installation – with feedback to installer – local – feedback on meter**
Metering device	gas/water/electricity/heat-meter
Pre condition	Follow steps 1 to 7 of the installation procedure. After step 7 the MUC is finished with the local installation of the meter.
Scenario	no feedback possible
Error scenario	▪ The MUC has been coupled to the wrong meter. ▪ The reception quality is not good enough. ▪ After key exchange the MUC can't decode the meter data.
Notes	As this is a simple basic meter and is not able to communicate in 2 ways, there is no possibility to give feedback of the successful installation to the meter

4.3.3 Feedback on MUC

Use case	**installation – with feedback to installer – local – feedback on PDA**
Metering device	gas/water/electricity/heat-meter
Pre condition	Follow steps 1 to 7 of the installation procedure. After step 7 the MUC is finished with the local installation of the meter.
Scenario	▪ The MUC can show either on a LED or a display, that the installation has been finished ▪ LED – only show successful installation ▪ Display – show meter ID, show reception strength
Error scenario	▪ The MUC has been coupled to the wrong meter. ▪ The reception quality is not good enough. ▪ After key exchange the MUC can't decode the meter data.
Notes	It is only possible to verify the communication between the MUC and the meter. It is not possible to verify the complete installation up to the AMM back office.

4.3.4 Optional Installation Mode for (Basic) Meters

Please note: In [OMSPC] an **optional** installation mode for (basic) meters is defined.

- Start of installation mode
  - Pushbutton
  - Command using Service interface of meter (e.g. optical interface)
- Activities within installation mode
  - Transmit of special telegram ***SND_IR*** (SendInstallationRequest)
    - Transmit interval 30…60 sec
    - Transmit minimum 6 telegrams
    - Different C-Field (= 46)
    - Application Data not specified
  - Receive of special respond telegrams, transmitted by the MUC
    - ***SND_NKE***
      - Transmitted from all MUC that receives SND_IR
      - DataContent
        - Link Layer address: MUC ID
        - Application Layer address: Meter ID
        - optional RSSI value coded in status byte
    - ***CNF_IR*** (ConfirmInstallationRequest)
      - Transmit from the MUC
        - If Meter is assigned to
      - Different C-Field (=06)
      - DataContent
        - Link Layer address: MUC ID
        - Application Layer address: Meter ID
        - optional RSSI value coded in status byte
- Stop Conditions of installation mode
  - Transmit min. 6 telegrams SND_IR
  - Max time of installation mode = 1h
  - Received CNF_IR telegram

Precondition: Basic Meter, Mapping meter to MUC not predefined

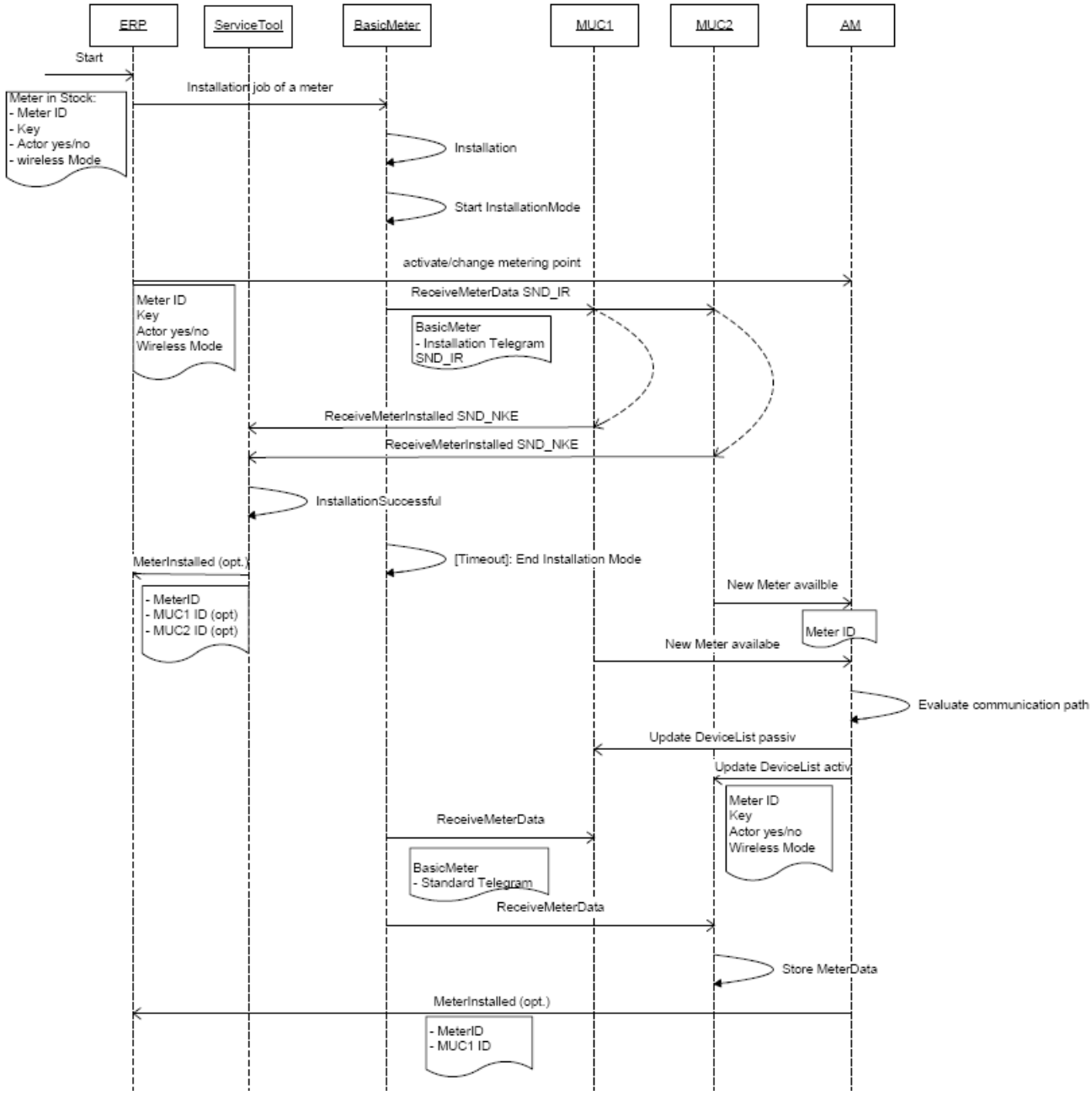

Fig. 9: Installation of Basic Meter

Precondition: Sophisticated Meter (implementing bidirectional communication). Mapping meter to MUC is defined before installation of meter.

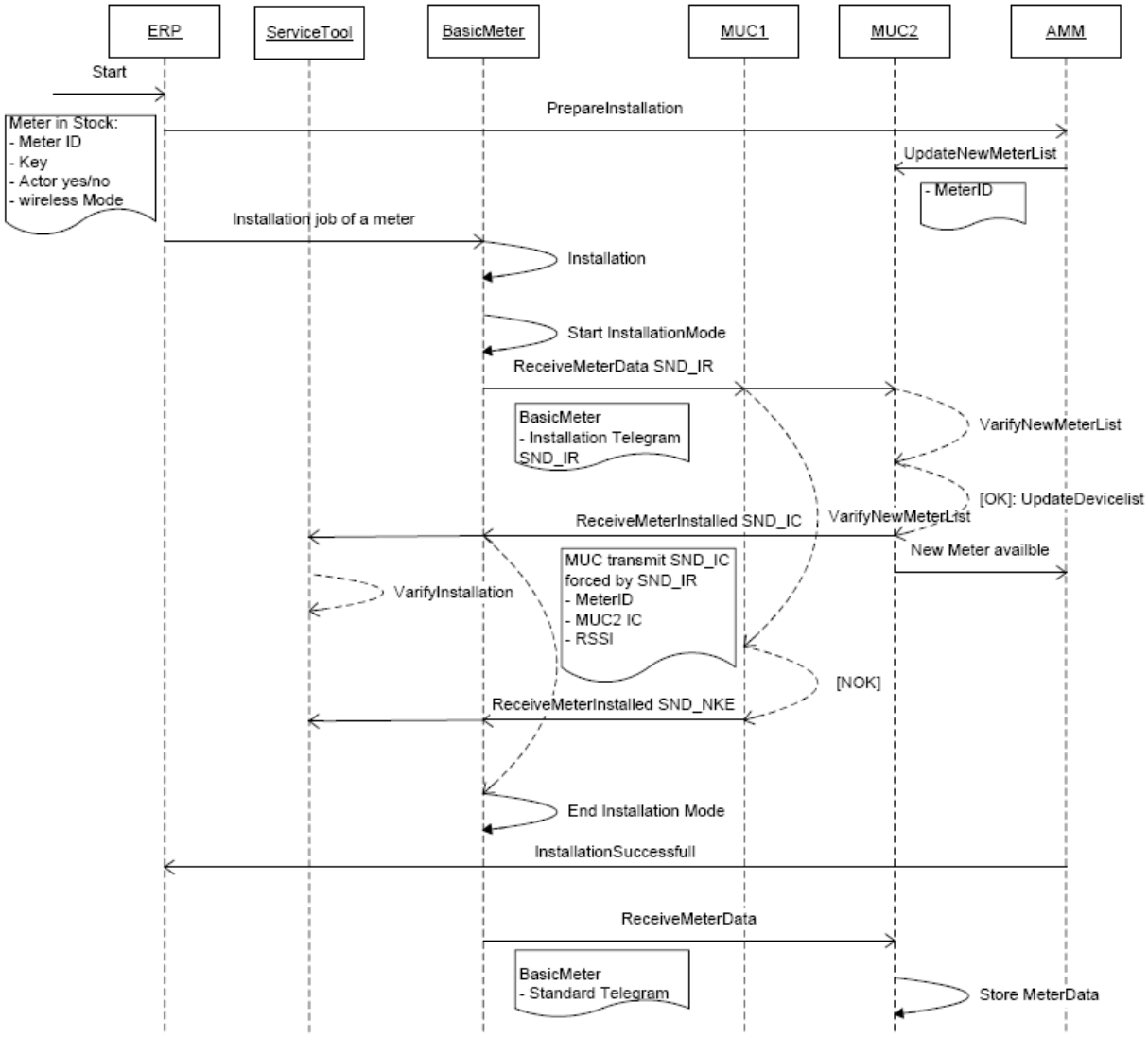

Fig. 10: Optional Installation Mode Soph. Meter

4.4 Configuration Process

The UseCase Configuration describes the parameterisation of metering devices via the MUC. The configuration use case ensures authenticated read or write access to device parameters by the control center.

4.4.1 Write Parameter

Use Case	**Write Parameter**
Metering devices actuators	Gas- / water- / heat- / electricity- meter + HCA Gas / electricity breaker or limiter
Actors	MUC, metering devices, AMMBO
Pre condition	MUC and metering devices are assigned and active. The task is to change a parameter of a metering device.
Scenario	AMMBO sends write command to the MUC. MUC establishes a communication link to the metering device and sends the command. Metering device checks the authentication and authorisation for the command. ➔ Metering device writes the new parameter into its memory. ➔ Metering device sends acknowledge.
Error scenario	Authentication failed, Authorisation failed, selected parameter not permissible, not existing or not changeable: ➔ Denial of parameter write ➔ Metering device sends negative acknowledge.
Notes	The MUC only checks for a valid connection to the metering device. It does not check the configuration command, since e.g. authorisation is checked only at the end points. Anyway an acknowledge is generated. So the absence of it indicates a communication error.

4.4.2 Read Parameter

Use Case	Read Parameter
Metering devices actuators	Gas- / water- / heat- / electricity- meter + HCA Gas / electricity breaker or limiter
Actors	MUC, metering devices, AMMBO
Pre condition	MUC and metering devices are assigned and active. The task is to read a parameter of a metering device.
Scenario	AMMBO sends read parameter command to the MUC. MUC establishes a communication link to the metering device and sends the command. Metering device checks the authentication and authorisation for the command. ➔ Metering device reads the parameter. ➔ Metering sends the answer telegram including the parameter value.
Error scenario	Authentication failed, Authorisation failed, selected parameter not permissible or not existing: ➔ Denial of parameter read ➔ Metering device sends negative acknowledge
Notes	The MUC only checks for a valid connection to the metering device. It does not check the configuration command, since e.g. authorisation is checked only at the end points. An acknowledge is generated anyway. So the absence of it indicates a communication error.

4.5 Data Acquisition

These use cases describes data acquisition procedures between MUC and metering devices and between AMMBO and MUC.

4.5.1 MUC – Metering Device, Unidirectional (DA-1)

Use Case	**Data Acquisition – Metering Device – Generic – Meter index**
Metering devices	Gas- / water- / electricity- / heat- meter
Actors	metering device, MUC
Pre condition	The communication between metering device and the MUC via the primary communication is established. The identification of the metering device indicates it to be processed by the MUC. The metering device sends its data periodically to the MUC.
Scenario	The metering device sends a message via primary communication containing generic meter index information. The MUC receives the message. The MUC checks the identification of the metering device to determine, whether the received message must be processed by the MUC. The MUC decodes the received message if necessary. The MUC identifies the meter index out of the received message. The MUC checks the status for possible alarm actions and performs these actions. The MUC saves the received message in its internal memory.
Error scenario	The MUC receives a faulty message. ➔ The message will be ignored. The MUC can't decode the received message. ➔ An error state event will be generated and logged in the event log storage of the MUC.
Notes	The AMMBO can detect a permanent disturbance of the data acquisition through missing metering data.

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4.5.2 MUC – Metering Device, Bidirectional (DA-2)

Use Case	**Data Acquisition – Metering Device – Generic – Meter index**
Metering devices	Gas- / water- / electricity- / heat- meter
Actors	MUC, metering device
Pre condition	The communication between metering device and the MUC via the primary communication is established. The MUC periodically initiates a data readout towards the metering device.
Scenario	MUC creates the request command (identification, register, and request). MUC encodes the transmitting message if necessary. MUC sends the command and waits for the answer. MUC receives the answer message. MUC checks the identification. MUC decodes the received message if necessary. MUC identifies the meter index out of the received message. MUC saves the received message in its internal memory.
Error scenario	The MUC doesn't receive an answer (timeout). ➔ An error state event will be generated and logged in the event log storage of the MUC. The MUC receives a faulty message. ➔ The message will be ignored. The identification of the message is invalid. (MUC doesn't know the metering device). ➔ An error state event will be generated and logged in the event log storage of the MUC. The MUC can't decode the transmitted message. ➔ An error state event will be generated and logged in the event log storage of the MUC.
Notes	Every time the MUC sends a request it expects an answer of the metering device. The AMMBO can detect a permanent disturbance of the data acquisition through the missing metering data.

4.5.3 AMM Back Office – MUC, Pull Mode (DA-3)

Use Case	**Data Acquisition – Metering Device – Generic – Meter index**
Metering devices	Gas- / water- / electricity- / heat- meter
Actors	AMMBO, MUC
Pre condition	The AMMBO has established a connection to the MUC.
Scenario	The AMMBO sends a request command message to the MUC, to get the meter index(es) of a certain metering device. MUC receives the request message. MUC decodes the request message if necessary. MUC identifies the request. MUC checks the access rights. MUC reads the requested meter index(es) out of its internal memory. MUC builds the response message. MUC encodes the response message if necessary. MUC sends the response message to the AMMBO. AMMBO receives the message and processes it.
Error scenario	MUC receives a faulty command message ➔ The MUC sends an error message to the AMM back office. The MUC can't decode the message. ➔ The MUC sends an error message to the AMMBO (key could be corrupt). The MUC can't identify the request. ➔ The MUC sends an error message to the AMMBO. The MUC denies access to the data. ➔ The MUC sends a denied access response to the AMMBO. The MUC can't find the requested data. ➔ The MUC sends an error message to the AMMBO
Notes	In this case it is the request of the AMMBO system to read the meter index(es) of a specific metering device. This is not a spontaneous action due to a change in the status! All requests of the AMMBO are directed towards the MUC. For data acquisition only the data of the MUC's internal memory will be used. The actuality of the data depends on the send intervals of the metering devices. The MUC does not start a new data read request.

4.5.4 AMM Back Office – MUC, Push Mode (DA-4)

Use Case	**Data Acquisition – Metering Device – Generic – Meter index**
Metering devices	Gas- / water- / electricity- / heat- meter
Actors	AMMBO
Pre condition	The MUC is configured to transmit its meter indexes to the AMMBO in regular intervals.
Scenario	The MUC schedules new meter index push information to the AMMBO. The MUC establishes a connection to the AMMBO (if a constant connection is not available). The MUC builds a meter index message. The MUC encodes the message if necessary. The MUC sends the message to the AMMBO. The AMMBO receives the message and processes it.
Error scenario	The MUC can't find the configured data in its internal memory (wrong configuration). ➔ The MUC sends an error message to the AMM back office.
Notes	The latest read status of the metering device is used. The actuality of the data depends on the send intervals of the metering devices. The MUC does not start a new data read request.

4.6 Event Handling

Event handling scenarios are described for cases of communication problems or device problems to be written into the event log of the MUC.

4.6.1 MUC – Metering Device, Unidirectional (EH-1)

Use Case	**Data Acquisition – Metering Device – Generic – Status**
Metering devices	Gas- / water- / electricity- / heat- meter
Actors	metering device, MUC
Pre condition	The communication between metering device and the MUC via the primary communication is established. The identification of the metering device indicates it to be processed by the MUC. The metering device sends its data periodically to the MUC. A telegram contains one generic status information of the metering device at least.
Scenario	Metering device sends a message via primary communication, containing generic status information. MUC receives the message. MUC checks the identification of the metering device to determine, whether the received message must be processed by the MUC. MUC decodes the received message if necessary. MUC identifies the status out of the received message. MUC checks the status for possible alarm actions and performs these actions. The MUC saves the received message in its internal memory.
Error scenario	The MUC receives a faulty message. ➔ The message will be ignored. The MUC can't decode received message. ➔ An error state event will be generated and logged in the event log storage of the MUC.
Notes	The AMMBO can detect a permanent disturbance of the data acquisition through the missing metering data.

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4.6.2 MUC – Metering Device, Bidirectional (EH-2)

Use Case	**Data Acquisition – Metering Device – Generic – Status**
Metering devices Actuators	Gas- / water- / electricity- / heat- meter, Gas / electricity breaker or limiter
Actors	metering device, MUC
Pre condition	The communication between metering device and the MUC via primary communication is established. The MUC periodically initiates a data readout towards the metering device.
Scenario	MUC defines the request command (identification, status request). MUC encodes the transmitting message if necessary. MUC sends the message and waits for the answer. MUC receives the answer message. MUC checks the identification. MUC decodes the received message if necessary. MUC identifies the status out of the received message. MUC checks the status for possible alarm actions. MUC saves the received message in its internal memory.
Error scenario	The MUC doesn't receive an answer (timeout). ➔ An error state event will be generated and logged in the event log storage of the MUC. The MUC receives a faulty message. ➔ The message will be ignored. The identification of the message is invalid. (MUC doesn't know the metering device). ➔ An error state event will be generated and logged in the event log storage of the MUC. The MUC can't decode the transmitted message. ➔ An error state event will be generated and logged in the event log storage of the MUC.
Notes	Every time the MUC sends a request it expects an answer of the metering device. The AMMBO can detect a permanent disturbance of the data acquisition through the missing metering data.

4.6.3 AMM Back Office – MUC, Pull Mode (EH-3)

Use Case	**Data Acquisition – Metering Device – Generic – Status**
Metering devices Actuators	Gas- / water- / electricity- / heat- meter, Gas / electricity breaker or limiter
Actors	AMMBO, MUC
Pre condition	The AMMBO has established a connection to the MUC.
Scenario	AMMBO sends a request message to the MUC, to get the status of a certain metering device. MUC receives the request message. MUC decodes the request message if necessary. MUC identifies the request. MUC checks the access rights. MUC reads the requested status out of its internal memory. MUC builds the response message. MUC encodes the response message if necessary. MUC sends the response message to the AMMBO. AMMBO receives the message and processes it.
Error scenario	MUC receives a nonconforming request command message ➔ The MUC sends an error message to the AMMBO. The request data decryption by the MUC fails ➔ MUC sends an error message to the AMMBO (the internal decryption key could be wrong) Request with access right violations (authentication procedure fails) ➔ MUC sends a message “access right violation/authentication procedure fails” to the AMMBO MUC finds no current status message for this request within the log file ➔ MUC sends a “no status available” message to the AMM back office The MUC can’t identify the request. ➔ The MUC sends an error message to the AMMBO. The MUC denies access to the data. ➔ MUC sends a denied access response to the AMMBO.
Notes	In this use case the status is requested by the AMMBO from a specific metering device. This is not a spontaneous action due to a change in the status! All requests of the AMMBO are directed towards the MUC. For data acquisition only the data of the MUC’s internal memory will be used. The actuality of the data depends on the send intervals of the metering devices. The MUC does not start a new data read request. All AMM back office requests for a meter/actuator status are addressed to the MUC. For assembling the response, the MUC uses only the log file items. The MUC checks the log file item for being up-to-date over the date/time stamp.

4.6.4 AMM Back Office – MUC, Push Mode (EH-4)

Use Case	**Data Acquisition – Metering Device – Generic – Status**
Metering devices Actuators	Gas- / water- / electricity- / heat- meter, Gas / electricity breaker or limiter
Actors	AMMBO, MUC
Pre condition	The MUC is configured to signal an alarm event to the AMMBO in case of a specific change in the status of a metering device.
Scenario	The MUC detects a status change of a metering device. The MUC evaluates this status change as a request to raise an alarm to the AMMBO. The MUC establishes a connection to the AMMBO (if not a constant connection is available). The MUC builds an alarm message The MUC encodes the message if necessary. The MUC sends the alarm message to the AMMBO. The AMMBO receives the message and processes it.
Error scenario	
Notes	This is the spontaneous action due to the change in the status! The latest read status of the metering device is used. The actuality of the data depends on the send intervals of the metering devices. The MUC does not start a new data read request.

4.6.5 MUC – AMM Back Office (Error Message) (EH-5)

Use Case	**Event Handling – Metering Device / Actuator – Generic**
Metering devices Actuator	Gas- / water- / electricity- / heat- meter, Gas / electricity breaker or limiter
Actors	AMMBO, MUC
Precondition	The MUC set-ups a communication link to the AMM back office
Scenario	AMM back office receives the message AMM back office verifies the identification AMM back office decrypt the message
Error scenario	AMM back office receives a nonconforming message ➔ AMM back office sends a retransmit request to the MUC
Notes	The purpose is the real-time message transfer from MUC to AMMBO in the case of a meter fatal error (measurement data are invalid for payment processes) or a actuator fatal error (actuator action may result in a security problem)

4.7 Control Commands

Use cases for control commands describe access to meter devices by a control center (AMMBO). This ensures the resources for cut-off or limitation of the OMS.

Please refer to OMSS Vol. 1 for definitions and recommendations on actuator devices.

4.7.1 Breaker Cut-Off (BR-1)

Use Case	**Cut-Off**
actors	AMMBO, MUC, Actuator (Breaker)
Pre condition	Breaker is installed behind the MUC. MUC and Breaker binding is done. MUC and Breaker are online. No communication is established. AMM is connected to MUC
Scenario	MUC receives disconnection command sent by AMMBO. MUC establishes primary communication to the breaker. MUC sends disconnection command to the breaker device Breaker validates authentication. ➔ Breaker sends acknowledge to MUC. ➔ MUC sends breaker acknowledge to AMMBO (push or pull). Breaker activates disconnection. ➔ All devices behind the breaker are without power/flow. MUC reads back the breaker status and stores the status in its internal memory. ➔ MUC stores event in its internal memory.
Error Scenario 1	Authentication fails ➔ Breaker ignores the command. ➔ MUC reads back the breaker status and stores the status in its internal memory ➔ MUC stores event in its internal memory
Error Scenario 2	Decryption fails ➔ Breaker ignores the command. ➔ MUC reads back the breaker status and stores the status in its internal memory
Error Scenario 3	MUC couldn't send the command: ➔ MUC will send an error message to AMMBO. ➔ AMMBO will retry to place the command again.
Notes	The actuator neither shall accept any reconnection of the disconnection device, by remote order from an end customer device (if such a device exists) nor by an external manual action on the disconnection device, until it receives a new authenticated order to reconnect from the AMMBO.

4.7.2 Read Breaker Status (BR-2)

Use Case	**Read Status**
actors	AMM, MUC Breaker
Pre condition	Breaker is installed behind the MUC. AMMBO is connected to MUC. Every meter readout task reads also the breaker status.
Scenario	AMM sends status read command to MUC MUC answers with the last read breaker status.
Note	

4.7.3 Enable ON through Customer (BR-3)

Use Case	Enable Power-Up
Actors	AMM, MUC Breaker, Customer
Pre condition	Breaker is installed behind the MUC Breaker state is disconnected MUC and Breaker binding is done. MUC and Breaker are online. No communication is established. AMMBO is connected to MUC.
Scenario	AMMBO sends „Enable Power UP“ command. MUC establishes primary communication to the breaker. MUC sends “Enable Power UP” command to Breaker Device. Breaker validates Authentication. Breaker sends command acknowledge to MUC. Breaker activates „Power UP Enable“. ➔ Customer activates reconnection manually. ➔ MUC reads back the breaker status and stores the status in its internal memory. ➔ MUC stores event in its internal memory.
Error Scenario 1	Authentication failed ➔ Breaker ignores the command. Breaker State is disconnected ➔ MUC reads back the breaker status and stores the status in its internal memory ➔ MUC stores the event in its internal memory
Error Scenario 2	Decryption failed ➔ Breaker ignores the command. Breaker State is disconnected ➔ MUC reads back the breaker status and stores the status in its internal memory
Error Scenario 3	MUC couldn’t send the command: ➔ MUC will send an error message to AMMBO. ➔ AMMBO will retry to place the command again.
Notes	Remote ON without customer interaction is not allowed.

4.8 Clock Synchronisation

The use case clock synchronisation describes the procedures to synchronize the internal clock of the MUC and of the meters (if equipped). All time deviations between the MUC time and the local time should be in line with the final WELMEC recommendations “Time depending consumption measurements for billing purposes” (currently as a draft), where the MUC can be seen as an auxiliary device.

4.8.1 Synchronization of MUC Device Clock (CS-1)

Use Case	**Synchronization of MUC Device Clock**
Actuator	MUC (incl. device clock) NTPv4 Server with asymmetrical signature
Precondition	NTP Server address(-es) are initialized (valid value). Key for verification of signature of NTP time is configured. MUC device clock synchronization interval is initialized (valid value).
Scenario	Synchronization interval has expired -> MUC device clock should be synchronized. MUC sends NTP request to NTP Server. MUC receives NTP response. Signature of received NTP response will be checked. NTP response will be decoded and the deviation between the internal clock will be checked. If deviation is inside allowed range of MUC since last update of time (deviation is <= 1% of measuring interval time in case of interval metering): ➔ internal MUC device clock will be synchronised ➔ Reset “Meter site synch timer”, ➔ allow synchronization of metering point ➔ Reset device status ‘ClockSynchError’ If deviation is outside the allowed range since last time synchronisation (deviation is > 1% of measuring interval time in case of interval metering) : a) ➔ Internal MUC device clock will be set immediately, and this event will be captured in the status belonging to the interval values and log-book if available. ➔ Reset of the ‘Meter site synch timer’. ➔ allow synchronization of metering point ➔ Reset device status ‘ClockSynchError’ or b) ➔ Reset of the ‘Meter site synch timer’ ➔ Internal MUC device clock will be stepwise synchronized with temporary controlled speed up or slow down within certain tolerance to correct deviation (no synchronisation of more than the allowed deviation per measuring period shall apply; the full synchronisation process can take several measuring periods). As long as the synchronisation is in process, no meter point shall be synchronized. ➔ Allow synchronization of metering point. ➔ Reset device status ‘ClockSynchError’.
Error condition	No message from NTP server was received, message is corrupt or signature is wrong: ➔ Enter a retry cycle to acquire the time from the NTP server (perhaps shorter than normal synchronization interval) ➔ Set device status ‘ClockSynchError’ after expiration of validity period after the last successful synchronization. ➔ Continue with the retry cycle for NTP time acquisition. Adjust of MUC device clock failed: ➔ Set device status ‘ClockSynchError’. ➔ Repeat of synchronization after defined time interval (perhaps shorter

	than normal synchronization interval). ➔ Prohibit synchronization of metering point to avoid meters to be set to wrong time. Long term synchronization not successful (“Meter site synch timer” > 48 hours): ➔ Prohibit synchronization of metering point Deviation outside expected accuracy ➔ repeat of synchronization ➔ repeated error condition ➔ Entry in to log-file
Remark	Device status discrimination between ▪ MUC device clock synchronization successful ▪ Synchronization of metering point is possible Date back of device clock is possible Entry into log file in case of error

4.8.2 Synchronization of Metering Device Clock, MUC is Active (CS-2)

Use Case	**Synchronization of metering point device clock, (MUC active)** **the MUC initiates the time synchronisation/ setting of the meter time**
Actuators	MUC (incl. device clock) Metering point
Precondition	MUC device clock is synchronized (synchronization of metering point is allowed) MUC ‘metering point synchronization interval’ is initialized (valid value). It is known which metering device needs synchronization of time (broadcast is not possible!). All authorisation parameters to access the meter (passwords, commands, protocols etc. must be available to the MUC and proper assigned.
Scenario	Synchronization interval has expired -> metering device clock should be synchronized. Check if MUC device clock is synchronized (see above: „Synchronization of MUC device Clock“) For every present metering device with time synchronization the MUC determines the current MUC system time. ➔ MUC sends command of time synchronization with current system time to metering point. ➔ Metering point receives and decodes the command (authenticity, authorization and structure of command). ➔ Metering point sets internal device clock with new time
Error condition	MUC device clock isn’t synchronous (synchronization of metering point forbidden): ➔ Synchronization of the metering device will not be performed. Authenticity, authorization fails and structure of command is faulty ➔ Device clock will not be set
Remark	

4.9 Service Data Container (SDC)

4.9.1 Data Readout Using SDC (SD-1)

Use Case	**Reading Data via SDC from a metering device using push mode**
Actuators	MUC with implemented SDC Metering device
Precondition	The MUC is configured with a device list of meters that it is responsible for. Requests are related to these devices.
Scenario I	1. The meter is transmitting its telegram 2. The MUC receives this telegram 3. The MUC validates the telegram and checks if the emitting meter is a member of the device list.
Check condition YES	➔ The MUC will store the received telegram in the SDC buffer of the memory. If the meter transmits different telegram types (using the telegram type bits in the Signature field) each of these telegrams has to be stored separately. The telegrams will be stored in the format as received; additional data (e. q. RSSI value) could be added.
Check condition NO	➔ The received telegram will be rejected.
Scenario II	1. The AMMBO requests meter data
Data available	➔ If a valid telegram of the meter is available in the SDC buffer the data will be transmitted to the AMM including optional additional data. The meter telegrams stay unchanged.
No data available	➔ If there is no valid telegram of the requested meter in the SDC buffer, the request is pending until a valid meter telegram is received.
Remark	

Use Case	**AMMBO requests Data via SDC from a metering device using pull mode**
Actuators	AMM Back Office (AMMBO) MUC with implemented SDC Metering device
Precondition	The MUC is configured with a device list of meters that it is responsible for. Requests are related to these devices.
Scenario	1. The MUC receives the request from AMMBO 2. The MUC validates the telegram and checks if the requested meter is a member of the device list.
Check condition YES	The MUC checks if a valid meter telegram is available in the SDC buffer. ➔ If YES: the MUC sends the telegram to the AMMBO. ➔ If NO: the MUC sends an error message to the AMMBO.
Check condition NO	➔ The MUC is requesting the data from the meter using the proper communication method. ➔ The received Meter telegram is stored in the SDC buffer of the MUC together with additional optional data. ➔ The MUC will transmit the meter telegram together with additional information to the AMMBO.
Remark	

4.9.2 Data Transfer to a Meter Using SDC (SD-2)

Use Case	**Data transfer from AMMBO to a metering device via SDC**
Actuators	AMM Back Office (AMMBO) MUC with implemented SDC Metering device
Precondition	AMM knows the routing to the meter and the used primary communication method.
Scenario	1. The AMMBO generates the command sequence to be performed by the meter. 2. The AMMBO processes encryption and signature (optional) as defined in [OMSPC]. 3. The AMM transfers the command sequence to the MUC 4. The MUC stores the command sequence into the SDC buffer. 5. The MUC will transfer the command sequence as received from the AMMBO to the meter using the proper primary communication methods (M-Bus, wM-Bus, …) 6. After executing the command sequence a feedback is given to the AMMBO using SDC at the end of primary communication and the command sequence will be deleted in the SDC buffer.
Error condition	If there is not enough memory available at the MUC the new command sequence will not overwrite an existing pending command sequence.
Remark	

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5 Annex B: User Concept Example

5.1 Data and Device Access

Data read out and access from or to MUC and metering devices are restricted by an access rights management.

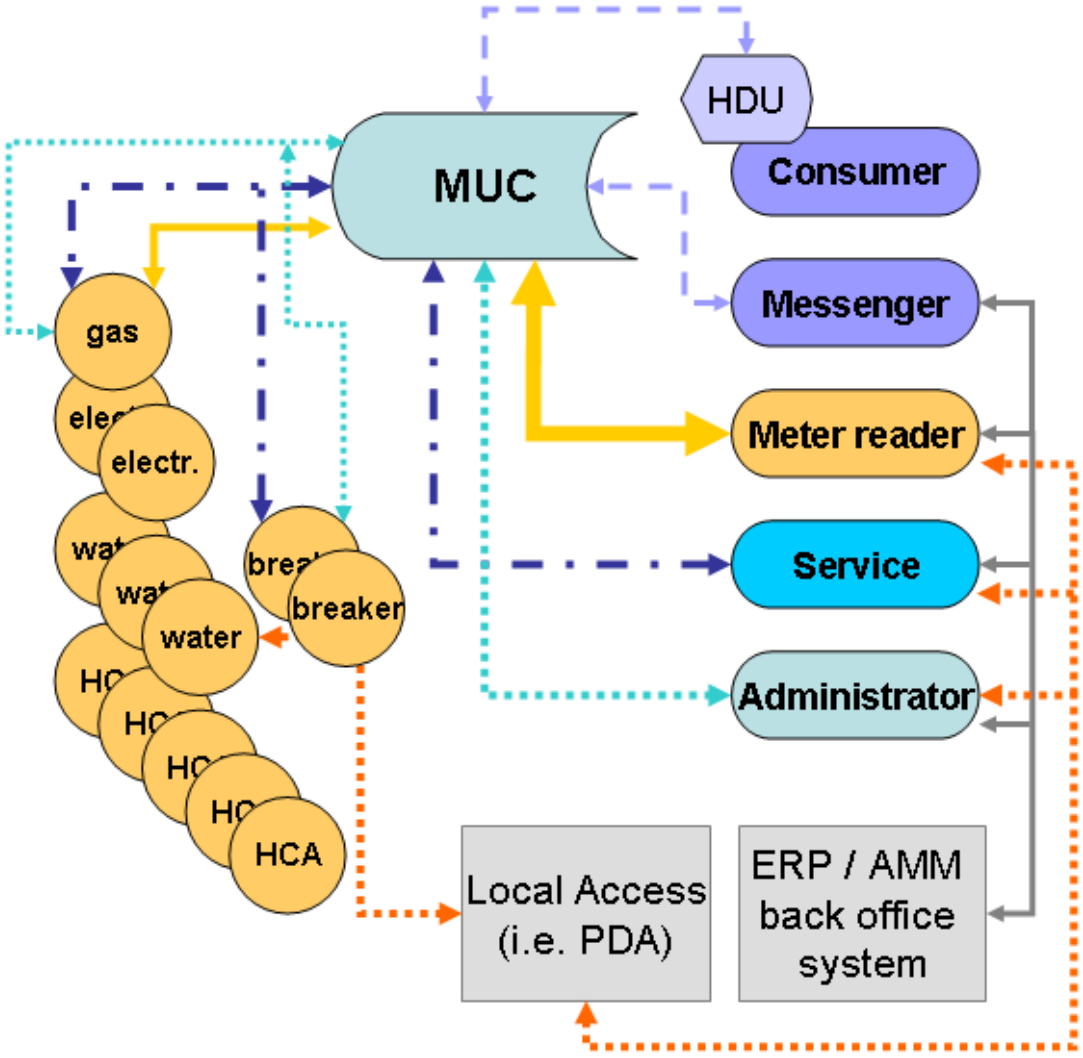

Fig. 11: Users and Data Access

5.2 User Data Fields

The user and access management uses the data fields

- User ID
- User name
- Password
- User group
- Assigned meters

5.3 User Types

5.3.1 Access to a Virgin OMS-MUC Device

- A virgin OMS-MUC provides a standard user account with a standard password that is only active as long as no users are configured for configuration purposes only:
  - Configuration of a new MUC
  - Set up users, access rights and passwords
  - Assign metering devices to MUC
  - Assign metering devices to meter readers
  - Assign AMM back office system

5.3.2 Access to a Equipped MUC

The MUC access is splitted into 5 levels:

User Group	Access rights	Number of Accounts
Consumer	• read stored data from assigned metering devices • read and operate home automation devices	1 - n
Meter reader	• read stored data and status information from MUC • call data from assigned metering devices	1 - n
Messenger	• Send data to consumers o Tariff information o delivery notes • Get data from consumer o Delivery order o Information request	1 - n
Service	• Restore alarm • set parameters • limited configuration and assignment • send command to actuator (protected by signature) • check communication with all assigned devices	1 - n
Administrator	• read and write configuration • add, change or delete users and access rights • write encryption code • write signature code	Only 1

5.3.3 Access to Sophisticated Metering Device

For access to sophisticated meters additional options are used:

Meter reader	• read stored data and status information from MUC • call data from assigned metering devices	1
Service	• Restore alarm • set parameters • limited configuration and assignment • send command to actuator (protected by signature) • check communication with all assigned devices	1
Administrator	• read and write configuration • add, change or delete users and access rights •	1

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